Energy Access in an Era of Low Carbon Transitions: Politicising Energy for Development Projects in India

KUMAR, ANKIT

Energy Access in an Era of Low Carbon Transitions:

Politicising Energy for Development Projects in India

For the Degree of
Doctor of Philosophy

Ankit Kumar

Department of Geography
Durham University

August 2015

Abstract

This thesis examines the role of low carbon energy projects in widening energy access, progressing energy transitions and furthering development goals in rural India. Currently in development contexts, energy access and transitions are mobilised through micro energy projects like solar lanterns and micro-grids. The successes and failures of these projects are primarily assessed quantitatively – number of villages covered, number of households connected etc. However, this approach fails to understand how energy transitions projects perform in people's everyday lives. It does not capture the reasons why they work for particular groups of people and not for others.

To go beyond the quantitative understanding, this thesisfocuses on the micro-politics of everyday life that shape the effects energy transitions projects have on different groups of people. Itconsiders how power, politics and culture are vital for understanding the successes and failures of these projects. Theoretically the thesis conceives low carbon projects as low carbon assemblages to understand their fluid and contingent nature and the ways in which they are configured and reconfigured through relationships of power and everyday politics. Engaging with governmentality studies, it further considers how different, pre-existing and newly configured relationships of power conduct people's conducts and sometimes lead to resistances for low carbon projects.

The thesis critically examines three crucial aspects of low carbon energy projects by engaging with three key ideas – trusteeship, significances and resistances. Firstly, it explores how, by positioning themselves as trustees, particular actors seek to assemble and govern low carbon projects in order to achieve specific outcomes. Secondly, it investigates how, by focusing on particular significances of electricity, these interventions work to achieve particular development goals in different spaces of everyday life. Finally, it asks how and why different pressures and contestations emerge as everyday resistances in low carbon transitions.

The thesis takes an ethnographic route of enquiry in order to examine energy in everyday life, using participant observations, interviews and photography. It explores two different low carbon projects – Lighting a Billion Lives (LaBL) solar lanterns project and Husk Power Systems (HPS) biomass micro-grids project – and contrasts them against the central grid and kerosene oil networks, in five villages in Bihar.

Three key arguments emerge from the thesis. Firstly, electricity access should be understood as a spatially heterogeneous and temporally fluid idea. Its firm quantification and standardisation are problematic because electricity access is geographically and socially differentiated.It needs to be explored in an ethnographic manner, in which not onlyquestions of 'how much' but also of who, how and where are critical. Secondly, in energy and development projects, context matters. The society, culture, politics and economy of spaces in which projects are implemented mediate their impacts. Finally, the upkeep and maintenance of low carbon energy projects is not just about economies and

supply chains of spare parts but also about cooperation and coordination between the project designers and users.Being able to fulfil people's changing electricity requirements by building flexibility in the projects is critical to respond to these three issues. This will make projects more sustainable and increase people's trust on low carbon projects leading to a convergence between energy access and energy transitions.

Peer reviewed publications from this research

Kumar, A. (2015). Cultures of lights. Geoforum. 65. p.pp. 59–68. Available from: http://dx.doi.org/10.1016/j.geoforum.2015.07.012.

Kumar, A. (2015). Sustainable energy for all: can we take care of the 'all'? In: J. Tomei & D. Gent (eds.). Equity and the energy trilemma Delivering sustainable energy access in low-income communities. London: IIED, pp. 8–16. Available from: http://pubs.iied.org/16046IIED.html?c=energy.

Acknowledgements

This thesis has been possible due to the help and support of many people.

I would like to thank my supervisors, Prof. Harriet Bulkeley and Dr. Colin McFarlane for their relentless intellectual support. This thesis would not have been possible without their guidance and inputs. I have also benefited greatly from discussions with several members of staff here at Durham University. Thanks to Prof. Cheryl McEwan, Dr. Divya Tolia-Kelly, Dr. Rob Shaw, Dr. Gordon McLeod, Prof. Lynn Staeheli among many others. Thanks for making a social scientist out of me.

I am deeply indebted to my family, without whom embarking on this PhD would not have been possible. Thanks to my parents Dr. Abhilash and Neelam Singh for countless debates on Bihari people and culture. I hope you got as much out of it as I did. Thanks for your support, patience and pickles and for not asking too many times – when are you going to finish?

I am grateful to the people of the five villages that I conducted research in, for not only participating in the research but also giving me unlimited glasses of tea. A special thanks to those who gave me food, shelter and guidance for extended periods of time without complaining even once. With their incredible and sumptuous food, they also contributed to another long-term target for me – a substantial weight gain.

My Durham friends have been one the greatest supports during this PhD. They supported me through moments (and there were many) of frustration and self-doubt. They participated in intellectual conversations and often gave the timely and much needed advice of taking a step back from the intellectual conversations. Thanks to Marisa, Boris, Brendan, Lara, Raihana, Britta, Pammi, Madhu, Lucy, Ruth, Simon, Philip, Mattand everyone else in W301, W102, W601and Christopheson building. Thanks for the pizzas, pints and curry nights.Thanks to Chandni, Smita and Priyanka for highly stimulating debates about India and its people and for helping me at different stages of the thesis. Finally, special thanks to Marisa for pushing my gender thinking and for often discussing debating and questioning my arguments.

Table of Contents

1 Introduction 1

1.1 RESEARCH AIMS 1

1.2 PURPOSE OF THIS THESIS 1

1.3 IMPORTANCE OF THE THESIS 2

1.3.1 WHAT IS ENERGY ACCESS 2

1.3.2 KEY DILEMMAS: ENERGY-DEVELOPMENT-SUSTAINABILITY LINKAGES 3

1.3.3 SUSTAINABLE ENERGY TRANSITIONS 4

1.4 ENERGY AND DEVELOPMENT IN INDIA AND BIHAR 6

1.4.1 HISTORY OF ELECTRIFICATION: RISE AND FALL OF ELECTRICITY AND DEVELOPMENT 6

1.4.2 OTHER 'DEVELOPMENTS' AND OTHER ENERGIES 9

1.5 KEY ARGUMENTS AND CONTRIBUTIONS OF THE THESIS 11

1.6 STRUCTURE OF THE THESIS 14

2 Literature Review and Theoretical Approach 19

2.1 INTRODUCTION 19

2.2 LINKING DEVELOPMENT WITH LOW CARBON ENERGY TRANSITIONS 20

2.2.1 THE PROCESS: MOVING TO CLEANER, SAFER, SUSTAINABLE ENERGY 21

2.2.2 TOOLS AND CONCEPTS 23

2.3 ENERGY AND POLITICS OF THE EVERYDAY 28

2.3.1 TAKING AN ASSEMBLAGE APPROACH 33

2.3.2 ASSEMBLING AND GOVERNING 37

2.3.3 RESISTANCES 47

2.3.4 MATERIALITY OF CONTROL AND RESISTANCE 50

2.4 CONCLUSIONS 53

3 Spaces and Places of the Research 57

3.1 INTRODUCTION 57

3.2 PLACES OF THE RESEARCH 57

3.2.1 BIJURIYA 64

3.2.2 SAHARIYA 68

3.2.3 HARDIYA 71

3.2.4 RANGPUR 73

3.2.5 BERANGPUR 76
3.3 REGIONAL CONTEXT MATTERS: HOW HAS THE HISTORY OF INVESTMENT IN ENERGY INFRASTRUCTURE IN BIHAR SHAPED PATTERNS OF ENERGY ACCESS? 79
3.4 SPACES OF RESEARCH 85
3.4.1 SEPARATION OF MALE AND FEMALE SPACES 85
3.4.2 CASTE SYSTEM AND CASTES THAT APPEAR IN THIS THESIS 89
3.5 TIME OF RESEARCH – ANNUAL AND DAILY RHYTHMS OF VILLAGES 92
3.5.1 ANNUAL RHYTHM AND ECONOMIES 92
3.5.2 DAILY RHYTHM 93

4 Researching Energy Access in Rural India 96

4.1 INTRODUCTION 96
4.2 THE CASE STUDY ROUTE 96
4.2.1 LIGHTING A BILLION LIVES (LABL) 96
4.2.2 HUSK POWER SYSTEMS (HPS) 100
4.3 THE ETHNOGRAPHY WAY 103
4.4 METHODOLOGICAL TOOLS 105
4.4.1 PARTICIPANT OBSERVATION 105
4.4.2 INTERVIEWS AND FOCUS GROUPS 111
4.4.3 ANALYSING AND WRITING THE DATA 122
4.5 BARRIERS AND ACCESS 123
4.5.1 ACCESSING THE VILLAGES AND CASTES: CHOOSING A GATEKEEPER 124
4.5.2 ACCESSING CASE STUDY PROJECTS 125
4.6 POSITIONALITY 126
4.7 ETHICS 128
4.8 CONCLUSIONS 131

5 Energy Trusteeship: Assembling and Governing Low Carbon Assemblages 134

5.1 INTRODUCTION 134
5.2 TECHNIQUES OF ASSEMBLING: CONNECTING TO PARTICULAR DISCOURCES 136
5.2.1 SIGNIFICANCES 137
5.2.2 INNOVATION 145
5.2.3 APPROPRIATENESS 150
5.3 TECHNIQUES OF GOVERNING AND STANDARDISATION 153
5.3.1 TECHNIQUES OF EXPERTISE: STANDARDISING MENTALITIES TO MATCH MATERIALITIES 154

5.3.2 TECHNIQUES OF LEGITIMACY: LEGITIMISING AND DELEGITIMISING EXPERTS 159
5.3.3 TECHNIQUES OF SUBJECTIVITY: IMAGINING PARTICULAR SUBJECTS 164
5.4 MANY TRUSTEES: MULTIPLE IDENTITIES 168
5.5 CONCLUSION 172

6 From Assembling to Acting: Low Carbon Assemblages in Everyday life 174

6.1 INTRODUCTION 174
6.2 CULTURAL MEDIATION OF SPACES OF LIGHT AND DARK 176
6.3 TRUSTEES' SIGNIFICANCES OF ELECTRICITY 185
6.3.1 ELECTRICITY AND EDUCATION 186
6.3.2 LIVELIHOODS AND ECONOMIES 201
6.3.3 HEALTH AND WELL-BEING 213
6.4 ADDING MORE COMPLEXITY TO AN ALREADY COMPLEX ENERGY LANDSCAPE 221
6.5 CONCLUSIONS 224

7 Resistances and Reassembling 226

7.1 INTRODUCTION 226
7.2 OTHER SIGNIFICANCES OF ELECTRICITY: THE FIRST SOURCE OF RESISTANCE 227
7.2.1 MORE THAN LIGHTS: MOBILE PHONES 227
7.2.2 MORE THAN MOBILE PHONES: FLUIDITY OF ENERGY ACCESS 234
7.3 RESISTING THE DISPOSITIF: THE SECOND SOURCE OF RESISTANCE 240
7.3.1 DISCIPLINING DISRUPTIONS AND RESISTING DISCIPLINING 247
7.3.2 PUNISHING DISRUPTIONS AND REWARDING COMPLIANCE 254
7.4 REASSEMBLING: REORGANISING LIVES AND THE ASSEMBLAGES 262
7.4.1 REORGANISING LIVES 263
7.4.2 REASSEMBLING THE LOW CARBON ASSEMBLAGES 269
7.5 CONCLUSIONS 271

8 Conclusions 274

8.1 INTRODUCTION 274
8.2 HOW DO PARTICULAR ACTORS SEEK TO ASSEMBLE AND GOVERN LOW CARBON ASSEMBLAGES IN ORDER TO ACHIEVE SPECIFIC OUTCOMES? 275
8.2.1 TRUSTEESHIP 275
8.2.2 STANDARDISATIONS: CREATING MODEL PROJECTS AND PEOPLE 277

8.3 HOW DO LOW CARBON ENERGY INTERVENTIONS WORK IN ORDER TO ACHIEVE PARTICULAR GOALS OF DEVELOPMENT IN DIFFERENT SPACES OF EVERYDAY LIFE? 279

8.3.1 WHICH GOALS ARE ACHIEVED AND IN WHAT WAYS? 279

8.3.2 WHO BENEFITS FROM THE PROJECTS? 282

8.4 HOW AND TO WHAT CONSEQUENCES DO EVERYDAY RESISTANCES EMERGE IN LOW CARBON ENERGY TRANSITIONS? 284

8.4.1 RESISTANCES AGAINST IMPROVEMENT OF PARTICULAR CONDITIONS AND NOT OTHERS 284

8.4.2 RESISTANCES AGAINST IMPROVEMENT OF CONDUCT 286

8.4.3 ENTERTAINMENT AS A DRIVER FOR LOW CARBON PROJECTS 287

8.5 CHALLENGES AND LIMITATIONS 289

8.5.1 TOO MANY THINGS TO ACCOUNT FOR 289

8.5.2 ACCESSING GENDERED SPACES 290

8.6 AREAS OF FUTURE RESEARCH 290

8.6.1 MEDIATION OF CULTURE 291

8.6.2 FOCUS ON FEMALES 291

8.7 IMPLICATIONS FOR DOING ENERGY RESEARCH 292

8.7.1 NEW WAYS OF THINKING ABOUT ENERGY TRANSITIONS 292

8.7.2 ATTENTION TO SPACE 293

8.7.3 DOING ETHNOGRAPHIC RESEARCH 294

8.8 IMPLICATIONS FOR ENERGY AND DEVELOPMENT POLICY 294

References 297

Appendices 326

APPENDIX 1 – QUESTIONERS 327

VILLAGE HOUSEHOLD INTERVIEWS 328

VILLAGE GROUP DISCUSSIONS 329

FOR LABL NGO 331

FOR HPS MANAGER 333

APPENDIX 2 – CONSENT 334

CONSENT FORM FOR INTERVIEWS 335

HINDI – साक्षात्कारकेलिएसहमतिफॉर्म 336

VILLAGE NOTICE – गाँवमेंहोनेवालेशोधकेविषयमेंसूचना 337

List of Figures

Chapter 1

Figure 1-1: A group of men sitting in complete darkness watch a daily soap on a mobile phone. 11

Chapter 2

Figure 2-1: A schematic representation of MLP. 24

Chapter 3

Figure 3-1: State wise percentage of urban population. 59

Figure 3-2: State wise percentage of households having electricity access. 59

Figure 3-3: Lakhisarai district. 60

Figure 3-4: HPS projects in Lakhisarai. 61

Figure 3-5: Locations of the five case study villages. 63

Figure 3-6: Location and geographical and social distribution of Bijuriya. 65

Figure 3-7: Location and Geographical and social distribution of Sahariya. 69

Figure 3-8: Location and geographical and social distribution of Hardiya. 72

Figure 3-9: Location of Rangpur and Berangpur and geographical and social distribution of Rangpur. 74

Figure 3-10: Geographical and social distribution of Berangpur. 77

Figure 3-11: Percentage of population using kerosene as a source of lighting in rural and urban area 84

Figure 3-12: Outside and inside spaces of a higher caste household in Rangpur. 86

Chapter 4

Figure 4-1: Solar panels with charging station and solar lanterns. 97

Figure 4-2: The LaBL model and its key actors. 98

Figure 4-3: HPS gasification plant and transmission lines. 100

Figure 4-4: Village infrastructure and motorbike as the common mode of transportation. 105

Figure 4-5: The flash helps revel women and children invisible in ambient light conditions 107

Figure 4-6: Photographs added to field notes. 108

Figure 4-7: Diagrams and field notes. 111

Figure 4-8: *Dalit* women sitting 'outside' the homes with small one room house in the background. 116

Figure 4-9: Interviewing males and females together. 118

Figure 4-10: The camera, recorder and field notebooks used during the research. 119

Figure 4-11: Organising data under codes for easier and faster retrieval and coding and transcription of data. 121

Figure 4-12: Working and reworking data. 123

Chapter 5

Figure 5-1: Pre-LaBL image. 139

Figure 5-2: Creating a new image. 141

Figure 5-3: Pre-HPS image. 143

Figure 5-4: Creating a new image - electric light, happy children. 144

Figure 5-5: Locally fabricated gasifiers and transmission lines on bamboo sticks. 147

Figure 5-6: LaBL lanterns are designed like kerosene lanterns. 148

Figure 5-7: Unsafe kerosene lamps made of empty glass bottles. 150

Figure 5-8: LaBL and HPS can be appropriately used for the same purposes without the same problems associated with kerosene lamps. 152

Figure 5-9: Solar lantern with an open switch panel. 156

Figure 5-10: Employees undergoing training at the HPS University and Husk Power University at work. 158

Figure 5-11: LaBL model: relationships and flows between various actors in LaBL. 160

Figure 5-12: LaBL poster in a NGO office outlining the dos and don'ts for entrepreneurs and users. 165

Figure 5-13: Numbered lanterns and names being entered into a register in Sahariya. 166

Chapter 6

Figure 6-1: Lights in outside spaces in various research villages. 177

Figure 6-2: After the ‘luminous reaction’. 180

Figure 6-3: Everyday lighting from a solitary kerosene lamp and wedding night lighting from the diesel generator micro-grid in a household in Rangpur. 182

Figure 6-4: Gifts presented to the soon to be married couple on display during a wedding ceremony. 184

Figure 6-5: A child in Berangpur studying under a kerosene lamp and children in Sahariya studying under a LaBL solar lantern. 188

Figure 6-6: Children collecting solar lanterns in Sahariya. 190

Figure 6-7: The girl child studies under a kerosene lamp in the Manjhi household as the conversation goes on. 194

Figure 6-8: A tuition class under electric lights in Berangpur. It is full of boys with a solitary girl child at the far end. 195

Figure 6-9: Children studying under LaBL lanterns. Young men can be seen but no young women. 197

Figure 6-10: A girl child in Mr. Rohit Singh's household in Rangpur cooks dinner while her brothers study. 198

Figure 6-11: Gender politics of energy access: male child studies under electric light while female child cooks on an earthen hearth. 198

Figure 6-12: Raju's shop near Berangpur lighted by a kerosene lantern. 202

Figure 6-13: A screenshot of the customers section of the image gallery of HPS website. 204
Figure 6-14: Commercial activities and market place in Mirpur. 204
Figure 6-15: Market place in Hardiya on the left and Mr. Shah's shop on the right. 207
Figure 6-16: Commercial activities in Sahariya. 206
Figure 6-17: Commercial activities in Bijuriya. 208
Figure 6-18: Various spaces of the entrepreneur's household lit with LaBL solar lanterns. 213
Figure 6-19: Multiple kerosene lamps being used in Mr. Devendra Manjhi's household in Bijuriya to light multiple spaces at the same time. 215
Figure 6-20: A woman in Berangpur who has access to electric lights is cooking on biomass while also carrying out child care. 216
Figure 6-21: In Sahariya, children study in the kitchen under a LaBL lantern while the mother cooks. 217
Figure 6-22: Mr. Manohar Manjhi's daughter-in-law in Berangpur shows her *saari* that caught fire in the hearth. 218
Figure 6-23: On a winter morning, a group of men sit around a *ghura* in Berangpur. 219
Figure 6-24: women and children use *borsi* in Sahariya while a LaBL lantern lights the space. 220
Figure 6-25: Mr. Shah's brother using a torch while waiting for the HPS supply. 222
Figure 6-26: Mr. Mandal's shop in Bijuriya lit up by his solar home system. 223

Chapter 7

Figure 7-1: Mr. Sevek Gupta's mobile charging shop in Hardiya. 230
Figure 7-2: A television set and DVD player in storage in a household in Berangpur. 236
Figure 7-3: Television set in Mr. Kedar Singh's household in Bijuriya. 237
Figure 7-4: LaBL poster in the NGO office outlining the Dos and the Don'ts. 241
Figure 7-5: In LaBL part of generation equipment is in people's hands. In HPS people are away from the generation equipment. 245
Figure 7-6: In Hardiya, one day during fieldwork, the micro-grid frequently turned on and off. Unsure of supply, Mr. Harish Gupta's son, like many others, used candles along with HPS electricity to do his homework. 247
Figure 7-7: Bulbs used as 'choke points' by HPS. 251
Figure 7-8: LaBL lanterns with numbers in Bijuriya. 257
Figure 7-9: Solar lantern in Sahariya with names and identification marks put by people to identify 'their' lanterns. 259
Figure 7-10: Electrification debris in Mr. Ramesh Singh's house. His son studies under kerosene lantern. 265
Figure 7-11: Mr. Rajendra Singh's house in Bijuriya lit by his solar plate. 268

Chapter 8

Figure 8-1: LaBL forging alignments by centralising multiple development concerns. 280
Figure 8-2: Before and after HPS. 282

List of Tables

Chapter 2

Table 2-1: Six practices of assemblage. 39

Table 2-2: Key theoretical terms used in this thesis. 56

Chapter 3

Table 3-1: Social makeup and lighting sources in various research villages. 79

Table 3-2: Various relationships in a Bihari village. 88

Table 3-3: *Verna* system and historical jobs of various *vernas.* 89

Table 3-4: Castes that were part of this research, their *varna* origins and historical jobs. 90

Chapter 4

Table 4-1: Summary of roles of various actors involved in LaBL. 99

Table 4-2: Summary of roles of various actors involved in HPS. 102

Table 4-3: Numbers and types of interviews and focus groups. 114

Chapter 5

Table 5-1: Multiple positionings, as trustees and subjects, of the various actors in LaBL and HPS assemblages. 171

Chapter 6

Table 6-1: Ranking of various occasions and lights used during these occasions based on their relative importance. 183

Table 6-2: Daily expense calculation for lighting Mr. Mandal's shop. **Error! Bookmark not defined.**

Table 6-3: Daily expense for various light sources used during special occasions. 212

Chapter 7

Table 7-1: Variable costs of charging mobile phones vs fixed cost of the micro-grids. 234

Abbreviations

ANT	Actor Network Theory
CFL	Compact Florescent Lamp
DDUGJY	Deen Dayal Upadhyaya Gram Jyoti Yojna
DFID	Department for International Development, UK
GHG	Greenhouse Gases
GoB	Government of Bihar
GoI	Government of India
HPS	Husk Power Systems
IEA	International Energy Agency
kW	Kilo Watt
LaBL	Lighting a Billion Lives
MDGs	Millennium Development Goals
MLP	Multi Level Perspective
MNRE	Ministry of New and Renewable Energies, Government of India
MW	Mega Watt
RGGVY	Rajeev Gandhi Grameen Vidyutikaran Yojna
SDGs	Sustainable Development Goals
SHS	Solar Home System
SSL	Solar Street Light
TERI	The Energy and Resources Institute
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
W	Watt
WB	World Bank
WCED	World Council for Environment and Development

1 Introduction

1.1 Research aims

The global debate on energy access and its connections with development have been growing in prominence (Reddy & Nathan 2013; Pachauri et al. 2009; Laufer & Schäfer 2011; Tully 2006). It has also been recognised that energy access is a bigger problem in rural areas (Cook 2011; Doll & Pachauri 2010). As opposed to 94% of the global urban population, only 68% of the rural population has access to electricity (IEA 2014). Globally, out of the 1.3 billion people who lack access to electricity, about 84% live in rural areas (IEA 2011). In India, about 45% rural households lack access to electricity compared to only about 7% urban households. This has resulted in an increased focus on rural electrification (Schäfer et al. 2011; Reddy & Nathan 2013; Khandker et al. 2012).

This focus on rural electrification has led to an expansion in the number of projects aiming to improve energy, and through it, development conditions in rural areas. While many of these projects have been considered successful and as 'models' of energy for development projects, this research aims to critically understand how development aims and energy projects constitute each other in people's everyday lives in rural India (see Bairiganjan et al. 2010; Ishikawa et al. 2012).

1.2 Purpose of this thesis

The purpose of this research is to conduct an enquiry into the logics of energy for development projects. How, and why, are they designed in particular ways? How, and why, are their development aims configured and reconfigured by everyday relationships of power? The research questions for this thesis, which aim to shed light on the gaps in current understanding of energy and development projects, are:

1. How do particular actors seek to assemble and govern low carbon assemblages in order to achieve specific outcomes?

2. How do low carbon energy interventions work in order to achieve particular goals of development in different spaces of everyday life?
3. How, and to what consequences, do everyday resistances emerge in low carbon energy transitions?

These questions come together to provide a broader understanding of the issues around the design, implementation and maintenance of energy projects. They take the analysis beyond the normative understanding, where the failure to achieve the aims of the projects is often blamed on the on-ground implementation (Chaurey & Kandpal 2010).

1.3 Importance of the thesis

There are two key debates that this thesis addresses. Firstly, it problematises the idea of energy access and proposes new ways of looking at it. Secondly, the thesis looks at the linkages between energy access and sustainable development and tries to understand the role of micro-scale, decentralised energy in progressing energy transition. It does these by conducting an enquiry around three key questions related to sustainable energy transition and energy access (section 1.2).

1.3.1 What is energy access

To understand how energy and development constitute each other, it is important to briefly understand energy access, the key idea around which energy for development projects emerge. There is a small, but growing literature on defining 'energy access' (Pachauri 2011). Energy access is seen as the ability to secure modern energy, at affordable prices, through a connection to pre-established infrastructure (Kanagawa & Nakata 2008; Winkler et al. 2011). In addition to these, Pachauri (2011) includes notions of 'adequacy', 'quality and reliability' and 'fulfilling basic energy needs' to construct a set of matrices for energy access (see also Bazilian et al. 2010; Balachandra 2011). Taking this further, the International Energy Agency (IEA 2011) introduces the idea of increasing levels of consumption over time. From these, 'electricity access' can be defined as the ability to connect to, and secure, affordable, adequate and reliable electricity supply for basic needs. However, affordability depends on the people's income levels and adequacy depends on the purposes for which electricity is required. The purposes define and are defined by, 'basic energy needs', which again depend on the people. Although here the idea of 'access' seems non-quantifiable, attempts to standardise and quantify it are often made (Pachauri 2011; IEA 2011). This is because quantification helps in standardisation whichmakes planning and implementation of large scale electrification projects easier (see Rose 1999).

1.3.2 Key dilemmas: energy-development-sustainability linkages

Rutherford and Coutard (2014: 1354) point out that "a host of social and political issues and stakes" exist at the points of intersection of the domains of energy, development and sustainability. However, they have not been accurately and completely captured by "energy transition" (Rutherford & Coutard 2014: 1354). Sustainable energy transition, on the one hand calls for a shift from traditional energy to modern energy for the world's poor, and on the other, for a shift from high to low carbon systems and lifestyles. However, as people shift to modern forms of energy, electricity demand and stress on the electricity systems also increase (Winther 2012; section 1.4).

Countries like India have a large share of their population without access to electricity (33%[1]). They also depend greatly on high carbon modes of energy production (IEA 2015). They, at least in the short term, will be forced to meet the increasing demand with increasing carbonisation. Coal produces 54% of India's electricity and "the dominance of coal in the energy mix is likely to continue in foreseeable future" (NSO 2013: i; see also IEA 2015). The question then is, how can the increasing demand, and the consequent need for more electricity generation, be balanced with the need to reduce demand and greenhouse gas emissions (see Pachauri et al. 2013; Tomei & Gent 2015 for a discussion on energy trilemma)?

[1] Percentage of households without electricity as a source of lighting (Census of India 2011b)

Although energy transition is often considered at the global or national levels, it clearly means different things in different contexts (Rutherford & Coutard 2014). This thesis looks at these diverse, but convergent aims of energy transition, contextualises them to rural India, and argues that objectives driven by global ideas, like Sustainable Development, Sustainable Energy for All, and the forthcoming Sustainable Development Goals, do not work for everyone. It investigates energy projects emerging from these global goals through questions outlined in section 1.2. Section 1.3.3 explains the emergence of these particular questions in relation to the global ideas of sustainable energy transition.

1.3.3 Sustainable energy transitions

The Sustainable Development Goals (SDGs), an outcome of Rio+20 summit in 2012, will take the baton from the Millennium Development Goals (MDGs) after their possible approval, in September 2015 (UN 2015). The seventh SDG aims to "ensure access to affordable, reliable, sustainable and modern energy for all" (UN 2015: 13). However, the link between energy and sustainable development is not new. In 2011, the United Nations (UN) launched the Sustainable Energy for All initiative, which had universal access to modern energy services as one of its aims (UN 2012: 01). The UN Secretary General, Mr. Ban Ki-moon argues that sustainable energy for all is a "top priority because it is central to all aspects of sustainable development" (in his preface in UN 2012).

This link between sustainable development and energy, and global calls to mitigate climate change have made 'low carbon' decentralised energy prominent in global discourses of energy access (Bulkeley et al. 2013; Sokona et al. 2012; Kaygusuz 2012). Low carbon energy helps progress development goals, at the same time reducing resource consumption and greenhouse gas emissions (Kaundinya et al. 2009; Alanne & Saari 2006; Rehman et al. 2011). Low carbon energy and its relationships to development are the focus of enquiry in this thesis.

Taking governance beyond the state

By developing a global agenda, which proposes to act locally while *thinking globally,* sustainable development has made governance of energy multinational and transnational. The boundaries between state and non-state havebecome "dynamic, porous, fragile and malleable" (Bulkeley & Schroeder 2011: 744). In addition to this, the failures of the state to improve conditions of the people and of the environment, have come to prominence(Li 2007c). This has raised the role of actors beyond the state in the governance of energy and development (Bulkeley et al. 2013; Li 2007c; Li 2007a)[2]. However, Bulkeley and Schroeder (2011: 745) point out the gap in the understanding of the ways in which actors beyond the state attempt to govern. A key aim of this thesis is to enquire into the role of actors beyond the state in developing and governing low carbon projects.

Broad ideas, standardised solutions

Sustainable development is too broad an idea to materialise as "narrow standardised solutions" (Bulkeley et al. 2013: 960). However, although driven by the sustainable development discourse, low carbon energy often materialises on the ground as standardised projects that target particular goals. This is because, sustainable development has helped reinforce the pre-existing standardised territory, the developing world (Perkins 2013). This is seen as a territory with states and people with "similar environment and development" challenges (Perkins 2013: 1006). This is problematic as different issues are of importance not just to different states, but also different people within those states (Escobar 2012: 195). Therefore, a second aim of this thesis is to investigate how standard low carbon interventions work to achieve standard development goals in people's everyday lives.

[2] Bulkeley et al. 2013 discuss sustainability governance which applies to sustainable low carbon energy too.

Heterogeneity of spaces

The 1987 report of the World Commission on Environment and Development (WCED)[3], which set the idea of sustainable development in motion, quoted people and grassroots organisations who had participated in the various WCED public hearings around the world. Specific 'local' ideas were involved in evolving a broad 'global' problem. Although sustainable development recognises the local challenges, it seeks to establish a global framework assuming that the problems defined, and solutions devised, at the global level "are equally compelling for all communities" (Escobar 2012: 195; see also Hopwood et al. 2005). However, neither the problems, nor the solutions, are compelling for everyone. Complications appear when problems and solutions devised at a different scale are applied at a different scale (see Lawhon & Patel 2013). As the same specific solutions move from one space to another, they face challenges. Therefore, a final aim of this thesis is to explore how, and to what consequences, do everyday resistances emerge in low carbon energy transitions.

1.4 Energy and development in India and Bihar[4]

1.4.1 History of electrification: rise and fall of electricity and development

The nexus of electricity and development, in India, arose from the first prime minister "Nehru's faith in reason and modernity" (Corbridge 2010: 6). Since about 83% of the Indian population lived in rural areas and about 70% depended on

---

[3] Also commonly known as the Brundtland report, named after the Chairman of the Commission, Gro Harlem Brundtland, former prime minister of Norway.

[4] This section is based on a review of the Five Year Plans of India http://planningcommission.nic.in/. Under the Planning Commission of India, five year plans were conceived to streamline the development planning in India. The planning commission has now been replaced by NITI Aayog (http://niti.gov.in/content/).

agriculture[5] when India's first five year plan was conceived, the idea of development of India became the idea of rural development.

A focus on rural areas was also important for the production of food and raw materials for industrialisation (Varshney 1998: 28-35). The lack of scientific knowledge and modern approaches in agriculture were an impediment to development (Prakash 1999: 191; Varshney 1998: 41). Keeping all these in mind, the Indian planners envisaged rural electrification[6]. While rural areas, agriculture, and irrigation became the spaces of development, "production of power" became the critical ingredient for development (Guha 2008: 211).

India faced food shortages in 1965 and 1966[7]. Following these, high yielding varieties were introduced as part of India's Green Revolution. They needed irrigation through pump sets and tube wells (EPW 1969: 1256). It is not surprising then, that the histories of the electrification of most villages in this research begin from the allotment and construction of state tube wells (chapter 3).

A focus on agriculture made electricity political. Low cost and free electricity for irrigation policies were devised in various states of India (Dubash 2007: 46). A win-win option, irrigation, which helped food security and farmer profits, positively affected vote banks (Dubas & Rajan 2001: 3369). This political move instilled a culture of bad accountability and management in the electricity sector, and resulted in low quality power[8] and ground water depletion (Dubash 2007: 46-47; Kimmich 2013: 261). In addition to these, people, often informally, extended and used electricity from the central grid in ways that the state did not intend (section 3.2). There was also widespread stealing of wires in Bihar. In Bihar, all this led to the crumbling of the grid network, especially the fields. Electricity became limited to domestic spaces and irrigation became dependent on diesel generators.

---

[5] Chapter 1, first five year plan
[6] Chapter 1, first five year plan
[7] Point 11.10, Chapter 11, fourth five year Plan
[8] Low voltage and intermittent supply of electricity

Status check: current state of electrification

Indian's current electrification approach targets the provision of basic domestic energy needs (RGGVY 2011). The focus has shifted from agriculture. Under Deendayal Upadhyaya Gram Jyoti Yojna (DDUGJY)[9], the state's main rural electrification programme, low-capacity electricity transformers (16 and 25 kVA) and single phase connections are being installed in the villages. As the Bihar Chief Minister pointed out, these cannot be used for pumping irrigation water (ToI 2011).

The crumbling of earlier infrastructure and the lack of any plan for new infrastructure has had a negative impact on agriculture, a sector that still employs about 74% of the workforce in Bihar (Kishore 2013: 2). The "energy squeeze", resulting from the lack of electricity and high diesel prices, has forced farmers to use less water and resulted in low yields (Kishore 2013: 1; Sharma 1995). In addition to this, as families grow and land holding sizes remain the same, subsequent generations are left with smaller parcels of land.

Due to a lack of means, expensive irrigation and the fragmentation of holdings, agriculture as a livelihood option is becoming unsustainable[10](See also, Gupta 2013: 197). Most people want to leave farming, or want future generations for find work in urban areas (Gupta 2013). Government jobs and business have emerged as new and more attractive forms of livelihoods (Jeffrey et al. 2005). These, people in the research villages argue, can only be gained through education (chapter 6). Due to a search for new livelihoods, the value placed on education has increased substantially for the landowning classes. The result is an increase in the value of forms of electricity that can support education (section 6.3.1).

[9] Earlier known as Rajeev Gandhi Grameen Vidyutikaran Yojna (RGGVY)

[10] Same reasons were given by the farmers in all research villages for their disenchantment towards agriculture.

Energy and sustainable – development

There has been substantial research into both the positive and negative aspects of the linkages between sustainable development and energy in India. Access to energy has been found to extend working hours, reduce drudgery and time for collecting fuel, foster livelihoods, positively impact education and raise Human Development indicators (Chaurey et al. 2004; Pachauri et al. 2004; Rao 2013; Khandker et al. 2012; Kanagawa & Nakata 2008; Srivastava & Rehman 2006). Modern energy also supports flows of information and entertainment and leads to better health services and indoor air quality (Dubash 2003: 149; Ailawadi & Bhattacharyya 2006: 11; Parikh et al. 2012: 484).

However, the arguments for improved conditions – health, education, livelihoods, environment and economy – do not apply to all forms of energy. Since with the widening energy access, greenhouse gas reduction and sustainable development are also needed, the discourse around low carbon decentralised energy – solar homes systems, micro-grids and solar lanterns – is becoming stronger in India. Electrification through the central grid is being ruled out because of economic and environmental unsustainability(Srivastava & Rehman 2006; Reddy et al. 2006). On the other hand low carbon decentralised energy is seen as a way of reducing transmission and distribution losses, reducing greenhouse gas emissions and progressing energy security (Reddy et al. 2006; Chakrabarti & Chakrabarti 2002; Kaundinya et al. 2009).

1.4.2 Other 'developments' and other energies

The Indian state plans development through experts who see India as a homogeneous unit with Indians, who have "*human needs*" (emphasis added) (Prakash 1999: 198; see also Corbridge et al. 2005: 36). This 'homogeneity of plan' however constantly clashes with the heterogeneity of the country (see Khilnani 1999). Different people, with different priorities, have different ideas of development (Chatterjee 1997: 8; see also, Kaviraj 2000: 138-140). Mobile phones have emerged from two such ideas of development, connectivity and entertainment.

Between 1999 and 2003, the Government of India allowed private players into the mobile phone market and abolished incoming call charges (Gupta & Jain 2012: 709). This made owning and maintaining mobile phones cheaper and easier, making mobiles a formidable means of communication. The rise of verbal communication, through mobile phones, has extended the ability of long distance communication and connectivity to those who are not able to read or write. This is especially important in Bihar, which is second among the Indian states for outward migration (Census of India 2001). People, who used to receive letters once a month or phone calls once a week, are now able to connect daily. This situation has become pervasive and people expect to be continuously connected to each other. Because of this, for many, mobiles and mobile charging take precedence over electric lights.

The importance of mobile phones for communication and connectivity have been widely discussed (Beuermann et al. 2012; Duncombe 2014; Thompson 2009). However, mobile phones are now widely used for entertainment. The availability of less expensive multimedia mobile phones in India in the last 5-6 years has made affording one or more mobile phones easier. This has brought entertainment into many everyday mundane activities, like working in the fields, milking the cattle, cooking or just relaxing in the evenings (fig.1-1).

The presence of more than one mobile phone has given personal choice over entertainment to different members (males, females) of the family. Their mobilityhas provided spatial and temporal convenience. Now men, women, and children can consume specific forms of entertainment in their own separate spaces, and at their own times.

By centralising several services like connectivity and entertainment, while also making them mobile, mobile phones have opened up new electricity requirements which often take precedence over some other, more normatively accepted requirements. This has a bearing on who participates in the low carbon projects and why (chapter 7).

Figure 1-1: A group of men sitting in complete darkness watch a daily soap on a mobile phone.

1.5 Key arguments and contributions of the thesis

This thesis argues that a focus on power, politics and culture is key for understanding the successes and failures of the low carbon energy transition projects. It problematises the idea of energy access and argues that energy access should be looked at as a fluid and heterogeneous concept. Attempts to standardise and build standard models to address it should be avoided. In energy and development projects, context matters. The society, culture, politics and economy of spaces in which the projects are implemented mediate their impacts. Cultural biases often establish relationships of power, and result in politics through which some social groups augment the impoverishment of others(Li 2007c). In addition to this, the trustees of energy and development projects often attempt to establish new relationships of power and foster new 'cultures' through the projects. These need to be centred in the analysis. The thesis argues for an ethnographic approach towards understanding energy access in which, not just 'how much', but who, how and where should also be critical. Planning, implementation and assessment need to focus on who gets access to particular forms of energy, how and in which spaces. Energy access and transition are fundamentally political issues. Attempts to render them technical should be avoided (see Li 2007c; Ferguson 1990).

The findings of this thesis will be of interest for two groups of people – those working in policy and practice domains of energy access and transitions and those conducting research on energy access and transitions.

The thesis presents evidence that projects based on fixed models and fixed numbers do not benefit every social group. It argues that a qualitative understanding of energy access which goes beyond numbers to understand, acknowledge and respond to the heterogeneous requirements of various social groups in different spaces will help project planners and policy makers develop projects that are contextual, flexible and improvisational. These projects will be able to respond better to the continuously changing requirements of people. In addition, the thesis provides evidence that the upkeep and maintenance of projects is not just about economies and supply chains of spare parts and manpower but also about cooperation and coordination between project trustees and the people. In the two case studies that this thesis engages with, due to a lack of flexibility the experts focus on controlling people and their electricity use. The use of these control mechanisms lead to resistances and conflicts rather than cooperation. Project designers, implementers and policy makers need to find more ways coordination with local communities. Being able to respond to changing electricity requirements by building flexibility into the projects is one way to do this. This will make projects more sustainable. Increased sustainability of the projects will increase people's faith on low carbon energy technologies leading to convergence between energy access and energy transitions.

This is not to argue that project designers, developers and policy makers do not have a sensibility for context. Many of them do, and this is also evident from the wide contribution of practitioners and policy makers to the energy access literature. However, for low carbon projects, looking for allies and forging alignments is important to gain knowledges and finance (chapter 5). To forge alignments with actors looking to address a big problem like energy access, the experts need to provide a big solution. To provide a big solution the projects are designed and structured to develop general and universal 'models' which can be easily and swiftly implemented in different places. General and universal 'models' are also important for finance and policy actors as they help them develop fixed and concrete investment estimates and budgets for these projects. The model thus ends up lacking context and particularity. Due to the need to develop universal 'models' the structures of low carbon energy projects do not materialise on the ground the sensibility for context that many experts have. The 'model' limits the capacity of technical experts to account for and embed the particularities and context of spaces and places to which the low carbon projects travel.

The thesis also contributes to literature on culture, energy and development. It provides evidence that culture tailors the effects of energy access projects in people's everyday lives. Until now research on energy transitions has been mainly based on either the sustainability transitions literature or the political economy literature (section 2.2.2). However, this thesis adds to the recent growth of engagement with poststructural theories in energy transitions studies. This is important because poststructural theories help make energy access and transitions research more attuned to everyday life, and provide critical tools to analyse and understand the everyday (sections 2.2.2 and 2.3). In addition, the thesis argues for the critical role of ethnography in understanding how energy and development projects unravel in people's everyday lives. Studies of energy access until now have been concerned with numbers – i.e. the number of people served by projects to widen access to modern energy services – but ethnography provides an important tool to understand the long term impacts that these projects have in people's lives. Ethnographic studies can help develop new frameworks for assessing, understanding and designing energy and development projects.

1.6 Structure of the thesis

The thesis follows a thematic pattern of analysis – discussing different themes in different chapters – rather than a geographical pattern – discussing different villages in different chapters. Chapter 2 presents the key theoretical debates useful in analysing and understanding this thesis. Chapter 3 introduces the context that this study is embedded in. Chapter 4 discusses the methodology of the research. Chapters 5, 6 and 7 engage with the empirical work explaining the logics and process through which projects are assembled and governed, and the ways in which they work on the ground. Chapter 8 draws out the conclusions and flags up some areas of future research.

Chapter 2 starts with a debate on the various approaches used to understand energy transition. It argues that development and energy transition have, until now, been looked at from a macro perspective. The chapter argues for a micro, everyday understanding of how energy transitions projects and development constitute each other. For this, it flags up the need for attention to the issues of power and politics. To attend to these, the chapter brings together assemblage and governmentality theories and focuses on three key concepts – trusteeship, significances and resistances – which inform the analysis in the empirical chapters. Trusteeship relates to the role played by particular actors in assembling and governing the low carbon projects. Significances are the various things that electricity means to people. It relates to the various things that people use or intend to use electricity for. Resistances are the pressures and contestations that the assemblages face from the various actors.

Chapter 3 presents the spaces and places of this research. It introduces and presents brief electrification histories of the five villages in which the fieldwork was carried out. The five villages have different social makeups and represent different energy landscapes. It also introduces two key social and cultural notions that inform the analysis in chapters 6 and 7. These are the separation of genders and the Hindu caste system. The chapter briefly discusses the annual and daily rhythms of the villages to contextualise how, when and in what spaces people engage with different forms of energy.

Chapter 4 outlines the two low carbon energy case studies – Lighting a Billion Lives (LaBL) solar lantern project and Husk Power Systems (HPS) micro-grid project – that the thesis engages with. The thesis compares them with kerosene oil and the central grid of India. Kerosene and the central grid are the most commonly used energy systems in India. The chapter outlines the methodological tools used during the 9 month period of ethnographic research. It explains why due to particular cultural notions, engaging with females was difficult and what methods were used to partially overcome this. The chapter discusses the barriers of accessing different villages, caste groups and case study projects. It debates the issues around positionality and the ethics of conducting this research.

Chapter 5 engages with the idea of trusteeship and argues that particular actors, who aim to assemble and govern low carbon assemblages, position themselves as trustees (Li 2007c). By connecting to particular discourses around sustainable development, they attempt to connect to common agendas to “forge alignments” with other actors (Li 2007b). At the same time, by connecting themselves to the ideas of innovation and appropriateness, they distinguish themselves from other low carbon assemblages who also attempt to forge alignments with the same actors (see Smith et al. 2010; Cherp et al. 2011; Byrne 2009; Wong 2010). The chapter argues that trustees convert local, contextual and particular knowledges into standard ‘models’ that are general and universal, to make their efforts large scale(see Scott 1998). To match these standardisations, they use dispositifs which help stabilise, securitise and operationalise the low carbon assemblages. In particular, they use techniques of expertise (to train more trustees), techniques of legitimacy (to legitimise and de-legitimise different trustees for different activities) and techniques of subjectivity (to foster standard subjectivities among people). Although these low carbon assemblages attempt to foster standard subjectivities among the people, in reality people move between their multiple positionings. This problematises the development goals and technologies of control of the low carbon assemblages.

Chapter 6 follows the significances of electricity – education, livelihoods and health – that the trustees prioritise. It argues that culture mediates different people's uses of electricity in different spaces, and at different times. Although the trustees ignore the social, cultural, economic and political landscapes of the villages, the low carbon assemblages end up becoming embedded in them (see Li 2007c). This moulds their development effects for different groups of people. The chapter argues that due to various existing conditions, *dalits* do not give the same level of importance to education as their higher caste, landowning counterparts. Similarly, families ascribe less importance to education for girls compared to boys. Since education remains limited to the higher caste males in these villages, electricity for education also remains primarily limited to them. Although the low carbon assemblages help commercial activities run for longer durations in the villages, this has mostly social, rather than commercial, benefits. They help households and shops save money previously spent on expensive fuels, but do not result in additional incomes because the shops' incomes are rooted in the limited customer pools of the villages. By helping avoid kerosene lamps, the low carbon assemblages provide healthier studying conditions. However, most women in these villages are involved in cooking and house work and the low carbon assemblages do not make these activities healthier and safer. Therefore, the effects of the low carbon assemblages become gendered and casted (different for different castes). In addition to this, for the low carbon assemblages, electricity signifies education, livelihoods and health only in particular modes and particular moments. Outside these modes and moments, people are still left exposed to the conditions that the trustees claim to improve.

Chapter 7 explains the two sources of resistances for the low carbon assemblages. Firstly, people who prioritise other significances of electricity, like connectivity, entertainment and comfort, resist by either not participating in the assemblages or attempting to use electricity in ways that are significant for them. Since LaBL does not provide mobile charging facilities or lights in multiple spaces, *dalits* do not participate in it. Many people, predominantly from the higher castes, attempt to use HPS electricity for televisions and fans. For most people in these villages, electricity for electronic equipment like mobile phones takes precedence. This is because, unlike lights, which can be produced even with kerosene, mobiles can *only* be charged with electricity. Secondly, the socio-material organisations of the low carbon assemblages create certain loci for power struggle. The trustees use these to control and conduct people, and the people, to resist the dispositif. The changing socio-cultural landscapes also problematise the dispositifs. As they move from one space to another they encounter new conducts and counter conducts (see Legg 2007). Mounting resistances often lead to disruptions and breakdowns in the low carbon assemblages. This gives trustees justification to reassemble the assemblages to either extend their powers (as in case of LaBL), or withdraw from spaces of power struggles (as in case of HPS). However, when the assemblages breakdown, the people who have become 'used to' electricity struggle to either readapt to old habits, practices and energy assemblages, or to join new energy assemblages like solar home systems. Reassembling old habits and practices is difficult. This leads to the question: are the programmes of improvement 'improving' people's lives or ending up making them more difficult?

Finally, chapter 8 draws the conclusions together, outlines some areas of future research and flags up some key outputs for energy research and policy.

2 Literature Review and Theoretical Approach

2.1 Introduction

This thesis aims to understand how low carbon projects are designed and experienced on an everydaybasis. It focuses on the micro-politics of energy access.This chapter outlines the theoretical basis of this thesis and discusses the conceptual ideas useful in analysing the project. This is done in four steps. Firstly, a survey of literature on energy transitions and development is conducted and it is argued that the complex and often reinforcing relationship between energy and development makes it important that we understand how they constitute each other on an everyday basis. Here, a discussion on the most relevant theoretical approaches is used to understand energy transitions, and their critiques are also presented.

Secondly, a detailed discussion on energy transitions is used to draw out specific focus areas for this thesis – power, politics and resistance. Foucault (1994: 340) argues that "that there is no such entity as power….power exists only as exercised by some on others". What according to him exist, are relationships of power, which could be investigated through "forms of resistance"(Foucault 1994: 329). Politics can be understood through the interactions between relationships of power, and tactics and types of resistances (Li 2007c; Foucault 1994).

Thirdly, two specific theoretical approaches – assemblage and governmentality – are discussed and used to understand the micro-politics of energy access. Here, the conceptual language used in the thesis, in particular four conceptual ideas – assemblages, trusteeship, dispositif and significance –, are introduced and explained. The engagement with this diverse set of concepts reflects the empirical fields in which this thesis is situated. Empirically the thesis is situated in the fields of energy and development, where the "will to improve" (Li 2007c) people's conditions also contains a 'will to govern' (Legg 2011; Li 2007b). The thesis follows energy projects in the research villages, formed (assembled) as a result of the 'will to improve' of key actors (trustees) as they apply their ideas of what electricity represents to them (significances). However, from the key actors' perspectives, the projects also need to be protected for the people's long-term good. The people need to be kept limited to specific uses of electricity – they need to be guided and governed. For this, the projects need to be accompanied by rules, regulations, directives and technologies (dispositif) that can control and conduct people's electricity use.

Assemblage provides a good entry point into the continuous, contingent and fractured nature of energy and development projects – they are never completely formed or broken down, they assemble and reassemble "from an existing repertoire, a matter of habit, accretion, and bricolage" (Li 2007b: 265). At the same time governmentality, primarily based around the works of Foucault (1991a), provides a good focus on "technologies, techniques, rationalities and knowledge formations that" govern these projects (Legg 2007: xiv). Following the works of Tanya Murray Li (Li 2007b; Li 2007a; Li 2007c) and Stephen Legg (Legg 2011; Legg 2007) who have used assemblage and governmentality in developing country contexts, the thesis draws on governmentality and assemblage theories to theoretically and empirically situate itself in the field of critical development studies.

Finally, drawing from the discussions above, an analytical framework that guides the thesis, integrates the empirical chapters together and is useful for the wider understanding of the thesis, is presented.

2.2 Linking development with low carbon energy transitions

Baker et al. (2014: 794) argue that the term low carbon energy transitions, "provides both a description of a process of transformation from one energy system to another as well as a set of tools and concepts, to explain and enable such transitions". This section briefly discusses various aspects of the *process* and *tools and concepts* of transitions and provides a critiqueof the current approaches for studying transitions.

2.2.1 The process: moving to cleaner, safer, sustainable energy

Sagar (2005: 1367-1368) argues for transitions from “traditional fuels” like animal dung, crop residues and wood to “safe, clean fuels” because they would lead to development.They would save time and effort, particularly for women, lead to better health, and make energy cheaper for the poor. He (2005: 1368)indicates that these transitions have been hindered by a development approach which prioritises the “commercial energy segment” for “expansion and transformation of the energy sector”. This contributes to a lack of “resources and attention” towards household energy transitions (Sagar 2005:1368). From their research in sub-Saharan Africa, Sokona et al. (2012: 1) argue that prioritisation of electricity reforms resulting in financial and operational efficiencies have “not made access to electricity for the poor any easier” because they focus on electricity provision to “those able to pay”. In contrast to Sagar, they argue that there has been too much focus on the household level and more emphasis needs to be on energy that mobilises the “productive sector” (Sokona et al. 2012: 7).

Sagar (2005: 1369) also brings carbon emissions from the use of traditional fuels to attention and argues that energy transitions will support human development and the goals of the United Nations Framework Convention on Climate Change (UNFCCC)[11] (see also Romijn et al. 2010: 327). Similarly, Walker and Cass (2007: 458) explain (although with reference to the UK) the need for transitions towards renewable and cleaner forms of energy in order to reduce carbon emissions for climate change mitigation. However, bringing in the issue of energy equity, Sokona et al. (2012: 4-7) contest that “depending on availability and costs” both high and low carbon systems will be required for transitions to modern energy sources. At

[11] United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol are coordinating and governing global efforts to reduce Climate Change causing Green House Gases (GHGs) http://unfccc.int/2860.php

the same time, they accept that development and energy transitions goals "need to grow in a carbon-constrained world" (Sokona et al. 2012: 7).

Thus, the challenge of energy transitions is a move "towards a more sustainable energy system characterised by" access for all, energy security and low carbon emissions (Bridge et al. 2013: 331; see also Tomei & Gent 2015 on energy trilemma). Adding the issue of livelihoods to this, with reference to energy transitions in South Africa, Baker et al. (2014: 793) argue that low carbon energy enhances "employment prospects" and reduces energy poverty. This, they further argue, has led to a "discursive embrace of rhetoric about the 'green economy'" (Baker et al. 2014: 793).

What emerges from the above discussion is the complex relationship between energy transitions and development. While energy transitions appear to be a tool to mobilise development goals, what also becomes clear is that the paths for energy transitions depend on how development is conceptualised. Thus, when development is seen as increasing income and economic growth (Nayyar, 2006: 816), the focus of energy transitions is trained on industries and large energy systems like the central grid, their restructuring and optimisation (Sokona et al. 2012; Sagar 2005). However, calls are now being made for transitions to decentralised energy, because compared to the central grid, these options are considered to be economically more viable for electrification of small, remote villages (Mahapatra & Dasappa 2012: 8; Nouni et al. 2009: 434).

Several studies discuss the critical role of decentralised renewable energy for non-grid connected areas and areas where the grid connection is financially not feasible (Kumar et al. 2009: 1947; Chaurey et al. 2004: 1704). The argument for transitions to decentralised and low carbon energy has further strengthened as the debates around climate change and sustainable development have taken prominence (Bridge et al. 2013; Walker & Cass 2007; Sagar 2005). These forms of energy promise to fulfil multiple goals simultaneously – creating local livelihoods, reducing GHG emissions, and preventing unsustainable harvesting of local resources like wood.

However, the transitions to low carbon energy are neither simple nor straightforward. Baker et al. (2014: 792) argue that historical, social, political and economic aspects continue to influence the “contemporary politics of energy transitions”. As a result, race has come to define “inequality of access” in South Africa. In addition to this, Newell (2013: 335) points to the need to bridge the distinction between governance in theory and practice by “researching ‘every day’ and informal decision making through networks and practices of power”[12]. The complex relationship between energy transitions and development makes it important to understand the work that they do in constituting each other on an everyday basis i.e. seeing both energy transitions and development in action. The next section discusses theories and approaches that have been used to explain energy transitions.

2.2.2 Tools and concepts

The most widely used tools and concepts to study energy transitions have come from the field of socio-technical transitions (Verbong et al. 2010; Romijn et al. 2010; Raven 2007; Verbong & Geels 2007). Socio-technical transitions “involve alterations in the overall configuration” of the system “which entail technology, policy, markets, consumer practices, infrastructure, cultural meaning and scientific knowledge” (Geels 2011: 24). Socio-technical systems see “technologies not simply as designed and engineered material objects” but as an entanglement of “producers, infrastructures, users, consumers, regulators and other intermediaries” (Walker & Cass 2007: 459; see also Geels 2004: 900). The most commonly used theory in socio-technical transitions, Multi-Level Perspective (MLP) conceptualises transitions as regime shifts in socio-technical systems (Geels & Kemp 2007: 442). Regimes are formed of semi-coherent socio-technical rules and low carbon innovations require protection (niche[13]) from the mainstream (regime[14]) until they mature, as the

---

[12] Newell does this with reference to Clean Development Mechanism (CDM) – a mechanism under the Kyoto Protocol for financing greenhouse gas abatement projects – and clean energy in Argentina.
[13] The lowest level in socio-technical systems.
[14] Middle level of socio-technical systems.

conditions (rules) in the regimes are adverse for the innovations (fig.2-1). Transitions from niche to regime are also helped by landscape[15] pressures like global sustainable development goals and climate change conventions and protocols (Geels 2011; Geels & Kemp 2007; Verbong & Geels 2007). Transitions attempt to explain how "technological and political change is embedded within and affected by broader global processes" like climate change (Baker et al. 2014: 794).

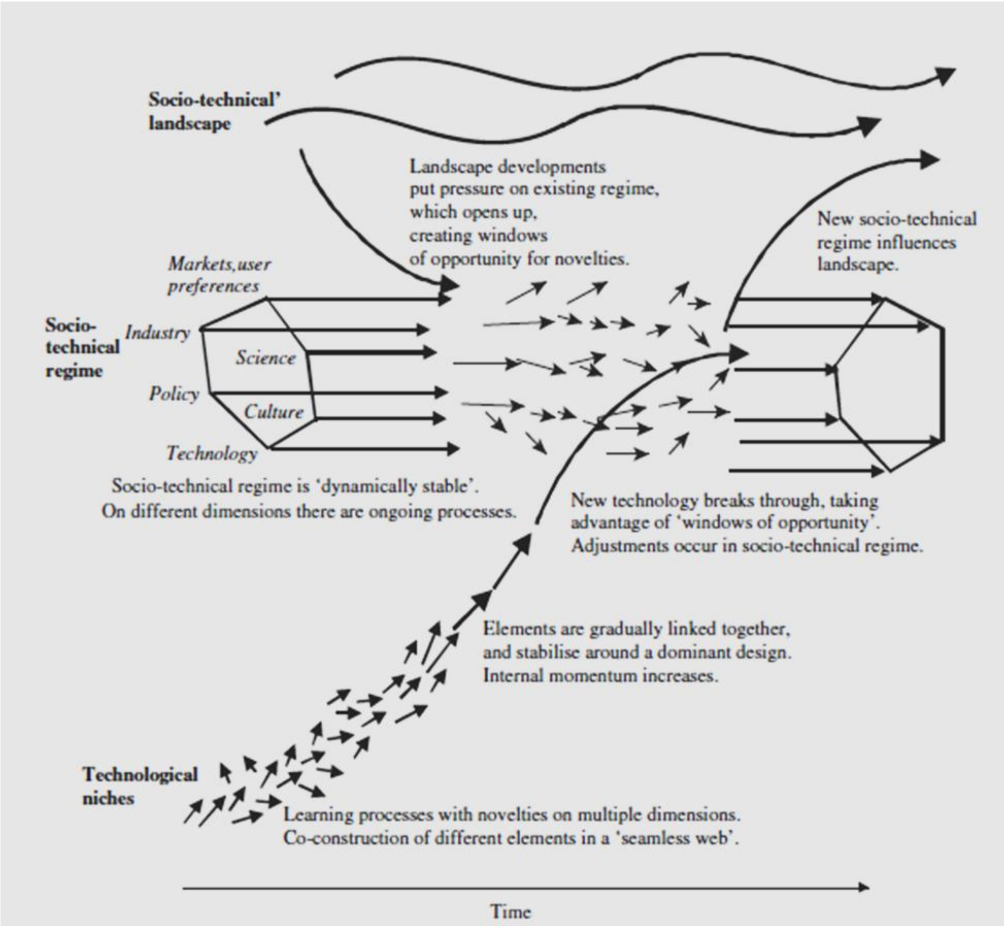

Figure 2-1: A schematic representation of MLP (Geels 2011: 28; Geels & Kemp 2007: 444)**.**

Although the presence of multiple actors and groups in socio-technical systems raises the issues of politics and struggle for defining transitions targets and system boundaries (Smith & Stirling 2010: 7-9; Berkhout et al. 2004: 16), the agency of power struggles and cultural-discursive activities are less developed in MLP (Geels

[15] Top level of socio-technical systems.

2011: 30). Lawhon and Murphy (2011: 371) critique socio-technical transitions for their overemphasised focus on “elite actors” (technical experts and entrepreneurs) and their capability of ‘guiding’ successful transitions (See also Smith & Stirling 2010: 7-9). In addition to this, the socio-technical transitions literature sees transitions as “orderly and managed process of change” which they almost never are (Baker et al. 2014: 792). Although socio-technical transitions in general, and MLP in particular, register resistance, they do so in a very limited manner – the resistance to change, from existing regimes (Papachristos et al. 2013: 55; Geels 2011: 25; Smith et al. 2005: 1504). They provide a very limited analysis of resistances from within the low carbon energy systems and resistances outside the regimes.

Smith and Raven (2012: 13) argues that a “focus on niche[16] actors…soon indicates why any protections secured often tend to be incomplete or insufficient…and as a result have consequences for the development of socio-technical alternatives that fall short of their ideal” (see also Romijn et al. 2010; Smith 2007). This, they argue, is because of the messiness if the everyday life “in which knowledge and notions of the problem are contested” (Leach et al. 2007: 24). Given the socio-technical transitions’ “ambitions to transform the structures of our everyday lives” (Smith & Stirling 2008), it is problematic that they “lack an explanation for how to better account for the everyday politics that…shape socio-technical transition outcomes and their distribution within society” (Lawhon & Murphy 2011: 364 citing Meadowcroft 2009). In summary, socio-technical transitions theory falls short in providing adequate ‘tools’ to analyse how power, politics and resistance play out in the everyday lives of people and low carbon energy projects.

Other theoretical approaches used to analyse energy transitions attempt to address these critiques. Newell et al. (2014); Newell (2014); Phillips and Newell (2013); Newell and Bumpus (2012); Kuby et al. (2011); Bumpus and Man (2008) take a political economy approach to understand energy transitions and various associated

[16] Niches are the protected spaces in which socio technical innovations like low carbon energy projects which participate in energy transitions emerge and are nurtured.

process,such as thereduction of carbon emissions and CDM.Newell (2013: 322) argues that there has been a neglect of “the broader political economy within which policy processes around…clean energy are situated”. Baker et al. (2014: 812) argue that the “political economy of transitions requires greater attention to highlight “the relations of power and the importance of politics that…are decisive in enabling or frustrating the potential for change in the energy sector”. Newell et al. (2014: 2) argue that “power and political economy will play a key role in determining technological and social outcomes: the winners and losers from different energy pathways and on whose terms and how the trade-offs between competing policy objectives are resolved” and thus it is critical to focus on such issues.

Taking a step further, Petrova et al. (2013: 1440) focus on “different ways in which political, cultural or ideological interests” work at different scales in energy transitions in post-communist cities. Bradshaw (2010: 275) brings together approaches from “global energy security, the economic geography of globalisation and the politics and economics of climate change” to look at energy transitions and development from a geopolitical perspective. Elsewhere, he also examines the geopolitics of energy security with reference to the need for energy transitions (Bradshaw 2009).

Huber (2009) engages with Marxism to conduct an “investigation into the historically specific relations between fossil fuel energy and capitalism conceived as a ‘mode of production’” and explains the transitions from solar to biological sources and subsequently fossil fuel sources of energy. Ahmed (2010) uses neoliberalism to understand the development of the electricity sector in India and to discuss resistance (Ahmed 2012) to these developments. Engaging with the history and materiality of transitions to coal and oil, Mitchell (2009) discusses the organisation and reorganisation of global and national politics of energy and its transitions.

From the discussion above it is concluded that most approaches used to study development and energy transitions focus on unravelling issues of power and politics, but at the macro-scale. Criticisms of these structural approaches also focus on the issues of power and agency. Spaargaren (2011: 815) while discussing sustainable consumption practices argues that structuralist perspectives overlook “agency and subjectivity”. In addition to this, Hannah (2011: 1038) flags up the lack of focus on resistances. However, these critiques of agency and resistances are misplaced, as the works of Gidwani (2013); Gidwani (2008); Gidwani and Sivaramakrishnan (2003) on Marxism and politics of waste, agency of migrant workers and assemblage and neoliberalism demonstrate[17].

Although most work on energy and development has been based on structural approaches – e.g. political economy (Kuby et al. 2011; Bradshaw 2010; Bradshaw 2009), Marxism (Huber 2009), neoliberalism (Ahmed 2012; Ahmed 2010) – more recently the use of poststructural approaches has been increasing (e.g. Day & Walker 2013; Harrison & Popke 2011; Powells 2009; Maassen 2009). These try to address the gaps in structural approaches, especially by focusing on politics at the micro-scale. Birtchnell (2012: 498) argues that poststructural theories are more sensitive to the agency, power, and messiness of the real world. Crampton and Elden (2007: 360) argue that “a poststructuralist sensibility is necessarily attuned to space” which helps analyse “the relational play of differences, juxtapositions and contingencies”. However, poststructural theories have been critiqued for disregarding questions around the “structural contexts” in which actors are embedded (Brenner et al. 2011: 233). MacKinnon (2010: 27) argues that there has been a “neglect of the politics of scale” in poststructural accounts (see also Jones & Murphy 2011: 367). However, as “the diversity…of everyday…cannot be reduced to differences in class, culture, urbanism, economic organization or evolutionary stages”, poststructural theories are more attuned to the “complex…organization of everyday life” (Shove et al. 2009: 1-4). They can help bring “a conceptual connection between spatial mobility and social flexibility” (Bouzarovski 2009b: 504). The poststructural “fluidity of scale” can also

[17]Gidwani and Sivaramakrishnan (2003) build on and contribute to Marxist accounts of labour production to discuss the agency of the migrant to subvert existing power structures and create new relationships of power and politics. In his work on waste, Gidwani (2013) engages with Marxism to bring to fore the agency and politics of material and non-material waste. More directly, Gidwani (2008) uses an assemblage approach with neoliberalism to understand capital and labour relations (see also McFarlane 2011b).

help understand various actors and processes which move across scales (MacKinnon 2010: 26).

Keeping these in mind, in the next section a detailed discussion on energy transitions is used to draw out specific research question around power, politics and resistance.It briefly presents some advantages of poststructuralist theories with reference to this thesis. It lays out various justifications for using particular poststructuralist theories – assemblage and governmentality – and then goes on to lay out an analytical framework.

2.3 Energy and politics of the everyday

In the case of resources like energy, it is important to consider what they "make possible" (Van Vliet et al. 2005: 19). "What energy is for" therefore, is at the root of this analysis (Walker 2014: 50). In this research "energy is an ingredient of the doing or performing"[18](Walker 2014: 49) and signalling (section 2.3.2.1) of development, and development is seen as a path for energy access. This complex relationship makes issues of power and politics critical – e.g. the power to decide development goals and the power to define energy access. Most transitions research has focussed on macro-scale power and political economy, while issues of micro-scale, everyday power and politics have received lower attention. This section discusses energy transitions, the process, and importance of the three key themes of this thesis: power, politics, and resistance. It also discusses the importance of focusing on these themes with reference to everyday life. Ultimately, it outlines the key questions that the thesis looks to explore.

Space and scale

Arguing for a more 'geographical' understanding of energy transitions, Bridge et al. (2013: 332-333) point out that, although space and scale "shape energy systems and

---

[18] For Walker (2014: 49) "energy is and 'ingredient of the doing or performing of social practices". However, in case of this thesis, the notion of 'doing' or 'performing' fits well with how development is done or performed in people's everyday lives.

influence their capacity for transformation", work on low carbon transitions has not given much attention to these (see also Shove & Walker 2007). More focus needs to be put on physical, cultural, social, political and development spaces, which shape and are shaped by energy and development projects (Bridge et al. 2013). Mclaren et al. (2013: 158) add temporal to the spatial arguing for a better understanding of "relations between actors and across time and space". The issue of scale is critical as most of the focus in energy transitions has been on macro-scale politics – geopolitics, state and political economy – and micro-scale politics has been less emphasised.

It is important to understand how spatial biases, often created by social and cultural relationships, influence people's access to electricity (Chapters 3, 4 and 5). As the low carbon energy projects move from the spaces of one village to another, they encounter different concerns. Within the villages, they encounter the entrenched nature of various social and cultural spaces (higher lower caste colonies, inside – outside spaces of homes). In agreement with Legg (2007: 17), in this thesis, spaces are a "stubborn, alive and problematising medium". Since, most research on energy transitions has been on the macro-scale, this thesis focuses on the micro-scale and multiple spaces – different social groups within a village and between different villages.

Everyday life

Much existing research still does not address how the linkages between various energy and development issues[19] "operate at the level of everyday life" (Bouzarovski et al. 2013: 30). Shove and Walker (2010: 472) argue that sustainable energy transitions will "involve new expectations and understandings of everyday life". This raises a need for inquiry into the "spectrum of rhythmic performance in everyday

[19] In case of Bouzarovski et al. (2013: 30), these are fuel poverty, energy efficiency, poor housing and health

life, ranging from successful synchronization to tension and disruption" (Shove et al. 2009: 10).

Bridge et al. (2013: 333 with reference to IEA 2008 and Mernier 2007) argue that energy transitions will require reconstituting "the geographies of producing, living, and working with energy". An attention to the "the lived experience" of energy and development is required to understand the "choices and fundamental changes in the daily lives of already disadvantaged" people (Harrison & Popke 2011: 959). These can come from a focus on the everyday as it helps enquire, the "different ways of relating to, using, disposing of and acquiring" and explore "the identifications, practices and symbolizations arising from these manifold connections" (Pfaff 2010: 344)[20]. Acknowledging the importance of these issues, this thesis focuses on how energy and development interventions play out in people's everyday lives. What is needed is not only an understanding of the "macro-level dimensions" of the relationships between energy and development, but also how their "material enactment" "in the spaces of everyday life" result in their assembly and dispersal (Cupples 2011: 941). By focusing on "different scales, networks…topologies" and the "links between global and local", poststructural approaches provide the required conceptual ideas to attend to the processes of everyday life in relation to energy and development projects (Gill 2010: 638).

Relationships of power

Bridge et al. (2013: 333) explain that the contexts in which energy and development projects are embedded and "the networked nature of the system itself produces geographies of connection, dependency and control". As the spatial context changes, the projects get embedded in different networks of control and connection. These geographies of dependency and control produce their own geographies of power and politics. Bouzarovski (2009a: 453) points out that the lack of research on how energy infrastructures are productive of space has resulted in a gap in the

[20] In Pfaff's case these connection relate to mobile phones.

understanding of how power is maintained and extended through energy projects. There is a need to look at the multiple spaces in which projects get embedded and which different projects create, and to compare them in order to understand how energy projects and development are constantly reshaped and contested (section 2.3.1). In the case of energy transitions, Eames and Miriam (2013: 60) explain that "uneven social and economic consequences" result from a lack of focus on issues of power and an overemphasis on the technocratic capacities and perspectives of the elite (see also Smith & Stirling 2010: 7-9). In addition to this, uneven power relations exist between communities and those who bring development interventions (Arora & Romijn 2009: 5).

Actors who plan development and energy interventions often start with a new technology or idea and believe that most of their work is done (Sovacool et al. 2011: 1539). However, this elitist perspective leads to an incompatibility between new technologies and the social and cultural contexts of their implementation (García & Bartolomé 2010: 305). Sovacool et al. (2011: 1533) argue that "cultural attitudes" can obstruct the wider adoption of low carbon energy. Shove and Walker (2014: 43) agree that "forms of social and cultural organization can…block technological innovation". Ignoring these often leads to resistance from people as has been noted in case of bioenergy projects in India where power play and "socio-political disagreements among local factions with competing interests" (different spaces of the same village) led to project failure (Romijn et al. 2010: 311).

Resistances

At the same time, focus needs to be put on resistances. In the case of electricity "new forms of connectivity (in a political and technical sense) and new kinds of everyday material practice" emerge in the face of power (Cupples 2011: 945). Similarly, Lawhon and Murphy (2011: 370) argue that "even when power inequalities are significant, consideration of resistance strategies is also essential" (see also Shove & Walker 2007: 765). With reference to sustainability transitions, Leach et al. (2007: 31) argue that rather than trying to include "marginalised" actors in the planning process, we must acknowledge their "counter-politics" through which resistances emerge.

There is a necessity to move beyond the elite perspectives and a "need for recognition of alternate cultural understandings (of risk), situated knowledges, and the ability of marginalised groups to be heard" (Bickerstaff et al. 2013: 5-6). This can come through more attention on "social, political-economic and material processes" in low carbon energy policies and infrastructures (Bickerstaff et al. 2013: 2). After all, expressions of power and resistances depend on the material as much as they depend on the social. As Scott (1985: 297) argues, "it is impossible…to divorce the material basis of the struggle from the struggle over values – the ideological struggle".

Therefore, with a focus on the "exchanges between things and people", an enquiry of power relationships between people, and between people and the 'experts', and the politics of resistance that these open up, becomes important (Arora & Romijn 2009: 30). In addition to this, it is important to understand the why and how of resistances that operate on the micro level, and the forms these resistances take in everyday life – sometimes cautious and routine and sometimes aggressive and violent (Scott 1985).

What emerges from the above discussion is the critical nature of, and current deficiency in, understanding:

1. How particular actors seek to assemble and govern low carbon assemblages in order to achieve specific outcomes.
2. How low carbon energy interventions work in order to achieve particular goals of development in different spaces of everyday life.
3. How and to what consequences everyday resistances emerge in low carbon energy transitions.

These are the three research questions that this thesis aims to answer. The rest of this chapter discusses some concepts and theoretical approaches that are useful in addressing these questions and are used in this thesis.

Two particular poststructural approaches – assemblage and governmentality – are adopted in this thesis. The further sections of this chapter explain the reasons for doing this and tease out elements of these two approaches that are useful for analysing and understanding energy and development projects.

2.3.1 Taking an assemblage approach

Assemblage theory is not a unified theory but a heterogeneous set of ideas (Legg 2011: 129). It can refer to the analytical lens of a scholar, to the perceptions or world view of a subject, or to the "form of an object" or a process of "becoming" (Marcus & Saka 2006: 102). Considering the theory itself as an "assemblage that operates as specific conceptual combinatories in addressing specific problems" (Venn 2006: 108), out of the various ideas around assemblage, the ones that are most useful for this research will be outlined here.

Day and Walker (2013: 26) argue that assemblage allows the examination of "an array of heterogeneous actors[21]", in "different spatial locations" and with "temporal rhythms", that more constrained theoretical approaches do not allow. Rather than taking "social structures and relations at face value", it focuses on the particular processes and histories through which they have been formed(Harrison & Popke 2011: 950; see also Dewsbury 2011). The attention to heterogeneity of actors, social structures, their spatiality and temporality and the histories that shape them, make an assemblage approach useful in enquiring the issues of historically embedded power and politics that operate in the everyday life of people.

By consistently attending to the agencies of both individual actors and the whole assemblage where both entities and their agencies "can change over time and

[21] In the case of Day and Walker (2013) these actors relate to energy vulnerability

through interactions” (McFarlane 2011a: 25), assemblage thinking allows for registering “diversity of situations” and at the same time “revels commonalities” of trajectories, influences, definitions and approaches (Day & Walker 2013: 26). This brings to attention the “heterogeneous character” of social structures and relations “as well as the cultural attitudes that shape their use” (Harrison & Popke 2011: 950). This can help attend to the similarities and differences that exist but also consequently develop in people’s interactions with energy and development projects. It can reveal how different energy trajectories, originating from diverse cultural contexts, can meet or diverge, to shape successes and failures for energy and development projects in different spaces of everyday life.

The focus of assemblage is less on the resultant structure and more on its formation, deformation and reformation (Anderson & McFarlane 2011: 125)which makes it useful in understanding the dynamism of energy and development. Assemblage approaches help put attention on the “performative work in progress that involves multiple and situated forms of improvisation, provisionality, and contingency” (Cupples 2011: 940). This can help understand how and why some energy interaction may be transitory and others more stable (Day & Walker 2013: 27). Through this assemblage can foster attentiveness to the diversity and dynamism that ‘energy access’ signifies (chapter 1).

The focus of assemblage on the transitory has however been found problematic. Marcus and Saka (2006: 102) argue that assemblage “offers an odd, irregular, time-limited object for contemplation” and creates “certain tension, balancing, and tentativeness” due to the “contradictions between the ephemeral and the structural”. However, situations, relationships and projects in real life are often at the same time ephemeral and stable. They form in one place while also being deformed in another and reformed in yet another. At the same time, more long-term impacts are often left behind as projects go through the process of deformation in one place and reformation another. Looking at these different situations may be uncomfortable, yet a necessary analytical balance to make. Harrison and Popke (2011: 950) maintain that energy (poverty) can be seen as a "geographical assemblage" of relationships, flows, infrastructures, properties and socio-economic networks. Taking this kind of relational approach can help develop critiques of the ways in which, and reasons for which, various material and non-material entities are brought together in "very particular ways and not in others" (Harrison & Popke 2011: 950). By paying attention to performative, provisional and contingent relationalities, the assemblage approach can help bring to research on energy the much needed messiness of the real world (see also Dewsbury 2011).

Although assemblage approach has been criticised for not being able to comprehensively understand and explain inequalities of power and ways to overcome them (Day & Walker 2013: 19),McFarlane (2011a: 27) brings to attention key actors and unequal relations of power in assemblages (explained in the next section). These actors and relationships are critical, and lead to an interaction between assemblage and governmentality approaches in this thesis. Here "government" refers not only "to political structures or to the management of the states; rather, it designates the way in which the conduct of individuals or of groups might be directed" (Foucault 1994: 340).This interaction puts more focus on relationships of power and the inequalities generated by them.

Brenner et al. (2011: 233) contest that assemblage approaches reject structural approaches[22] and "deprive themselves of a key explanatory tool for understanding the sociospatial, political–economic and institutional contexts in which (urban) spaces and locally embedded social forces are positioned". However, Cupples (2011: 941 with reference ot Zimmerer 2011) reasons that these can "reveal how neoliberalism and the global political economy are constructed in the spaces of everyday life". In this thesis, an assemblage approach helps reveal how development and politics are constructed in the spaces of everyday life. Rather than ignoring "the political–economic structures and institutions in which they are embedded" (Brenner et al. 2011: 234), assemblagescan help understandthe lived experiences of

[22] Additionally, section 2.2.2 argues with reference to assemblage approach that Gidwani (2008) has gone beyond the binary of structural and non-structural.

energy and development as those arising “from the ways in which nature, technology, cultural norms, and the individual biographies of households”are“drawn together into particular networked configurations” (Harrison & Popke 2011: 950).

Rather than beginning from scratch or “from a single source”, development and energy projects are often “formed through an assemblage of objectives, knowledges, techniques, and practices of diverse provenance” (Li 2005: 386). The focus of heterogeneity and consistency, appearance and dispersal, instability and momentary stability (Anderson & McFarlane 2011: 124-125; McFarlane 2009: 562) and “the shape shifts according to the terrain and the angle of vision” (Li 2007b: 265) gives an opportunity to see energy and development in action. Further, Bennett (2005: 461) argues that an assemblage has “the mood or style[23] of an open whole where both membership changes over time and the members themselves undergo internal alteration”, pointing to the constant ‘action’ through which we need to understand energy and development in people’s everyday lives. Following from these, since an assemblage approach is “alert to compositional alignment and realignment” (McFarlane 2011a: 24 refering to Phillips 2006), looking at the low carbon energy projects as low carbon energy assemblages will help understand the work that energy projects and development do in “assembling and disassembling” and reassembling each other on an everyday basis(Anderson & McFarlane 2011: 125).

McFarlane (2009: 562) points to the “labour” required for assembling, which McCann (2011: 144) explains as “a purposive gathering of people, institutional capacities, expertise, models, techniques and technologies, political sustenance, etc. from local sources and, crucially, from elsewhere”. This *labour* will be the focus of discussion the next section.

[23] Bennett uses the term *shi* from the Chinese tradition for this mood or style. She explains – “Shi is the style, energy, propensity, trajectory, or élan inherent to a specific arrangement of things” (Bennett 2005: 461)

2.3.2 Assembling and governing

Assembling involves politics which relates to the “choices about how the assembled parts will cohere” which are “negotiated, struggled over, made” and then renegotiated (McCann 2011: 144-145). Although Bennett (2010: 24) argues that “assemblages are not governed by any central head”, there are “unequal relations of power, resources and knowledge” through which assemblages can be “captured, structured, and storied more effectively and with greater influence by particular actors or processes than by others” (McFarlane 2011c: 655). McFarlane (2011a: 27) argues that “assemblages can be made singular through the action of particularly powerful agendas or groups”. This is done by prioritising “certain parts and certain relationships among parts of an assemblage” whichMcCann (2011: 144) refers to as the “politics of assemblage”. He gives an example of “clearly identifiable models” of harm reduction policy which are associated with particular cities that exemplify replicable practices. Following McFarlane (2011a: 27), it could be argued that the components and actors of such models, due to their “power, resource and knowledge” are the “particular actors”, “powerful agendas or groups” involved in sociospatially structuring, hierarchalising and narrativising the low carbon assemblages. But how do we understand and categorise these particular ‘key actors[24]’ who can capture and structure – assemble – the low carbon energy assemblages?

2.3.2.1 Trusteeship and forging alignments

Li (2007b: 265) identifies six practices for assemblages from the study of government. The practices relate to how development projects are formed and governed, how they unravel on the ground and how resistances are contained and the projects reformed. This thesis engages with these practices in various chapters.

[24] The idea of key actors also comes from Latour (2005: 31-32) who argues that groups (which are contingent and need the constant labour of defining and redefining) need “‘spokespersons’ who ‘speak for’ the group existence” or a “recruiting officer”. He puts these “spokespersons” or “recruiting officers” in ‘key actor’ positions of power by comparing them to a shepherd and his flock of sheep.

In table 2-1, the various practices have been briefly explained and their connections to various chapters are indicated.

Table 2-1: Six practices of assemblage (Li 2007b).

Sl. No.	Practice	As explained by Li 2007b	Chapters
1.	**Forging alignments**	The work of linking together the objectives of the various parties to an assemblage, both those who aspire to govern conduct and those whose conduct is to be conducted.	2, 5
2.	**Rendering technical**	Extracting from the messiness of the social world…a set of relations that can be formulated as a diagram in which problem (a) plus intervention (b) will produce (c), a beneficial result.	2, 5
3.	**Authorizing knowledge**	Specifying the requisite body of knowledge; confirming enabling assumptions.	2, 5
4.	**Managing failures and contradictions**	Presenting failure as the outcome of rectifiable deficiencies; smoothing out contradictions so that they seem superficial rather than fundamental.	7
5.	**Anti-politics**	Reposing political questions as matters of technique.	2, 5
6.	**Reassembling**	Grafting on new elements and reworking old ones.	7

The first practice, "forging alignments", related to the labour of assembling, is the "the work of linking together the objectives of the various parties to an assemblage, both those who aspire to govern conduct and those whose conduct is to be conducted" (Li 2007b: 265). Due to their power, resource and knowledge, the 'key actors' who carry out the labour of assembling low carbon energy assemblages do so due to their "will to improve" people's lives (Li 2007c). Due to the power, resources and knowledge at their disposition and through their "will to improve", they place themselves as "trustees" of people – for their development and energy access – "a position defined by the claim to know how others should live, to know what is best for them, to know what they need" (Li 2007c: 4). Li (2007c: 4) explains trusteeship as "the intent which is expressed, by one source of agency, to develop the capacities of another". This emerges from Cowen and Shenton's (1996: 23) explanation of Saint Simonians[25]' arguments "for property to be placed in the hands of 'trustees' who would be chosen on the basis of their *'capacity' to decide* where and how society's resources should be invested" (emphasis added). The 'capacity to decide' which emerges from their power, resources and knowledge also becomes the reason to structure assemblages with particular purposes and with particular motives. The second practice of assemblage that Li (2007b: 265) identifies is "rendering technical" which relates to simplifying problems and interventions that will lead to beneficial results. The capacity to do this "confirms expertise and constitutes the boundary between those who are positioned as trustees, with the capacity to diagnose deficiencies in others, and those who are subject to expert direction" (Li 2007c: 7). But how do trustees assemble the low carbon assemblage? An important step in this is assigning or prioritising significances.

What is best for people is subjective and dictates what electricity signifies to them. Significance is important because it helps bring together (assemble) actors for whom electricity signifies the same things, but also take actors apart (resistance) for whom electricity signifies different things.

Significances

Significances are the various interpretations that people make, and understandings that they develop, of various material and non-material entities that they interact with. Through its

[25] The followers of the French political and economic theorist Henri de Saint-Simon.

significance, an entity comes to represent something else. In the case of this thesis, significance is about what electricity 'means' for different actors, the "practical conditions" that electricity comes to signify and represent (Legg 2007: 13).

Trustees with their "capacities to decide" (Cowen & Shenton 1996: 23) devise their own definitions of electricity access and create their own "specific targets" (Legg 2007: 9) prioritising services, outcomes, and inadvertently (often advertently) people. Specific ideas of education, commerce, health and environment (chapters 1 and 6) motivate them. After all, "to govern….is to seek not one dogmatic goal" (Li 2007c: 9), rather "a whole series of specific finalities" (Foucault 1991a: 95). These "specific targets" and "specific finalities" – education, commerce, health and environment – are the 'significances' of electricity that the trustees prioritise (Legg 2007; Foucault 1991a; Li 2007c). Due to these specific significances, the low carbon assemblages come to focus on specific electricity services – in this case light. They see electric lights as creating better conditions for studying, helping commercial activities continue for longer durations in the evening, eliminating kerosene lamps to create a better and healthier indoor environment, and reducing fossil fuel use and greenhouse gas emissions. As Verbeek and Kockelkoren (1998: 31) argue, what electricity does, is not concerned with "products (electricity) *themselves* but…the *ideas* they embody".

Giving particular significances of electricity priority is also to "express in one's own language what others say and want…it is to establish oneself as a spokesman" (Callon 1986: 18-19). The energy trustees, by claiming trusteeship, establish themselves as the spokespersons and express the significances of electricity, on behalf of the people. After all, the whole idea behind trusteeship is to know what is good for people and direct them accordingly (section 2.3.3). These significances are "considered as the interest of the population regardless of what the particular interests and aspirations may be of the individuals who compose it" (Foucault 1991a: 100). By prioritising these particular significances of electricity, the trustees attempt to connect to particular discourses of sustainable development (see introduction) and "forge alignments" with other actors (Li 2007b: 280; see also Rose 1999: 48).

These significances form a part of the 'script' created for low carbon assemblages. Verbeek and Kockelkoren (1998: 34 refering to Akrich 1992) explain a 'script' as "the deposit in an object of the world-view of designers" including definitions of users – "in terms of their taste, competence, motives, aspirations, and political prejudices". These definitions are embedded in the objects (Verbeek & Kockelkoren 1998). In this thesis, the object is replaced by an assemblage formed of several objects, people and relationships. Here, the designers are the trustees who choose the formation in which the actors will come together and the script that *theywill follow*(McCann 2011: 144). These scripts, as Gidwani (2008: 129) argues, "summon particular sorts of 'conducts' from human and nonhuman actors". However, significances also allow the existence of different possibilities in the low carbon assemblages (see also McFarlane 2011c: 659). As energy and development projects "move between contexts of conception and design, to contexts of use, consumption or display", different people associate "different meanings and values" to their electricity (Cross 2013: 5). Significances vary and consequently resistances to particular significances emerge. Significances help forge alignments but also fracture them (section 2.3.3.1).

Plurality of trustees and chain of trusteeship

Before moving on, it is also important to look carefully at the "boundary" (Li 2007c: 7) or the "line of fracture" that Li (2007b: 269) sees between the trustees and the people. This boundary or line makes the trustees seem like a singular entity, a monolith, which is distinctive from 'the people'. However, Bebbington (2010: 230) warns against this kind of analysis and argues that trustees, programmers and experts are not always "one of a kind, and aligned with the institutional goals". Those who have studied the Indian state have often argued that the 'command' from the top and the 'demand' from the bottom invariably flows through a number of intermediaries, many of whom are part of the state machinery and many beyond it(see Corbridge et al. 2005; Khilnani 2004; Chatterjee 2004). These include intermediate and lower level state officials and community leaders and brokers. These intermediaries are embedded in the milieu of the everyday life which consists of relationships and subjectivities of religion, caste, class, gender etc. and their actions often result from a combination of the ethos of programmes they seek to implement and the ethos of their social relationships(see Corbridge et al. 2005; Khilnani 2004; Chatterjee 2004).

Li (2007a: 276)argues for plural intentions or wills and adopts the notion of assemblage because it helps "recognize the range of parties involved in attempts to regulate". She does this with an intention of focusing the analysis on actors beyond the state that attempt to govern.

However, within this assemblage several actors with different goals and objectives come together with aims to improve conditions and govern conducts. Drawing from studies on Indian state and this thesis, there are two key points to note about these actors:

First, there is a need to move from thinking about trusteeship and trustees in one project or programme as being singular. What is present is a plurality of trustees. These different trustees come together because they share the "will to improve" but they also have variedidentities, aims, goals and expectations. Electricity often signifies different things for these different trustees. Many of these actors are trusteesand subjects at the same time (see section 5.4).

Second, it is essential to examine the relationships between the different positions of the trustees, those based on "geographical location (margins or centres), social standing (dominant or subaltern), and political stance (acquiescent or resistant)"(Li 2005: 385). These different positions bring to light the plurality of trustees and trusteeship but they also indicate a chain of trustees. As various actors join the trusteeship, key trustees who inhabit the centre of the assemblage put in place a chain for the flow of knowledges and materials (see section 5.3.2). In this chain of trusteeship, different trustees have different levels of power and control depending on their location, social standing and political stance.

2.3.2.2 Making the assemblage governmental

The first out of Li's (2007b: 265) six practices of assemblage, forging, is not just an act of labour – labour to assemble – but also an act of governance – to conduct the conduct of actors in the assemblage (Legg 2011: 131). The "will to improve" – energy and development in this case – does not only involve assembling low carbon assemblages which will provide energy, but also governing these assemblages so that people make 'proper' use of energy. Trustees have their own ideas of energy access and the linkages between energy and development.They draw on these to structure the assemblage and control, conduct and direct people towards these ideas for the upkeep of the assemblage. For the "welfare of the population[26]", not the "interests and

[26] The welfare of population, according to Foucault (1991a: 100)includes the improvement of its conditions, the increase of its wealth, longivity, health etc.

aspirations…of the individuals who compose it" (Foucault 1991a: 100), trustees "aim to foster beneficial processes and mitigate destructive ones" (Li 2007c: 6).

Within the assemblage of materials, people and ideas meant for low carbon energy access to improve people's lives, the trustees also create and embed a dispositif. A dispositif is formed of "diverse elements with a particular purpose, specific targets, and controlling strategies" with an aim to foster appropriate conduct(Legg 2007: 9; see also Rose 1999: 52). Although, the differences (Anderson & McFarlane 2011; McFarlane 2011c) and similarities (Li 2007a; Legg 2011) between dispositif and assemblage with reference to *what they are* have been widely discussed, in this thesis, the purpose behind engaging with both terms is less to do with what they are than *what they do*.

Li (2007b: 280) explains in the fifth practice of assemblage, anti-politics: keeping the assemblage governmental, that "if communities were perfectly responsible they could be autonomous" and the trustees "would have no techno-scientific rationale" for their existence. Recognition of the deficiencies of the communities enables trustees "retain their customary role as the party that produces policies, plans and regulations, prescribing and enforcing the proper relations" in the assemblage (Li 2007b: 280). Thus, "governmental ethos of improvement backed by coercive conditionalities" is what enables trustees "to position themselves within the…assemblage" (Li 2007b: 279-280). Following this, the next section will argue that, what dispositifs *do* is add the "coercive conditionalities" that back the "ethos of improvement" of the assemblage. Since, communities themselves are not responsible; trustees feel that their conduct needs to be conducted. Dispositifs contain the regulations that foster "proper relations" (Li 2007b: 279-280).

Technologies of conduct

Forging an assemblage as part of the "will to improve" is also about governing by the trustees (Li 2007b: 265). The focus on governing comes clearly in the concept apparatus.Legg (2011: 130 with reference to Agamben 1998) argues that apparatuses are the "mechanisms through which living beings become subjects". Legg (2011; 2007) and Li (2014b; 2007c) use assemblages and dispositifs in developing country contexts and see similarities between them[27]. However, there is a need to distinguish between them, because in the case of energy and development projects, an assemblage formed due to a "will to improve" has a dispositif with a central governing power – the trustees – embedded within it for the purposes of governing the conduct of people.

While assemblage, in this thesis, is used to denote projects that aim to bring electricity to people, dispositif is used to denote the particular "tools and devices", controlling tactics and "heterogeneous elements" deployed to produce "a machinic contraption whose purpose in this case is control and management" of the people, and the specific aims, objectives and targets of the low carbon projects (Rabinow & Rose 2003: 10-11). Dean (2010: 30) argues that "rather than replacing discipline or sovereignty, the modern art of government recasts them within this *concern for the population* and its optimization (in terms of wealth, health, happiness, prosperity, efficiency), and the *forms of knowledge and technical means* appropriate to it" (emphasis added). Assemblages accommodate the governmental *concern for the population,* and dispositifs within them, accommodate the *forms of knowledge and technical means* used to achieve these concerns. Although, in reality, the improvement of conditions and improvement of conduct are intertwined, here, they are separated using assemblage and dispositif for analytical clarity. Dispositifs are concerned with the regulation of circulation within the assemblages (here circulation of energy and of money in return) i.e. "freeing of circulation and the unblocking of log-jams" and the "problem of differentiating good circulation from bad circulation"(Dillon 2015: 58-59). They are used to stabilise, operationalise and securitise the low carbon energy assemblages.

Since an assemblage formed as a result of the will to improve "carries within it a will to govern"[28](Li 2007b: 267), in the case of the low carbon energy projects, dispositifs and assemblages emerge as "part of each other" and "operate in a dialectical sense in practice" (Legg 2011: 129-131). They together, but also due to resistances, produce effects that may be different from the initial intentions.

---

[27] Legg discusses the distinctions and similarities in details while Li uses them interchangeably.
[28] Elsewhere, Li (2007a) equates the will to improve to the will to govern.

Li (2007c: 5) argues that "the objective of trusteeship is not to dominate others – it is to enhance their capacities for action, and to direct it". The purpose of government is "not the act of government itself, but the welfare of the population, the improvement of its conditions" (Foucault 1991a: 100). Although, the objective of the trustees is not domination, through their claims of expertise, they end up attempting to claim power over others (Li 2007c: 5). Foucault (1991b: 80) argues that governing involves various strategies that may be in conflict, but may still coincide and work as a collective. They produce "effects which can perfectly well be understood in terms of their rationality, even though they don't conform to the initial programming"(Foucault 1991b: 81). Since, both the trustees and the subjects are heterogeneous, there are heterogeneous "practices of government"(Dillon 2015: 85).

These practices, are deployed as "changes of the mode, moods and moments", "rather than succession or substitution of power relations" (Legg 2007: 3). After all, although government is not about imposing laws (Foucault 1991a: 95), Li (2007c: 16) argues that "law as a tactic to govern conduct is effective only because it is backed by the threat of punishment". While apparatuses of security aim to foster freedom, they also attempt to regulate the "non-self-regulating individuals**"** (Legg 2007: 11).Thus, dispositif signifies the different strategies and specific technologies of power – governmental, disciplinary and punitive, in this thesis – used to conduct others conduct so that the trustees can maintain their claims of power over others.

Further, as part of the dispositif of energy assemblages, standardisation of mentalities are expected and attempted to match the standardisation of materialities (section 2.3.3). People are expected to 'conduct themselves' in the 'ideal' manner so that "people, following only their own self-interest, *will do as they ought*" (Scott 1995: 202 reffering to Bentham 1988). However, people do not always behave as "*they ought"*. After all, "the notion of government as the 'conduct of conduct' presupposes the primary freedom of those who are governed entailed in the capacities of acting and thinking" (Dean 2010: 24). "Things never work out as planned" (Foucault 1991b: 80) as the freedom of thinking and acting of the governed often lead to resistances. Section 2.3.3 discusses resistances and the reasons for their emergence in low carbon energy assemblages in more detail.

2.3.3 Resistances

Li (2005: 386) explains that an assemblage is "always subject to contestation and reformulation by a range of pressures and forces it cannot contain". Resistance is one such pressure. Scott (1998: 49) argues that "we must keep in mind not only the capacities of state simplifications to transform the world but also the capacity of the society to modify, subvert, block, and even overturn". It is the "line of fracture" between the trustees and the people – "the line drawn by the will to govern supplemented by the capacity to coerce", the same line that enables trustees to assemble – that "threatens the assemblage" (Li 2007b: 269). Based on this distinction between the trustees and the people, governmental "practices position people as subjects with variable capacities for action and critiques" (Li 2005: 385). These capacities enable people to "responds to multiple fields of power" and resist them (Li 2005: 385; see also Legg 2007: 5). An understanding of relationships of power can emerge from investigations into "the forms of resistance and attempts made to dissociate these relations" (Foucault 1994: 329).

Foucault (1994: 342) argues that "power is exercised only over free subjects". By free subjects he(1994: 342) means people for whom "several kinds of conduct, several ways of reacting and modes of behaviour are available" are possible. Power and freedom are not exactly antagonistic; they have a "more complicated interplay" (Foucault 1994: 342). As Li (2007c: 17) argues, to govern is "to act on the actions of subjects who retain the capacity to act otherwise". Freedom then, as Foucault explains, is a "precondition" but also a sustained condition for the exercise of power.

Foucault (1994: 347)argues for a "reciprocal appeal, a perpetual linking and a perpetual reversal" between "strategy of struggle" and "relationships of power". Following Foucault, Li (2007c: 11) argues that "the unsettled meaning of the terms *politics* and *the political* hinges on this element of linking and reversal". "Strategies for struggle" or "forms of resistance" then become critical for the analysis of politics and power (Li 2007c; Foucault 1994). The importance of resistance in understanding the exercise of power is clear but the critical question of why resistances emerge, remains.

Li (2005: 384) argues that experts "define *what counts* as development and *how it can be achieved*" (emphasis added). Following Li, this thesis argues that there are two sources of resistances in the low carbon energy assemblages. The first source of resistance is the conflicting significances of electricity – resistance and power play by various actors to legitimise their definitions i.e. to legitimise "what counts". The second source is the resistance to the conduct of conduct attempted by trustees through the dispositifs i.e. "how it can be achieved". These two sources of resistance are discussed in sections 2.3.3.1 and 2.3.3.2.

2.3.3.1 Conflicting significances: the first source of resistance

To understand why resistances emerge, it is important to understand the ways in which assemblage sometimes accommodates, and at other times does not accommodate, the possibilities that may not be a part of its script (McFarlane 2011c: 658). These possibilities are the things that electricity signifies for some people, but not for trustees.

Significance implies "both similarities and differences" (Law 2006: 3 referring to Akrich's 1992, 1993)[29]. Law explains Akrich's example – Swedish briquetting machine – as remaining 'the same' even when it was transferred to Nicaragua but also different as it went under changes to fit in the new contexts (see also de Laet & Mol 2000). In a similar fashion, electricity from the low carbon energy assemblages, in different contexts, signifies different things to different actors. In other words, electricity 'means' different things to them. These meanings are often different from, and incompatible to, what electricity signifies to the trustees. Li (2007c: 9) argues that the "diverse 'finalities' (that emerge from low carbon energy assemblages) may be incompatible" resulting in tensions and contradictions in the interventions.

The specific targets do not always result in 'expected outcomes' as resistances emerge due to conflicting significances of various actors. Rather than electricity signifying education, commerce, or health, to some people, it signifies entertainment and consequently a requirement to charge mobile phones or operate television sets (Section 7.2). These are the "possibilities" that the low carbon assemblage may or may not accommodate (McFarlane

[29] He does so with reference to the transfer of technology from one context to another. This happens in the case of low carbon energy assemblages too as trustees develop 'models' (chapter 5) and transfer them from one context to another.

2011c: 658). If these possibilities are not accommodated[30], people either resist by not participating in the assemblage or negotiate and struggle to accommodate them (see McCann 2011: 144). Both these processes result in disruptions in the low carbon assemblages (empirical 3) and often raise the need for further "control and management" (Rabinow & Rose 2003: 10-11).

2.3.3.2 Resisting the conduct of conduct: the second source of resistance

Legg (2007: 12) argues that "government predominates, but does not decimate, previous types of power relations". To understand this second form of resistance, it is important to invoke another apparatus at work – one formed historically, socially and culturally. McFarlane (2011a: 27) argues for a focus on "how forms of power, rationality and intelligibility enclose (urban) assemblages". Bennett (2005: 455) explains that "the active power of assemblages is concealed under the rubric of (social) structures, (cultural) contexts, (religious) settings, (economic) climates, or (environmental) conditions—terms which denote…states of affairs whose sole power is…one of constraint or resistance". Following McFarlane and Bennett, this thesis argues that, as the low carbon energy assemblages get embedded in the socio-cultural landscape of a village, they also come in contact with the trustees of everyday life, who have historically, socially and culturally built their trusteeship on the basis of gender, age, caste and class (section 5.4). If a lower caste man attempts to enter the house of a higher caste man to check for 'unauthorised' uses of electricity, there is resistance (section 7.3.1). These trustees at times contest for, and at times share power with the trustees of the low carbon assemblages, giving rise to new forms of resistances.

In addition to this, due to their free will, people interact with the low carbon assemblages "in a variety of ways, and sometimes in ways not foreseen" (Dean 2010: 21-22). People often resist techniques of control and conduct that are part of the dispositif so that they are not bound by the trustees' significances, but rather, are able to use electricity in their own ways. Also, as a standardised low carbon assemblage, with standard techniques of government, moves from one place to another, one village to another, it faces new conducts and counter conducts. As

[30] Since these significances are not prioritised by the trustees and form a part of the 'script' of the low carbon assemblages, they become 'unauthorised' or 'improper' for the trustees.

Legg (2007: 16) argues, “places problematise the operation of apparatuses; they have a tendency to bleed, become infected, break, leak, collapse and also to foster innovation and conspiratorial spaces of counter-conduct or outright resistance”.

However, unauthorised significances, their control and conduct, and the consequent resistances, result in a vicious cycle which often disrupts the low carbon assemblages. They cause “gaps between plans, claims, and ‘facts on the ground’” and “compromise the authority” of trustees and their “ability to exert control” (Li 2005: 390). Resistances, in addition to their own deficiencies, compromise the ‘claims of improvement’ of the low carbon assemblages and lead to further resistances. As Li (2007c: 2) argues, “when processes of class formation, the damaging effects of improvement programmes, and the failures of experts to deliver on their promises coincide – mobilisation is apt to follow”.

Resistances do not result from the actions of the social only. They result from the socio-material interactions. Therefore, understanding the materiality of the parts and the socio-material organisations of the low carbon assemblages is important. It is also important to understand how these materialities prevent and foster resistances, how they demand repair and lead to disrepair. The next section discusses why the materialities of the low carbon assemblages matter.

2.3.4 Materiality of control and resistance

Foucault (1994: 344) argues for a focus on both, the material and the non-material when analysing power relations. Drawing on Li (2007c; 2007b), Bulkeley and Castán Broto (2013: 363) argue that “interventions (as part of the will to improve) matter in both a social and a material sense…through which particular forms of governing assemblage are established and maintained within an (urban) milieu”. They (2013: 367) emphasise “an explicit understanding of governing as accomplished in material, practical terms”. Since the low carbon energy assemblages are an “ad hoc groupings of diverse elements, of vibrant materials of all sorts” (Bennett 2010: 23), understanding the materiality of assembling, deassembling and reassembling becomes very important.

Fragility, repair and disrepair

Lovell et al. (2009: 94) argue that the materiality of transitions is specifically important in the case of policy issues like energy provision as they are “dominated by a geographically widespread, capital-intensive, *durable infrastructure*, comprising a complex system of energy generation, transmission, and distribution” (emphasis added). Durable infrastructures that remain in the background, “tend(s) to become visible upon breakdown” and “manifest when they cease to function or when the flows sustained by them are interrupted” (Graham & Thrift 2007: 8). However, in this thesis, the material infrastructure is often fragile[31] and hence, always visible and in the foreground. Fragility is not extraordinary here.It is an everyday reality. It demands repair and upkeep, and when fragility is an everyday reality, “repair and maintenance are not incidental activities” (Graham & Thrift 2007: 19), they are also everyday. Materiality, in this thesis, relates to the inherently fragile characteristics of individual material parts of the low carbon assemblages – a solar lantern or a micro-grid transmission line.

Focusing on fragility,Graham & Thrift (2007: 7) argue that the analysis of infrastructures needs to move beyond “connection and assembly” to “disconnection and disassembly” as they “resist entities’ means of enacting themselves: failure is key”. The focus needs to be on the “*politics* of repair and maintenance” where often materials are assembled in such a way that “the possibilities of maintenance and repair are foreclosed” for some, and are open for others (Graham & Thrift 2007: 17-18). Different levels of ‘experts’ are authorised to conduct maintenance and repairs for different levels of disruptions (sections 5.3.2). In the third practice of assemblage, “authorising knowledge”[32], Li (2007b: 265-276) explains that the experts feel that “training and appropriate regulatory frameworks” for people but also “sanctions” are the “enabling conditions” for the upkeep of the assemblages. By “specifying the requisite body of

[31] The wires of central grid in the villages often breakdown, transformers short-circuit; kerosene needs to be moved from one container to another every day and lighted in glass bottles; the switches, LEDs and cases of solar lanterns breakdown often; the micro-grid distribution wires run on bamboo stick which often fall in windy conditions and electricity overuse people often causes overloading and shutdown.

[32] Li (2007b: 265-276) explains "authorising knowledge" with reference to scholars of forest management who advocate community forest management by “specifying the requisite body of knowledge” through research at a few successful sites and contain critique by producing counter critique of the state. However, they end up confirming the “enabling conditions” for the state to control and conduct the communities. In this thesis, this chain has been interpreted slightly differently.

knowledge" and maintaining control over it, 'key' trustees legitimise and delegitimise other experts and authorise them to conduct some repairs and un-authorise to conduct others (Li 2007b: 265). Some repairs are conducted and due to the blocking of others, disrepair becomes the order of the day, which lead to inequalities of access and 'unauthorised' conduct (see Mcfarlane 2010). However, this is considered legitimate because it contributes to the stabilisation and securitisation of the low carbon assemblages for the experts.

Understanding the politics of the low carbon assemblages also requires an understanding of how their socio-material organisation fosters political possibilities. It creates "choke points" (Mitchell 2009: 404) which become points of contention, sources of disruption, disrepair, deassembling, reassembling and often failure. This thesis particularly focuses on the materiality of disassembly and resistance i.e., how the materiality of certain parts and the socio-material organisation of the assemblage create 'choke points'. In addition to being used as techniques of control, these give opportunities for politics, resistance and counter conduct to the people and create conditions of repair, disrepair and failure.

'Choke points'

Mitchell (2009: 403) explains the political power gained because of the "extraordinary concentrations of carbon" and the particular patterns of flows, due to a move from bio energy to coal. By invoking concentrations and flows, which could be controlled in various ways, Mitchell essentially refers to materiality. This new materiality was not just a source of power for the trustees of this energy – the state and the capital – but also of resistance by people (Mitchell 2009: 404). The move to oil helped avoid the resistances, as now there were "more than one possible paths and the flow of energy could (can) switch to avoid blockages or overcome breakdowns" (Mitchell 2009: 404).

The difference in materiality and the socio-material organisations of the two energy sources – coal and oil – is applicable to the low carbon energy assemblages under consideration in this thesis. Solar lanterns have a different materiality which allows a different flow of electricity compared to the micro-grid. They also have different levels of contacts and interactions between different actors, which give different actors different levels of power over different parts of the assemblages. Some of these parts are "choke points". Through 'choke points' “disciplinary” and “regulatory” mechanisms are used to control and conduct people and their electricity use (Legg 2007: 8).

However, “power is a loose and changing” entity (Dean 2010: 40) and is “unstable and reversible” (Legg 2007: 2). While materiality and the politics of repair and disrepair around it work as expressions of elite power and create inequalities of access, the different socio-material organisation of the energy assemblages, as Mitchell (2009: 401) argues, also provides an opportunity of struggle. The‘choke points’also produce “possibilities for…conditions…to be contested, imagined differently and altered” (McFarlane 2011b: 376).

2.4 Conclusions

This chapter has explained the different concepts useful for developing an analytical framework for this thesis. The key idea behind this research is an exploration of the micro-politics of energy access through tracing power, politics, and resistance in the activities of the elite (trustees), the activities of people, and the socio-material configurations of the low carbon assemblages.

The chapter outlined four key terms – trusteeship, assemblage, dispositif, and significances – that the empirical chapters of the thesis will engage with. Table 2-2 summarises these terms, their empirical understandings, and the chapters that they feature in. In the empirical chapters, the idea of trusteeship will be used to explain how certain organisations and individuals, motivated by the ‘will to improve’, position themselves as trustees for energy access (chapter 5). Based on their own understanding of what energy is and should be used for, what the significances of energy are for them (chapter 6), they design, set up, and run low carbon energy projects i.e. assemble the socio-material low carbon energy assemblages (chapter 5). However, trusteeship, motivated by the will to improve, also contains within it a will to govern. Trustees also assemble a dispositif, as part of the low carbon assemblage, to conduct people’s conducts (chapters 5 and 7).

Four key arguments resulting from this chapter will be used to analyse the empirical chapters. Firstly, assemblage theory provides tools suited for understanding and analysing the messiness of everyday life. In this thesis, low carbon projects are seen as low carbon assemblages because they often develop from pre-exiting ideas, people and materials (chapter 5). They are never fully formed and constantly recruit new ideas, people, and materials. They get deformed and reformed as some entities leave and others join, but never completely break down.

Secondly, what electricity signifies matters. Depending on the space and context, the same significances do not work for different groups of people and electricity signifies different things to different people (chapters 6 and 7). This helps understand how low carbon energy interventions achieve or do not achieve particular goals of development in different spaces of everyday life (chapter 6). Significances help bring actors for whom electricity signifies the same things together and actors for whom it signifies different things apart. They help forge alignments (chapter 5), but also fracture them (chapter 7).

Thirdly, although assemblages are not controlled by singular actors, there are unequal relationships of power. Governmentality studies have been useful in understanding these unequal power relations. Particular actors (trustees in this thesis) are able to structure the low carbon assemblages due to the power derived from the knowledge and resources available to them (chapter 5). The trustees prioritise the significances of electricity that are more important for them and establish themselves as spokespersons of the people. By prioritising these significances, they connect to particular discourses which help forge alignments with other actors (chapter 5).

Finally, to maintain the power relations, stabilise the assemblages and operationalise their significances of electricity, albeit temporarily, trustees use particular techniques of control, which constitute dispositifs within the assemblages (chapter 5). However, as the low carbon assemblages move from one place to another, they interact with different spaces and different contexts. This problematises the significances that trustees prioritise and results in resistances to and within the low carbon assemblages (chapter 7). As trustees try to control people, there are also resistances against technologies of control. The resistances lead to disruptions in the low carbon assemblages and their dispositifs (chapter 7). The momentary stabilisation, in which the low carbon assemblages face resistances, leads to the reassembling of the assemblage and dispositif, so that trustees can re-secure their power.

Rather than getting generated from or being generative of any particular process, power, politics and culture pervade all these processes. This is a continuous process, as Allen (2011:

155) argues – “each assembled heterogeneous mix of power is constructed through its relationships and interactions, and as those interactions change so, potentially, do the actors and materials in the arrangement”.

Table 2-2: Key theoretical terms used in this thesis.

Terms	Theoretical explanations	Empirical explanation / use in the thesis	Chapters
Trustees	Key actors, driven by the 'will to improve', who assemble and govern the low carbon assemblages.	Organisations and individuals who design, set up and run the low carbon energy projects.	5, 6, 7
Significance	What electricity signifies for the trustees and for the people.	The claims of improvement that trustees make i.e. better education, livelihood, health and environment The possibilities, like entertainment that people see from electricity.	5, 6,7
Assemblage	A socio-material formation emerging as part of the 'will to improve' people's conditions.	Energy projects set up to provide access to those who lack access.	5, 6, 7
Dispositif	A socio-material formation emerging as part of the 'will to govern' people's conducts.	Technologies (material and social) for controlling 'unauthorised' and 'improper' use of energy.	5, 7

3 Spaces and Places of the Research

3.1 Introduction

This chapter introduces the location of the research and its cultural context. It introduces Bihar, the state where the fieldwork was conducted and the five case study villages. It also provides a brief history of electrification of each village through some key events (section 3.2).

The chapter presents and discusses background material useful in explaining some of the socio-cultural aspects of village life that chapters 5, 6 and 7 engage with. It describes two particular cultural notions – the separation of genders (section 3.4.1) and the Hindu caste system (section 3.4.2) – as the rest of the thesis explains how these tailor people's interactions with electricity. It also describes the annual and daily rhythms of the villages in order to give an insight into particular moments in the year or the day in which particular forms of energy become more important (section 3.5).

3.2 Places of the research

The research is situated in Bihar, a northern eastern State of India (fig. 3-1 & 3-2). Bihar is one of India's poorest States with a per capita income of INR 16,119 (2009-10) and 54.4% (2004-05) of its population below the poverty line (GoB 2012: 5, 223). The UK's Department for International Development (DFID), with its reoriented plan of funding in India, has been focusing on three poor States. Bihar is one of them (DFID India 2011).

With only 16% households electrified, Bihar has the lowest electrification rate in the country(Census of India 2011b). Within Bihar, electrification is concentrated in the urban areas. 67% of urban households are electrified, compared to only 10% of rural households (Census of India 2011b). The issue of rural electrification is more prominent in Bihar as about 89% of its population lives in the rural areas(Census of India 2011a), mostly dependent on agriculture. With only 493MW generation capacity feeding the central grid in Bihar, electricity access here is not just about connecting to the grid but also about receiving a stable supply (GoB 2012: 159). Bihar is an important state for the two low carbon energy case studies under consideration in this research. It a priority state for Lighting a Billion Lives, and Husk Power Systems also has all its projects there.

After several decades of slow economic growth, weak law and order, and degrading infrastructure, with a new political regime in place, Bihar appeared to be making a turnaround during the last 5-7 years. It registered an economic growth rate of 11.36% between 2004-05 and 2010-11 (GoB 2012: 4), the second highest among the Indian States. With a clear focus on infrastructure development and social equity, Bihar, until recently, was seen as an example of good governance. In the last year (2014-15), politics has been highly volatile in Bihar. Political parties associated with the recent period of good governance have aligned with the parties associated with the decades of bad governance. Due to its development and electrification status, Bihar provides the ideal conditions to observe and analyse the electricity-development interplay in action.

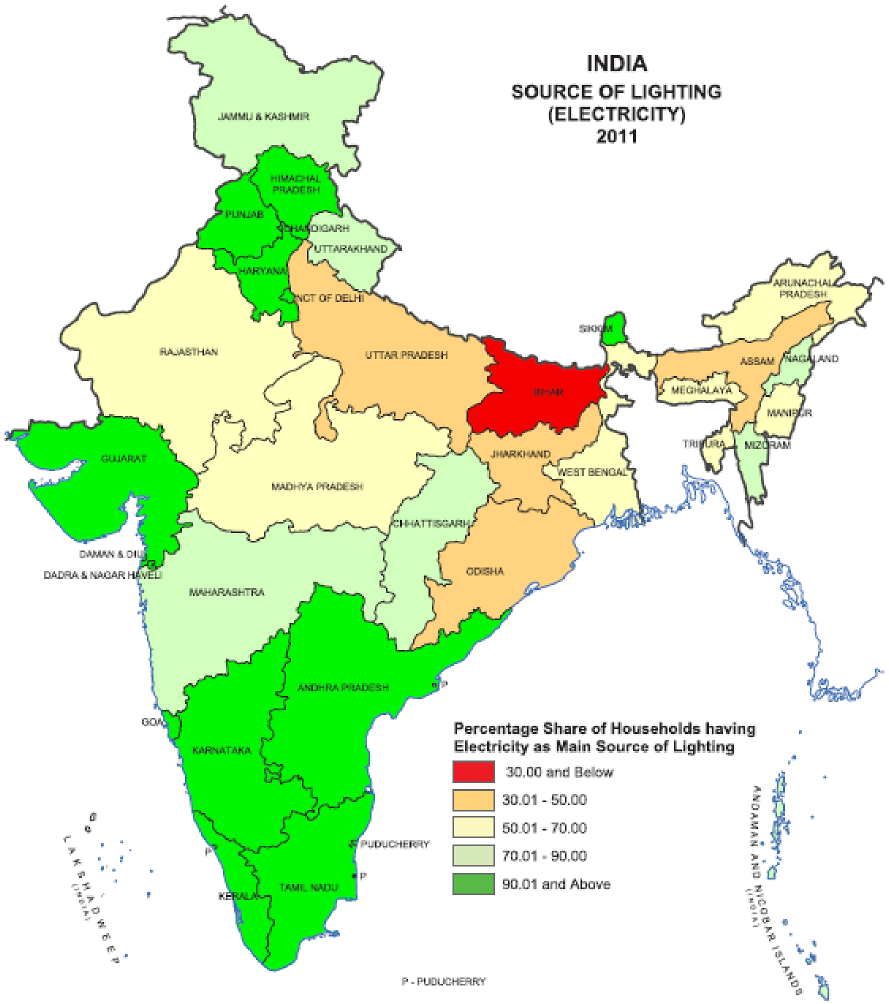

Figure 3-2: State wise percentage of households having electricity access(Census of India 2011b).

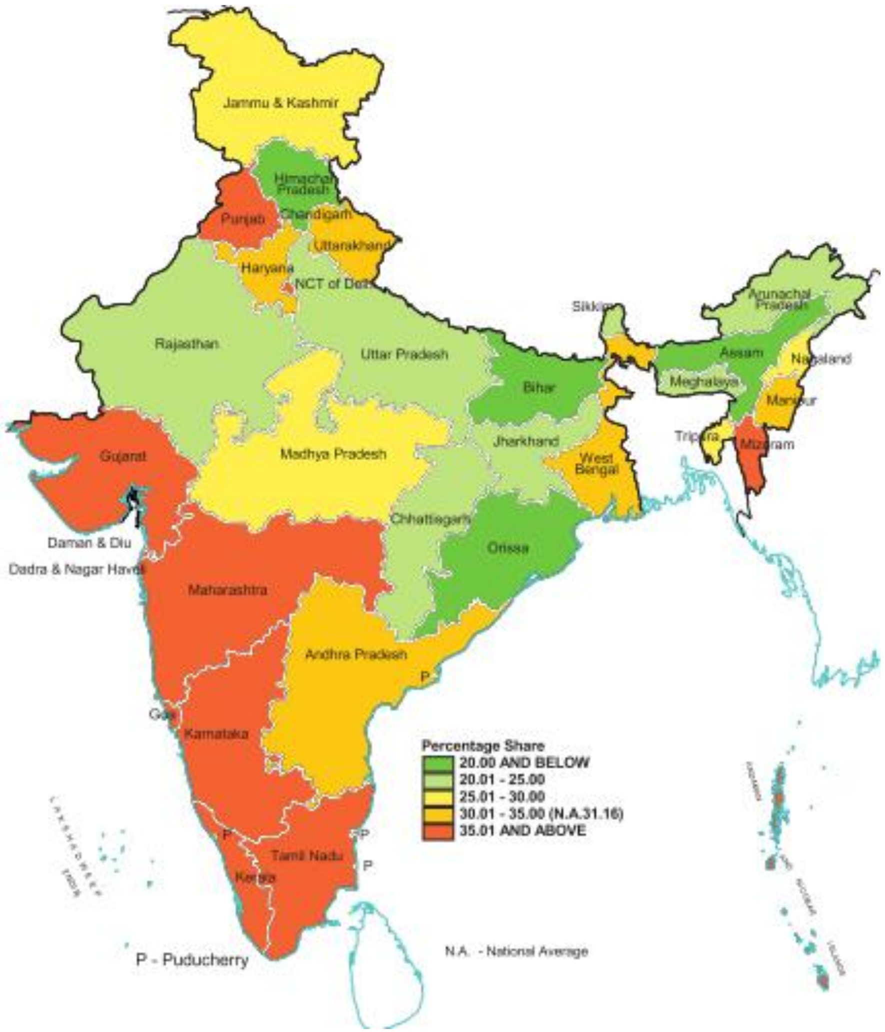

Figure 3-1: State wise percentage of urban population(Census of India 2011a). **(Bihar falls in the lowest category in both)**

Within Bihar, I planned to focus on one particular district, Lakhisarai (fig. 3-3). Through their websites, I found that both LaBL and HPS had projects here. LaBL had more than 60 projects and HPS had 4. Initially, I was going to select 4 villages, each representing a different electrification scenario – two with the presence of one case study each, one connected to the central grid and one with no access to electricity.

Figure 3-3: Lakhisarai district (Google maps).

However, upon enquiry in Lakhisarai, I found that most unelectrified villages were in the south-eastern parts of the district. In the past decades Lakhisarai has had a strong presence of Maoist guerrillas. Local enquiries revealed that Maoists were more active in the south-eastern parts, especially on the eastern side of the river (right side in fig. 3-4). Locals advised me not to venture there. Consequently, fieldwork was limited to northern and western Lakhisarai. It was now difficult to find an unelectrified village in the district. Therefore, I decided to select an unelectrified village from the neighbouring district, Begusarai.

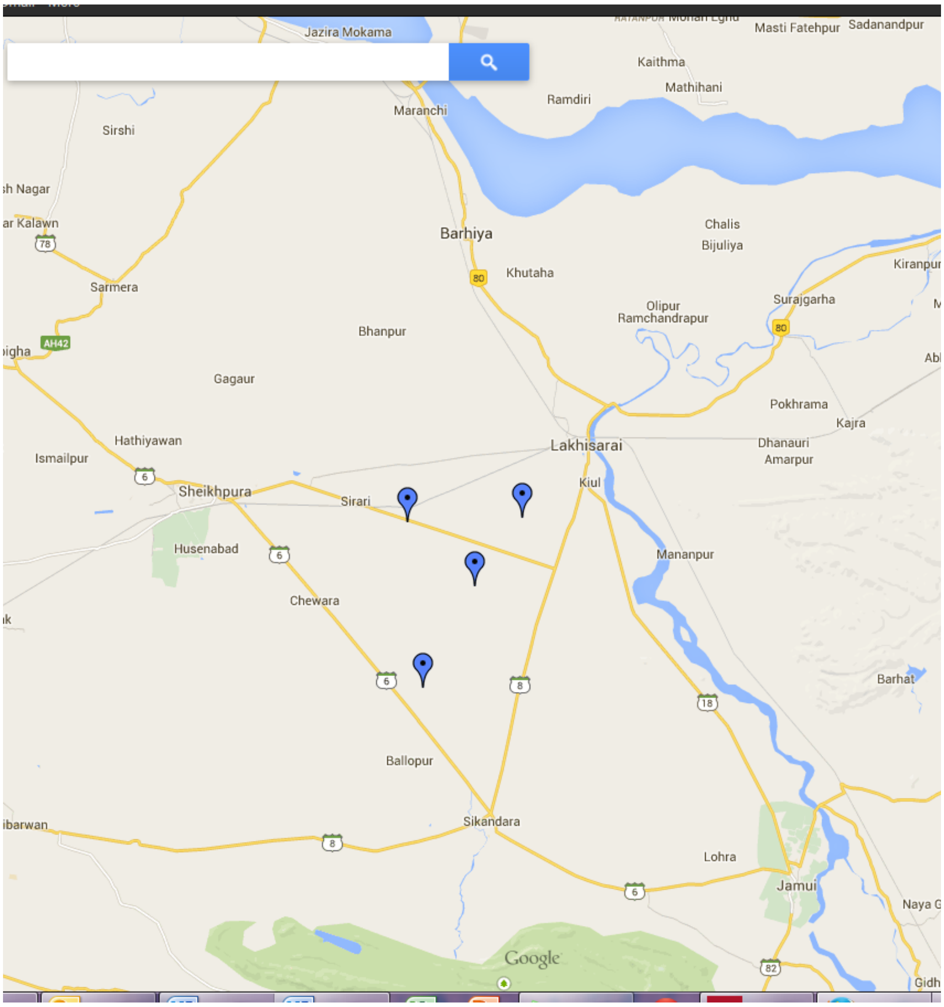

Figure 3-4: HPS projects in Lakhisarai (from HPS website).

Due to my pre-existing contacts[33] in Begusarai, finding villages and access were easier. In addition to this, both districts were earlier part of a larger district Munger. In 1972 Begusarai and in 1994 Lakhisarai were carved out of Munger to form new districts. Due to their proximity and shared history and geography, the two districts have several social, cultural and economic similarities. For comparative analysis, I decided to select a grid-connected village from the same district.

I started fieldwork in Lakhisarai where, due to the presence of several projects, there was a reduced risk of not being able to get access to a LaBL village. I decided to focus on finding the HPS villages first. All HPS villages were in central Lakhisarai, away from the unsafe areas. However, all four HPS micro-grids in Lakhisarai were dysfunctional. In consultation with my

[33] I was born, and grew up, in Begusarai district.

supervisors, I decided to conduct some brief interviews in Lakhisarai to understand the reasons for the shutdown of the HPS micro-grids. As Graham and Thrift (2007: 7) argue:

> “The problem with contemporary social theory is that it has predominantly theorized connection and assembly. But there are good reasons to think that, in the overall scheme of things, disconnection and disassembly are just as important in that they resist entities’ means of enacting themselves: failure is key”.

Following failure, I reached Bijuriya to conduct some brief interviews about the failed HPS micro-grid. The first interview revealed that the village also had a LaBL project, which was not working well. Out of the 60 LaBL lanterns, only 15-20 were being rented. This was another failed case study. Further questioning revealed that Bijuriya had been connected to the national grid in the past – another failed electrification attempt. Bijuriya became a unique case study, one that had experienced all electrification scenarios – LaBL, HPS, the central grid and kerosene oil.

However, this also posed a challenge for the research – it would be one-sided looking only at the failures of HPS. To bring a balance, it was important to look for successful HPS projects. This led me to Paschim Champaran district which has most HPS projects. At this point, in consultation with my supervisors, I decided to change the number of case study villages from 4 to 5, to include this unique case study, Bijuriya (fig. 3-5).

The next sections discuss the 5 case study villages.

Figure 3-5: Locations of the five case study villages.

3.2.1 Bijuriya[34]

Bijuriya is about 20km to the south-west of the district headquarters, Lakhisarai. It is situated on a state highway that goes to Lakhisarai. There is a train station and a small market place within 2km of the village (fig. 3-6). The railway line also connects the village to Lakhisarai. Although there are frequent private bus services, most people prefer to take the train. The train is faster, and more importantly, free. Most people do not purchase a train ticket when they travel to and from Lakhisarai. The two villages nearest to Bijuriya are, Rora to its south, and Yama to its south-east. While working in Bijuriya I found accommodation in Yama.

Bijuriya has 393 households and a population of 2,539 with 53% males and 47% females. It has an equal proportion of lower and higher caste families. Some villagers report that the lower caste population is higher than the higher castes. The four main caste groups are Bhumihars, Yadavs, Chamars and Musahars. As evident in fig. 3-6 the various caste habitations are located in different parts of the village. Higher caste Bhumihars occupy prime locations, by the road. Musahars, who are lowest in the pecking order and considered unclean, are located outside the main part of the village. Chamars, also considered unclean, are on the fringes of the village (section 3.4.2). The main habitation of Yadavs is away from the national highway, but many Yadav households are also in Bhumihar areas of the village.

[34] The data presented about the villages' population are from Census of India, 2001. The descriptions of social makeup and oral electrification histories are based on the interviews and observations in the villages.

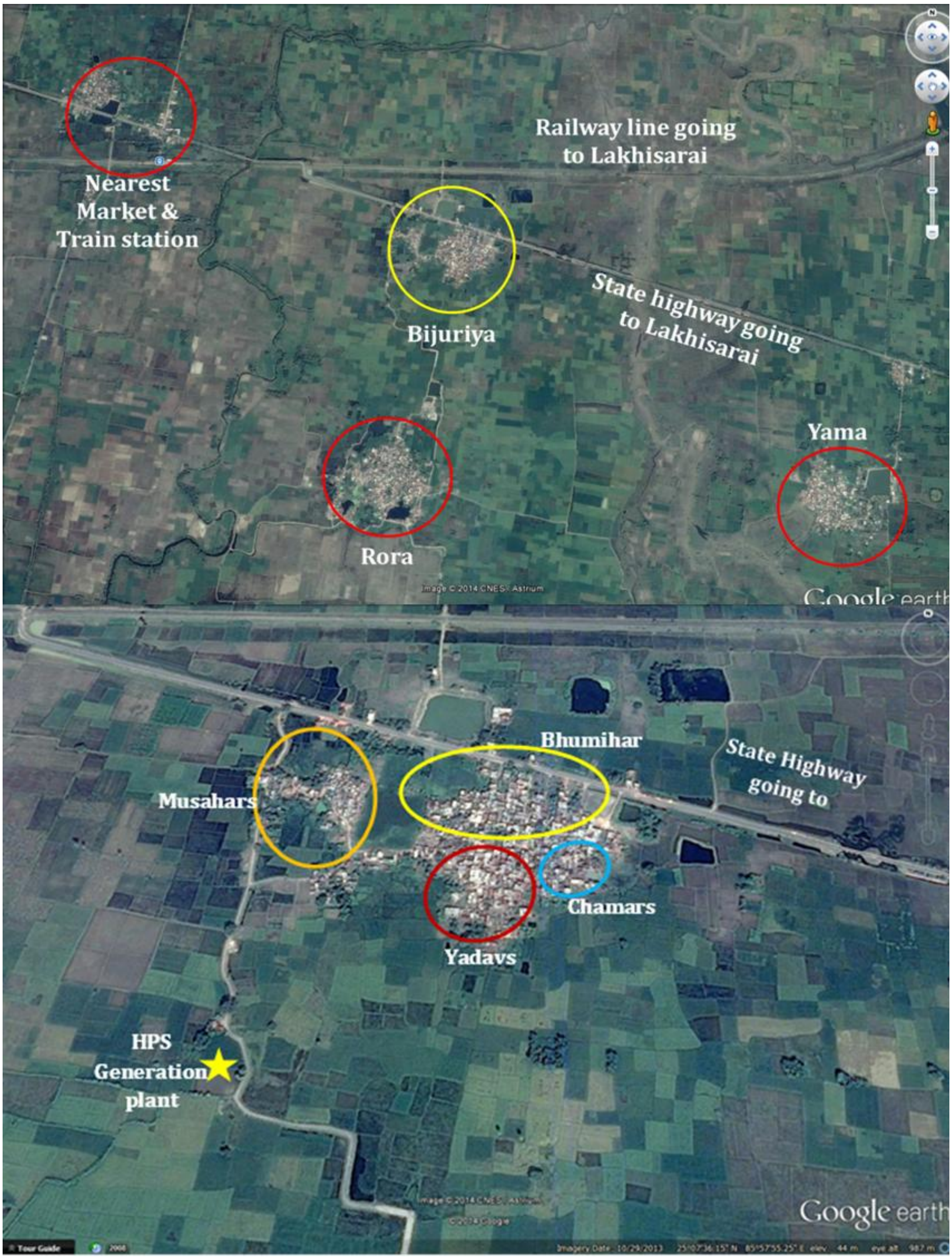

Figure 3-6: Location (top) and geographical and social distribution of Bijuriya (bottom).

Bhumihars are the most educated and also own most land of the village. Many of them are in jobs and some run businesses in the nearby market place. Yadavs are less educated than Bhumihars. They are involved in agriculture and animal husbandry. Many Yadavs also rent or sharecrop Bhumihar fields. The other social groups – Musahars and Chamars – are the least educated and mostly work as agricultural or industrial labourers. Most of them are landless.

Many men from these two groups work as migrant labourers in various cities while the women manage the households in the village.

Due to their control over land, Bhumihars and Yadavs wield most power in the village. Most members of the two other social groups are primarily dependent on Bhumihars and Yadavs for their livelihood. The councillor for the *panchayat* is a Yadav from the village. However, the *Mukhiya*[35] is a higher caste man from Rora. Bhumihars and Yadavs seem to be in a soft power struggle in the village, often balancing each other out. The village has several small ponds where fish are reared and harvested. These community resources are distributed amongst the villagers. During the fieldwork in Bijuriya one of these ponds was due to be contracted for harvesting. Many Bhumihars and Yadavs were trying to mobilise various sections within the village to support their candidature. The other social groups seemed to have no say in this.

Key electrification events

Bijuriya was unelectrified until 1967. In 1966-67 Bihar went through droughts and famines. The crops of farmers and share croppers in Bijuriya were dying in the absence of irrigation. This is when a chance encounter with Mr. Tej Narayan Jha[36] of the communist party of India, the then minister for state for irrigation and electricity in the Government of Bihar, helped Bijuriya get electricity. Bijuriya had voted for the communist party and had a lot of active party members. Mr. Jha was passing by the village one day. He called an active party member for a status update. The member informed him of the situation and said that even though they had helped the communist party win, it was not doing anything to help them. Soon after, Mr. Jha met the local electricity board officials in Lakhisarai and sanctioned an electricity connection for the village. The work took some time and electricity finally arrived in 1968.

However, this electricity was only for irrigation and limited to the fields. Two years later, through bribery and other informal means, electricity was extended to the residential areas.

---

[35] *Mukhiya* is an elected representative from the *panchayat.* He/she interacts with the state for development schemes in the *panchayat* and has financial powers.

[36] Mr. Tej Narayan Jha was the Minister for state for irrigation and electricity in the first coalition government in Bihar in 1967. He was also a communist leader and the General Secretary of Bihar Kisan Sabha (Bihar Farmer's Association). (NEW AGE WEEKLY: Central Organ of the Communist Party of Indiahttp://www.newageweekly.com/2011/01/tej-narayan-jha-passes-away.html)

Until this time they were using kerosene lanterns. In the following years, more people from the village became connected to the central grid. Many connected informally and did not pay rents. Along with this, the stealing of electric wires by thieves, who sold the metal from the wires, started. Due to the extra load of informal consumers, the electricity transformer in the village short-circuited and by 1976 the village was completely disconnected from the central grid. Irrigation became totally dependent on diesel generators and lighting in homes went back to kerosene lanterns.

12 years later in 1988, the then prime minister of India, Mr. Rajeev Gandhi was travelling through the state highway next to Bijuriya. In India, local officials often try to 'polish' the areas that dignitaries like prime ministers and chief ministers travel through. This is to 'show' the ministers the level of development and to shield them from dissatisfied people by providing them with momentary satisfaction. Keeping the prime minister's visit in mind, a 25kV transformer was allotted to Bijuriya. However, the villagers refused this transformer, as it was measly compared to the earlier 100kV that they had been used to. They argued that the villagers would have to struggle among themselves for access and fights might break out amongst them. For the next 22 years there was no electricity in the village.

2010 was a very eventful year for Bijuriya. Some villagers set up two diesel generator based micro-grids. On a fixed rental, the micro-grids provided fixed amount of electricity to each household. This was generally for a few light bulbs and charging mobiles phones. In the next 6-7 months both micro-grids shut down as the people operating them found other means of livelihood. They report that running the micro-grid was difficult due to 'unauthorised' use and non-payment of rentals. Soon after this, in July/August, one of the micro-grid owners – Mr. Rajesh Kumar – started LaBL operations in Bijuriya. By December 2010, HPS micro-grid also started in the village. Both these projects were headed by higher castes. However, lower castes were employed for various purposes in HPS. HPS faced the same problem as the diesel micro-grids had. By April 2011, under the Govt. of India's rural electrification programme (RGGVY), the village was electrified. This, along with the earlier problems, took a toll on HPS and the micro-grid shut down. Because of HPS and the national grid, LaBL also lost customers and only people who could now spare money for another light source participated in it. Under the rural electrification programme, two transformers of 16kV each were installed in the village for the

Below Poverty Line (BPL) families of the village. However, again, most people from the village connected to the grid informally and soon the transformers broke down.

Now the village has no electricity supply from the central grid, HPS or diesel generator micro-grids. LaBL is working, but very much below par. Kerosene oil remains the main source of light.

3.2.2 Sahariya

Sahariya is about 2-3Km from the district headquarters, Lakhisarai. It is connected by a very narrow road, whichtravels through 2-3 other small villages and then goes to National Highway 80. The national highway passes through Lakhisarai. The nearest train and bus stations are in Lakhisarai. Due to the proximity of a big town, many people from Sahariya work in Lakhisarai – owning shops, working in shops, working as labourers – and commute to and from the village everyday. Children from the village go to Lakhisarai to attend schools, colleges and tuitions[37]. While working in Sahariya, I also stayed in Lakhisarai.

Sahariya is a small village with 276 households and a population of 1,899, with 54% males and 46% females. The village is predominantly higher caste, with only a few lower caste families. In the past, the village had an equal population of higher and lower castes. However, a decade or so ago, many lower caste families settled in the nearby village, Chakoriya (fig. 3-7). The three main caste groups are Bhumihars, Thakurs (Barbers) and Chamars. As evident from fig. 3-7, the various caste habitations are located in different parts of the village. Higher caste Bhumihars occupy a prime location at the entry to the village. Chamars are located outside the main village.

Bhumihars are most educated and own most land. Many are in jobs and some run businesses in Lakhisarai. Thakurs are less educated than the Bhumihars but, during the research it was evident that they were keen on education. They also run barber shops in Lakhisarai. Chamars are the least educated and mostly work as agricultural or industrial labourers. Most do not own any agricultural land. Many Chamar men also work as migrant labourers in cities.

[37]Tuition classes are after school study sessions organised in India

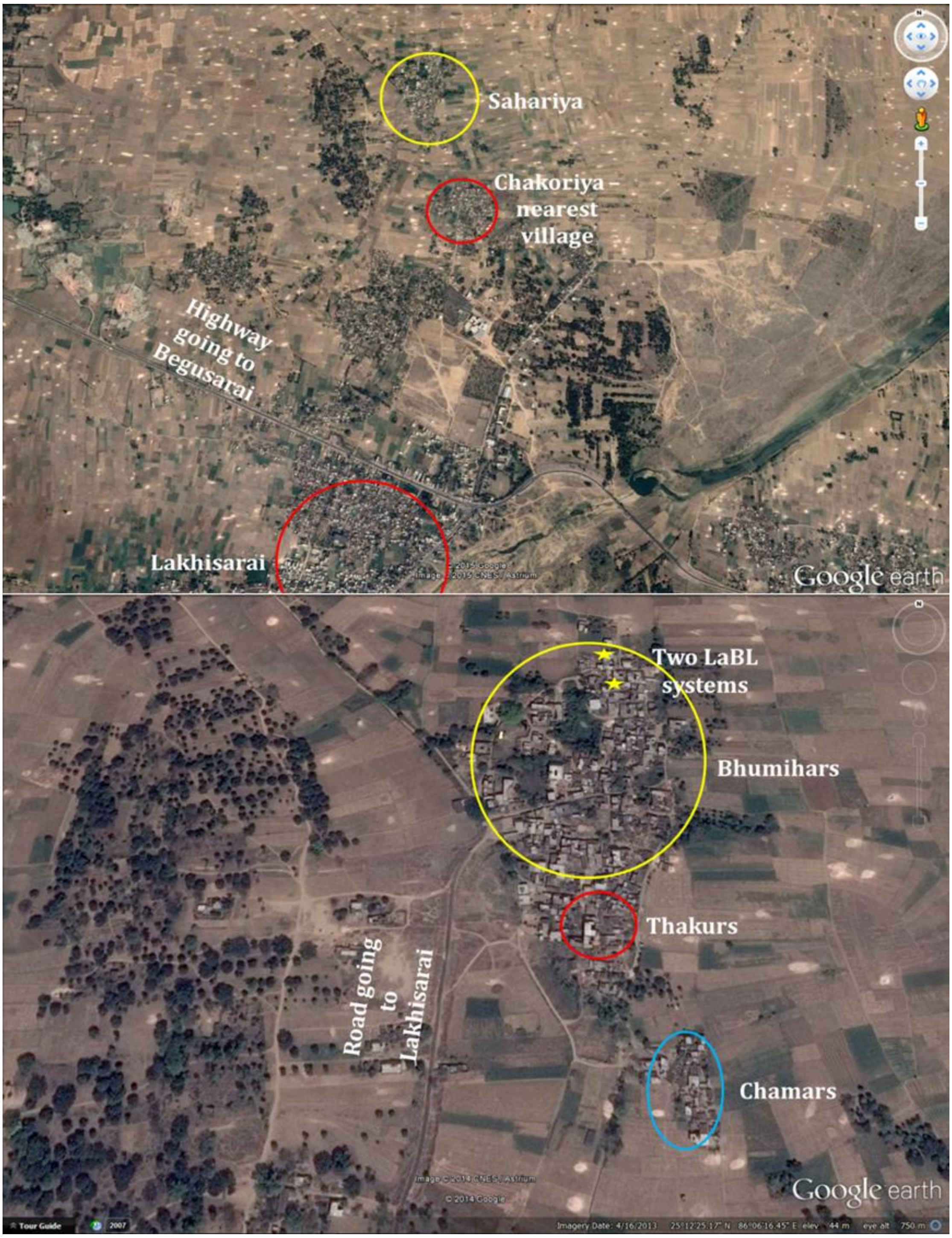

Figure 3-7: Location (top) and Geographical and social distribution of Sahariya (bottom).

The Bhumihars, due to the control over land, wield most power in the village. Most members of the two other social groups are primarily dependent on Bhumihars for their livelihoods (section 7.3.2). The *Mukhiya* (head) of the *panchayat* is a higher caste man from another village nearby. I was told that he was biased towards his own village where he had installed many solar street lamps, as opposed to only a few in Sahariya.

Key electrification events

Sahariya was also unelectrified until 1967 when large parts of Bihar were under drought. The local MLA, Mr. Kapil Deo Singh[38], was also the Agriculture Minister of Government of Bihar. He paid special attention to his constituency and a state tubewell[39] was approved for the village. Electricity came to power it (note that Bijuriya also got electrified through political connections). However, this was limited to the fields. Later, the network was extended to the homes. Again, due to extra load, and the stealing of wires, the infrastructure in the fields broke down. However, the state tube well and the electricity transformer erected for it were still present.

Soon, due to overload, the only transformer in the residential area also broke down. The villagers were not able to get a replacement from the state. Although, the tube well and the transformer were owned by the state, for the villagers it was the 'village's transformer' and they could use it for their own priorities. The transformer was informally shifted from the state tube well to the village. Since then, the village has always had electricity supply from the grid.

In 1988 the wires were informally extended to the Chamartoli (colony of Chamars). Chamars are formally not a part of the central grid but they have staked an informal claim on it by participating in its upkeep in the village. They cooperate (*sahiyog*) when the network in the village breaks down by contributing money for spares and servicing.

However, like most villages in Bihar, the electricity supply in Sahariya is erratic. It never lasts for a full day and is especially absent in the evening hours between sundown and bedtime. To fill this gap, a LaBL project started in the village in 2011 and was fairly successful. Looking at its success, another LaBL project started. However, the first system runs more successfully. People report that the main reason behind this is the behaviour of both entrepreneurs. The first is very personable, while the second is often rude. People from the higher castes operate both systems and most customers are also those from the higher castes.

---

[38] Mr. Kapil Deo Singh was the Member of the Legislative Assembly – the state parliament – from the Badhaiya constituency of Lakhisarai district.

[39] During the first wave of electrification, irrigation being the target, a state tube well preceded the grid network in most villages. This was a tube well set up from government funds and run on pay for service basis.

Both central grid electricity and LaBL currently operate in the village. However, kerosene also remains one of the main sources of light.

3.2.3 Hardiya

Hardiya is about 4Km from the district headquarters (of Paschim Champaran), Bettiah. It is connected to Bettiah by a very narrow, brick paved road which passes through 2-3 other small villages (fig. 3-8). The nearest train and bus stations are in Bettiah. Due to the proximity to a big town, many people from Hardiya work or live in Bettiah and commute to and from the village everyday. Many children attend schools and colleges in Bettiah. While working in Hardiya, I also stayed in Bettiah.

Hardiya is a very big village of 2,067 households and has a population of 11,961, with 53% males and 47% females. The village uniformly consists of members of lower castes. The main caste group here is Kurmi. After Yadavs, Kurmis are the second most powerful lower caste in Bihar. The current chief minister of Bihar, Mr. Nitish Kumar, also belongs to Kurmi caste. The various areas of habitation in Hardiya are located in a wheel and spoke pattern but during the fieldwork no prominent parts of the village were identified as outside its boundaries. This is due to the lack of the need for separation between higher and lower castes.

Most people in the village are farmers. The village has a big market place which attracts people from many nearby villages (fig. 3-8). Many people from the village own shops in its market place. The village is also big enough to be deemed as *panchayat*. Due to its large size, land ownership and caste power, Hardiya also wields substantial political power in the local area.

Key electrification events

Hardiya was also electrified about 35 years ago. As in case of other villages, due to informal hooking-on-to the grid network, the only transformer in the village broke down. In 2010, a HPS micro-grid was set up in the village. Initially people from the village were employed by HPS to run the plant. However, during the fieldwork it was discovered that, due to nepotism they were replaced by local entrepreneurs, and finally by HPS staff hired from other villages. HPS is still running in the village.

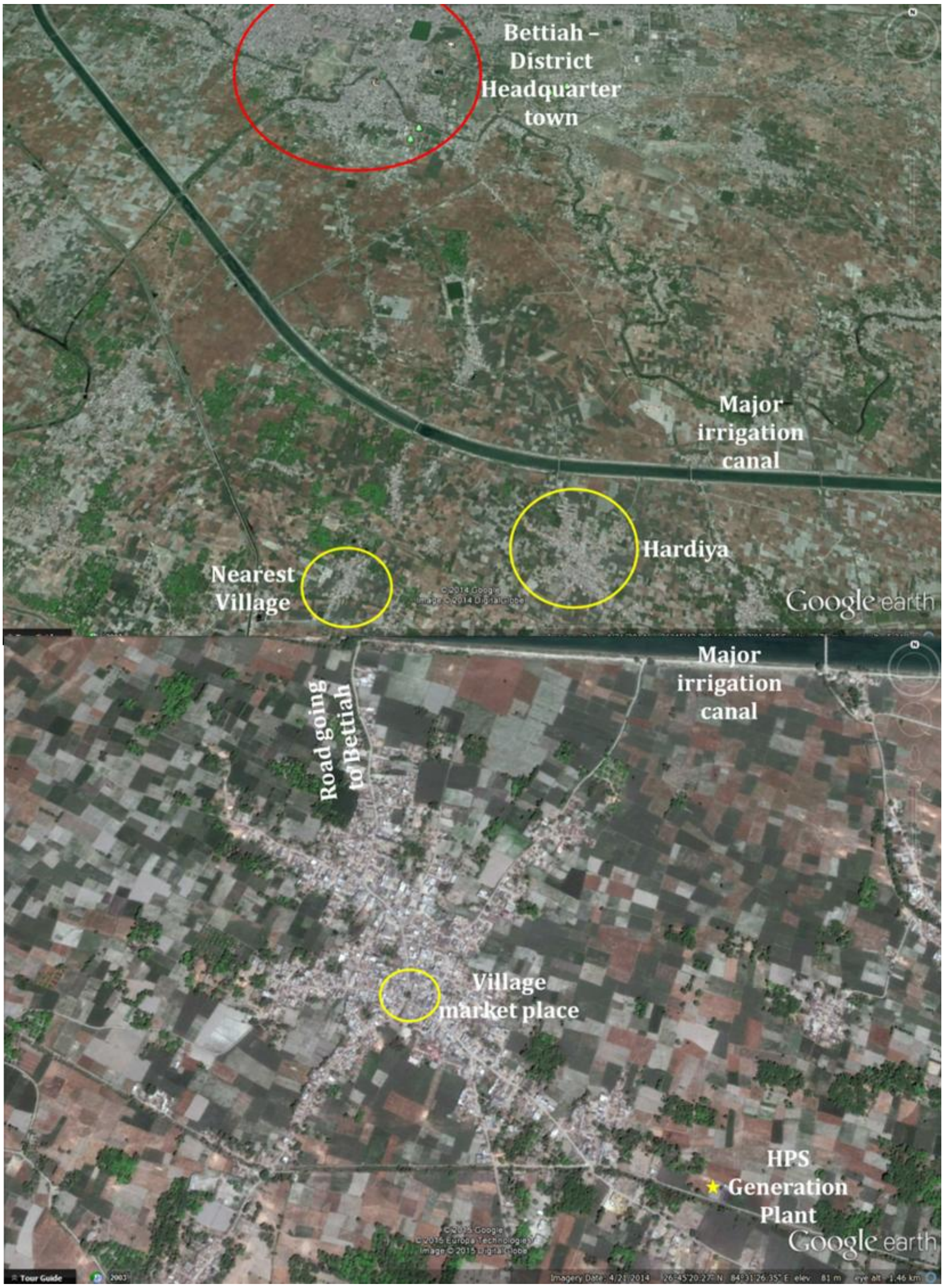

Figure 3-8: Location (top) and geographical and social distribution of Hardiya (bottom).

More recently, the villages made efforts to get the central grid transformer in the village fixed. When the chief minister[40] was visiting Bettiah, some youngsters from the village published an announcement in the newspapers. They threatened to carry out self-immolation at a prominent road crossing if the road to the village and electricity were not fixed. After this, electricity department officials conducted surveys (*muaayna)* and installed a new transformer in the village. Now, with the renewed electricity supply, as in the case of Bijuriya, some people here are also leaving HPS. However, due to the usual intermittency of electricity from the grid, many continue to use HPS. Kerosene still remains a prominent source of light.

3.2.4 Rangpur

Rangpur is about 10Km from the district headquarters, Begusarai. A very narrow road connects it to National Highway 31. The highway passes through Begusarai and Balia (fig. 3-9). The nearest train and bus stations are in Balia, only about 5Km from the village. Some people from Rangpur work in Begusarai but generally do not commute to and from the village everyday. While working in Rangpur, I stayed in the village overnight and used to travel to Begusarai during the day.

Rangpur has 816 households and a population of 4,208 with 53% males and 47% females. The village has almost an equal proportion of higher and lower castes. The three main caste groups are Bhumihars, Yadavs and Chamars. As evident in fig. 3-9, the various caste colonies are located in different parts of the village, with the higher caste Bhumihars occupying a prime location, nearer to the national highway. Chamars are outside the main habitation of the village.

[40] The Chief Minister of Bihar visited Bettiah on September 19th 2012 (http://articles.timesofindia.indiatimes.com/2012-09-19/india/33951302_1_special-status-nitish-kumar-vijay-kumar-choudhary).

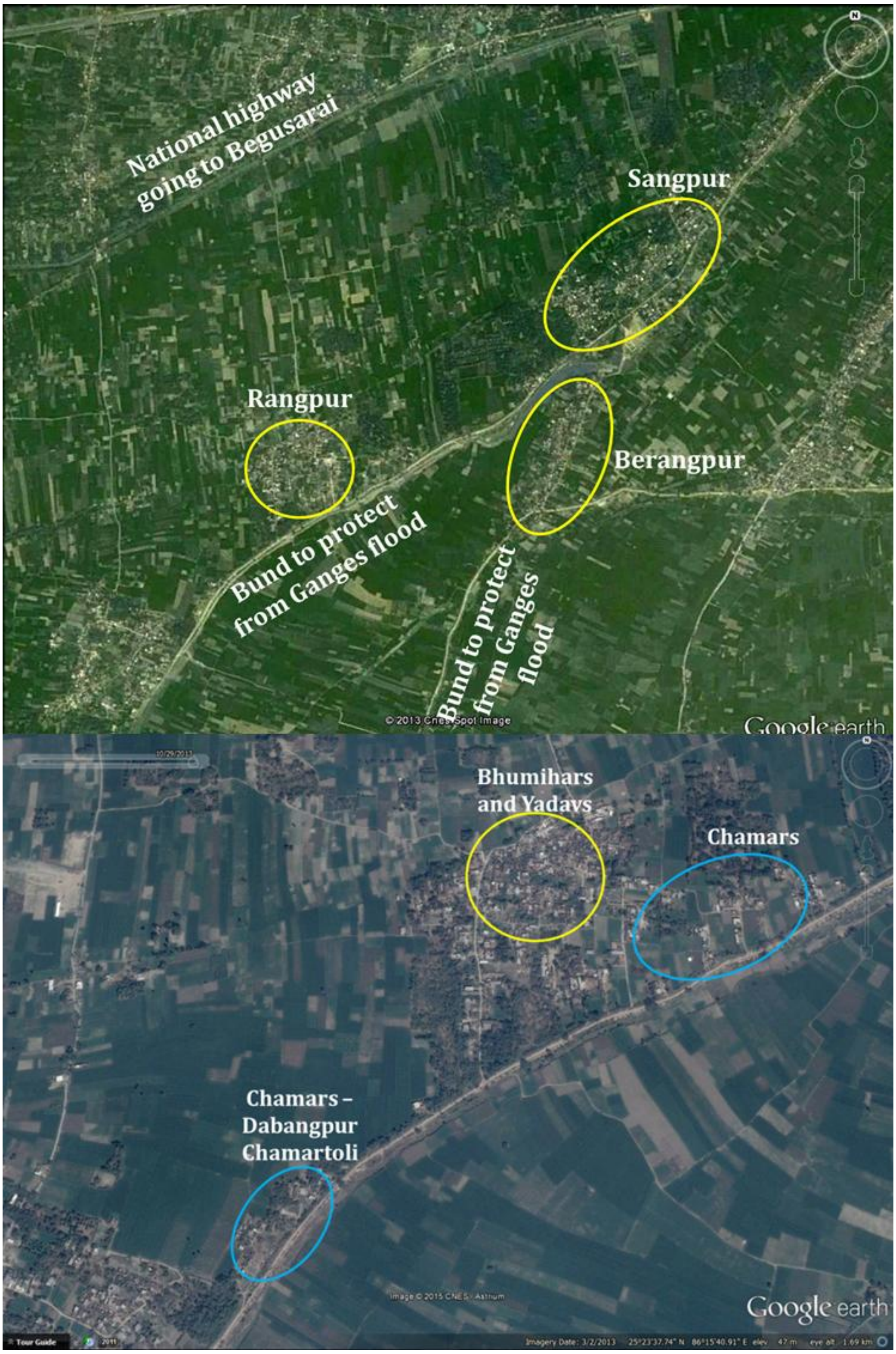

Figure 3-9: Location of Rangpur and Berangpur (top) and geographical and social distribution of Rangpur (bottom).

Bhumihars are the most educated and own most land. Many of them are in jobs. Yadavs are less educated than Bhumihars. In the recent past, many Yadavs from the village have relocated to another village on the other side of the national highway. Chamars are the least educated and mostly work as agricultural or industrial labourers. Most do not own any agricultural land.

Bhumihars, due to the control over land, wield most power in the village. Most members of the other social groups are primarily dependent on Bhumihars for their livelihoods. The *Mukhiya* (head) of the *panchayat* is a Bhumihar man from Rangpur. The village has always had a higher caste *mukhiya*.

Key electrification events

Rangpur was electrified between 1957 and 1960. Like the other villages, electricity arrived here primarily for irrigation. However, as reported by the first *sarpanch*[41]of the village[42], this happened only after a delegation from the village went to meet the then Minister of Irrigation and Power in Government of Bihar, Mr. Ram Charitra Singh. The delegation's political negotiations with, and accessibility to, Mr. Singh was because of political patronage. Mr. Singh belonged to the same district, Begusarai (Note that Bijuriya and Sahariya also got electrified through political connections).

When I arrived in Rangpur, Dabangpur Chamartoli (fig. 3-9), a colony of Chamars on the border of Rangpur, was criss-crossed by a network of wires and a transformer had been unloaded to install in the colony[43]. Throughout the different phases of national grid electrification, wooden poles installed about 30 years ago, iron poles about 15 years ago and cement poles installed recently, were erected in the colony. However, this was the first time that the poles had been followed by wires, transformers and subsequently, electricity. As the wires never followed the wooden and iron poles, people from stronger social groups transferred them to other parts of the village. Due to their weaker social position and economic dependency on the landed higher castes, the residents of *chamartoli* could neither challenge (politically or socially) the suppression from higher castes nor garner support from the power centres within their own

[41] Sarpanch is also an elected representative from the *panchayat* but has only judicial powers. (http://www.indianexpress.com/news/bihar-panchayat-polls-everyone-in-race-for-mukhiya-s-post/775317/)
[42] Interview conducted during this research with Mr. Shivpal Singh, the first *sarpanch* of Rangpur.
[43] Electricity supply started in the colony by the end of fieldwork.

village. The political leaders and brokers within the village never felt the need to extend patronage in exchange for political loyalty. Economic dependency assured loyalty.

In Rangpur, the informal connections of the grid network started during special occasions, like weddings, when people with power and resources extended the grid to their homes by running wires over bamboo poles. This later led to informal use in domestic spaces. The grid network could not take this added load, resulting in a fall in the quantity of supply. The power cuts that ensued gave thieves an opportunity to cut and steal wires[44]. Because of the ensuing long blackouts the villagers shifted to diesel pumps for irrigation. This resulted in the breakdown of the electricity distribution network in the farmlands. Electricity completely shifted from the fields and is now limited to homes in Rangpur.

However, the electricity supply in Rangpur is also erratic. It never lasts for a full day and especially in the evening hours. Electricity sometimes disconnects for several days at a time. Most people primarily depend on kerosene oil for lighting.

3.2.5 Berangpur

Berangpur is a neighbouring village to Rangpur (fig. 3-9). The nearest urban areas, train stations and highways are the same. However, to access the highway people from Berangpur either have to pass through Rangpur or another neighbouring village Sangpur. While working in here, I stayed in Rangpur overnight and used to travel to Begusarai during the day.

Berangpur has 561 households and a population of 3,137 with 52% males and 48% females. The village consists mainly of lower caste families with a few higher caste families. Berangpur is also the only village in this research to have a substantial Muslim population. The three main social groups here are Muslims, Yadavs and Mushars. Muslims and Yadavs seem to wield more power than Mushars who, like *dalits* in every other village, live on the fringes of Berangpur (fig. 3-10).

---

[44] During this time the distribution wires were made of aluminium. Some local industries engaged in the melting wires and selling them to other industries. These created a market for stolen wires.

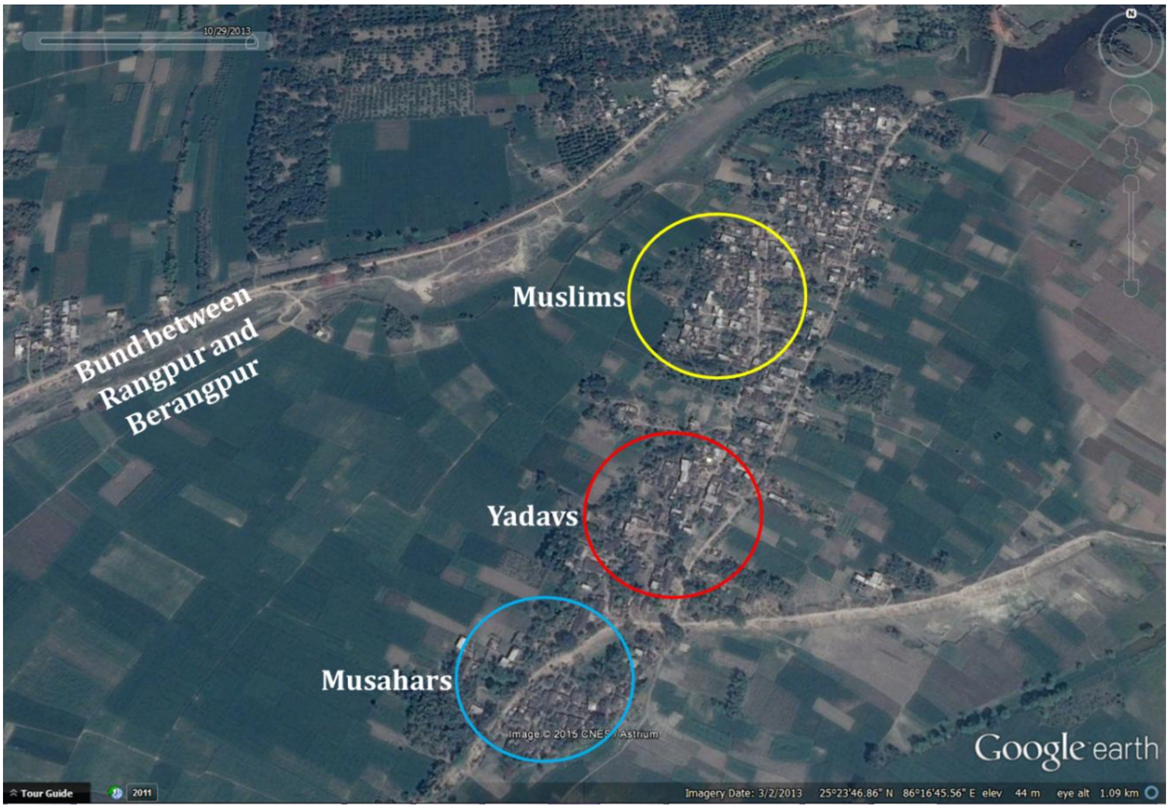

Figure 3-10: Geographical and social distribution of Berangpur.

The 2-3 Bhumihar families are the most educated and also own most land. Yadavs and Muslims are less educated than Bhumihars. They also own some land and are involved in animal husbandry. Musahars are the least educated and mostly work as agriculture workers on the fields of higher caste families from Rangpur or Sangpur. Most of them do not own any agricultural land. Their dependency on the higher castes is similar to the Chamars in Rangpur. Many Musahar men also work as migrant labourers in various cities.

The *Mukhiya* (head) of the *panchayat* is a higher caste man from Sangpur. However, the local councillor is a Muslim man from Berangpur. Most of the *mukhiya*s of the *panchayat* have been from Sangpur. Although, *sarpanch*s have been from Berangpur, people claim that the socially and politically powerful Sangpur has always controlled them.

Key electrification events

Although a part of the same *panchayat*[45], Berangpur was not electrified along with Rangpur. Later, Berangpur and its neighbouring village Sangpur separated to form another *panchayat*. Several parts of Sangpur were electrified in 1980. However, again, Berangpur was left unelectrified. Being a predominantly lower caste village, Berangpur has historically been socio-economically weaker than Rangpur or Sangpur. This economic dependency has translated into political 'unfreedom'. People here have not been able to leverage political patronage (as in case of Bijuriya, Sahariya and Rangpur) for material benefits like electrification.

Another reason for the missing electricity infrastructure in Berangpur is that the villagers, in the past, did not feel the need for electricity. The earliest electrification efforts by the state were to support agriculture. Although most people in Berangpur depended on agriculture, they did not own any land. Irrigation had no direct benefit for them. Therefore, Berangpur residents were not eager to acquire electricity.

Most people in Berangpur agree with this narrative but subscribe equally to the narrative of caste suppression and systemic bias. This narrative played out partly during the fieldwork here. I observed that the transmission and distribution infrastructure had been erected in the village but the supply had not been switched on. Villagers reported that this was due to interruptions by some higher caste people from Sangpur. They were reluctant to allow the connection of transmission lines through their transformers. Even after connecting to the transformer, some residents of Sangpur had forcefully disconnected the lines. Berangpur villagers see this as forceful dominance by the upper castes and an attempt to keep Berangpur less developed and subservient.

However, enquiries in Sangpur revealed technical reasons[46] behind the reluctance of Sangpur to let Berangpur connect through their transformer. Still, the fact remains that higher castes could prevent access for lower castes illegitimately and forcefully, and no state support or

---

[45] The administrative level above village. Several villages form a *panchayat*.

[46] For example, the transformer would have overloaded leading to disruptions in Sangpur. If there were any disruptions in either village, the electricity to both villages would have been shut down for repairs. Keeping all this in mind, people from Sangpur suggested that it was better if Berangpur did not connect through their transformer.

political connection could balance the skewed power dynamics. Berangpur villagers argued that if nothing worked they would organise collective action against those interrupting the connections. This raises questions about the state, and the lack of trust in the state, of people who have historically been left out of the state's development agenda.

Before this, Berangpur villagers had taken a petition to the local MLA. They had also organised protests, agitations and processions. Whether the political action in this case worked or not is disputable. However, by the time fieldwork ended in Berangpur, the electricity had finally been connected. The village also has a diesel generator micro-grid. However, not everyone is connected and most people still primarily depend on kerosene oil for lighting.

Table 3-1: Social makeup and lighting sources in various research villages.

Village	Social makeup	Light sources
Bijuriya	Hindus, larger population of lower castes	Central grid, kerosene, Lighting a Billion Lives (LaBL), Husk Power System (HPS)
Sahariya	Hindus, predominantly higher castes	Central grid, kerosene, LaBL
Haridiya	Hindus, predominantly lower castes	Central grid, kerosene, HPS
Rangpur	Hindus, equal proportion of higher and lower castes	Central grid, kerosene
Berangpur	Hindus and Muslims, predominantly lower castes	Kerosene, Diesel generator micro-grid

3.3 Regional context matters: How has the history of investment in energy infrastructure in Bihar shaped patterns of energy access?

This section will present a brief history of electrification in Bihar. It will discuss how the political economy of Bihar has shaped investment in the state's electricity infrastructure which, in turn, has shaped patterns of energy access. It is important to point out that this section has been placed after the discussion about the case study villages because it draws on the oral histories of electrification of these villages to tie up a narrative of electrification Bihar through four key historical stages – the Congress era, the post Congress era, the Laloo era and the Nitish era.

Congress Era (Independence -1967)

The partition of India reduced the organised resistance for India's central political leadership (by parting ways with the Muslim League) and the Congress leaders were able to develop a scalar command system later to be called "the 'Congress system'" (Chatterjee 1998: 8 quoting Kothari 1970). Since most states were also governed by the Congress, it was easy for it to continue with the ideas with which the internal party functioning was governed and apply them to govern "the politics of the whole society"(Kaviraj 1984: 228).This system came to include the idea of "national (as opposed to regional) policy" (Kaviraj 1984: 228).

Following the national ideas of rural electrification for irrigation and rural industries, electricity came to most villages in Bihar for state tube wells and stayed limited to the fields. As in New Delhi, members of the higher caste were power centres in Bihar Congress and the government. Caste connections often manifested into political connections and villages with dominant higher caste land owning communities were able to gain electricity connections. This is evident in the electrification history of Rangpur (section 3.2.4) which was able to get electricity due to its connection and accessibility to the then Minister of Irrigation and Power in Government of Bihar.

Post Congress Era (1967-1990)

In 1967, like many other states, the first non-Congress government was formed in Bihar. Political mobilisation gained pace after the weakening of the Congress in the centre and in several states (including Bihar) and the emergence of several contender parties looking to facilitate people's claims (Kaviraj 1984: 234).In Bihar, the communist parties came into power along with socialists SSP. This was a politically volatile period in Bihar as successive Congress and non-Congress governments lasted only for brief periods of time.

1966-67 there were major droughts in India which caused famines especially in Bihar(Brass 1986: 246; Guha 2008: 442). At the same time, Government of India had a renewed focus on energising irrigation pump sets to push through the Green Revolution (EPW 1969a; EPW 1971). Due to the presence of socialist and communist parties in the Bihar government, villages like Bijuriya were able to gain electricity for state tube wells due to their alignment to the communists (section 3.2.1). By 1989 about 65% villages in Bihar were electrified(Prasad 1997). However, in the absence of any new power generation projects, the situation of intermittent power supply continued through these decades (World Bank 1973; Pant 1984). In addition to this, many transformers burnt out due to overloading and the theft of distribution infrastructure was also rampant(Prasad 1997). The overloading of transformers was mainly due to the informal use of electricity (Section 3.2.1). As evidence suggests from Rangpur and Bijuriya, this lead to the breakdown of the central grid infrastructure in the fields, and electricity became limited to the domestic areas. Irrigation became completely dependent on diesel (Planning Commission 2008: 66).

Laloo Era (1990-2005)

The year 1990 is another landmark in the political history of Bihar. The socialist Janta Dal came into power and Mr. Laloo Prasad Yadav became the chief minister. Mr. Yadav is widely credited for creating and maintaining *jungle raj*[47] in Bihar. During this period, when he ruled either directly or indirectly (by making his wife the chief minister), investment in infrastructure went consistently down. Funds allocated from the central government were left unused and often returned because the Government of Bihar could not match them with its own funds. Due to the lack of investment, electricity infrastructure continued to degrade. In 1995 the state electricity board had an installed capacity of only 1,440 MW out of which only 300MW were being generated (Roy 1995).

---

[47]Laloo's rule in Bihar is often referred to as *jungle raj* (law of the forest) because it was a lawless period. Crime in Bihar was at an all-time high, often supported by the state machinery. In this period, development activities took a back seat and corruption, nepotism, violence and lawlessness because the order of the day in Bihar.
http://www.catchnews.com/patna-news/why-lalu-rabri-era-is-known-as-jungle-raaj-in-bihar-1443412576.html
http://swarajyamag.com/magazine/lalu-prasads-jungle-raj/

This era also continued the downfall of the higher caste dominant politics of the Congress and the rise of subaltern politics that Laloo and his socialist predecessors followed. Laloo also provided political stability (compared to the very volatile post congress period) and prevented communal riots in the state. However, among all this and due to Laloo's politics of caste empowerment, infrastructure development took a backseat (Kumar et al. 2008). One of the important themes around which lower caste politics in Bihar has been based is "the struggle for power and a search for honour (*izzat*)" (Corbridge et al. 2005: 74). This kind of mobilisation sometimes leads to material claims but at other times politics organised around caste and religion is mobilised solely on the idea of non-material claims like *izzat.* In fact, Laloo often used empowerment and security concerns to appropriate people's support. Because of this, people often failed to negotiate material benefits like electricity. Evidence of this could be seen in Laloo's interaction with a group of Muslim weavers in Bhagalpur.

> They wanted power supply because their looms were idle most day and that was affecting their livelihood. Laloo just turned on them and said, "You have your heads safe on your shoulders now you want power too?"
> (Mr. Faizan Ahmad, Senior Patna Journalist (Thakur 2006: XV))

Bhagalpur has had a history of communal tensions and this promise of security gave an opportunity to appropriate the support of Muslims resulting in their failure to broker the welfare function, electricity. Political parties get support for 'power' and 'honour' but this often gives subaltern groups leverage for a share (although not an equal share) of the development claims in the villages. This may come in form of claims on the village grid network and participation in the village level informal management of the network, as was the case in Sahariya (section 3.2.2).

However, ultimately due to a lack of focus on electricity the sector was in a deplorable state in this period. Oda & Tsujita (2010) report:

> The growth rate of total energy availability in 1990-91 to 2000-01 (62.9%) was less than that in 1980-81 to 1990-91 (78.0%) (CMIE, 2010: 184). The length of transmission and distribution lines in the state in 1990-91 was 175,270 CircuitKm; it was still only 177,567 Circuit Km in 2000-01 when the Bihar was

bifurcated into two states (CMIE, 2010: 187). According to the government…only 427 villages were electrified from 1992-93 to 2000-01, while the number of electrified villages had more than doubled in the previous decade (ibid.).

Nitish Era (2005-Now)

When the next chief minister, Nitish Kumar, another socialist leader, inherited the state from Laloo Yadav only 5% of the rural households had electricity (World Bank 2007). At this point about 97% of farmlands in Bihar were being irrigated using diesel pump sets (World Bank 2007). In addition, Bihar was generating only 10% of its requirement with about 90% being purchased from national power companies like the National Thermal Power Corporation (NTPC) and the National Hydro Power Corporation (NHPC)(World Bank 2005). It is also critical to remember that the demand itself was low because very few villages and households were connected to the central grid in Bihar. The transmission and distribution losses (including informal electricity use) in the state were about 45-50% (World Bank 2005). The Bihar State Electricity Board was metering 20-25% domestic and commercial consumers out of with only about 25% meters functioned (World Bank 2005).

In terms of power generation, currently the state utilities of Bihar own only two large generation plants, both thermal. Together they have a capacity of only 440MW (GoB 2012d). Electricity coverage in urban Bihar has improved markedly during the past decade, and there are now 266,375 individual domestic electricity connections in Patna District alone (Rodgers & Satija 2012).This represents almost 10% of all such electricity connections in Bihar(Rodgers & Satija 2012). However, as the figures from the national census 2011 show, a big gap in electricity access exists between Bihar and all India average (fig.3-11). The problem is particularly rural as almost three times the number of urban households lack electricity in rural Bihar.

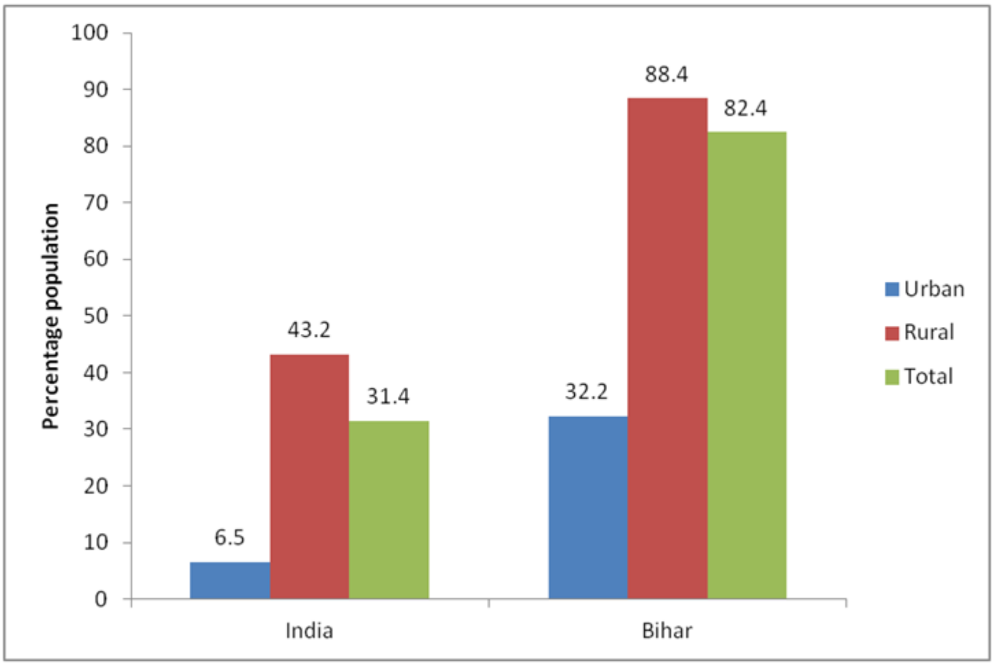

Figure 3-11: Percentage of population using kerosene as a source of lighting in rural and urban areas (All India and Bihar) (Census of India 2011b)

Keeping the bad state of electricity infrastructure in mind, and to tackle the lack of electricity for irrigation and farmers' dependence on diesel, Government of Bihar launched a scheme for promoting solar irrigation pumps in 2011(GoB 2012b). However, this was targeting only 10% of the irrigation electricity demands of the state(GoB 2012a: 102).In addition, the state government also gives special subsidies to farmers for irrigation diesel. Although the price of diesel and the regulations for its distribution are determined by the central government, the various state governments play a role in it by varying local taxes.

During this time other reforms were also brought in power sector in Bihar. Long after the Electricity Act 2001, following the provisions of the act the Bihar State Electricity Board was restructured and unbundled in 2011. This led to the formation of a holding company, a generation company, a transmission company and two distribution companies. This has made the different roles independent and competitive. Although the results are still to be seen, these reforms are expected to bring better financial results for the power sector and hence improvement of power infrastructure and supply in Bihar. However, in this interim period renewable energy and micro generation will play a key role in the state. Many low carbon energy projects are coming up in Bihar to fill the gaps left by the state, both in the field of energy access and low carbon energy transition. The restructuring of the power utilities has also given impetus to various companies to generate and supply electricity from low carbon sources.

3.4 Spaces of research

3.4.1 Separation of male and female spaces

Women in Bihari villages have historically and traditionally been involved in cooking, cleaning and childcare (sections6.3.1 and 6.3.3). These jobs mostly take place within the four walls of homes. In addition to this, the notion of a 'cultured woman' staying outside the sight of 'other' men (a form of *purdah*[48] – veil – must be maintained between men and women) means that most women are limited inside their homes (Kumbhare 2009: 76). Chakrabarty (1992: 543) argues that the "actual spatial arrangements may embody this division (of inside/outside) but the cultural practices productive of 'boundaries markers' cannot be reduced to the question of how physical space is used in particular circumstances". However, cultural practices *are* constructive of the use of the physical spaces. McCarthy (2005: 120) explains that "social roles and conventions are…another mechanism that can regulate, determine, and produce interiority" and thus, *also* exteriority. The construction of cultural and physical inside-outside leads to the *dalaan, bangla* or *baithaka*[49], which could be seen as spaces similar to a veranda or patio in western homes (fig. 3-11). These open, and in most cases, uncovered spaces, outside or in front of most Bihari houses, are a part of the home but are designated as 'outside' due to their cultural construction. Due to their open, uncovered nature – lack of *purdah* – women avoid these spaces and men almost always exclusively occupy them. Men gather there for meeting and greeting or evening chit-chat. Guests are often entertained in these spaces. Men also use this space to sleep at night[50].

[48] This involves women covering their faces or staying out of sight of 'other' elder males.

[49] In Rangpur and Berangpur these spaces are known as *dalaan,* in Bijuriya and Sahariya as *Bangla* and in Hardiya as *Baithaka.* This is because these three clusters of villages represent three (out of many) sub-cultures of Bihar and use three different dialects.

[50] During the fieldwork I often slept in these spaces.

Women either sleep in the rooms, on the roof of the house or in open spaces in the middle of the house called *aangan* (fig.3-12). *Aangan* is made for ventilation and comfort of those inside and is also used as a meeting space by women. During summers, cooking is also carried out in this space. Some higher caste houses build a boundary wall around the 'inside' space so that

Figure 3-12: Outside and inside spaces of a higher caste household in Rangpur. The outside space is inhabited only by men (top). The roofless inside space in the middle provides venitilation and comfort for the inhabitants (bottom).

women have *purdah* but also the comfort of an open space. It is also important to mention that the responsibility for *purdah,* although primarily on women, also lies on men. As a result, men from one household seldom go into and hence see the insides of other people's homes.

Table 3-2 outlines the various relationships (of importance for this thesis) that are found in a Bihari village, the extent of their mobility and the spaces they occupy. The phrase 'of the village' has been added to every relationship to convey the fact that the relationships in one family are maintained across the various generations of all the families of the village. These relationships contribute to cultural boundaries of inside-outside. A daughter-in-law of the village needs to maintain *purdah* from all the elder male members of the society and hence cannot go outside at all. In a similar manner, a father or grandfather of the village needs to respect all young women's *purdah* (except daughters) and must limit himself to the outside spaces. His food is served outside and he sleeps outside. A daughter of the village needs no *purdah* but must maintain 'cultured' behaviour and avoid male company. Therefore, she avoids sitting in *dalaan, bangla* or *baithaka* and limits herself to the rooms or *aangan* of her or other's home (she has more mobility and can easily go to other homes). Similar to the daughters, sons and grandsons of the village do not need to respect *purdah* and can occupy any space. However, they are 'expected' to sit with male members of the society and mostly occupy outside spaces. The boundaries of inside and outside created by these relationships applyacross caste lines. A daughter-in-law of a higher caste sees a father or grandfather of the lower caste as her father or grandfather in the sense that she maintains *purdah* with him and vice versa.

Table 3-2: Various relationships in a Bihari village.

Classification of the relationship	Explanation	Extent of mobility	Spaces occupied
Daughter-in-law of the village	A female who has come to the village after marriage to a village male (including wives of younger brothers/cousins)	No mobility - must stay within the four walls of the home	Inside
Daughter / granddaughter of the village	A female who was born in the village	Full mobility - but must maintain 'cultured' behaviour through the separation between male and female. Will avoid occupying 'male' spaces like the patio, especially as they grow older.	Young: Inside and outside Older: inside
Father / Grandfather of the village – a senior member of the village	A male born in the village but is older than the daughter-in-laws of the household	Partial mobility - should stay 'outside' in the 'male' space and enter into the home only when the daughter-in-laws are in *purdah*	Outside
Sons / grandsons of the village – a junior member of the village	A male born in the village but is younger than the daughter-in-laws of the household	Full mobility	Inside and outside

3.4.2 Caste system and castes that appear in this thesis

The question of caste is an important one for both,this thesis and me. The thesis explores how castes, and the social, economic and political statuses of various castes, result in their varied everyday experiences with low carbon assemblages (sections 6.3.1 and 7.3). In addition to this, my own identity as a higher caste male tailored my interactions with various castes in the villages (section 4.6). To contextualise both, this section discusses the Hindu caste system and outlines the various castes that appear in the thesis. "Caste is Portuguese word that conflates two Indian words: *Jati*, the endogamous group one is born into, and *varna*, the place that group occupies in the system of social stratification mandated by Hindu scriptures" (Guha 2008: xix).It originates from the *varna* system of Hindu mythology which divides human beings into 4 *varnas* based on their place of origin from the body of *Brahma*, the creator god (table 3-3). The 4 *varnas* are, *Brahmins* who originated from the head, *Kshatriyas* who originated from the arms, *Vaishyas* who originated from the stomach and *Shudras* from the feet[51]. Based on their mythological origins *Brahmins* were historically involved in intellectual work (knowledge bearers of the society), *Kshatriyas* in defence and governance (protecting the society), *Vaishyas* in trade and commerce (feeding the society) and *Shudras* in labour work (serving the society).

Table 3-3: *Verna* system and historical jobs of various *vernas.*

Hierarchy	***Varna***	**Origin from *Brahma***	**Historical work**
1.	*Brahmin*	Head	Intellectual works like studying, teaching, advising kings
2.	*Kshatriya*	Arms	Defence and governance. Many of them were kings
3.	*Vaishya*	Stomach	Trade and commerce
4.	*Shudra*	Feet/legs	Labour work

[51] There are various variations of this description but the order (top to down) of human body parts and their relations to various *vernas* remain the same.

However, not every caste is covered under the *varna* system. *Dalits* or untouchables are considered outside the *varna* system (Mitra 2006: 276). This gives them the lowest position in the hierarchy of caste groups. It has also means that historically they have been involved in the lowest level jobs like handling dead animals and leather and cleaning sewage and night soil. Both mythology – their place outside the *varna* system – and the resultant history – them being trapped in jobs that are considered unclean and impure – has led to their status as unclean and untouchables. This has resulted in widespread discrimination against *dalits*. Although untouchability is a criminal offence in India, in the Bihari villages (as in most other states of India), *dalits* are not just socially, but also spatially, separated from the other castes. Their habitations are generally on the fringes, often separated from the rest of the village (examples in section 3.2). To create an alternative discourse, Gandhi gave *dalits* – which literally means 'oppressed' – another name, *harijans* – meaning 'children of god' (Guha 2008: 535).

Mythology and history have created a hierarchy of castes with Brahmins, Kshatriyas and Vaishyas considered as higher castes and Shudras and *dalits* considered as lower castes (originating from feet and below). However, within the lower castes too, *Shudras* have a higher social status than *dalits*. Table 3-4 lists the castes that appear in this thesis.

Table 3-4: Castes that were part of this research, their *varna* origins and historical jobs.

Varna	**Castes in this thesis**	**Historical Jobs**
Brahmin	*Brahmin*	Education, Priests
	Bhumihar	Farming, land lords
Kshatriya	*Rajpoot*	Farming, land lords
Shudra	*Yadav*	Farming, cattle rearing, selling milk (some land lords)
	Kurmi (Gupta)	Farming, agriculture workers (some land lords)
	Thakur	Barbers
Dalits	*Chamars*	Dealing with animal hide and leather, agriculture labourers
	Musahars	Historically known as rat catchers and eaters, mostly agriculture labourers

The caste system gives rise to inter-caste discrimination, especially of the lower castes by the higher castes. Lower castes are often not allowed to enter the homes of the higher castes (section 7.3.1). This applies more sternly to*dalits* due to their perceived unclean status.

Witsoe (2012: 10) argues that caste dominance and caste networks have now spread beyond villages into the state machinery and the political class. He (2012: 5) explains how powerful caste groups were facilitated and promoted by the *Raj*[52] and argues that “the centrality of caste as a political identity and the continued influence of local dominance…are both products of the colonial legacy”. The local political dominance of certain castes helped them “obtain privileged access” to government schemes (Jeffrey 2002: 22). Although, the higher caste population is smaller than the lower caste population in Bihar, “this numerical weakness is largely compensated by greater ritual status, economic power, and modern skill and knowledge” (Mitra 2006: 107). This has particularly helped the higher castes to continue their social, economic and political dominance and maintain the lower castes’ dependency on them – for farm work, money lending etc.

The caste system also gives rise to intra-caste solidarities. In Bihari villages most people from one caste trace their origins to the same ancestors. This creates a feeling of family. This often extends to the same castes of nearby villages too. Srinivas (1955: 1230) explains caste as “a collection of kin groups—agnates (related on father’s side) and affines (related by marriage) living in a few neighbouring villages”. They are “governed by strict rules of endogamy and by taboos about purity, and arranged social hierarchy” (Khilnani 1999: 18). As a result, members of the same caste give each other preference in matters that benefit them (section 7.3.2). As various caste groups have strengthened and caste based politics has reinforced in India, the number of ‘power brokers[53]’ in villages has multiplied. While earlier one broker represented one village now brokers for individual castes have emerged (Witsoe, 2012: 12). These brokers, who give preferential treatment to the members of their own castes, are not only limited to party politics and the state’s development work but have become relevant for NGOs and other

---

[52] Referring to the British rule in India.

[53] Intermediaries between state and people. Corbridge et al. (2005: 108) argue that “when poorer people meet local state officials, they do so with reference to their non-state social networks” which includes “a broader range of caste leaders, brokers (*dalaals*) and political fixers (*pyraveekar*s)”.

private organisations working in these villages. Thus, “caste provides for an individual” in Indian society “some of the benefits which the welfare state provides for him in the…West” (Srinivas, 1955: 1230), such as social, economic and political support and solidarity. Caste, according to Srinivas (1957: 548 cited inGuha, 2008: 606),is “the unit of social action”. This notion of caste stands partly true even today. It affects people’s participation in the low carbon assemblages.

3.5 Time of research – annual and daily rhythms of villages

3.5.1 Annual rhythm and economies

There are two main crop seasons in Bihar. Kharif crops are planted during summers (June/July) and harvested during winters (November/December). Rabi crops are planted during winters (December/January) and harvested before summers (April/May). Most farmers argue that they fund their next plantation with the money earned from selling the previous harvest. In addition to this, most farmers do not own enough storage space for their crops. This is because warehouses are expensive and need a lot of space, which could otherwise be used for planting crops.

Since Kharif crops are closely followed by the plantation of Rabi crops, their harvesting (to free the fields), post-harvest processing and selling (to fund the next crop) become very important. Most farmers prefer to carry out these activities in close succession, as soon as the crop matures. Many farmers work for long hours, carrying out activities like irrigation[54] and post-harvest processing even during the night.

I started my fieldwork at the end of July in Bijuriya and found that most people were busy with the plantation and irrigation of paddy, their main Kharif crop. It was hard to get hold of people to interview and even more difficult to get people to work as gatekeepers or guides. Villagers suggested that it would be easier to talk to people after a month, when the irrigation period would have ended and most people would be relaxed with more free time in hand.

---

[54] Some farmers argue that irrigation, especially for Kharif crops is better during the evening as less water evaporates due to the extreme summer heat and more percolates into the ground.

This put a halt to the fieldwork and I was at the risk of losing a month of fieldwork time. However, some discussions with locals in Lakhisarai and Begusarai revealed that plantation of Kharif crops happens earlier in Begusarai.They do not plant paddy which requires more and sustained irrigation, for a longer period of time. In addition to this, due to pre-existing contacts and familiarity with Rangpur, I had easier access to the community. I was also able to find a gatekeeper who was much more familiar with people's daily routines. Thus, I was able to replace Bijuriya with Rangpur for this period of time.

Harvest time is also when most farmers have money from selling the produce. They invest it in various activities – funding the next crop, paying debts, buying land, organising special occasions like weddings and buying solar panels or paying rentals for solar lanterns and micro-grids. Once this money is invested, farmers are left with their land and crops, and wait until the next harvest to get more cash. Some big farmers, who have some spare storage space, decide to keep some of their harvest and sell parts of it at later stages when either the prices are higher or when sudden expenses arise due to a death or marriage in the family[55]. This is a 'crop economy' in which cash appears only a few times a year. In this economy payment for services all year round becomes problematic.

In contrast, shopkeepers and daily wage labourers have a constant circulation of cash. They sell their products or services everyday and get cash against these everyday. The constant availability of cash makes it easier for them to pay for daily or monthly rentals and they make better customers for solar lanterns and micro-grids (section 6.3.2).

3.5.2 Daily rhythm

Most people in Bihari villages wake up early with the sun – by 4-5am. During the summer months – March to September – most men sleep outside the house in the *dalaan, bangla* or *baithaka* (section 3.4.1). During the summer months of the fieldwork (July to September), I also slept outside with the men. Women sleep inside the house either in rooms, in open spaces inside or on the roof of the house, away from public visibility. Since most people sleep in open

[55] Mr. Jyoti Nath in Sahariya showed me grains of different kinds stored in one room of the house which he had kept to sell during times of urgent need.

spaces, the sun greatly influences the times they wake up. In the mornings people can be seen preparing for the day's work. Most men either work in the fields, which are often away from the habitations or in nearby towns. They need to prepare and leave early. Males are generally not found in the village during the day because they are away for work.

During this time, the women are busy with household chores and often rest too. Males, who work in the fields, also come back in the afternoon as temperatures during the summers often soar up to 45^{0} C. Afternoons, during the summer months, are generally a time of rest and relaxation. People also take siestas during this time. Since the streets of the village are deserted due to the extreme heat and public visibility is minimal, some women take the opportunity to go to other's houses to catch up. The weather provides them *purdah*. However, due to the temperature and siesta time, conducting fieldwork in the afternoons is difficult and not advisable.

In the evenings, by 5-6pm, most males are back from work and prefer to stay outside their homes in *dalaans, bangla* or *baithaka*, exchanging the day's news, talking with friends and discussing matters of the village. This is a time of relaxation, a time when people can spare a few hours for interviews, household tours and generally walking around and talking about the village. This is also a time when children and young boys are back from schools or colleges and can be seen playing in the communal spaces of the villages – grounds, streets or temple premises. Many young boys can be seen sitting by the roadside chatting with each other, listening to music or watching daily soaps and films on their mobile phones (section 1.4.2). Children are busy with their evening studies. During this time, women and girls stay inside the homes and are generally engaged in cooking dinner for the family.

By 8-9pm, males, followed by females, have dinner. While the males head out to sleep, the females do the dishes and sleep by 10pm. The time between 5-6pm and 8-9pm is ideal for fieldwork. During this period a lot of activities, like cooking, studying and eating go on in the home. People are happy to talk and show visitors around their homes. To match these social timings, I used to begin fieldwork everyday at 5pm and end it by 9pm. This was convenient for the research participants and gatekeepers in various villages. This was also the best time to observe and note the activities and relationships in the village, as most people were present in the village.

During the winter, people follow similar patterns. However, due to the cold weather, they preferred to go to bed earlier. So, I started fieldwork around 3/4pm and ended by 9pm.

The next chapter will discuss the various methods used to conduct this research and how the spaces and places discussed in this chapter influenced them. It will also discuss the barriers for this research and the issues of positionality and ethics.

4 Researching Energy Access in Rural India

4.1 Introduction

This chapter introduces the two case studies that this thesis engages with and the various methodological tools used for this research. It explains and discusses some critical issues – barriers, access, positionality and ethics – that have shaped this research.

4.2 The case study route

This research takes a case study approach that looks at two low carbon energy projects – Lighting a Billion Lives and Husk Power Systems. Although, this approach has been criticised for the lack of rigour and scalability (Zainal 2007: 5 referening to Yin 1984), Hardwick (2009: 444) argues that case studies play acritical role in linking "local issues to global challenges" by "scaling up the findings…to respond to larger research questions". Cases were selected to accommodate diverse social, technical and financial approaches – solar, biomass, micro-grids, lanterns, not-for-profit and for-profit – and to conduct a comparative analysis. The target was to look at similar findings and contrasting results from the case studies. They were also chosen in the same state of India, so that the socio-cultural background remained same. This made comparison of the characteristics of the case studies easier. The core issues and analytical framework discussed in chapter 2 guided the comparisons.

4.2.1 Lighting a Billion Lives (LaBL)

In 2007 The Energy and Resources Institute[56] (TERI) made a commitment towards lighting a million lives to the Clinton Global Initiative (Clinton Foundation 2008). Formulated by TERI, and championed by its previous Director General Dr. R. K. Pachauri[57], LaBL aims to provide solar lighting facilities to a billion people around the globe. LaBL engages with two technology options, solar charging stations and solar micro-grids.However, the charging stations have been most commonly used. Under this option, an entrepreneur is chosen in a target village and a solar lantern charging station (fig. 4-1) with 50 or 60 lanterns is set up in their house. LaBL works on a fee-for-service model. Solar lanterns are rented to villages on a daily or monthly rental basis (section 5.3.3).

Figure 4-1: Solar panels (top) with charging station and solar lanterns (bottom).

[56] TERI is an Indian educational and research institute established in 1974. It works on the issue of Energy and Environment. It works on various programmes, LaBL being one of them.

[57] Mr. Pachauri also headed the Intergovernmental Panel on Climate Change (IPCC) which is a joint initiative set up by the United Nations (UN) and the International Meteorological Organisation (IMO). It is responsible for providing evidence on climate change.

TERI, the key actor in LaBL, has also put in place a very complex network for the operation and maintenance of the stations and lanterns. The project consists of TERI, regulatory authorities, finance providers, technology providers, partner organisations (local NGOs), village entrepreneurs and users (fig. 4-2). Table 4-1 summarises the roles of the various actors in LaBL. The financing of projects relies heavily on public perceptions. The donations for LaBL come in return for the 'satisfaction of doing good', 'fulfilment of corporate social responsibility (CSR)' or publicity (section 5.2). So far TERI has been successful in setting up projects in 2,222 villages in India, affecting more than 100,000 households (Palit 2013a). Out of the five villages covered during this research, LaBL was present in Bijuriya and Sahariya.

Figure 4-2: The LaBL model and its key actors (LaBL website).

Table 4-1: Summary of roles of various actors involved in LaBL.

Actor	Example	Role
TERI		• Manager, assembler, coordinator • Organise and manage finance • Co-ordinate with NGOs for village identification and maintenance needs and feedbacks • Co-ordinate with technology suppliers for setting up and maintenance of the charging station and lanterns • Co-ordinate with funders and NGOs for site visits and impact assessments • Train partner organisations (NGOs)
Regulatory Authorities	Ministry of New and Renewable Energy (MNRE), Government of India	• Set up appropriate regulation and assure conformity • Provide subsidy funding to projects • Receive regular reports from projects (if necessary)
Technology Provider	Solid Solar	• Supply initial technology, maintenance service and spare parts
Finance Providers	MNRE, corporate, bilateral-multilateral organisations, individuals (crowd funding)	• Fund as grants, CSRs, state subsidies and individual donations
Partner Organisation (NGO)		• Identify villages and carry out baseline assessments • Co-ordinate with TERI and technology providers to set up charging stations • Train entrepreneurs and users • Provide maintenance services and spare parts for charging stations • Co-ordinate with the village entrepreneurs and TERI for maintenance services (for problems that cannot be solved locally) and spare parts • Co-ordinate with TERI and the funders for site visits and impact assessments
Local Entrepreneurs	• Rajesh Kumar, Bijuriya • Brij Kumar, Sahariya • Bimlendu Singh's wife, Sahariya	• Manage everyday operations • Conduct basic troubleshooting • Train users • Co-ordinate with partner organisations for maintenance • Co-ordinate with partner organisations and funders for site visits and impact assessments
Users		• Handle lanterns properly • Pay rentals on time

4.2.2 Husk Power Systems (HPS)

Two school friends – Gyanesh Pandey and Ratnesh Yadav – set up HPS in 2008 in Bihar. It finances, operates and maintains biomass gasifier based micro-grids in villages. HPS focuses on setting up locally fabricated biomass gasifiers and engines with the distribution wires running on bamboo poles to minimise costs (fig. 4-3). This helps provide low cost electricity. HPS also runs on a pay-for-service basis. Fixed electricity wattages of 15W or 30W are allotted to the customers (section 5.3.3). As opposed to LaBL, HPS is a private limited company looking for profits from the rural electrification business.

Figure 4-3: HPS gasification plant (bottom) and transmission lines (top).

HPS also carries out baseline assessments to identify lighting needs and uses kerosene expenditures to determine payment capacities (Singh 2010: 9). While an initial commitment by the users is optional in LaBL, HPS starts functioning in a village with a commitment from at least 250 households in form of deposits of INR100 each (WII 2011). This gives the company a reliable customer base and initial capital to invest in the electricity infrastructure in the village. HPS has assembled a network of regulatory authorities, technology providers/manufacturers, finance providers and local entrepreneurs. Although some of these actors are similar to LaBL (the two networks share some actors), their roles in the projects are different. Table 4-2 summarises the roles of the various actors in HPS. HPS has more than 80 micro-grids in Bihar, covering 300 villages and affecting over 200,000 people (HPS 2013). HPS was present in two out of the five villages covered in the research, Bijuriya and Hardiya.

Table 4-2: Summary of roles of various actors involved in HPS.

Actor	Example	Role
HPS		• Design and improve technology • Identify villages and conduct baseline studies • Invest in setting up and maintaining projects • Set up electricity production and distribution infrastructure • Operate, manage and maintain electricity network • Co-ordinate with village entrepreneurs for maintenance services and spare parts (if applicable)
Regulatory authority	MNRE	• Set up appropriate regulation and assure conformity • Provide subsidy funding to projects • Receive regular reports from projects (if necessary)
Technology providers/ manufacturers	Ganesh Engineering	• Fabricate equipment based on HPS's design and criteria
Finance Providers	MNRE, Shell foundation, Acumen fund, International Finance Corporation	• Fund as grants, state subsidy, equity stake
Local entrepreneurs	Bimlesh Gupta, Hardiya	• Manage and maintain local unit (in a village) • Pay fixed monthly fees to HPS • Co-ordinate with HPS for maintenance services and spare parts
Users		• Do not overuse electricity • Pay rentals on time

4.3 The ethnography way

Ethnography can be seen "as the graph of ethnos: the scientific study of 'people's, 'cultures', or populations" (Li 2014a: 34). Ethnography attempts to make social phenomenon comprehensible and engages with "the material and cultural elements of the rapidly changing social, spatial and natural world" (Chari & Gidwani 2005: 268). Since my aim was to "explore the tissue of everyday life to reveal the processes and meanings", micro logics and materials of the social, cultural and spatial world that I planned to research, ethnography was the ideal methodology (Herbert 2000: 551).

Bebbington (2010: 231) argues that in development research "bringing a 'village' ethnographic lens to these development organizations would influence the nature of interpretations offered". Like Li (2007c: 27), the aim was to bring together an "analysis of governmental interventions (their genealogy, their diagnoses and prescriptions, their constitutive exclusions) and analysis of what happens when those interventions become entangled with the processes they would regulate and improve". However, Bebbington (2010: 230) points out the flaws in Li's ethnographic method which focuses on more textual analysis for the first part – ethnography of the governmental organisations – and observations and interviews for the second part – analysis of the unravelling of the intervention on the ground. While this recognises the nuance, "diversity and dynamics within village life", it has a "tendency to see 'programmers' as being one of a kind, and aligned with institutional goals" (Bebbington 2010: 230). Aware of this, I tried to strike a balance between the analysis of the villages and the development planning organisations. Participant observations and interviews were conducted with some people – village entrepreneurs, NGOs – who are part of the 'organisations'. I also tried to nuance the multiple identities and goals of programmers (section 5.4). This was guided by previous knowledge and arguments by several scholars that in places like India, the lower level ground officials often act within the "cellular structures of the Indian social life – a life structured by family, kin, caste and community" (Corbridge et al. 2005: 36). They are not always aligned with the technical, non-political focus of the higher officials (sections 5.4 and 7.3.2). The approach that emerged was to understand how development and energy projects are made, unmade and remade in people's everyday lives (see also Ferguson & Gupta 2002: 995).

Since, electricity (primarily in the form of light), and people's interactions with it, were key themes of this research, it was important to carry out fieldwork after sunset when people required lights. This was also important due to people's daily rhythms (section 3.5.2). This added the unique dimension of conducting fieldwork in the dark to the research. Working after sunset created problems of accommodation and transport. Depending on availability, accommodation was found in the research village (as in case of Rangpur),in a nearby village (as in case of Bijuriya and Berangpur) or a nearby town (as in case of Sahariya and Hardiya). In case of accommodation in a nearby village or town, daily transportation into and out of the village was required. This was navigated by hiring a motorbike locally.

The preference of a motorbike over a car was important and based on two main factors. Firstly, the modesty of the bike helped avoid the distance from the research participants that a car would have created. Motorbikes are a common means of transport in Bihari villages and cars, if any, are owned only by select elites. Often cars are seen in the village only when elites like state officials[58] and 'outsiders' come to visit. To integrate with the research participants for an ethnographic study, it was important to avoid being seen as elite. Secondly, most villages lacked infrastructure conducive to cars such as metal roads, and often had narrow lanes navigable only on foot or a bike (fig. 1-1). In such situations the motorbike proved to be an ideal medium of transport. A distance of about 5500Km in total was covered during the 9 months fieldwork. While staying in nearby villages or towns, daily trips to the research villages were made.

[58] In fact, even lower level state officials use motorbikes.

Section 4.4 explains the tools used to conduct ethnography.

Figure 4-4: Village infrastructure and motorbike as the common mode of transportation.

4.4 Methodological tools

Three tools that were employed to conduct this ethnography of energy projects are discussed in the sub-sections below.

4.4.1 Participant observation

Participant observation was carried out throughout the time spent in the villages. It involved "spending time, living or working with people or communities in order to understand them" (Laurier 2010: 116). Participant observation has "no pre-set formal step", as it arises "out of the phenomenon and setting" of the research (Laurier 2010: 117). Since it is "a means of developing *intersubjective* understandings between researchers and researched" (Crang & Cook 2007: 37), it involved participating in the village life in three ways. The first was sitting around with groups of men or women and getting involved in various discussions about the village and its people, Bihar and India in general. In these discussions, I sometimes took the role of a silent spectator and at others provoked discussions on particular aspects of interest.

The second way of making observations was to walk around the village noting people, places and their interactions– for example, who sits, where, at what time, and why. Most time was devoted to the third way, household visits. It also involved conducting interviews with household members (section 4.4.2.1). Observations were made about the sources of energy, their uses, their placements and the people engaging with them. Since, men avoid going into the house due to notions of *purdah* (section 3.4.1), females sometimes guided the tours. This provided an opportunity to interact with them.Thus, interviews and observations were generally entangled with each other. Photography and field notes were used to record observations made during the fieldwork (sections 4.4.1.1 and 4.4.1.2).

Participant observation critically depends on how researchers manage their multiple and conflicting roles (Jarvie 1969: 505). In participant observation Junker (1960 referred to in Jarvie 1969: 505) sees various levels of participation – "complete participation; the participant doubling as observer; the observer doubling as participant; and the complete observer". As one moves from being a participant in people's everyday lives to a social scientist who looks at things objectively, "the problems of being a traitor may arise" (Jarvie 1969). In addition to this, Nelson (2013: 420) explains that "rumours about…true intentions and identity proliferate(d) based on local observations" of the researcher's presence in certain places, with certain people, and in certain situations. Participant observation in this research was as much about being observed as it was about observing (Nelson 2013). Section 4.6 on positionality discusses these critical issues.

4.4.1.1 Photography

Photography was extensively used as a research tool for two particular purposes. The first was to record of observations. Photographs were especially useful for recording the various light sources, their quality, quantity, placements in the households and the people using them. Considering the importance of light in this research, photography provided a way of observing and understanding the light conditions, as I had to constantly change the camera settings to suit the high or low light conditions around me. I often took photographs in the ambient conditions and then used the camera flash to take another photograph of the same place. This helped compare not only the light conditions, but also the people, spaces, objects and practices that the presence of light reveals and the absence of light hides (fig. 4-5).

Figure 4-5: The flash helps revel women and children invisible in ambient light conditions (above). For the women lack of light helps maintain *purdah* but also makes them vulnerable to animal attack.

Photographs gave support to the field notes and helped develop thicker descriptions of observations as their printouts were added to the field notes (fig. 4-6). Photographs often revealed information that may have been missed during fieldwork. Upon return from fieldwork, the process of looking, sorting and arranging photographs forced me to think carefully about them. This led to more 'post field' notes, which were useful in developing arguments and analysis. Thus, photographs were also used as a means of gathering information "after the fact" (Hawkins 2015: 251).

However, photographs are "more than visual field-notes" (Hawkins 2015: 251). The second use of the photographs was as evidence. Since, the research uses participant observations and interviews as main tools, two main forms of evidences used in the thesis are interview quotes and observation notes. Photographs and written notes (section 4.4.1.2) come under the second category. Ethnographic "research concerned with feelings, textures, and experience of place can be complemented and enhanced by an exploration through the lens" (Hunt 2014: 165). Photographs here, are used as a "means to explore the co-constitutive flux and flow of places,

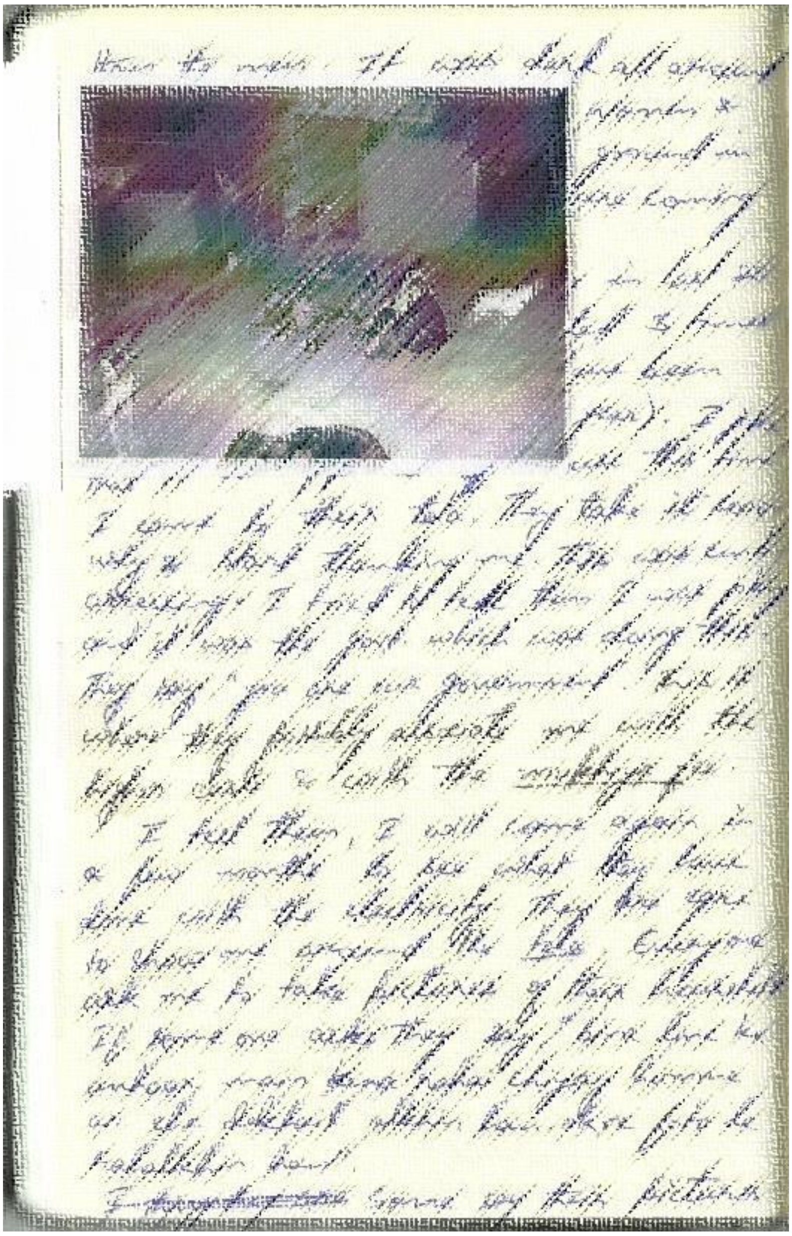

Figure 4-6: Photographs added to field notes.

their materialities and atmospheres” i.e. “‘get at’ the co-constitutive nature of experience” (Hawkins 2015: 251).

Photography also has the “ability to render things visually and cognitively graspable from angles and perspectives not available to unaided human sight” (Jasanoff 2004: 42). However, these angles can be problematic. While making certain things visible they can also make others invisible. It often depends on the photographer as to what is included in, and excluded from, photographs. Here, the ethics of research come into play. Researchers must record what they see. If they choose to include and exclude things based on their subjectivity, they should acknowledge and explain it. In addition to this, to avoid misinterpretations, photographs need to be accompanied with explanations to clarify their place in the argument. Detroit city photographs have often been accused of being “‘ruin porn’ that privileges the aesthetic charge of ruination, thereby ignoring the contextual economic and social devastation and the role of finance and government in its creation” (DeSilvey & Edensor 2012: 470). In this case photographs can be seen as inherently political. They have multiple meanings and interpretations, sometimes based on the angles and perspectives of the photographer. Photographs are, “at times both self-explanatory and mysterious” (Hunt 2014: 165). Thus, explaining the interpretation and clarifying how photographs fit with the overall argument becomes important, especially when they are used as evidence for social phenomenon. Although some scholars argue that “even if we choose to use visual methods in our work, text must be our primary medium” (Rose 2001 refered to in Garrett 2011), photographs “should be regarded as an equally meaningful element of ethnographic work” (Pink 2007).

4.4.1.2 Field notes

Field notes are a critical part of any fieldwork because it is difficult to “recall sufficient details of what happens or what people say during a lengthy engagement with them” (Laurier 2010: 121). As per the fieldwork plan, I was to write detailed field notes every evening. However, this was often not possible due to three reasons. Firstly, the villages and households that I stayed in often did not have enough provisions of lights to enable work at night, especially for someone who is ‘used to’ electric lights. Secondly, I generally ended my fieldwork when it was dinner and bed time for people (section 3.5.2). After returning to my hosts’ homes, I used to have dinner and go to bed swiftly to match their routines and not cause any inconvenience. Thirdly, after fieldwork, if there was enough time to spare, I spent this with people around me discussing my observations and various issues of the day. This often helped develop an understanding of various new issues that I came across. Consequently, most often I wrote detailed field notes in the mornings. However, to guide these notes and capture critical observations, I wrote short bullet points during the fieldwork. Later I elaborated on these from memory and with the help of the photographs taken during the fieldwork.

Diagrammatic representations of spaces were a critical component of the field notes. Diagrams helped place households, people, energy sources and lights in perspective to each other and the other things around them. Fig. 4-7 shows one such diagram. It was useful in noting that the men were outside and the ‘interview room’ in which I interviewed the women was located inside the house, conforming to the cultural separation of males and females (sections 3.3.1 and 4.4.2.4). The diagrams, along with the photographs and notes, often helped transport me to the field situation even after my return to Durham, which was particularly useful during the writing process. This created a feeling of ‘writing in the field’, which was useful in mentally connecting to the participants and their surroundings and embedding them in the writing process.

In addition to these, during the period of analysis and writing up, detailed field notes often became sources of arguments and themes that are now in the thesis. Comparing the field notes written after a visit to a particular household to the recordings of the household interview often helped confirm, correlate or critique various ideas (see Taylor & de Loë 2012: 1212).

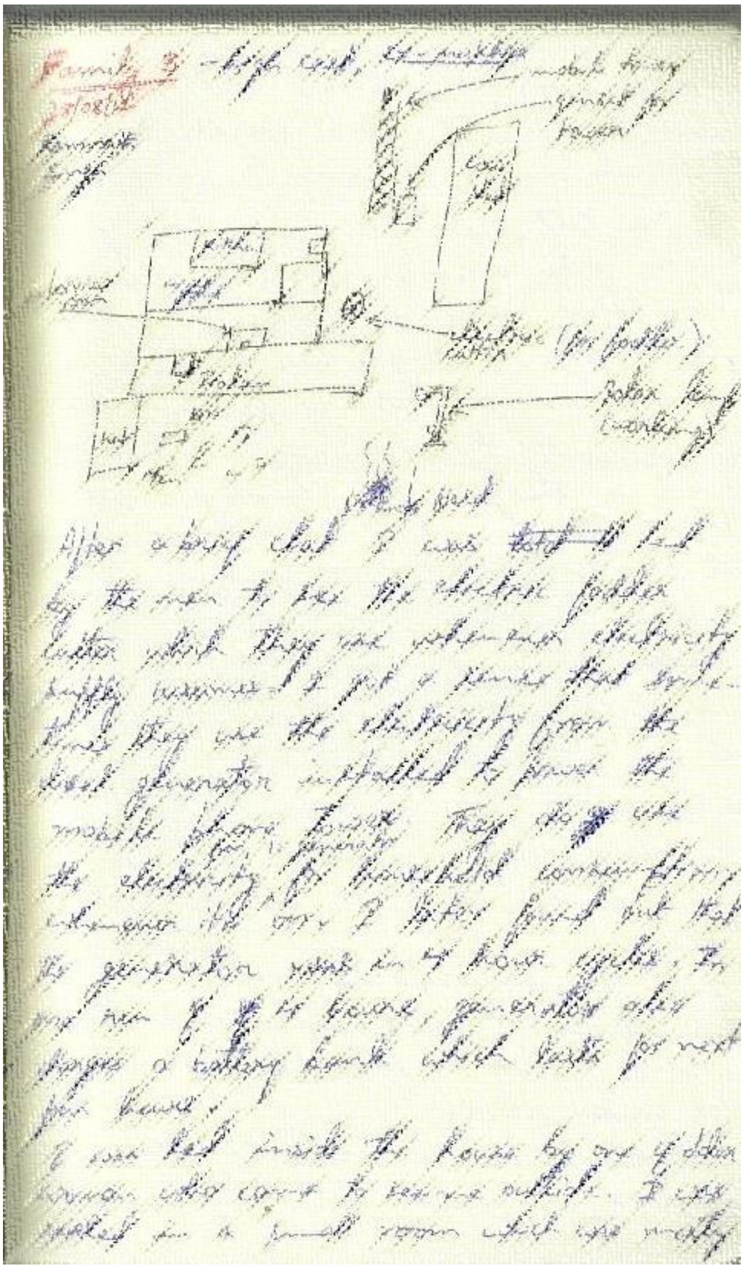

Figure 4-7: Diagrams and field notes.

4.4.2 Interviews and focus groups

4.4.2.1 Interviews: household and elite

In addition to participant observation, interviews are a key tool for doing ethnographic research (Crang & Cook 2007: 60). Two kinds of interviews were carried out in two separate phases in each village. The first were interviews with members of particular households during home tours. These were in the first phase of research in every village. The second were elite interviews carried out with prominent members of the village, like the village head/ex-head or prominent village elders, who provided key information,such as historical accounts of electrification.

Both interviews were in semi-structured formats. These are “valuable in generating qualitative data about how individuals perform practices but also…how they adapt to interventions” and are a “common method used by…researchers for exploring everyday practices” (Powells et al. 2014: 46-47). In the case of this research, the interviews were “self-conscious, orderly and partially structured” conversations with people (Longhurst 2010: 103).

Two key issues associated with interviews that shaped the data are the spaces of the interviews and the gender of the participants. Since these issues are also relevant for focus group discussions, they are discussed in sections 4.4.2.3 and 4.4.2.4.

4.4.2.2 Focus group discussions

Focus groups are a key method for finding out how “people work out their thoughts and feelings about certain matters in *social contexts*” (Crang & Cook 2007: 90). This helped work out shared ideas, thoughts and feeling that people had about various issues related to energy and development – what did energy access mean to people, how did they relate it to development, and what their shared views were about my observations in the village. This was also a way of confirming and debating my observations and views collected through household interviews. Longhurst (2003: 120 refered to in Hopkins 2007: 528) argues that focus groups can “enhance the role of the research participants in regulating the research findings”. In a way then, focus groups can be seen as a ‘peer review’ of the results from a particular village.

However, often in focus group discussions, one person ends up setting the agenda or an opinion that others follow (Crang & Cook 2007: 96). This results in many participants “only offering a shallow insight into a topic” and withholding “personal information and experiences” (Hopkins 2007: 529). This issue becomes particularly prominent when caste power relations are involved (section 4.6). Often members of the lower castes, due to their dependencies on higher castes, are sceptical about voicing contrary opinions. To navigate this problem, I decided to organise separate focus group discussions for lower and higher castes. It is important to mention that in one focus group in Bijuriya, which mainly consisted of members of the higher castes, the solitary member from lower caste was one of the most vocal participants. He was highly educated and had, in the past, been the principal of the local school. This focus group turned out to be based on education and age, rather than being based on caste. It consisted of educated, elderly men.

In addition to the problem of power, the same issues as the interviews – space of the interviews and gender of participants – also shaped focus group discussions. Section 4.4.2.3 and 4.4.2.4 discuss these.

Table 4-3: Numbers and types of interviews and focus groups.

Village	Participant Observation notes	Interviews/home (or commercial) tours		Group Discussions		Elite Interviews		Total interviews/ discussions
	Pages	Number	Characteristics	Number	Characteristics	Number	Characteristics	
Rangpur	200	17	13 higher caste, 4 lower caste	3	1 higher caste, 2 lower caste	2	1 Ex-*sarpanch*, 1 ex-*mukhiya* (both higher caste, there has never been a lower caste village leader)	22
Bijuriya	200	16	8 higher caste, 8 lower caste	2	1 mixed caste, 1 lower caste	3	Project manages of LaBL and HPS	21
Sahariya	120	13	10 higher caste, 3 lower caste	2	1 higher caste, 1 lower caste	2	Project manages of LaBL	17
Berangpur	38	9	3 higher caste, 6 lower caste	2	2 lower caste	6	1 ex-*sarpanch* (lower caste), 1 councillor (Muslim), 3 ex-*mukhiyas* (higher caste)	17
Hardiya	24	5	5 lower caste	1	Lower caste	2	1 ex-project manager, 1 mobile charging station operator	8
Patna		0		0		4	1 LaBL NGO, 1 HPS deputy director, 1 state rural electrification agency, 1 expert of renewable energy scenario of Bihar	4
Delhi		0		0		5	1 MNRE director, 1 LaBL manager, 1 expert of renewable energy scenario, 1 carbon finance consultant, 1 DFID manager	5
Total	**582**	**60**		**10**		**24**		**94**

4.4.2.3 Spaces and places of Interviews

The separation of genders and norm-governed behaviours greatly affected interviews and focus groups (section 3.4.1). Being a male and in most villages, an 'other', I mostly occupied the outside spaces – *dalaan, bangla* or *baithaka*. In most cases, the interview and focus groups took place in the 'outside' spaces. As a consequence, most interview and focus group participants were males and there was a risk of female voices getting excluded. Section 4.4.2.4 discusses the tactics used to navigate this.

Conducting interviews in an outside space, which is generally used for meeting and evening chit-chat, meant that males from other households often joined the interviews. Out of curiosity, they often joined in to listen to or contribute to the discussions. This often resulted in interviews turning into group discussions. Similarly, as focus group discussions were carried out, more people joined in, converting them into general discussions or debates with groups of people. Although sometimes the discussion strayed away from the topics of research towards topics about the village, country, party politics etc., this was useful in giving a sense of the socio-political landscape in which the research was embedded. However, in many cases I needed to make concerted efforts to bring the discussion back to topic or to ask people to let the household members answer. The presence of 'others' also meant that many people were careful about speaking openly (Hopkins 2007: 529). Although, in most cases, people spoke openly and countered each other, and the presence of more people often led to the inclusion of more views, ideas and debates, one can never be sure about what was hidden in these debates.

4.4.2.4 Gender of participants

My identity as a male 'other' and the notion of *purdah* could have excluded female voices from this research. However, *purdah* was more prominent among higher caste families. There are two reasons behind this.

Firstly, the higher castes, due to their greater material capacities, generally have bigger houses. These are properly divided into inside – *aangan,* inhabited by women – and outside spaces – *dalaan, bangla* or *baithaka*, inhabited by men. *Dalits,* being landless or with their minimum possession of lands (often 'given' to them by higher castes), have very small houses with 1-2 rooms and no individual *dalaan, bangla* or *baithaka*. In most cases they do not have open spaces inside the house. During summers, men and women can often be seen sitting outside the house (fig. 4-8). However, a separation between men and women is still maintained. They sit in separate groups, women trying to avoid the male gaze and men not looking at women. Of course, the lack of electric lights, the darkness and lack of gaze that they create help maintain *purdah* even in these situations (section 4.4.1.1).

Secondly, most *dalit* women also work in the fields or in higher caste homes. They are 'used to' the 'outside'. Additionally, many lower caste families in the villages had only women and children. Men from these families worked as migrant labourers in cities. This, in addition working outside, meant that *dalit* women had regular encounters with 'other' men, whether from the village or outside (salesmen, state officials), and were used to them.

Figure 4-8: *Dalit* women sitting 'outside' the homes with small one room house in the background.

Thus, it was easier to meet and speak with lower caste women. However, to talk to higher caste women I used two tactics. First was the use of my own position as a junior member of the research villages. I spent part of my childhood in Rangpur and knew many people there before starting the research. I was seen as the 'grandson of the village'[59] (section 4.4.2.3). According to village norms, everyone in the village was an uncle, aunt or a cousin. This gave me full mobility and access to men, women and children.

In the neighbouring village, Berangpur, I used the same tactic of positioning myself as a junior member of the society. People from both villages knew each other very well and frequently interacted. Because of their shared history, geography and sociality, there was a feeling of 'oneness' between the two villages. This gave me an opportunity to claim the 'grandson of the village' status in Berangpur too. Sometimes even the research participants said, "If he is a *naati* (grandson) of Rangpur, he is also a *naati* (grandson) of Berangpur" (rephrased). This helped me become embedded, up to an extent, in Berangpur village society which resulted in some access to the females. It also made respondents comfortable in my presence and they allowed me to conduct home tours. In other villages I was hesitant to ask people for home tours.

Being a male, I was 'expected' to sit with the males and talk to the males. This expectation dictated my behaviour partly as participating in village life also meant behaving according to village norms. Although I made concerted efforts to meet and talk to females, male members made up the majority of the respondents in this research. However, since home tours were an important element of the research, and most people were happy to show their homes for brief periods, I got opportunities for brief 'chats' with the females.

Often the male and female members of the household were interviewed together. Valentine (1999: 72) argues that "stories about households are woven out of the often differing and competing accounts of individual members". Cupples and Kindon (2003 refering to Valentine 1999) recommend "interviewing respondents in couples or groups, rather than individually, because of the insights that it provides into processes of negotiation and mediation". However, this was difficult due to the system of *purdah*. To navigate this, I often placed myself in

[59] To most people here I was either a *naati* (daughter's son) or a *bhagina* (sister's son).

strategic positions where I could talk to different members of the household while they still occupied their inside and outside spaces (fig. 4-9).

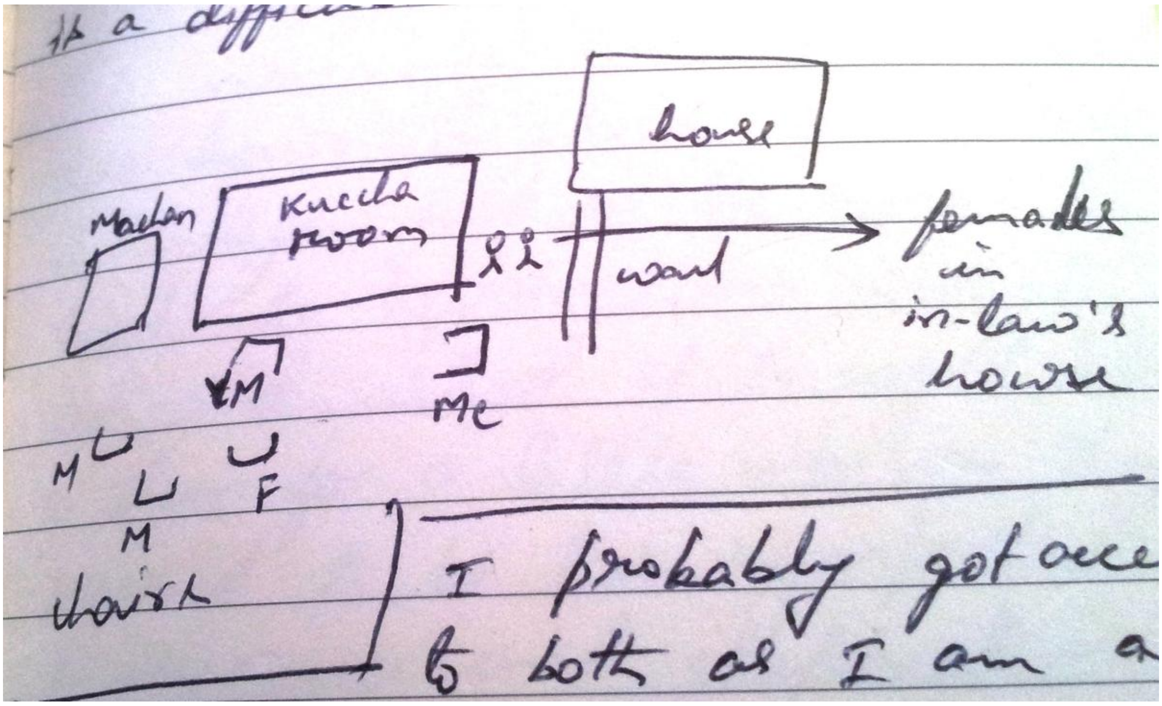

Figure 4-9: Interviewing males and females together. 'M' represents the locations of the male members. 'Me' represents my location. Females are in front of me and the males are to my left. Because of the wall, they cannot see each other but I can see and talk to both.

4.4.2.5 Recording interviews

A voice recorder was used for recording interviews (fig. 4-10). This was done with the permission of the research participants. In cases where permission was denied, responses were written by hand as bullet points and substantiated later from memory.

Although most people agreed for recording interviews, they often seemed slightly uncomfortable when the question of recording interviews was brought up. At one point my gatekeeper (section 4.5.1) in Rangpur suggested that since it made them uncomfortable, recording interviews without mentioning it to the interviewees might be better. However, due to the critical nature of informed consent, this was ethically questionable and I continued seeking permission from the participants (section 4.7).

The recorder has a LED light, which stays on when recoding. Since most interviews were carried out in the dark, the LED light was very prominent. This distracted the interviewees. After a few days, I started turning off the light on the recorder. This made a difference in the participants' behaviour and they were more focused on the discussion. However, I kept seeking permision to record interviews.

Figure 4-10: The camera, recorder and field notebooks used during the research.

4.4.2.6 Coding

During the 9 months of fieldwork, 60 household interviews, 24 elite interviews and 10 group discussions were conducted. In addition to this, 582 pages of participant observation notes were written and more than 1500 photographs were taken. To keep track of the data, organising it for easy and quick availability and retrieval was critical. In addition to this, as a first step of the analysis, the data needed to be summarised under key themes that the research had started with and that emerged during the fieldwork, or while going through the data.

For this, coding of data through Nvivo qualitative analysis software was carried out (fig. 4-11). Coding is "reducing respondent's words into smaller meaningful ideas by linking to specific concepts" (Boschmann 2011: 676). Nvivo was used as "a way of facilitating, particularly with a very large data-set….rapid and systematic retrieval of data according to particular themes or demographic categories” (Parkhill & Pidgeon 2010: 2009). It was also used to “systematise…analysis procedures and facilitate(d) storage and management of the data” (Taylor & de Loë 2012: 1212). The purpose behind using Nvivo was also to learn an analytical package which could be used for handling, organising and managing big data sets in the future (Crang & Cook 2007: 135).

Coding was carried out on audio files. This helped avoid transcribing whole interviews. It was possible to visit specific codes, listen directly to various parts of the interviews relating to a particular theme and decide to transcribe parts that were most relevant for particular parts of the thesis (fig. 4-11). Nvivo was also used for transcription. Coding recordings rather than transcripts helped better integrate with the data. Every time I listened to the recordings, the pauses, expressions, exclamations and background noises took me back to the field situation. This helped make the analysis more nuanced.

However, this was only the first step of analysis. Coding through Nvivo does not replace the human brain. The data always requires further analysis.

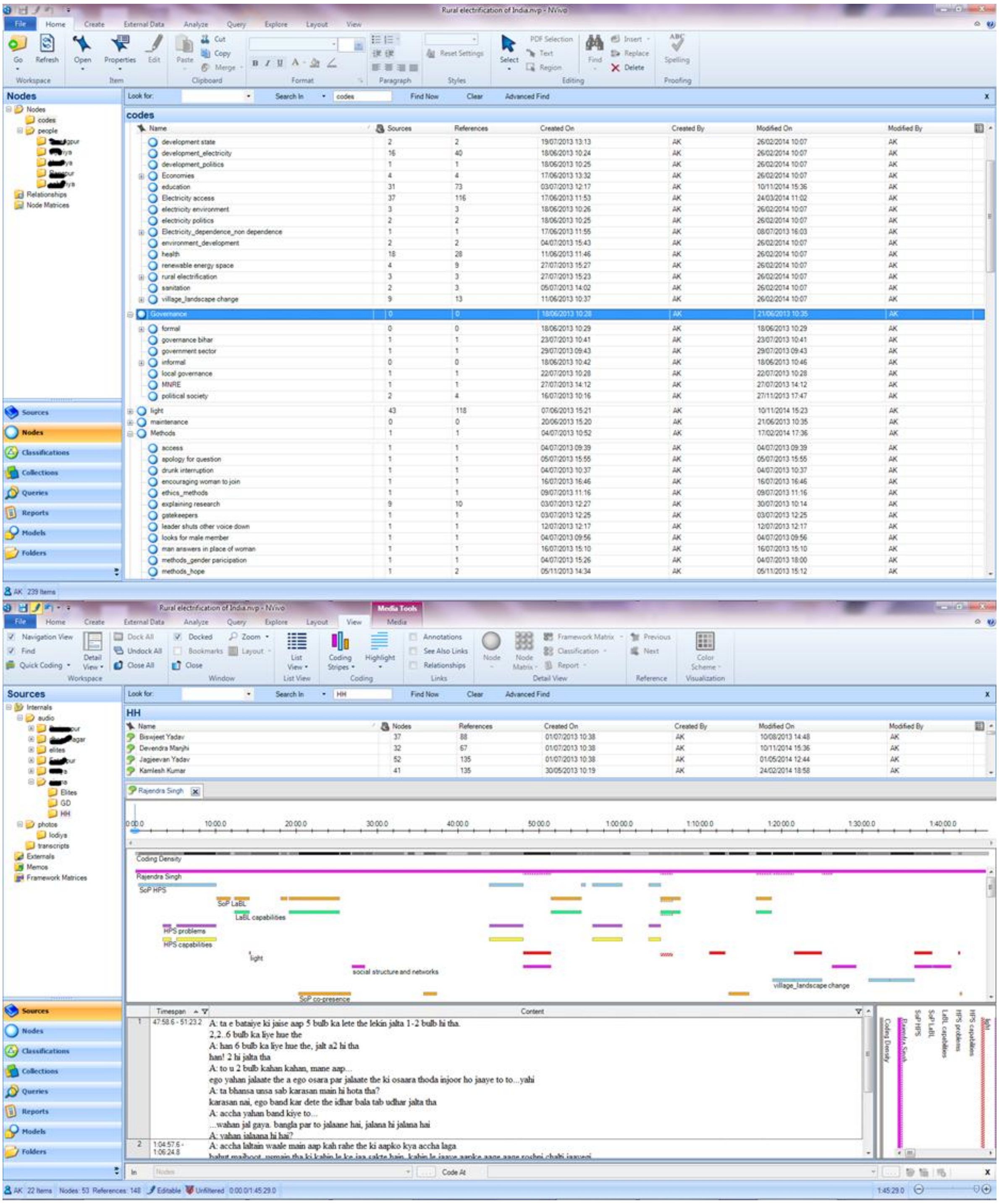

Figure 4-11: Organising data under codes for easier and faster retrieval (top) and coding and transcription of data (bottom).

4.4.3 Analysing and writing the data

Crang (2003: 130) argues:

> Analysis is not simply an issue of developing an idea and writing it up. Rather, it is thinking by writing that tends to reveal the flaws, the contradictions in our ideas, forcing us to look, to analyse in different ways and rethink.

This complexity of analysis is reflective of the process that this thesis went through. Writing in field diaries and looking at photographs were part of the analysis as themes for the thesis emerged from them. In addition to this, as per the suggestions of my supervisors, I wrote detailed emails to them every 3-4 weeks in order to feedback and discuss emerging ideas. These email discussions, a form of 'writing in the field', were also part of the analysis. They helped debate, concretise and make note ofseveral themes that are now in the thesis.

After going through the relevant codes and transcribing the relevant parts, information under specific codes was printed to generate 'code transcripts'. These were then carefully read through and a further level of coding, writing reflections on the margins and connecting various ideas was done (fig. 4-12). As Crang (2003: 130) argues, analysis is also about "working and reworking drafts".

Sultana (2007: 376 with reference to Jones et al. 1997; Falconer Al-Hindi and Kawabata 2002) argues that "reflexivity in research involves reflection on self, process, and representation, and critically examining power relations and politics in the research process, and researcher's accountability in data collection and interpretation". By using group discussions as 'peer reviews', I attempted to share the power of interpretation and analysis with the research participants.

As part of analysis and writing, I aimed to produce a close representation of the life and dynamics in the village. I use the present tense in the writing as the things I narrate are still unravelling the research villages. However, references to events during fieldwork are in past tense. Pseudonyms are used for the research participants and villages, rather than just giving interview numbers, to avoid dehumanising the people whose stories I present. In Bihari villages, generally the name of the head of the household is used to refer to all members of the household – their-husbands'-wives, their-fathers'-daughters, their-fathers'-son. These have been represented accordingly.

Since, almost all the interviews were in Hindi or local dialects, translation was another critical issue threatening the accuracy of interpretation and representation. While I tried my best to translate statements and words accurately, some mistranslations were unavoidable. However, Hindi/local dialect words have been used in brackets for some terms that could not be accurately translated.

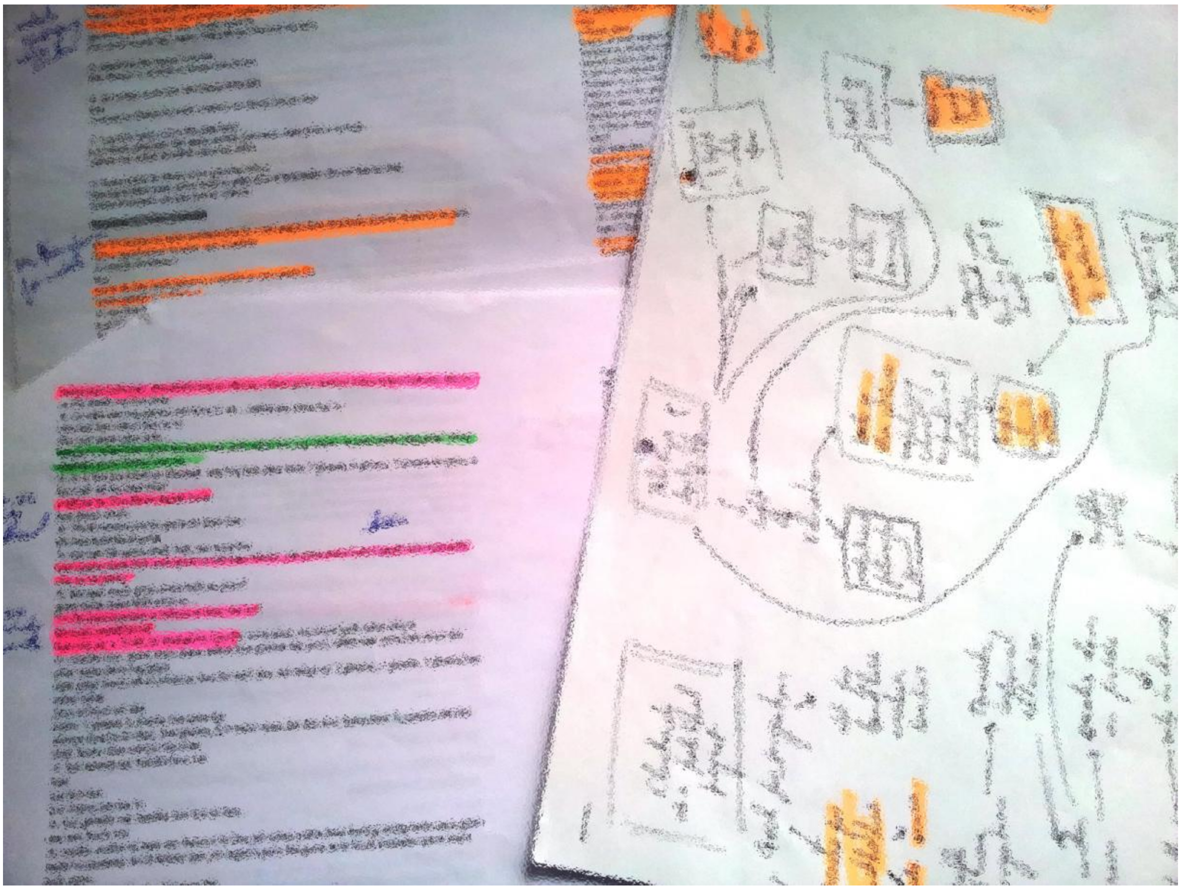

Figure 4-12: Working and reworking data.

4.5 Barriers and access

The access to the project villages was a significant concern. However, this risk was minimised due to the presence of case study projects in several villages. Additionally, my own familiarity with the culture and geography of Bihar helped minimise the risks. However, getting access to various castes, classes and genders was still a concern. Negotiating these power relations was critical for the project as they could curtail the flow of information and create barriers to access. Being a higher caste male, I was at risk of not getting access to two very important groups – lower castes and women. I decided to give special attention to these two groups during the fieldwork. Sections 4.4.2.3 and 4.4.2.4 discuss the tactics used to gain access to women. In addition to this, understanding the power relations that accord or deny energy access to certain groups was a part of the research and negotiating these barriers contributed to it.

Other than accessing women, there were two main barriers –accessing the villages and other castes, and accessing the case study projects.

4.5.1 Accessing the villages and castes: choosing a gatekeeper

The importance of gatekeepers has been emphasised time and again in the literature (Hopkins 2007; Nelson 2013; Crang & Cook 2007). I probed people about this from the methodological point of view. In Hardiya, after interviewing Mr. Devesh Kumar, I asked whether he would have talked to me if I had come alone. He replied that he would have, but the presence of a "known person" – RK (my guide) – made him more comfortable. This comfort is critical especially when the researcher is working in unfamiliar contexts and field situations. Putting respondents at ease helps them to open up. This is important in research methodologies that require participation, rapport building and interviews. However, the question that I raised with Mr Kumar resulted from some remarks in Bijuriya.

> (laughs) It's his (looking at my guide) presence here that people are talking to you for this long. Because they see a known person. Otherwise who is ready to listen to all this in the villages?!
>
> **(Mr. Jagjeevan Yadav, lower caste, farmer, Bijuriya)**

Having a gatekeeper and choosing the 'correct type' of gatekeeper is important, even for a partial 'insider' – like me – who is aware of the social and cultural context and can speak the participants' language. However, often researchers *have to* make do with anyone they can get, as long as they know the local area and people.

In my case, the ideal gatekeeper was someone who understood and was sympathetic to my work (Crang & Cook 2007: 18). This was also a person who had a good rapport in the village and was known and respected by people from various sections of society. In all cases, this was also a person who was educated and understood what research and PhD were about. Many people in the villages were educated but very few understood what a PhD or a thesis was.

My gatekeepers were often from the same village – in Rangpur and Sahariya – or a neighbouring village – in Berangpur, Bijuriya and Hardiya. Being a higher caste man, my social network often begun with members of the higher castes. They became my gatekeepers in Rangpur, Berangpur and Bijuriya. However, as the fieldwork proceeded in the villages, these higher caste men recruited members from the other castes and in Berangpur, another religion to introduce us to people from their castes and religions. In Hardiya, my gatekeeper was a lower caste man from the neighbouring village to whom I was introduced by his employer, a higher caste man. So, in most villages, there was one gatekeeper – most often a higher caste man – who unlocked the gates to several other gatekeepers, who in turn unlocked the doors to their specific social groups.

In Sahariya, access came through the LaBL entrepreneur who was also from the higher castes. Since I wanted people to comment on their experiences with the LaBL, which included the entrepreneur, his presence was problematic. This was not a choice I made. I got access to the entrepreneur through the LaBL local NGO. However, being an 'understanding' and 'sympathetic' gatekeeper, Mr. Brij Kumar, the local entrepreneur introduced and left me alone with the research participants. This gave enough privacy to discuss various issues, some of which related to the entrepreneur's misconducts.

4.5.2 Accessing case study projects

LaBL and HPS websites have lists of their project villages. This makes locating and selecting villages easier. However, on the ground the situation is more complicated. This section discusses the process and problems of accessing the two case studies on the ground.

To access LaBL, I planned to do an internship with TERI. I contacted one of the project directors, who agreed to the internship on the condition of co-authoring a paper. Although sceptical about the objectivity of a paper co-authored with TERI, I agreed. This would have been a good way to take the outputs from the research to policy and practice. However, a verbal agreement on the internship never materialised into an official confirmation. This is when I decided to use other tactics for access. A pre-existing contact in TERI put me in touch with the local NGO in Lakhisarai. I visited the NGO office and Mr. Anand Jha, its director, was kind enough to take me to Sahariya and introduce me to Mr. Brij Kumar, the LaBL entrepreneur. Because of my familiarity with the local culture and language, I could easily build a rapport with both Mr. Jha and Mr. Kumar.

However, things were not as straightforward in case of HPS. I emailed one of their founders in October 2012 to seek access. When no reply came for the next couple of months, I telephoned another founder (I got his number from another contact in the energy sector in Bihar). He agreed to allow access but informed me that a fee needed to be paid for this. Although this seemed strange, during consultations with my supervisors, it emerged that this was common practice for projects that feel over researched. Since, they have to regularly divert resources to help out researchers, they ask the researchers to pay for these. I emailed the founder back agreeing to pay. No reply came for the next couple of weeks in spite of reminder mails or texts. I realised that HPS might have changed its mind about access.

I decided to go to Paschim Champaran district (which has most HPS projects). Being from the state, I had existing contacts in the district through my social network. I shared the list of villages with these contacts and found that the micro-grids were working in some villages. Out of these, Hardiya was easiest to access and my contact in the district, a doctor, had an employee from a village neighbouring Haridya who was ready to help me. Already familiar with the socio-cultural landscape of Bihar, I was confident about being able to talk to the villagers once introduced by my gatekeeper. The fieldwork went according to the plan. In retrospect, this worked out better. Most literature about HPS refers to one particular village and discusses how successful the project is. It was possible that HPS would have given me access to the same village – a model demonstration village. By gaining access through my social network, I was able to avoid this bias and get data that was richer and nuanced. However, this may not have been possible in another country or state in India.

4.6 Positionality

Positionality was a critical issue for me. “Doing research at ‘home’ also brings in different dynamics, in terms of concerns of insider-outsider and politics of representation” (Sultana

2007: 378). I am a higher caste Bihari man from Begusarai district who spent part of his childhood in one of the research villages – Rangpur. I am very familiar with the Bihari society and culture, but not as much as those permanently living in the villages. Having lived in a town for a very long time, received higher education in Delhi and undertaken a PhD in the UK, I have been away from the villages for a substantial time period. I can understand and speak the local language, but not as well as the locals.

These multiple identities made my positionality complicated. They made me "both a stranger and a friend among the people" I was working with (Jarvie 1969: 505). Jarvie, (1969:505) discusses this identity crisis and recommends taking the role of a stranger to negotiate it. The strangerness was natural. As Sultana (2007: 375) argues, "even if the researcher is from the Global South…class and educational differences (i.e. material, social, political power differences) remain trenchant markers of differences".

I had never had a long-term, sustained engagement with the villages and there were lot of unfamiliar issues for me. In addition to this, being from a higher caste family, most of my long-term interactions had been with members of the higher castes (although I had several friends and colleagues from the lower castes) in the villages. I was largely unfamiliar with the conditions of the lower castes. Being a higher caste man also made me a distant and unfamiliar person for the members of the lower caste. While the familiarity with the culture made me an insider, the distance from villages and caste relationships made me an outsider for several social groups. In any case, anyone not from the village or not living in the village has a partial outsider identity. As Jarvie (1969: 506) argues, "there are few cultures in which an outsider can ever completely overcome his role as stranger". Thus, at the same time, I was an insider, outsider, both, and neither (Mullings 1999).

In ethnographic research the researcher needs to build a rapport with the participants and gain 'their' confidence (Crang & Cook 2007; Zavisca 2007; Clifford 1983). However, when a community is highly diverse, socially fragmented and with conflicting interests, and when the researcher has conflicting identities, it becomes difficult to gain 'their' confidence. This is because the researcher is expected to choose who her/his 'their' are. Building the confidence of one section of the society means risking the loss of confidence of the other sections. To build a rapport, and to integrate, it is also important to live in the village for a long period of time and interact with people regularly. However, this means that the researcher must live with a household or a family in the village. This means risking the perception of allegiance to certain households and a certain parts of the society, which may alienate the other parts of the society. In addition to these, I was already an insider at different levels for many villages. Being a higher caste man put me in the insider category – 'one of our own' – for the higher caste households of the villages. However, for the lower castes, I could not be 'one of our own'.

To navigate the issue of allegiances and confidence building I decided keep my urban, educated, living in foreign country identity. This put me in a less contentious position. To maintain this, rather than staying with a family in the village for an extended period of time, I decided to come in and out of the village everyday. I slept in some villages overnight but never stayed there for the whole day (section 3.2). Although, getting a neutral status and confidence of all sections of the society was impossible, the constant departure from the villages gave me an outsider's positionality which to an extent helped me separate from the any particular alignments. In addition to this, the urban, educated, living in foreign country identity – someone who is away from the various village groups and their politics – also put me in the outsider category.

However, the constant departure from the village and being a *videshi* (foreigner) leading to my outsider status was also problematic as it made it difficult for me to integrate fully with every aspect of the village, its life and its people (see also Sultana 2007: 377).

4.7 Ethics

Ethical concerns were very important, particularly from the perspective of multiple identities, relationships of power, social status and cultural rules for men, women, higher castes and lower castes (see Sultana (2007: 375). There are two key ethical issues (among many others) that I want to flag – managing the expectations of research participants and gaining informed consent.

The first is about explaining the research to the potential research participants and avoiding misunderstandings. There was a dilemma about being truthful about the fact that my research and I (due to my limited power) would not be able to bring any immediate and tangible benefits. This was a dilemma because being truthful may have meant a loss of interest of the research participants. This was a dilemma of hope. If I raised the participants' hopes, they would have enthusiastically participated in the project. Hope can open gates for the researcher, build rapport, and enrol keen participants. This is tempting, but the researcher must think about questions like 'can there be quick change due to my research' or 'should there be a change' (see Corbridge et al. 2005: 266).

On the other hand, the research participants would have been reluctant to participate if they did not see any benefits, i.e., if hopes were not raised. The researcher must also be wary of the conflicting hopes of the research participants. Raising hopes may mean raising conflicting ideas and conflicts of caste, class and gender. Raising hopes, and not being able to fulfil them, may also lead to closing of gates, not only for returning to the community for more research, but also during the current research. However, "whether rightly or wrongly" it is important that the researcher explains "as clearly as possible the reason for his presence" (Jarvie 1969: 506).

I tried to be truthful and explained that I was a researcher who did not have any direct influence on the policy matters of the state or private firms. Since, the research was around rural electrification, people in the research villages often requested me to help out with electrification. In Bijuriya, when I was interviewing Mr. Rajendra Singh, his uncle requested:

> If there is a scheme Sir….You are associated with a scheme; you are doing survey for that Sir. I request Sir to provide us Sir (the benefits of the scheme)...

Since my questions were focused around electricity, he thought I was a state official conducting assessments for a government scheme. Even after explaining my research and capabilities, when I was leaving Mr. Singh's house, he requested:

> The way sir, has been visiting regularly, I think he would give special attention to Bijuriya….

By this time I had been visiting Bijuriya for about 20 days. This gave him some misleading ideas. However, he was not alone in this. In Berangpur, a woman complained to me that I was taking pictures of many households but had not done so for her household. Often, state officials take pictures of families to enrol them into various schemes. Even though I had explained my purpose and identity several times in the village, misunderstanding was spreading. I did not want to upset the woman and took a picture of her family. This led to a spiral and over the next three days I visited and took pictures of most households of the village, to keep everyone happy. Part of my commitment to my research participants was to not disturb them much and to do small acts of reciprocation like this in return of their kindness and participation[60]. This was tiring but it did help widen my observation circle. I was able to see many more households.

In these cases people eagerly interacted and engaged with me. But often when I explained my actual position and role, they disengaged and in some cases ignored me. In many cases, misunderstandings and raised hopes were dangerous. One day, during the research, I needed someone to introduce me to a household. I saw a young man nearby, who I had interacted with in the beginning of my fieldwork. Thinking of him as a familiar and sympathetic person, I asked him to introduce me. The young man shot back:

> (Slightly agitated) You have been visiting our village regularly for the last one month but we haven't got electricity yet..... (Rephrased)

I did not receive any help from him. He was upset that I was not doing anything for the village, and hence did not want to do anything for me. This was 'research fatigue'. However, this is probably how fieldwork 'works'. Balancing multiple identities, expectations and understandings is difficult and some misunderstanding is unavoidable.

My solution for the dilemma of hope was to constantly balance truth and tact. I told respondents truthfully what my capabilities were. However, at the same time I pointed out that during the course of research I would encounter and in many cases interview those in the positions of power. As part of the research, I was going to discuss the issues faced by the research participants withthose in positions of power. This may influence their thinking. I also pointed out that several publications like papers, magazine/newspaper articles, blog posts, and books will come out of the research which will bring the respondents problems into the public domain. These may reach those in the positions of power and influence them.

This explanation was also important in that it clarified the fact that the data collected during the research will go into a thesis, books, journal articles and other publications and will be available in public domain. While doing this, I informed the participants that their names and

[60] I also printed photographs of several households in the research villages and presented them with a copy.

villages would be anonymised to protect their identities. As part of anonymity for the participants and for building their confidence, I never recoded (on the voice recorder) their names during the interview. At this point, permission was also taken from the research participants for photography.

This was part of the process of gaining informed consent from the research participants (Zavisca 2007). According to the university procedures, I planned to get written informed consent and prepared forms in Hindi[61] and English. For those who could not read (and I expected many such participants), I planned to have someone they had confidence in read the form to them so that they could, if required, thumb-print the form. However, when I began fieldwork (and also based on my prior knowledge of the research context), I found that most people in the villages were doubtful about signing a document presented to them by an 'outsider' (and were even more sceptical if they could not read it). This could have been a significant research barrier. I discussed this with my gatekeepers who advised against written consent and in favour verbal consent. I chose to continue with verbal rather than written consent for both interviews and photography. Sultana (2007: 376-77) argues that "often ethics are then shifted away from the strict codes of institutional paperwork, towards moral and mutual relations with a commitment to conducting ethical and respectful research that minimizes harm".

4.8 Conclusions

This chapter has introduced the two low carbon energy case studies that this research is based on. It has outlined the methodological approaches and tools used during the research. It has also discussed the issues of access, positionality and ethics. Due to multiple identities, relationships of power and cultural subjectivities, these issues are critical for this research. To conduct an ethnographic study this research has used participant observations, household tours, household interviews, focus group discussions and elite interviews.

The thesis engages with Lighting a Billion Lives (LaBL) and Husk Power System (HPS) case studies because they accommodate various technical, social and economic approaches used for

[61] Because most people in Bihari villages, if they can read, are more comfortable with Hindi.

energy access. Together they provide insights into solar, biomass, lanterns, micro-grids, not-for-profit and for-profit approaches. In addition to this, the research has spanned five villages in Bihar, India. Although the five villages broadly followed the same social and cultural norms, the presence of at least three different micro-cultures was easily discernible. This helped conduct comparative and correlative analysis of the two different case studies in diverse social settings. This approach has been instrumental in developing an understanding of how energy and development projects unfold in people's everyday lives.

5 Energy Trusteeship: Assembling and Governing Low CarbonAssemblages

5.1 Introduction

In India, the national grid network is the main source of electricity access. However, there are wide spaces outside this network which are occupied by people without access to electricity[62]. Many people, who are connected to the national grid network are unable to use electricity due to the quality, quantity and erratic nature of the electricity supply. They are part of this energy assemblage but are unable to participate in it. Inside the assemblage, the establishment of large dams and thermal power stations[63] has created spaces of environmental degradation. Now low carbon decentralised energy is trying to fill these spaces (Palit 2013; Kumar et al. 2009; Akella et al. 2009; Reddy et al. 2006; Jolly et al. 2012; see also section 2.2.1).Distributed low carbon energy has emerged as “an efficient, reliable and environmentally friendly alternative” (Alanne & Saari 2006: 540) that can fill the spaces that lack access and also the spaces of environmental degradation. These low carbon energy projects are often funded and developed by NGOs, for-profit private firms, and bi-lateral and multilateral organisations like the United Kingdom’s Department for International Development (DFID) and the World Bank.

Until the late twentieth century, the provision of energy services has been the domian of the State in India. Understanding how and why other actors have come to occupy a position in this domain neccesitates an interrogation of, and engagement with, what Tania Murray Li (2007c: 4) terms “trusteeship”. In her book “The Will to Improve”, Li (2007c: 24) explores “the position of trustee, and the position of deficient subject whose conduct is to be conducted”. Until now, the state in India has been the trustee for energy, especially electricity. Now, bodies other than the state have started stepping in (see Scott 1998).Cowen and Shenton (1996: 23) argue that trusteeship is based on the idea that those

[62] The development of the national grid network is briefly discussed in Chapter 1.

[63] Once seen by Nehru, the first Prime Minister of India as the “visible symbols of building up the new India and of providing life and sustenance to (our) people” (Guha 2008: 225).

who have the "capacity to utilise" resources "in interest of the society", and the capability to decide, should be entrusted with the 'good of the people'. As the state is seen as failing to properly utilise resources and improve the lives of people (see IFC 2012), actors other than the state (sometimes supported and shared by the state) claim the capacity to decide through their "will to improve" (Li 2007c). The will to improve "carries within it a will to govern" (Li 2007b: 267). Li (2005: 384) argues for a need "to look beyond 'the state' to the range of parties that attempt to govern". "Government" here refers not only "to political structures or to the management of the states; rather, it designates(d) the way in which the conduct of individuals or of groups might be directed" (Foucault 1994: 340).

For many actors involved in energy access, claiming the spaces left open by the state and its national grid is claiming trusteeship.Scott (1998: 89) argues that those who position themselves as trustees often do so "with a comprehensive critique of existing society and a popular mandate to transform it". The actors assembling the two case study projects that this research looks at – Husk Power Systems (HPS) and Lighting a Billion Lives (LaBL) – position themselves as 'trustees' who have stepped in due to, either the absence of (unable to provide energy access), delay from (unable to provide energy access in the near term) or errors of (energy generated from high carbon or polluting sources and problems of climate change) the state. In addition, for many actors, the gap in rural electrification has come as an opportunity. This gap is an untapped market for energy products – solar lanterns, solar home systems, micro-grids – that can be tapped into, to make profits(see Martinot et al. 2002; MacLean 2012; Koh et al. 2012). Although profits are important, the key idea driving the low carbon energy projects is still that of trusteeship. Thus, whether it is the not-for-profit LaBL, or the for-profit HPS, doing "good by paying for itself" (Cross 2013: 9) has become the mantra where 'doing good' for the people and for the environment is the key through which these actors emerge or position themselves as the trustees for energy access. The trustees bring together materials, people, ideas, "objectives, knowledges, techniques, and practices" into the low carbon energy assemblages – LaBL and HPS – to mobilise their 'will to impove' energy access (Li 2005: 386).

While trusteeship is about the 'will to improve' people's conditions, it is also about the 'capacity to decide' the good of the people. These trustees of energy access, with their ‘capacity to decide’, have their own ideas of ‘energy access’ through which they try to direct the “conduct of individuals or groups” (Foucault 1994: 340). This capacity to decide, in addition to the fact that communities are never “fully responsible”, enables trustees “retain their…role as the party that produces policies, plans and regulations, prescribing and enforcing the proper relations” in the assemblage (Li 2007b: 280). These policies, plans and regulations that foster proper conduct and relations form the techniques of governing low carbon assemblages. Trustees want to “use power to bring about enormous changes in people’s habits, work, living patterns, moral conduct, and worldview” (Scott 1998: 89).To make these changes, trustees develop and put in place, technologies, rules, definitions and controlling strategies in dispositifs within the low carbon assemblages (Section 2.3.2.2). Dispositif refers to the “tools and devices”, controlling tactics and other “heterogeneous elements” deployed to produce “a machinic contraption whose purpose in this case is control and management” of the people, aims, objectives and targets of the low carbon projects (Rabinow & Rose 2003: 10-11).

Section 5.2 discusses the techniques used by trustees to attract other actors – trustees and subjects – to join the low carbon assemblages with a specific focus on how other actors are attracted to join the trusteeship. Section 5.3 discusses the techniques used to govern and standardise i.e. the dispositifs that are part of the low carbon assemblages. Section 5.4 argues that trusteeship is a contingent phenomenon. Various actors that are part of the low carbon assemblages at different times and in relation to other actors, could be seen as trustees or as targets (individuals or groups). Actors have multiple – at times simultaneous and at others separated – identities in these assemblages.

5.2 Techniques of assembling: Connecting to particular discources

Due to their power, resources and knowledge, trustees structure, hierarchalise and narrativise the assemblages sociospatially (section 2.3.2). However, they still have to carry out the “labour of assembling” to bring and keep different actors together (McFarlane 2009: 562; McCann 2011: 144-145). This section looks at this labour and the various techniques of assembling trustees use to appeal to, recruit and “forge alignments” with other actors (Li

2007a: 265). Newell (2013: 322 with refernce to Gallagher 2005) explains that projects often develop under pressure from international finance organisations to align to their preferences. Many low carbon energy projects, especially those under consideration in this thesis, receive financial support from transnational and international financial institutions. Some activities in LaBL are funded by DFID[64] and in HPS are funded by the United States Agency for International Development (USAID)[65]. In addition to these, finance also comes from private philanthropists and venture capitalists. To recruit these actors, trustees connect to particular discourses.

Through a discussion on what electricity from the low carbon assemblages signifies for the trustees, section 5.2.1 outlines the "specific targets" (Legg 2007: 9) and the particular purposes that are important for the them. They focus on the particular significances of electricity to connect to ideas around the global project of sustainable development and forge alignments with other actors who have common agendas.

In energy transitions, *innovation*(Smith et al. 2010; Haas et al. 2008; Cherp et al. 2011; IFC 2012) and *appropriateness* (Byrne 2009; Rehman et al. 2010; Harish et al. 2013; Wong 2010) have particularly gained currency. Actors often look to join projects that bring a new, and different from the previous, idea or approach – i.e. are innovative – and provide a 'solution' that fits not only the 'deficiency', but also the context under consideration – i.e. are appropriate. By connecting to these discourses, LaBL and HPS attempt to make their assemblages distinct from others claiming to provide energy access. Innovation and appropriateness are discussed in sections 5.2.2 and 5.2.3 respectively.

5.2.1 Significances[66]

> "Widespread energy poverty condemns billions to darkness, to ill health, to missed opportunities for education and prosperity"

[64] https://www.gov.uk/government/case-studies/lighting-a-billion-lives-throughout-india
[65] http://www.usaid.gov/powerafrica/partners/private-sector#hu
[66] Based primarily on analysis of project websites and brochures, and also interviews conducted during fieldwork.

(Ban Ki Moon, Secretary-General United Nations (SEFA/UN 2012))

For assembling the low carbon projects, the ideas that electricity embodies are more important than what electricity actually does (see Verbeek & Kockelkoren 1998: 31). One such idea is expressed in the UN Secretary-General's quote above. The ideas that electricity embodies in relation to development are often about identifying problems that need to be solved (Li 2007c: 7). These problems are the "specific targets" (Legg 2007: 9) and their solutions are the "specific finalities" (Li 2007c: 9) that the low carbon assemblages aim to achieve. Li (2007c: 7) argues that the "identification of a problem is intimately linked to the availability of a solution" and that "they co-emerge within a governmental assemblage in which certain sorts of diagnoses, prescriptions, and techniques are available to expert". Trustees "target the practical conditions that make something an object of knowledge" (Legg 2007: 13 with reference to Deacon 2000). For them, electricity comes to signify a solution to the practical conditions that the UN Seceratery General outlines in his quote (section 2.3.2.1,). Through a focus on these significances, electricity from the low carbon assemblages emerges as a sign of improving or rectifying these conditions.

Using these problems and the particular significances of electricity, trustees connect to discourses of sustainable development around which various actors assemble. However, it is not only crises or challenges that are targeted. Sometimes it is an opportunity; an opportunity of earning profits while doing good. This section looks at the particular significances through which electricity from the low carbon assemblages signals development activities which prompts other actors to join the assemblage.

Lighting a Billion Lives

- Inadequate lighting hinders progress and development opportunities
- Directly impacts health, environment, and safety.
- 2.2 billion litres of kerosene burnt each year for lighting
- About 5.5 million tonnes CO_2 emitted to the atmosphere by burning of this kerosene

The Lighting a Billion Lives campaign is making a concerted effort towards addressing these critical issues as well as bringing about *innovations* to facilitate interventions enable energy access for all. It has the *global understanding* of the

> *challenge of providing clean lighting to billions* that are at the *bottom of the pyramid*, and has adopted a *localized, bottom-up* approach to addressing it.

(What is Lighting a Billion Lives? LaBL website: 27/01/2014)

The above excerpt from the Lighting a Billion Lives website suggests that the practical conditions that it targets are the impacts of kerosene lighting – health, environmental and safety. The campaign brings together pollution from a kerosene lamp and the inadequacy of kerosene light, which according to it “hinder(s) progress and development opportunities”, to argue for the importance of electric lights. LaBL reasons that due to inadequate lighting, children find it difficult to study. This impacts their education and, as a consequence, progress and development. It creates an image, for other actors to see – an image of a child unable to study due to inadequate lighting and exposed to health impacts of the smoke from kerosene lamps.The image is also of a household with kerosene lamps likely to cause fire (fig. 5-1). It also creates an image of widespread fossil fuel – kerosene – use and greenhouse gas emissions causing climate change. Through these images, LaBL brings together muliple problems. It problematises energy access and goes on to propose a solution.

Figure 5-1: Pre-LaBL image (LaBL website).

LaBL presents its solution to other actors – that of "providing clean lighting to billions" of poor people, especially those at the bottom of the socio-economic pyramid. Its solution includes socio-economic progress and development, "local and global environmental benefits" and introduces a key actor for mobilising these – the solar lantern (LaBL 2014). LaBL's solution also contains a commitment to "enlightening" the lives of the rural poor (LaBL website). By invoking the idea of enlightenment, a terms that LaBL uses on its website more than once, and its 'capacity to enlighten', LaBL confirms its expertise, and distinguishes itself from the subjects who need "expert direction" (Li 2007c: 7). This is characteristic of Li's (2007b: 265) second practice of assemblages – "rendering technical". Rendering technical is the process of simplifying problems and interventions that lead to beneficial results (see also Rose 1999: 33). Rendering technical helps establish expertise and assemble other experts and subjects.

By rendering the problem technical, i.e. identifying multiple problems clearly, drawing them into a coherent narrative and proposing a clear solution, the solar lantern, LaBL positions itself asa trustee of energy access. With this solution, for other actors to assemble around, LaBL proceeds with "forging alignments" (Li 2007b: 265; see also section 2.3.2.1). It invites other actors to join the trusteeship – to enlighten a billion lives – and to forge alignments around its solution and the material incarnation of this solution – the solar lantern. On its website, LaBL goes on to argue:

> It is a known fact that clean and affordable energy is elementary to one's quality of life as well as for ensuring socio-economic development. Without access to affordable energy it will be impossible to eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women or even reduce child mortality and improve maternal health.
> Clean and bright solar light improves the quality of life, advances education, health, and livelihood.

(LaBL website: 27/01/2014)

With the solar lantern, LaBL projects a new image (fig. 5-2). In this new image, the child is still there. However, the kerosene lamp is replaced by a solar lantern. Now the child has ‘adequate light’ for studying. He is no longer exposed to the health impacts from the kerosene lamp. The image is also of a village home, safe from fires caused by kerosene

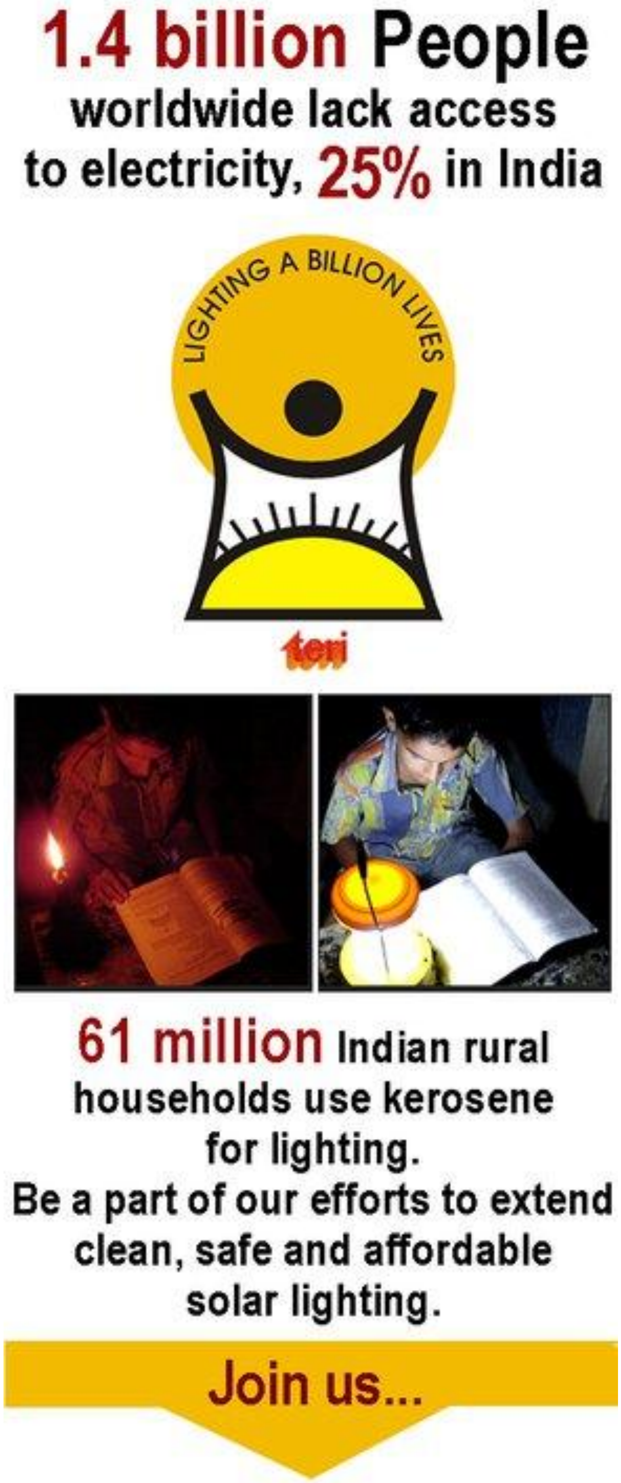

Figure 5-2: Creating a new image (LaBL Facebook page).

lamps. This image is joined by other images that are part of LaBL's solution and its 'enlightenment' comitment. These are images of livelihood made possible through renting solar lanterns and being able to work after dark, and images of women empowerment through the development of female entrepreneurs. LaBL's solution and its key actor, the solar lantern, embody particular significances of electricity – education, health and livelihoods. Electricity from LaBL becomes a sign of these significances. Around these significances, alignments are forged and the "labour of assembling" (McFarlane 2009: 562) is carried out.

Husk Power Systems

> Each plant serves around 400 households, saving approximately 42,000 litres of kerosene and 18,000 litres of diesel per year, significantly reducing indoor air pollution and *improving health conditions* in rural areas. By extending village life beyond daylight hours, HPS promotes economic development by enabling businesses to stay open after dark and allowing children to *study at night*. HPS creates an ecosystem around each plant by providing *income generation opportunities* to local farmers and entrepreneurs. Additionally, it creates employment through its *livelihood* programmes such as the incense stick manufacturing program which largely employs women. This *enables sustainable development* within the communities HPS serves.(Emphasis added)
>
> **(Community Impact Section, HPS Website: 29/07/2015)**

Like LaBL, HPS associates itself to 'practical conditions' like education, health and livelihoods and their connections to progress and development. By prioritising these significances, electricity from HPS is positioned as a sign for bettering these conditions. HPS creates similar images of kerosene lamps and children exposed to low light and high pollution (fig. 5-3). By reducing reliance on kerosene lamps, HPS invokes benefits for the local environment. At the same time, it connects to the discourses around global environmental benefits by reducing greenhouse gas emissions through its efforts to replace kerosene and diesel oils. In fact, the main topics mentioned under the section 'community impacts' on HPS website are the number of local jobs (created), number of people reached (for energy access), estimated CO_2 avoidance and litres of kerosene and diesel avoided. Similar to LaBL, it brings together multiple problems (the same problems as LaBL), problematises energy access, and goes on to propose a solution.

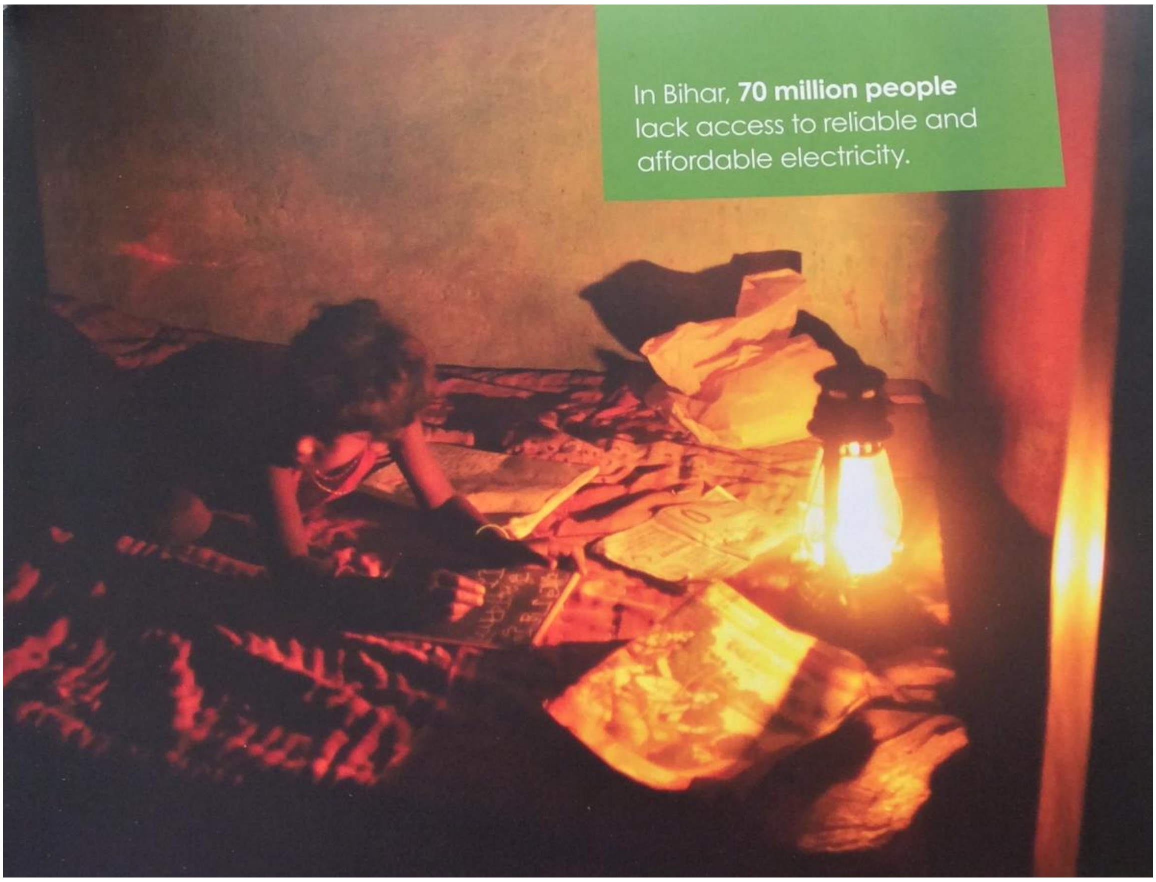

Figure 5-3: Pre-HPS image (HPS brochure).

HPS derives its motto "*tamso ma joytir gamaya*", meaning "lead me from darkness to light", from a Sanskrit hymn that Gyanesh Pandey and Ratnesh Yadav, two of its founders, used to chant every morning at their school[67] (Boyle & Krishnamurthy 2010):

"Asato ma sad gamaya,		"Lead me from ignorance to truth,
tamaso ma jyotir gamaya,	which means	from darkness to light,
mrityor ma amritam gamaya"		from death to immortality**"**

[67] The two founders were classmates during their school days in Bihar.

The motto, through its placement in the hymn, revels that HPS is not just about light in the literal sense. It has a broader message – that of light in the figurative sense[68]. The motto is also about enlightenment, good health and life, the same as LaBL. The image that HPS creates is similar to LaBL – that of a clean, healthy, happy household (fig. 5-4). Through its motto, which shows its commitment to 'enlightening' the lives of the rural poor, HPS invokes its trusteeship of energy access. It invokes its capacity to improve people's lives by taking them from ignorance – which stems from their lack of education and disconnect from the modern world – to wisdom. HPS does this by bringing education to people through electric lights and connecting them to the modern world. It takes them to a 'good life' and better health by removing kerosene from their lives. Like LaBL, the electricity from HPS becomes a sign of 'enlightenment', around which it invites other actors to forge alignments and to join the trusteeship. It invites the actors to join its solution – to provide "power to

Figure 5-4: Creating a new image - electric light, happy children (HPS brochure).

[68] Mr. Gurpreet Bedi, the LaBL manager also argued that LaBL thinks of light in both the literal and figurative sense, in ways similar to HPS (chapter 6).

empower" (HPS brochure)[69] – and assemble around the material incarnation of this solution – a biomass micro-grid. Thus "terminological significance" and its relationships to practical conditions become important as they often determine the "particular political work" that the low carbon assemblages do (Walker & Bulkeley 2006: 655)[70]. It is also important to mention that both projects specifically focus on lights as they, through their literal and metaphorical work, help bring multiple development concerns together. This helps forge alignments between the concerns of the trustees and the actors that they invite to join the trusteeship.

As Li (1999: 307) argues, the problematisations and solutions produced by trustees help imagine standard subjects "with the requisite deficiencies that rationalize and legitimate" the trustees' will to improve. Through these, the trustees create an "emotional appeal" for their energy assemblages and their significances of electricity (Gent 2014: 179 refering to Kumar 2013). The images, problems, and solutions, through which electricity from the low carbon assemblages emerge as a sign of development, and through which certain actors position themselves as trustees and forge alignments with others, are, as Ferguson (1990: 55) puts it, "fanciful, but it is always the same fantasy" – of improving people's conditions and conducts.

5.2.2 Innovation

Rose (1999: 28) argues that "naming is itself a creative act: it assembles a new individuation of concepts, symptoms, moralities, languages; it confers a kind of mobile and transferable character". Names like Lighting a Billion Lives and Husk Power Systems emerge as signs of innovation. They, through the use of words like 'lighting' and 'power', and by connecting

[69] HPS explains its vision in its brochure as follows:
"HPS aims to provide renewable and affordable electricity to 10 million energy deprived people across the world in over 10,000 villages by installing 3,000 plants by 2017." It further argues, "Together we can help communities in the world's poorest regions to achieve sustainable development. We can provide them the power to empower".

[70] Walker and Bulkeley (2006) argue the importance of terminological significance in case of terms like 'environmental inequality' or 'environment and social justice' in the UK.

them to ideas of 'enlightenment' and 'empowerment', (section 5.2.1) attempt to forge alignments. More directly, HPS argues:

> A business of rural electrification that *transcends the conventional ideas* around delivery of electrical energy to masses, HPS has created *unique models* of decentralized electricity generation and distribution that can be well managed by the *locals using local* resources, thereby *bringing the age old wisdom* of self-sufficiency of villages to life.

(HPS website: 13/04/2015)

In the quote above, HPS invokes two key ideas. The first talks about leaving the old and the second talks about embracing the old. In the first part of the quote, HPS talks about discarding old, conventional ideas of electricity delivery and taking up a new, unique model that it has developed. In contrast, in the second part where HPS discusses its unique model, it talks about using age-old wisdom and old ideas. HPS argues that it is learning from the ground to develop a new model and the materials associated with it. This is its innovation.

Another innovation that signifies HPS is frugality. HPS gets its gasifiers fabricated locally and uses bamboo sticks to relay transmission lines (fig. 5-5). This use of local, frugal material helps HPS reduce costs[71].

> Technological innovation and evolution is a central part of the energy provisioning process at Lighting a Billion Lives©. The programme's foremost mandate has been the development and provision of clean technology solutions that are *relevant and customized* to end user preferences, usage behaviour and affordability. Since 2008, the programme has continually applied *field experiences and feedback* to improve, modify and advance its energy solutions to better suit end users.

(LaBL Website: 13/07/2015)

Similar to HPS, LaBL, through its field experiences and feedbacks from users, focuses on local knowledge. By doing this, it aims to become relevant and customised to the local requirements. The LaBL lanterns are also designed like kerosene lanterns, which villagers have been using for decades (fig. 5-6).

---

[71] This however also causes fragility which results in disruptions in the assemblage (chapter 7).

The importance of grassroots, local knowledges and local people is increasing in debates around energy transitions for both scholars and funding agencies (Smith & Stirling 2008; Fressoli et al. 2012; Winkler et al. 2011; World Bank 2008; World Bank 2010). To connect to these discourses and forge alignments with the actors funding them, both HPS and LaBL are trying to connect their innovations to what Scott (1998: 313-316) refers to as "metis". He argues that metis conveys "practical skills" that "lies in that large space between the realm

Figure 5-5: Locally fabricated gasifiers and transmission lines on bamboo sticks.

of genius, to which no formula can apply, and the realm of codified knowledge, which can be learned by rote". Corbridge (2001: 84) interprets metis as "self-reliance" and "local knowledge". Both HPS and LaBL claim to learn from the ground and build ground up incorporating metis. They claim a reliance on local materials (HPS uses locally sourced rice husk as fuel), people (LaBL puts local people in-charge of the solar lanterns) and their knowledges. This makes them more contextual, easier to engage with, operate and maintain. Metis is the form of innovation that these two low carbon assemblages claim. LaBL explain on its website:

> The Lighting a Billion Lives campaign is making a concerted effort towards addressing these critical issues as well as bringing about *innovations* to facilitate interventions enable energy access for all. It has the *global understanding* of the challenge of providing clean lighting to billions that are at the bottom of the pyramid, and has adopted a *localized, bottom-up approach* to addressing it.

(LaBL Website: 27/01/2014)

Figure 5-6: LaBL lanterns are designed like kerosene lanterns.

Both LaBL and HPS also talk of replicable 'models' (see IEA 2011 for a discussion on the need for replicable models). Learning from the metis, and incorporating it in their design, they develop standard and replicable models which they apply everywhere. By doing this, they convert metis which is “contextual and particular” into techne which is “universal” (Scott 1998: 320). In the quote above, LaBL argues that it is connecting a global understanding – the universal – to localised approaches – the contextual and particular. Scott (1998: 319) explains techne as “technical knowledge” that “could be expressed precisely and comprehensively in the form of hard-and-fast rules (not rule of thumb), principles and propositions”. The same solar lanterns, the same charging station with the ability to charge the same number of solar lanterns, are set up in every village. The same micro-grid, with similar capacities, is set up in every village. These equipment and material assemblages go through quality controls and are accorded standards(see IRENA 2013 for arguments on a need for standardisation). Standardisation and control remove uncertainties, contingencies and chances of modification, removing the metis all together and leaving the experts and their techne.

The connection to metis becomes a mere disguise as the replicable ‘model’ is no longer socially contingent, “local and divergent” (Scott 1998: 332). However, through a connection to metis, the low carbon assemblages claim ‘bottom-up’ innovation. Scott (1998: 312) explains that often ‘experts’ attempt to translate metis into “more universalistic scientific terms”. They take the local knowledge out of the ‘local’ and make it the ‘experts’’. So, while these low carbon assemblages claim to innovate by incorporating metis, in attempting to standardise the ‘replicable models’, they end up lacking “context and particularity” (Scott 1998: 346). However, as Scott (1998: 346) argues, this is “not an oversight; it is the necessary premise of any large scale planning exercise(s)” – like attempting to light a billion lives or trying to electrify 10 million people by 2017.

Thus, the innovation, through which trustees appeal to other actors to join the low carbon assemblages, is localised knowledges and materials – metis. At the same time, it is also the ‘model’, the generalised knowledge and materials – techne. The model promises to transform these energy access projects into large scale projects, bringing electricity to significant number of people and bringing significant returns to their investors (Cross 2013: 9), both important objectives for financing institutions (see IFC 2012; IEA 2011 reports on how a significant gap in energy access is a significant opportunity for private companies).

5.2.3 Appropriateness

Both LaBL and HPS make claims about the appropriateness of their ‘solution’, for the ‘problem’ and the ‘practical conditions’ that they are trying to address. Since, the solutions of these low carbon assemblages are based around specific problem to be addressed, their appropriateness is also based on these specific problems (section 5.2.1). These problems emerge from the kerosene lanterns or kerosene lamps and the kerosene oil being used in them.

Kerosene lamps and lanterns provide very low light, which makes studying and work difficult. The smoke and greenhouse gases they emit are hazardous to health (section 6.3.1) and the environment. Their naked flame is a fire hazard (section 6.3.3). Empty glass bottles are often filled with kerosene to make lamps (fig. 5-7). These bottles are very prone to

Figure 5-7: Unsafe kerosene lamps made of empty glass bottles.

breaking and causing fire. In addition to these, trustees claim that fossil fuels, like kerosene and diesel oil, are expensive and electricity helps households and businesses save money (section 6.3.2). Since, material – glass bottles, glass cases, kerosene oil – is a part of the problem, material is a part of the solution too. In addition to this, appropriateness is also about the ethics and business models of the low carbon assemblages. Appropriateness is a comparative notion here, and the appropriateness of one solution can be seen only against that of the other.

Solar lanterns and biomass micro-grids are seen as the key actors instrumental in replacing 'non-suitable' actors like kerosene lamps. The low carbon assemblages can do the work of the kerosene lamps and lanterns without the problems associated with them, i.e., they take the place of kerosene lamps and lanterns appropriately(fig. 5-8). They provide smoke free, modern, adequate, safe and cost-effective lighting solutions. Solar lanterns look like kerosene lanterns but do not have the dangerous flame. If they break, they do not case fires. In addition to these, since they do not use fossil fuels and check greenhouse gas emissions, they are appropriate for the environment. These technology options also help 'leapfrog' the high carbon electrification options (like the central grid) to address development goals with minimal impact on the environment (Rehman et al. 2010; see also Nganga et al. 2013; Kreft et al. 2010).

HPS specifically mentions that its micro-grids use "bamboo or other sustainable material instead of concrete" (HPS Brochure). The use of locally produced 'waste material' from agriculture also makes HPS more sustainable (Governance Knowledge Centre 2011: 7). It has registered itself under the Clean Development Mechanism (CDM) – a mechanism under the UN's Kyoto Protocol for financing greenhouse gas abatement projects. LaBL also contemplated registering under CDM but found the process difficult and the (financial) returns minimal. However, according to Mr. Gurpreet Bedi, the LaBL manager interviewed during the research, "having a carbon verified project…gives a lot of credibility". He explains that a lot of actors (he specifically mentions corporates) are trying to become carbon neutral and a CDM registered project can give them carbon credits in return for finance for the LaBL project. Connecting to the global discourses of climate change, sustainability and carbon neutrality makes these low carbon assemblages appropriate – materially and ethically – for other actors, and help forge alignments with them. This material and ethical dependency of actors on each other – to gain finance and to gain an impression of being 'green' – helps hold the alignments between them (see Bulkeley & Schroeder 2011 for a discussion on holding alignments).

In addition to these, Palit and Singh (2011: 42-43) argue that LaBL, through its "appropriate service delivery model, focus(ing) on product quality, robustness of after-sales service and innovative financing", navigates the problems of high cost of panels, cost of maintenance and after sales services. This makes LaBL a more appropriate solution compared to other solar electrification projects. Palit and Sarangi (2014: 6) from their study of mini grids in India explain that "appropriate support systems should be a mixture of both 'participatory approach' and 'top-down approach'". Both HPS and LaBL argue that their designs are based on 'bottom-up' ideas of grounded knowledge and community participation and at the same time claim that they are plugged into top-down ideas of climate change and sustainable development (section 5.2.2).

Figure 5-8: LaBL and HPS can be appropriately used for the same purposes without the same problemsassociated with kerosene lamps.

A focus on lights also makes these projects appropriate for the trustees. Since the problem is big (1.2 billion people lack access to electricity globally), an appropriate solution also needs to be big. With limited financial availability, trustees can produce limited energy from the low carbon projects. To make a big impact from the limited energy available, they focus on energy services that can reach highest number of people. Since light bulbs require less energy than fans, television sets and irrigation pumps, a focus on light also means 'electrifying' most number of people. This makes LaBL and HPS appropriate for receiving funds from other actors.

However, whether these significances, solutions and measures of appropriateness are accurate or not "depends on the purpose and the context" (Scott 1998: 25-26). While the purpose of the low carbon assemblages may be the same in every village – to apply their solutions – the contexts vary significantly. Although the characteristics of the low carbon assemblages discussed in this section matter for the trustees for the act of assembling, whether they matter for the people or not is a different question altogether. This is discussed in chapter 6.

5.3 Techniques of governing and standardisation

Rose (1999: 52) argues that "technologies of government…are imbued with aspirations for the shaping of conduct in the hope of producing certain desired effects and averting certain undesired events". Since communities are non-rational and non-responsible, as Li (2007b) explains in the fifth practice of assemblages, these techniques are needed to keep the assemblages governmental (section 2.3.2.2). In this thesis, these technologies are represented by the dispositifs of the low carbon assemblages. They contain forms of knowledges, perceptions, calculations, judgements, command chains and authorities, materials that are brought together to "achieve certain outcomes in terms of the conduct of the governed (which also requires certain forms of conduct on the part of those who would govern)" (Rose 1999: 52).

The dispositifs, in this thesis, are formed of three particular kinds of techniques – techniques of expertise, techniques of legitimacy and techniques of subjectivity. Techniques of expertise consist of training procedures, manuals and schools use to train experts and establish them as local trustees of the assemblages. Techniques of legitimacy are used to divide responsibilities for various activities and establish command and reporting structures as well as clear relationships of power for the 'smooth functioning' of the assemblage. Through these, trustees at different levels are legitimised for certain activities and delegitimised for others. This is to create local autonomy but still maintain central control. Techniques of subjectivity are used to foster 'proper' and 'authorised' conducts among people with an aim to shape standardised subjects to match the standardisations of the low carbon assemblages. These standardisations also help large schemes of improvement create "standardised commodity for the market" (Scott 1998: 58). This make "central monitoring and controlled comparisons" possible (Scott 1998:30).

5.3.1 Techniques of expertise: standardising mentalities to match materialities

Techniques of expertise are put in place to facilitate the relationships between materials and people. As the materialities of technologies shift from the domain of metis to techne, they are standardised and made into 'models' (section 5.2.2). There are certain 'ways' in which these 'model' solar lanterns and micro-grids must be handled. As part of "rendering technical", the trustees attempt to bring local people and "expert prescription" together into what Li (2007b: 270-273) refers to as "a plausible, if awkward, alignment". Experts feel that training, but also control, are the enabling conditions for the upkeep of the assemblages. This is a characteristic of Li's (2007b: 265-276) third practice of assemblage, "authorising knowledge" section 2.3.4). To do this, they train local people, impart expert knowledge and attempt to develop local experts who can carry out everyday operations and upkeep of projects. For these, experts create guidelines, 'good practices', and training modules.

> The existing gap in implementation and sustenance of rural energy projects is that of a network of local-level institutions that facilitates micro-implementation of project deliverables, carry out training and capacity building and ensures after-sales services.
> [….]

> Apart from providing next door and reliable after sales support, it also aids in imparting training and local capacity building for the execution of other energy access projects in the area.
>
> **(Description of Technology Resource Centres, LaBL Brochure)**

LaBL has created a system of Technology Resource Centres (TRCs) (now also known as Energy Enterprises – EE) to train experts who are 'authorised' to handle the technology at the local level. Funded by the UK's Department for International Development (DFID), the TRCs are supposed to "ensure effective after-sales supply and service, handholding, local training and capacity building" (LaBL brochure). TERI envisages that, in the long run, TRCs will develop into local centres of expertise for all kinds of solar projects – TERI and non-TERI (Palit & Singh 2011). Through this, TERI is not only creating local experts but also establishing its own role as a leader in rural electrification. This helps forge alignments by establishing TERI's knowledge and expertise among actors in the LaBL and other low carbon assemblages.

LaBL has also developed a network of NGOs who are responsible for handling the technology, training and capacity building locally. TERI and its technology partners train the NGOs and TRCs. They are 'trained' to conduct basic village assessments based on LaBL criteria to identify the suitability of villages and entrepreneurs for participation in LaBL. NGOs and TRCs train the village entrepreneurs, who in turn 'train' people in the village to use solar lanterns 'properly'. A system is created in which knowledge and expertise flow from the centre (TERI) to the periphery (village entrepreneur) of the assemblage and local experts are enabled to manage and maintain the projects in everyday life. However, 'legitimate' knowledge and expertise reduce as they go from centre to the periphery.

Theoretically, the availability of local experts makes the operation and maintenance of solar charging stations and lanterns faster and disruptions occur for shorter periods of times. However, entrepreneurs in both Bijuriya and Sahariya report the lack of any formal training. In fact, the entrepreneur in Bijuriya argues that the training would have enabled him to fix minor problems with the lanterns locally. His lack of training, low knowledge of the lanterns and the inability to fix even minor problems was on demonstration during his interview. He opened the switch panel of a solar lantern to show the circuits but was not able to fix it back (fig.5-9).

Figure 5-9: Solar lantern with an open switch panel.

To train and create local 'experts', HPS has set up a training facility called Husk Power University[72].

> HPU (Husk Power University) is a one-of-a-kind vocational programme that is being built *to train and groom* the thousands of technicians and entrepreneurs (along the lines of McDonald's University) needed to support growth of Husk Power Systems in a distributed manner. (Emphasis added)

(HPS Brochure, Collected during fieldwork from HPS Office, Patna)

[72] As the quote below suggests, it has been found along the lines of McDonald's university which "has emphasized consistent restaurant operations procedures, service, quality and cleanliness. It has become the company's global center of excellence for McDonald's operations training and leadership development". http://www.aboutmcdonalds.com/mcd/corporate_careers/training_and_development/hamburger_university.html

The operators running the HPS micro-grids, visited during this research, had gone through the standard HPS training programme organised through HPU. For the university, HPS has created dedicated training facilities located at Barauni industrial area in Begusarai district (about 100Km from HPS headquarters in Patna). They train employees for the operation, maintenance and management of micro-grids (fig. 5-10). Mr. Ravi Kumar, the HPS manager interviewed during this research, argues that this is necessary because most "ground-level employees (of HPS) are not highly *qualified*…they are not well *educated"* (emphasis added). Therefore, in addition to the technical training, financial, managerial and social training become necessary to make the employees qualified enough to handle micro-grids. Mr. Kumar explains that employees who have undertaken training show improvements and the maintenance of the micro-grid becomes smoother. Schnitzer et al. (2014: 42) argue that standardisation – of material and people – is critical for the scalability of HPS.

However, observations and discussions in the villages revealed high levels of unprofessionalism[73] among the HPS staff, with some indulging in the mismanagement of funds and misconduct with customers. Mr. Kumar agrees that professionalism is still a serious problem and that HPS is working on training employees further, to instil good practices. Trained by HPS through its standardised training programmes, these staff are responsible for informing, sensitising and training the people in 'good practices' and proper use of the micro-grids. In a manner similar to LaBL, the legitimacy, level of expertise and control reduce as one goes from the top management of HPS to the ground-level staff running the micro-grids.

[73] On my arrival at the HPS operation centre in Haridiya, I found the local staff indulging in drinking while at work. During my rest of the time in Hardiya, I heard similar stories from research participants. In addition to this, Mr. Bimlesh Gupta, who managed the HPS micro-grid in Hardiya informed me that the staff indulged in nepotism and financial corruption.

Figure 5-10: Employees undergoing training at the HPS University (from HPS brochure) (top) and Husk Power University at work(Gaurav 2011)**(bottom).**

Through these programmes of training, both LaBL and HPS attempt to create ‘operating conditions’ which define “the ‘proper’ relation between an object and its surroundings” (Shove et al. 2014: 116). The local experts, instilled with “specific ways of acting, intervening and directing…and relying upon definite mechanisms, techniques and technologies”, emerge as local trustees of the low carbon assemblages (Dean 2010: 33). Much like Prakash's (1999: 198) argument about the Indian state planners, these experts are supposed to “practice(s) the policy of neutrality” keeping “people *with human needs* in mind regardless of their religion, caste, class, gender etc.”. Li (2007c: 7) argues that “experts are trained to frame problems in technical terms” and “questions that are rendered technical are simultaneously rendered non-political”. However, the questions or problems that the experts deal with are inherently political, as section 5.4, chapter 6 and chapter 7 explain.

5.3.2 Techniques of legitimacy: legitimising and delegitimising experts

While the techniques of expertise help create new experts, not all experts have the same level of legitimacy and control. The legitimacy of knowledge and the level of expertise depend on standards set by ‘key’ experts – those who inhabit the centres of the low carbon assemblages. Authorising knowledge is not just about training. It is also about “specifying the requisite body of knowledge” and maintaining control over it(Li 2007b: 265). With reducing legitimacy of knowledge and expertise, control also reduces. The materials used in low carbon assemblages are the proprietary of particular actors. LaBL solar lanterns or HPS biomass gasifiers can be remodelled, modified or changed only by specific actors who hold proprietary over these technologies – the technology providers in LaBL assemblage and HPS itself in HPS assemblage.

In addition to these, Scott (1998: 99) argues that “the rule of specialists and the new technological possibilities” help conceive large-scale projects that are both “both centralised and locally autonomous”. The trustees of the low carbon assemblagesput into place relationships that make the assemblages centrally controlled, and at the same time give certain functional autonomy to local/peripheral actors. To legitimise and de-legitimise actors, responsibilities for various activities are divided, command and reporting structures are put in place, and clear relationships of power are established. This, from the trustees’ perspective, helps in the ‘smooth functioning’ of the assemblages.

The LaBL model in fig. 5-11 outlines the relationships that LaBL puts in place for the ‘smooth functioning’ of its energy projects. Based on this diagram and field research, three key interconnected points need to be noted about this ‘model’. First, there are differential relationships between the experts and materials at various levels. Second, the experts at various levels have differential autonomy and relationships between with each other. Third, the flows of knowledges and materials in the 'model', with the exception of the top level, are unidirectional.

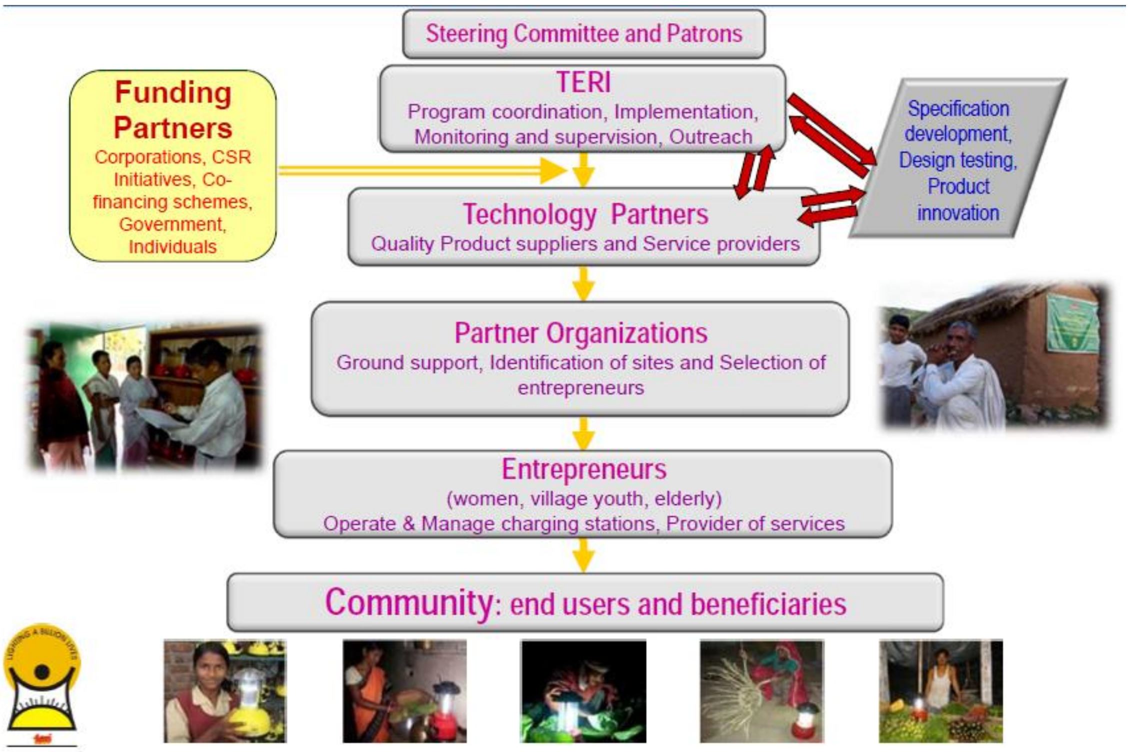

Figure 5-11: LaBL model: relationships and flows between various actors in LaBL (Palit 2011: 4)**.**

At the top, TERI or The Energy and Resources Institute, is the key actor involved in the innovation and development of ideas. Although the technology partners are on a level below TERI, as explained by Mr. Gurpreet Bedi, the LaBL manager interviewed during the research, they have a two-way relationship with TERI for the design and development of specifications, standards and 'products'. The two actors also have a deeper relationship with the materials. Based on their claims about the low carbon assemblage, these two actors decide the material characteristics of the projects – shape, size, battery life, number of LEDs in the lanterns and number of lanterns in each charging station.

Their exclusive domains of expertise and capabilities make them dependent on each other. TERI's expertise lies in social and technological research, in attracting funds for implementation, and developing an implementation network. In a way, it gives market access to technology partners through their recruitment in LaBL. The technology partners are experts in the development of solar lanterns and panels and have the capability of producing these at large scales. The materials and their configurations – lanterns, batteries and chargers – are the sole proprietary of the technology partners. Their need for each other's expertise and capabilities drives a two-way flow of knowledge and materials between TERI and technology partners. However, it is important to point out that while multiple technology partners are involved in LaBL, there is only one TERI. The presence of multiple technology partners and its capacity to replace one technology partner with another gives TERI more power. It can decide legitimate and illegitimate areas for the use of particular technology partner's lanterns.

Actors and relationships that are characterised by a unidirectional flow of materials and knowledges occupy the lower half of the 'model'. The partner organisations, which are typically NGOs or TRCs, identify villages to install solar charging stations and people to be made in-charge of these stations. Although they are 'trained' to conduct basic assessments for these, they often use their 'local knowledge' to decide the places and people[74](see also NCSRH 2013). Here techne and metis are merged and used based on the subjectivity of the partner organisations (section 5.2.2). In addition to this, the local experts – LaBL entrepreneurs – have the autonomy to decide who gets access to the solar lanterns in the village and at what price. The users of the solar lanterns are at the lowest level of the flow of materials and knowledges. They are trained by the local experts in the 'proper' use of the solar lanterns and made aware of the 'rules of engagement' (section 5.3.3). The users are seen as 'beneficiaries', who should be passive recipients of the solar lanterns. They should be thankful to the trustees for bringing modern energy to them.

Even though entrepreneurs and partner organisations have relative autonomy (compared to HPS), they are still dependent on the central actor – TERI – for the flow of materials and knowledges. Depending on the levels of disruptions their lower level of expertise legitimises and de-legitimises them from carrying out particular maintenance works. For more serious disruptions, they need to depend on technology partners who hold proprietary over the

[74] Based on discussions with Mr. Anand Jha, Owner and Manager, LaBL network NGO, Lakhisarai.

technology. This sometimes means that the solar lanterns and charging stations stay in a state of disrepair for long periods of time, waiting for the legitimate experts to arrive.

When a major disruption occurs, the technology partner sends its team to the local NGO, which then directs it to the village entrepreneurs. The primary responsibility of the technology partners lies with the village entrepreneur, local NGO or TERI. This is because these actors are connected directly with each other, through the flows of materials and knowledges. In addition to this, due to TERI's ability to legitimise and de-legitimise the technology partners, any actor, who can express dissatisfaction to TERI about the technology partner's role, becomes important for it. The only actors that come in direct and regular contact with TERI are the local NGOs or sometimes the village entrepreneurs. The users are in a position to express dissatisfaction and give feedback, but only occasionally, if and when a TERI team visits the village for assessment[75](see also Cross 2013 for when and how solar companies involve the users). Thus, the technology partners prioritise the NGO or the entrepreneur's and NGO's requirements, rather than the users' requirements, which are often in conflict (section 7.3.1).

The relationships in HPS are configured in a different manner. However, they still conform to the "centralised and locally autonomous" idea (Scott 1998: 99). The key characteristics mentioned in the LaBL model apply to HPS – it has a two-way interaction between experts and materials at the top and the flows of knowledges and materials are unidirectional. HPS has no technology partners or partner organisations. Although it has different teams dedicated to these jobs, HPS is the technological, research and implementation 'expert'. It has developed the technology for its micro-grids and holds the proprietary for any changes or modification. Based on its claims about its model, HPS decides the material characteristics of the project – type of gasifiers, engines, wires, poles, bulbs and fuel (husk). These materials are sourced from different actors based on the criteria and standards set by

[75] The entrepreneur in Sahariya, Brij Kumar, explains that this happens occasionally and in a superficial manner. In his opinion, their visits are more about show, less about work. People using the lanterns are completely unaware of an organisation called TERI. They are also unaware of how solar lanterns are funded, who funds them and which organisations are responsible. Their knowledge is limited to the entrepreneurs' and in some cases the NGO's role. Some people are under the impression that the lanterns are funded under some state scheme or by local politicians.

HPS. In a manner similar to LaBL, HPS through the HPS University (section 5.3.1) trains 'local experts' who are responsible for the day-to-day functioning of the biomass micro-grids.

However, the relationships and the levels of local autonomy are different. HPS micro-grids work on three business models. It started with BOOM (Build Own Operate Maintain) model in which HPS is responsible for the technology, its set up and the everyday operation and maintenance of the micro-grids. Next, HPS experimented with BOM (Build Own Maintain) in which it withdraws from the space of everyday operation of the micro-grids and hands it to a franchise – generally an entrepreneur from the village like Mr. Sevak Gupta in Hardiya. In both these models, HPS, as the owner of the micro-grids, is concerned about profits. Finally, HPS tried BM (Build Maintain) in which it sells the micro-grid to an entrepreneur who takes care of the everyday operations and is the only actor concerned about the profits. HPS provides technical services and spare parts for the repair and upkeep of the micro-grid. At the moment, most HPS micro-grids are based on the BOOM model. In this case the local experts – operators and managers of the micro-grids – can be seen as part of the same actor, HPS. Although, on a day-to-day basis, local staff have the autonomy to enrol new people into the micro-grid or penalise them for irregularities, the rentals and the list of people to be connected to the micro-grid aredecided by the higher-level actors. These change in BOM and BM where the local entrepreneurs have autonomy over tariffs, connection and disconnection.

Through the trainings local trustees are created for the low carbon assemblage. At the same time, due to the relationships between the various experts and the structuring of the flows of knowledges and materials, local trustees are legitimised for certain purposes and de-legitimised for others. Li (2007c: 7) explains that there is a "boundary between those who are positioned as trustees…and those who are subject to expert direction". However, in case of these low carbon assemblages, there are boundaries between various trustees too. From the 'key' trustees' perspective, "'reliable', centralised…solutions" need to be created because the actors on the fringes of development assemblages, due to their lower levels of knowledge and expertise, cannot be completely relied upon (Bridge et al. 2013: 338). These boundaries between the trustees help create a functional autonomy but at the same time keep central control. Both are important conditions for large-scale projects (Scott 1998: 346).

5.3.3 Techniques of subjectivity: imagining particular subjects

To match the standardisations of the assemblages, trustees use techniques of subjectivity to foster standard subjectivities among people. These are "the set of institutions and practices, from administration to education, through which people's conduct is guided" (Foucault 1994: 295). They "inculcate new habits and values" (Li 2005: 388) and are based on "forms of identity promoted and presupposed" by the trustees (Dean 2010: 43). Since, "subjectification is simultaneously individualizing and collectivizing", subjects imagined and attempted through processes of simplification are given a singular identity (Rose 1999: 43). This binds them in one collective – they are identified only as people without access to energy. These forms of identity are closely related to the discourses that trustees subscribe and connect to (section 5.2). They imagine that for everyone without access to energy, electricity signifies the same things – education, livelihoods and health.

Since, the technologies and materials used in LaBL and HPS are standardised, their capacities – levels of lights, backups of batteries, individual connections from the micro-grid – are also standardised. The LaBL lantern has three light modes and recommended usages for these modes – high for studying, low for other household works and night light for overnight use. However, the LaBL dos and don'ts poster in fig. 5-12 recommends that the bright mode (high setting) should be used only in exceptional circumstances (*vishesh sthiti*) (fifth point in the dos section on the left). These standardised settings are the "orchestrating concept[76] around which other forms of…flow are designed and organised" (Shove et al. 2014: 121). With such standardised settings, experts expect people to have standard uses. In addition to this, people are also expected to take care of lanterns that are allotted to them.

[76]Shove et al. (2014: 121) explore this in relation with the standardization of room temperature required for the operation of various electrical devices. They argue that "notion of a normal room temperature of 22°C acts as an orchestrating concept around which other forms of thermal flow are designed and organized".

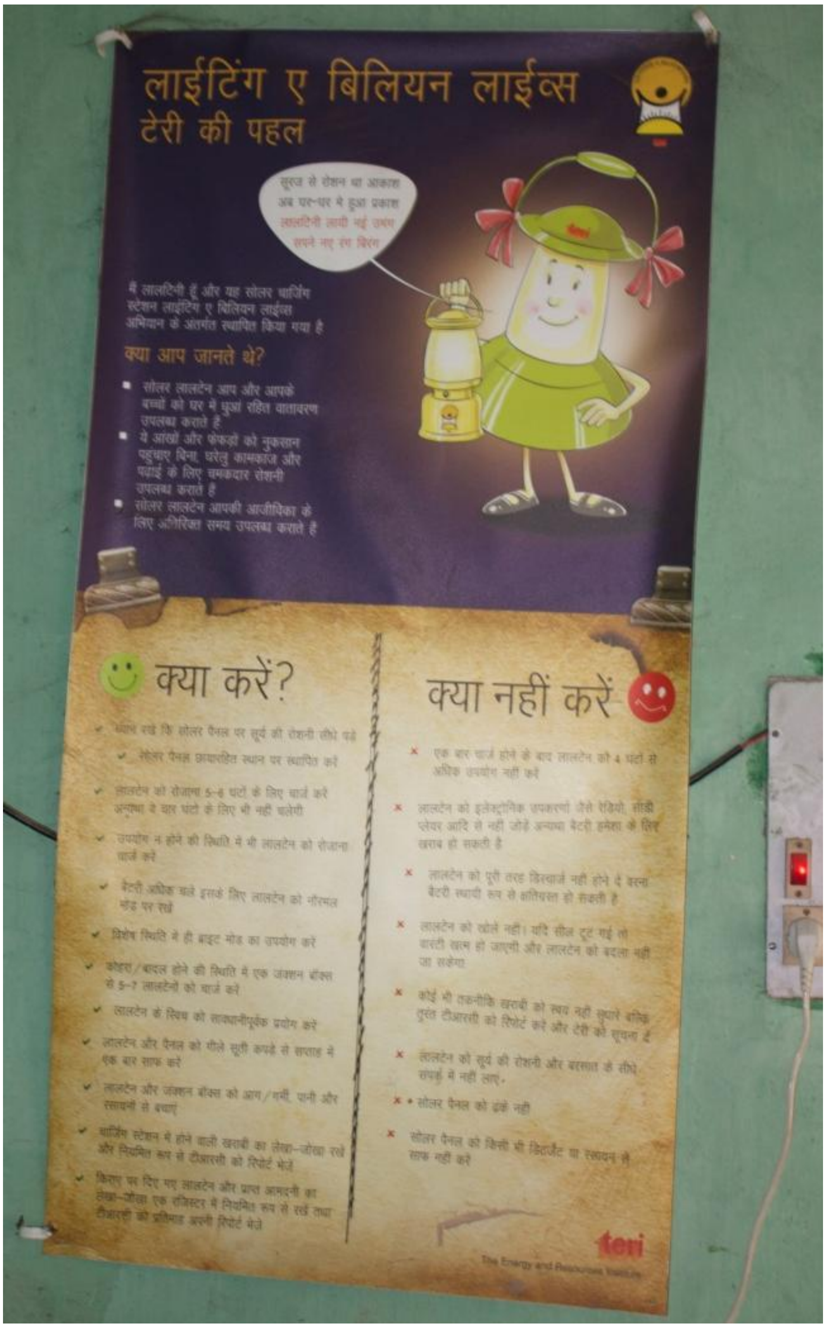

Figure 5-12: LaBL poster in a NGO office outlining the dos (left) and don'ts (right) for entrepreneurs and users.

During the fieldwork it was observed that the lanterns in the villages were numbered. Every evening, as people took them from entrepreneurs, lantern numbers allotted to them were put in front of their names in a register (fig. 5-13). This helps set accountability for improper use of, or harm caused to, the lanterns. Scott (1998: 65) explains that patronyms were assigned in fourth century B.C. China for creating “legible people” and holding the wives, children, and juniors “accountable for the fiscal obligation of the entire family”. Similarly, the lantern numbers allow clear identification of people who do not make ‘proper’ use of the lanterns and help in “holding them accountable” Scott (1998: 65). The numbers here, in an implicit form, represent the entrepreneur’s power of identification. They help the “application of calculation and deliberation” (Rose 1999: 198). Therefore, “it is not just that the domain of numbers is politically composed, but also that the domain of politics is made up numerically” (Rose 1999: 198).

Figure 5-13: Numbered lanterns and names being entered into a register in Sahariya.

In a similar manner, HPS has fixed levels of electricity supply – 15W and 30W. In this case, “quantification is significant because it standardizes both its object and its subject” (Rose 1999: 207) In addition to this, focusing on single numbers is critical for reducing complexity(Rose 1999: 205). Theoretically, within this fixed limit, people can use electricity for any purpose they choose. However, in practice, only compact florescent lamps (CFLs) or light emitting diode lamps (LED lamps) and mobile chargers can be used. If people try using electricity beyond these ‘authorised’ limits, fuses connected outside their houses indicate overuse and, in extreme cases, automatically disconnect people from the micro-grid. HPS employees survey the village at night and conduct surprise checks to ensure the levels of use. People found indulging in irregularities are warned, fined and, in extreme cases, disconnected from the micro-grid. Again, like LaBL, identification and holding people accountable is an important technique used to 'conduct people's conducts' (chapter 7).

According to the LaBL NGO officials and entrepreneurs interviewed during the field work, the lanterns last longer and people reap more benefits if they religiously stay within the 'limits' and make the 'right' use of the lanterns. In case of HPS, those who conform to the 'limits' theoretically get better and more regular electricity supply. People who accommodate themselves within these standardisations and conform to the subjectivities presupposed by the low carbon assemblages get electricity supply and those who do not conform get penalties and sometimes lose supply (chapter 7) (see also Hall et al. 2011: 193). Standardisations "reward those who comply" and "penalize those who ignore" them (Scott 1998: 73). These schemes become a form of "internal colonisation" that attempt to "shape a people and a landscape that will fit their (the improvement scheme's) techniques", materials and values (Scott 1998: 82).

However, since "regimes of government do not determine forms of subjectivity", "forms of identity promoted and presupposed" by the trustees cannot be taken as a reality (Dean 2010: 43).

> The stubborn caste system is something that HPS is striving to challenge through their power as an employer as well as a supplier…. HPS insists that all employees refer to each other respectfully, with the *ji* suffix to every name, but creating a sense of equality is a slow process.

(Boyle & Krishnamurthy 2010: 15)

Li (2005: 387) argues that "schemes deliberately remove (d) people from the relations in which their lives are (were) embedded to build on a clean slate". Both LaBL and HPS follow this idea. They do not discriminate between people based on their socio-economic[77] backgrounds. As the evidence above suggests, in fact HPS is trying to actively break social segregations like the caste system, to build a clean slate where people look at each other – regardless of their socio-economic background – respectfully and address each other with

[77]Discrimination based on economic backgrounds is however implicit. Only those who can pay the rentals get electricity.

an honourable suffix like '*ji*'. It employs people from every caste and class, who work with each other and interact with consumers from various castes and classes. In a similar manner, LaBL 'gives' entrepreneurship to people from every section of the society and its entrepreneurs rent the solar lanterns to 'beneficiaries' from every section of the society. This means that the solar lanterns or the biomass micro-grids can be operated and managed by members of lower castes or women. Someone from the lower castes, working for HPS, can now enter a higher caste home to conduct surprise checks for the 'authorised' use of electricity. A member of the higher caste now has to visit the home of someone from the lower caste to deposit and withdraw lanterns. These activities go against social structures and norms in many villages, where male members of higher castes generally control important resources like energy provision. This is a "vision of society in which social conflict is (was) eliminated in favour of technological and scientific imperatives" (Scott 1998: 99). All this is done with the "expectation that from the novel…arrangements improved conduct would follow" (Li (2005: 387). After all, Li's (2007b: 265) fifth practice of assemblage, anti-politics, is also about reframing "political questions as a matter of technique". The trustees expect that people will move out of the existing relationships of power – caste, class, gender, age – that 'conduct their conduct'. As they do this, in their interactions with the low carbon assemblages, their conducts will only be conducted by the dispositifs of these assemblages.

However, subjectivity and trusteeship become complex and problematic because both trustees and subject often have multiple identities. Many people are often trustees and also subjects. This is discussed in the next section.

5.4 Many trustees: multiple identities

> LaBL has evolved as an umbrella brand under which not only private enterprises and financial institutions but also public sector have come together to provide sustainable solutions for meeting basic lighting needs of rural households.
> [….]
> There are now several hands that are holding the umbrella which include private sector players, local level entrepreneurs, financial institutions, corporate, multilateral/government sponsors, and the last but not the least the end-users themselves.

(Mr. I. H. Rehman, Director, Social Transformation Division, TERI (Rehman 2013)**)**

Li's (2007c) distinction between trustees and subjects, and this chapter's discussion until now, create a "boundary between those who are positioned as trustees….and those who are subject to expert direction" (Li 2007c: 7). However, this boundary is fuzzy and porous. Li (2007c: 24 with the help of Stuart Hall 1990) argues that identities are "not an essence but a *positioning*". These *positionings* are what blur the boundary between trustees and subjects. 'Key' trustees invite actors to join the trusteeship and 'key' experts train other actors to create local experts (sections 5.2 and 5.3.1). This creates a distinction between various trustees and subjects. So, while Li (2007c) rightly makes a distinction between trustees and subjects, it is also important to look at the various trustees and their positionings more carefully and understand the distinctions between them.Due to these multiple positionings, a chain of trusteeship is established through which knowledges, materials and power flows. In this chain different trustees have different levels of power and authority (sections 2.3.2.1 and 5.3.2). In addition, those who are positioned as trustees are often also positioned as subjects depending on their location, standing and politics in the assemblage (section 2.3.2.1).

In the quote above, Mr. Rehman, who heads LaBL, explains that various actors (private, public, government, entrepreneurial), with their different positionings, come to form LaBL. This is because through its trusteeship, in addition to lighting lives and saving the environment, LaBL aims to incubate markets for energy products, develop better lighting technologies, give NGOs a foothold in villages, develop local skills for repair and maintenance of energy products and produce livelihood opportunities in the villages. Through these activities, which are under the "umbrella brand" of energy trusteeship, companies developing energy technologies, NGOs, local entrepreneurs and the beneficiaries of solar lanterns become the 'subjects' for the expert direction of TERI. However, when the technology providers join LaBL, they work as 'technology experts' and train NGOsin repair and maintenance and village entrepreneurs, who, along with the beneficiaries are seen as the subjects. Similarly, the village entrepreneur is a trustee (along with other central actors) for the people using the lanterns. However, for the central actors he is a subject for employment through LaBL. In fig. 5-11, actors at each level are subjects for the actors above them and trustees for the actors below them. Similarly, the central actors in HPS – the founders and financers –act as trustees for the more peripheral actors – providing them training and employment – and the customers – providing them electricity. The peripheral actors, like the staff who work everyday in the village micro-grids, are subjects for the central actors but act as trustees and experts for the customers.

In addition to the relationships of expertise (sections 5.3.1 and 5.3.2) and subjectivities (section 5.3.3) attempted by the low carbon assemblages, the various actors within the assemblages are also bound by social and cultural relationships and subjectivities. A LaBL entrepreneur, who is supposed to perform his role as a trustee equally towards all subjects, does so differently based on his religion, caste, class and gender (section 7.3.2). His performance then becomes provisional for different people and contingent on the multiple identities he juggles. Similarly, HPS staff operating the micro-grid everyday react differently, or are reacted to differently, because of their multiple identities.

Most actors in these low carbon assemblages have multiple, sometimes simultaneous, and at others, separated identities in relation to each other. As Hall (1990 quoted in Li 2007c: 24)argues, identities and as a consequence, trusteeship and subjectivity, “are subject to the continuous ‘play’ of history, culture and power” (see also Rose 1999: 40). These identities have a bearing on how various actors act and whose improvements are they concerned with (chapter 6). Again, as in the case of the Indian state, ordinary people (subjects), who also work on the fringes of trusteeship, often tweak and tinker the will to improve and reinterpret it “beyond recognition” (Corbridge et al. 2005: 36 with reference to Kaviraj 1991: 91) to suit their own ends. Table 5-1 outlines the multiple positionings of the various actors in the low carbon assemblages.

Table 5-1: Multiple positionings, as trustees and subjects, of the various actors in LaBL and HPS assemblages.

Actors	Trustee	Subject
LaBL		
TERI	• Always	• Never
Finance providers	• Always	• Never
Technology provider	• Developing and providing technology for lighting • Training NGOs and TRCs for repair and maintenance of equipment	• For TERI which gives them market opportunity for their solar products
NGOs/TRCs	• Training entrepreneurs to run, repair and maintain lanterns and charging stations	• For TERI and technology providers who train them and provide them with equipment and spare parts • TERI gives them an entry point into the villages which they can use to expand into other development activities
Entrepreneurs	• Renting lanterns to people • Training people in 'proper' use of lanterns	• For TERI, technology providers and NGOs/TRCs who train them, provide them equipment and maintenance services • They gain livelihood opportunities through LaBL
Users	• Never	• Always
HPS		
Founders	• Always	• Never
Financers	• Always	• Never
Managers and operators of village micro-grids	• Connecting and disconnecting people to the micro-grid • Training people in 'authorised' use of lanterns	• For HPS central actors who train them and provide them with equipment and spare parts • They get livelihood opportunities through HPS
Users	• Never	• Always

5.5 Conclusion

This chapter has traced the logic behind the development of trusteeship in energy access. It has explained how trustees attract and invite other actors to forge alignments by connecting to particular discourses (Li 2007b). Forging an assemblage as part of the "will to improve", is also about governing(Li 2007b: 265). Trustees put together various techniques of government, which help stabilise, securitise, and operationalise the assemblage. In particular, they use techniques of expertise (to train more trustees), techniques of legitimacy (to legitimise and de-legitimise different trustees for different activities) and techniques of subjectivity (to foster standard subjectivities in the people to match the standardisations of the assemblages). These techniques together form the dispositifs of the low carbon assemblages. These processes, along with historical, social and cultural processes, through which trusteeship and subjectivity are created, result in multiple positionings of trustees and subjects. They move between these positionings continuously and often balance them simultaneously.

To forge alignments, trustees connect to particular discourses. By focusing on specific significances of electricity, such as education, livelihoods, health and environment, trustees connect to discourses around sustainable development to appeal to other actors with a common agenda. Trustees prioritise light because it helps centralise these multiple development concerns and create and "emotional appeal" for other actors (Gent 2014: 179 refering to Kumar 2013). Simultaneously, they claim that their projects are innovative and solutions appropriate in order to distinguish themselves from other projects looking to forge alignments with the same actors.

Since the problem of energy access is big, the solutions targeting it also need to make a big impact. To develop big projects, trustees simplify and standardise the low carbon assemblages. This helps develop 'models' which can be implemented in different spaces. They use standard technologies with standardised settings which can easily be de-assembled and re-assembled in new places. Trustees train other experts and establish flows of knowledges and materials to accord certain levels of local autonomy while still maintaining central control. These standardisations are done with an imagined subject in mind, one who is only defined by a lack of access to energy. To match these standardisations and with this imagined subject, the subjects are expected to have standard conducts. To foster these conducts trustees train users to follow various rules, regulation and ‘good practices’.

In reality however, both trustees and the subjects have multiple subjectivities. The standardisations of the low carbon assemblages do not always work for everyone. Because of the complex social, cultural, economic and political landscape of the villages, the assemblages, their significances of electricity and their lights do not work for everyone (chapter 6). In addition to this, the standardisations also do not work because electricity signifies different things to different people (chapter 7).

The standardisations also create problems of conduct. As the projects move from one place to another, their dispositifs face different conducts and counter conducts. This disrupts technologies of control and sometimes creates the need for reassembling the low carbon assemblages (chapter 7).

6 From Assembling to Acting: Low Carbon Assemblages in Everyday life

6.1 Introduction

> Light in literal and figurative sense both. Because then light does not mean only light. It translates into a lot of other developments.
> [….]
> it...it...it actually...translates into many other facets such as education, empowerment in general, health, networking as I told you.
> [….]
> it acts as a foundation for them (NGOs involved in LaBL) to light up the whole sector of development as such, to be put precisely. It lights up the whole development sector in general, for the NGO...
> A: LaBL lights up the whole development sector…
> …the development sector in the village because if the NGO is providing livelihood opportunities
> [….]
> People have found new vocations such as…leaf plate making.

(Gurpreet Bedi, Manager, LaBL)

For the trustees, development activities like education, health and livelihoods are more important significances[78] of electricity (chapter 5). Through this, electricity from the low carbon assemblages comes to symbolise development in general and these development activities in particular. This is what Mr. Bedi indicates in the quote above. From his perspective, the electricity from LaBL lights up people's lives in both literal and figurative sense.It 'enlightens' them by mobilising education, health and livelihoods. For him, electricity from LaBL signifies a host of development activities – LaBL "lights up the whole development sector".

Since the trustees mobilise their significances of electricity through light, it is important to understand what light means and how it is used in culturally specific ways in Bihari villages. Section 6.2 looks at interactions between culture and lights and discusses how the low

[78] See a detailed discussion on significance in section 2.3.2.1.

carbon assemblages get embed into, shape and support the existing structures of these village societies (see Kumar 2015). It also discusses, how, due to the social and cultural notions in these villages, access to electric lights is primarily limited to males. The social and cultural notions, their interactions with lights, and the 'cultural politics' that this brings to light, mediate the significances of the low carbon assemblages.

Following Li (2007c: 7), this chapter argues that experts ignore the social and cultural landscapes that have been reproduced for centuries and that make it impossible for any 'scheme of improvement' to work outside an existing and highly entangled assemblage of notions, rules, structures and spaces. The significances of electricity focus only on the "capacities of the poor" and ignore the "the practices through which one social group impoverishes another" (Li 2007c: 7; see also Foucault 1994: 344). These practices give differential access to different social groups and create different priorities for different groups. The same significances of electricity do not work for everyone. Apart from this, electricity signifies different things for different people (section 7.2).

Section 6.3 looks at specific significances of electricity. Section 6.3.1 discusses the importance of education and the role of lights in mobilising education for various sections of the society. Section 6.3.2 looks at the role of the low carbon assemblages in people's everyday economies, both commercial and domestic. It also discusses how LaBL has specifically come to impact economies of special occasions which in turn impact people's everyday economies. Section 6.3.3 looks at the health impacts of the low carbon assemblages. It discusses, how, due to the complex energy and social and cultural landscape that villagers interact with in their everyday life, the effects and spaces of the low carbon assemblages become gendered. Section 6.4 argues that the co-presence of multiple energy assemblages negates many 'claims of improvement' (Li 2003: 5120; Li 2007b: 264) made by the low carbon assemblages. Although, education, livelihoods and health are dealt with in separate sections, health and safety are connected with all these and are continuing themes in all sections.

6.2 Cultural mediation of spaces of light and dark[79]

Light and honour

There are open, uncovered spaces called *dalaan, bangla, baithaka,* outside or in front of most Bihari houses (section 3.4.1). Although a part of the home, they are seen as 'outside' spaces due to their cultural constructions. Due to their open, uncovered nature they do not provide*purdah.*They are almost always, exclusively occupied by men, who gather there for meeting and greeting or evening chit-chat.In most cases, these spaces outside the houses are the only spaces visible to the 'others' i.e. men from other households. Due to their limited mobility most women from other households do not see these spaces. In a way these spaces – *dalaan, bangla, baithaka* – become a showcase for the households, similar to Cieraad's (1999: 31 quoted in Garvey 2005) exploration of Dutch windows as "'lighted showcase', a spectacle for visibility and a 'type of exhibitionism'" (see also Hannerz 1997; Garvey 2005).

The portrayal of this space constructs the perception of a household in the village.Light plays a prominent role in this. Most people in the research villages argue that they prioritise lights outside their houses, invariably in this space occupied by men, even if the insides of their houses remain dark. They explain that having a light in front of the houses, in spaces that are publically visible, upholds their honour in the society.

> Yes! This (leaving the *bangla* in dark) would be dishonourable. That is why in the past, in every village, every *bangla* had a lantern.
> […]
> …If there is no lantern people would say, "They cannot *afford* even a lamp on their *bangla*". This is a matter of honour. (Emphasis added)

(Mr. Ramesh Singh, higher caste, farmer, Bijuriya)

[79] See a more detailed discussion on the interactions between culture and lights in Bihari villages in Kumar (2015).

Mr. Singh explains how light, its presence and absence get associated with material and social status.They play into notions of honour and dishonour. In the research villages, most households either keep kerosene lanterns or light bulbs hanging in front of the house (fig. 6-1). Some people, who have access to solar lanterns and can afford to rent more than one, keep a solar lantern in their *dalaan, bangla* or *baithaka*. It is important to note that Mr. Singh uses the word 'afford' which implies that people associate light with their material possessions.This ultimately decidestheir social status.

Figure 6-1: Lights in outside spaces in various research villages (Top - Hardiya left and Bijuriya right. Bottom- Berangpur left and Rangpur right).

> We did not keep the solar light in the room; we kept it on the patio.
> [….]
> Outside because it lighted the whole patio…so it could be seen.
> [….]
> Yes, this is a question of honour.
> [….]
> The question of honour is that, if a visitor comes. My house is by the main road. I have a big house, people know me as the *mukhiya* (headman).

(Mr. Rajendra Singh, Farmer, Bijuriya)

Mr. Rajendra Singh has a big house and is an important person (ex-headman) in the village. For him, the presence of light, adds to his material and social status. In this way, light becomes a marker of material possessions of the household.The quantity and quality of light outside a house upgrades or degrades people's honour in the society. Winther (2008: 134) presents a similar argument when discussing bright lights outside a politician's house in Zanzibar as a material demonstration of his position, accomplishment, knowledge and resources.

As the quality of light becomes a factor, superior lights from modern solar lanterns or electric bulbs, clearly distinguishable from comparatively inferior lights of kerosene lanterns, come into play. This distinction between standards of lights, some villagers explain, has an impact on the societal perceptions of the household's standards of living.These are seen as material markers of honour (a big house in the case of Mr. Singh also signifies his standard of living). Appadurai (1986: 17) argues that in Indian society "there is hardly any interest in minimalism" and "what is sought and desired is the warmth of profusion and the enchantment of multiplicity" of both things and people. Consequently, the display of multiple and more things – in this case lights – becomes critical. Lights and better lights are also critical as they also illuminate other material possessions, like the kind of house, types and extent of material possessions of the household etc.Electricity systems like solar lanterns also seem to divide the various social groups into those who have access to the superior lights and those who do not (Wong 2010; Jacobson 2007). Thus, lights, and access to superior or inferior lights, produce and reinforce social stratifications by contributing to the rise or fall of people's honour levels.

Light and hospitality

The role of lights is not limited to just establishing or accentuating people's own honour but also to extending honour to others. There is a popular Sanskrit saying in India, '*atithi devo bhawah*' meaning 'guest is equivalent to god'. This special place given to guests translates into their special treatment. Derrida (2005: 6) argues that the principle of hospitality "demands…even creates the desire for, a welcome without reserve and without calculation[80], an exposure without limit to whoever arrives". Most people in the research villages claim to follow this. Garvey (2005: 173) has observed similar values among Somali migrants in Norway who are at "pains to illustrate their spontaneity, accessibility and sociability through an open household, based on ideals of hospitality". Day and Hitchings (2009: 52) have alluded to the use of energy in a "culture of hospitality" "to present a warm home for the visitors" in the UK.

In Bihari villages, even people who live very modest lives make special arrangements for guests. Guests are not always expected to come announced. The Hindi word for guests – *atithi*[81] – means 'one who has neither an arrival nor a departure date'. Often if a guest arrives suddenly, a child can be seen running to the nearest shop to get special provisions. Lights, their quality and provision also fit into the idea of serving guests with the best facilities. This played out in Rangpur, when during the fieldwork I reached a household unannounced for an interview. Two men were sitting outside the house – in their *dalaan* – in the dark, sipping tea. I said jokingly, "I see you are having tea in the dark". This was enough to start what I would call a 'luminous reaction'. Someone was promptly called and asked to light up, and quickly bring a lantern. Any number of protests and apologies from me did not work and soon a kerosene lantern arrived to light up the 'guest space' (fig. 6-2). Being a male, I also occupied the *dalaan*. Of course, tea and snacks followed the light.

If the house has access to different types of light sources, the best light (quality) is put in the 'guest space', again following the notions of hospitality – 'the best for the guest'. These gestures extend special honour to the guest as it happened in one household in Sahariya. Here, a solar lantern was rented by Mr. Jeetendra Singh to run tuitions for the village children. My arrival as a guest meant that the lantern was placed in my space – the 'guest space' – and the critical activity of studying (for the time being) happened under kerosene lamps. Again being a 'male other', I was hosted in the *bangla.* Upon my departure, the solar lantern with its 'better light' returned to the tuition space. Lighting up guests' space and not leaving them in the dark, accords honour to guests.They get precedence and importance over other activities which also require light or certain quality and quantity of light. In

[80] There is however some calculation involved as is explained later.
[81] *a-tithi = without-date.*

addition to this, provision of 'superior lights' in the 'guest space' shows that guests are receiving 'superior treatment' and establishes their 'higher place' in the social hierarchy.

Figure 6-2: After the 'luminous reaction'. I was sitting on the chair by the door. The lantern is placed nearby.

This act of hospitality also reinforces the host's honour in their society by establishing the fact that they take care and have the material capabilities for taking care of the guests well. This means that they are 'honourable people'. Bille and Sorensen (2007: 227) explain that hospitality materialises through the quality and quantity of "things presented and perhaps more importantly not presented – and used during its consumption". Hospitality, the extent of hospitality and the "material elements" of hospitality, of which the quality and quantity of light are constituents here, also contribute to the perception of the hosts' material possessions and therefore protects and reinforces their honour (Bille & Sorensen 2007: 227). Pandya (1998: 68) argues that some societies[82] "use the 'outsider' to publicize their position and standing within the community". Thus, hospitality, and the use of light in it are not always without calculation. Calculations of how and up to what extent, hospitality accentuates one's own prestige often take place. Derrida (2005: 6) explains that

[82] In his case Kachchhe – residents of Kachchh area of Gujarat, India.

unconditional hospitality and the conditions that make hospitality possible “do not contradict each other, they remain heterogeneous at the very moment that they appeal to each other, in a disconcerting way”. Following Derrida, it could be argued that, what ultimately makes hospitality, and certain forms and practices of hospitality possible in these villages are the cultural limitations (of space), reservations (of access) and calculations (of honour). Mediated by materiality, light plays a critical role in these practices, limitations, reservations and calculations of hospitality.

Light on special occasions

Light and its provision become all the more important during special occasions.Both, ‘protecting honour’ (of the self) and ‘providing honour’ (to the guest) are important during special occasions like weddings (Bloch et al. 2004; Rajaraman 1983). In Bihar (and many other parts of India) most special occasions, like wedding parties or funeral dinners, take place at night. This makes lights critical on these occasions. Even people with modest economic capacities beg or borrow money to provide as much light as possible (Bloch et al. 2004: 3). Often diesel generator sets are rented and temporary micro-grids are set up to light up the event space. The space in and around the household, in several cases, resembles an island of light in an otherwise dark village. Fig. 6-3 shows the contrast of lighting in a household on an ordinary night (top) and a wedding night (bottom).

Figure 6-3: Everyday lighting from a solitary kerosene lamp (top) and wedding night lighting from the diesel generator micro-grid (bottom) in a household in Rangpur.

Table 6-1 shows the relative importance of various occasions and lighting arrangements. In Bihari villages, weddings are the biggest event in people's lives and involve most expense, followed by funerals and child births. These three are the least frequent events in a household and involve hosting the highestnumber of guests. Prayers are organised once a year or in a few years and the whole village is invited to receive blessings. These also involve hospitality. Arrival of guests and festivals are more regular events. These happen several times a year and involve special provisions, like using the best lighting facility that the household has, but not going all out, like renting a diesel generator. In the table, the lights do not necessarily correlate to the events as their use also depends on the people organising the event. Some people, due to their lower financial capacity, never rent a diesel generator, even for a wedding.

Table 6-1: Ranking of various occasions and lights used during these occasions based on their relative importance. The more important an event, the more expense and better lighting arrangements it would have.

Occasions	Lights
1. **Weddings**	1. Diesel generator micro-grid
2. **Child birth/Funerals**	2. Gas lights
3. **Prayers – people sometimes have big prayer ceremonies in which they invite the whole/part of the village**	3. Gas lights/Kerosene lanterns
4. ***Kutumb* (relatives) and other guests**	4. Gas lights/Kerosene lamps
5. **Festivals**	5. Gas lights/Kerosene lamps

These special arrangements of light (and other provisions like food) are related to honour in several ways. As in the daily lives, these special provisions are meant to honour the guests attending the wedding through appropriate hospitality (Jeffery & Jeffery 1997: 92). After all, "the ultimate and most distinguished guest is the bridegroom" (Pandya 1998: 67). Bihari Hindu weddings consist of two main events – one that is equivalent to an engagement in western countries and the other that is the main wedding event. The first event takes place in the groom's village and a group of people from the bride's village visit for it. The second event is much bigger than the first and takes place in the bride's village. In both events, the respective sides make special arrangements for hosting not only the other side but also their own village. Both events are also used as displays of material possessions of the two families and gifts presented to the soon to be married couple are often kept for public display (fig. 6-4). The gifts consist of gold and silver jewellery, electronic equipment (television, fridge) and in many cases cars and motorcycles. These are meant to display and establish the material capacities and therefore the honours of the families in their society. However, often the bride’s side is pressured to go an extra mile to uphold the groom’s side’s honour. These arrangements are also important to save or establish their own (the bride side’s) honour in their society.Calculations of honour take place on both sides.

Figure 6-4: Gifts presented to the soon to be married couple on display during a wedding ceremony.

The kind of lighting provisions people make become honour markers and also things to be emulated, strived for and exceeded by others in the society (Bloch et al. 2004: 4). These lights, and their relations to people’s honour, create and reinforce existing structures of the society. Those with greater material capacities are able to make better arrangements and further raise their honours, compared to those with lower capacities. Often these better wedding arrangements are spoken of for years to come with reference to the particular households. LaBL has come to play a role in these special events.It helps those unable to afford the expensive diesel generator micro-grid to have ‘better’ lights in their special occasions. This has created a new business opportunity for LaBL entrepreneurs. However, this negatively affects those using the solar lanterns in their everyday lives (section 6.3.2).

The relationships of lights to honour and hospitality indicate the politics and “productive powers” of the low carbon assemblages (Tolia-Kelly 2012: 154). Edensor and Millington (2009: 117) argue that lights are instrumental in making class “through the motivations, understandings and values" of their producers. They (2009) discuss the reinforcement of class identities through Christmas lighting in Manchester and Sheffield in the UK. This is applicable to the superior lights and reinforced honours from modern electric lights in Bihari villages too. In these villages, LaBL solar lanterns and HPS light bulbs are more accessible to those with higher material and social resources (section 6.3.2). These are generally higher caste farmers who already command higher honour and social position.

To foster standard subjectivities, the trustees aim to break social structures like caste, class and gender (section 5.3.3). However, their contribution to honour reveals the "productive powers" of light.The low carbon assemblages end up reproducing and accentuating existing social structures, and creating new ones. Due to notions of honour, and requirements for a public display of lights and 'better lights', often those who are able to occupy public spaces – men in these villages – benefit from the 'better lights'. This brings a discrimination within the home, a politics of home, to light. Women – whether daughter-in-laws or daughters of the village – commonly occupy private spaces inside the house (table 3-2).This limits their access to the 'better lights'. These notions, and the spaces they create, mediate the significance of electricity, and the people who these work and do not work for.

6.3 Trustees' significances of electricity

This section looks at the particular 'practical conditions' that are significant for the trustees.It focuses on the particular actors these significances work for, and how these particular significances create new power relations or propagate existing power relations. This section focuses on the three significances of electricity – education, health and livelihoods – that both LaBL and HPS prioritise (section 5.2.1,). These significances are also the intended uses of light. However, the chapter focuses on how these purposes are made practical and operationalised into everyday context, and in doing so reworked, disrupted and contested.

HPS argues for access to "reliable and affordable electricity to improve" people's "health, education and livelihoods" (HPS Brochure). LaBL explains that it "provides illumination that advances education, health, and livelihood activities" (LaBL Brochure). Since, for them, electricity signifies education, health and livelihoods, they focus on mobilising these three development activities (see sections 5.2.1 and 2.3.2.1 for discussions on significances).Sections 6.3.1, 6.3.2 and 6.3.3 look at each of these claims.

These significances are often mediated by the culture of the villages and the roles of gender and caste are vital in understanding the links between education, health and light. The role of light in livelihoods is linked more to cost-saving and socialisation than raising incomes or market development. Indeed, key beneficiaries in terms of livelihood are the entrepreneurs of alternative sources, such as LaBL, rather than the users themselves. Another important claim is that of removing kerosene and replacing it with alternatives through which health conditions will improve. However, this research shows that this too is a complicated argument, and that new health problems may arise.

6.3.1 Electricity and education

> M1: Agriculture is a compromise…there is no profit in it
> M2: Agriculture has become very expensive
> [….]
> M3: those with jobs are better off

(Group Discussion, Higher caste, Farmer, Sahariya)

In the research villages, many people from higher castes see education as an enabler for a better future for their next generations. These families belong to the farming communities and cite the problems and perils of agriculture as their source of disenchantment towards farm work (section 1.4.1). This has challenged agriculture as a sustainable means of livelihood.Jobs and small businesses have emerged as preferred livelihood options. These families do not want their future generations to continue with agriculture (neither do the young men encountered during the field work) and see their future mainly dependent on jobs and businesses (see also Banerji 2013: 180). Many young men from this section of the society prepare for competitive exams to gain government jobs which are considered as sources of stable livelihood (see Jeffrey, P. Jeffery, et al. 2004: 967 for a discussion on the value placed on government, private and labour jobs). They argue that success in jobs and businesses is impossible without a good education. This impacts their interactions with lights.

A: so you need only one (solar lantern)….
Yes, only one …
A: And…and this is used for studying?
Yes, only for studying.
The main motive (for renting the solar lantern) is studying.
A: So, this has no other use (for you)?
No, no other use.
[…]
A: So, what do people inside the home do?
In the home, there are lamps or lanterns.
A: The one with oil…?
Yes, the one with kerosene oil.

(Ranjeet Singh, higher caste, farmer, Sahariya)

The quote above illustrates a wider trend seen in Sahariya, Bijuriya and Hardiya. In these villages, many people are motivated to rent solar lanterns or connect to the biomass micro-grids to facilitate education through access to better lighting facilities. Like the trustees of the low carbon assemblages, for them, electricity from LaBL and HPS signifies education. Like many others in Sahariya and Bijuriya, Mr. Singh's family rents only one solar lantern, exclusively for the children to study in the evenings. They explain that solar lantern lights are superior to the usual alternative, kerosene lights. These lights are brighter and light a wider area (see also Cross 2013). Due to their brightness and wider coverage, electric lights improve visibility. Thismakesstudying easier and reduces the negative impacts of working under low lights of a kerosene lantern on the eyesight. The solar lanterns and electric bulbs are also seen as healthier and safer options compared to kerosene lamps.

In the research villages, people report that, due to the low lights from kerosene lamps, children often need to bend down to study.This results in direct inhalation of fumes from the kerosene lamps (fig. 6-5). The villagers observe that after studying under the kerosene lamps for a few hours, children's noses and nostrils turn black due to depositions of layers of soot (see Obeng, Akuffo, et al. 2008; Obeng, Evers, et al. 2008; Lam et al. 2012; Kumar et al. 2013). While studying in the evenings, younger children often doze off and fall on the kerosene lamps. Thisresults in burns to the children or fires due to the toppling of lamps with naked flames and kerosene oil (See Mashreky et al. 2010; Mills 2012; Mills 2005). It is also difficult and dangerous for younger children to fill kerosene in the lamps and light them up, an activity that needs to be carried out daily before sitting down to study (see also

Chaurey & Kandpal 2009). This impedes their studies in the absence of older siblings or adults and makes them vulnerable to the more dangerous kerosene oil. Some villages argue that solar lanterns and husk power micro-grids make younger children more independent. They can easily, with the flick of a switch, turn the light on, and continue the activity of studying, without depending on anyone else to fill a kerosene lantern.

Figure 6-5: A child in Berangpur studying under a kerosene lamp (top) and children in Sahariya studying under a LaBL solar lantern (bottom).

Several people in both Sahariya and Bijuriya report that LaBL has made controlling children's study habits easier. In Bijuriya, HPS (before its breakdown) supplied electricity at fixed times. The supply started at 6pm and lasted up to 10pm or 11pm. Some villagers argue that this automatically set study timings for children. Earlier, in the evenings, parents needed to chase children to fill the lanterns with kerosene and sit for studying. This often gave children an excuse to be reluctant and resulted in delays. As opposed to this, the fixed time of the HPS supply (6pm) made an implicit rule for the children to begin studying. So, as Mr. Shankar Singh (a higher caste farmer) of Bijuriya puts it, every day, the start of the electricity supply by HPS and the automatic[83] turning on of the lights in homes emerged as a "signal for the children" to sit down for their evening studies.

LaBL lantern users also support this argument. LaBL has created a new daily practice.People visit the entrepreneurs' house every morning and again in the evening, to submit the discharged, and collect the recharged solar lanterns respectively. Although the collection timings are not fixed, during the research it was observed that most collections took place in an hour's window before the sunset. Most collections were also carried out by children (fig. 6-6). This implicitly sets a fixed time for children to begin studying and eliminates any excuses of difficulty in handling the kerosene lanterns. The fixed battery backup of LaBL– 3 to 4 hours – and the fixed supply timings of HPS – 6pm to 11pm further reinforce the set timings.They help fix durations of study. Some people report that earlier children often half-filled the kerosene lanterns and used the fact that the kerosene had run out as an excuse to stop studying. Mr. Jeetender Singh, who runs tuitions for some children in Sahariya,explains that often, during the day, children throw some kerosene out of the lantern so that it would last for a lesser duration during the study time. These manoeuvres are not possible with the solar lanterns. New practices and habits related to education are taking shape due to the presence of the low carbon assemblages. Parents who are often seen as the trustees of children in their everyday life find HPS and LaBL better than kerosene lanterns for conducting the children's conducts. Thus, the low carbon assemblages are 'better' for education for two reasons.They provide 'better' or superior lights that make studying easier

[83] Most people did not have any switches to regulate the electricity supply. They connected light bulbs directly to the electricity supply and the bulbs lighted up automatically as soon as HPS started supply.

Figure 6-6: Children collecting solar lanterns in Sahariya.

and help avoid the health and safety hazards of kerosene lamps.In addition to this, they help control and conduct the activity of studying by fixing study times and modifying studying habits.

The importance of light for education is visible in the research villages. However, ‘better’ lights are mobilising education only for the section of society which has historically had more access to education. Li (2007c: 7) argues that experts “exclude structures of political-economic relations from their diagnoses and prescriptions” and “focus more on the capacities of the poor than on the practices through which one social group impoverishes another”. Following Li, this section argues that the idea of ‘better’ lights for education is linked to the education systems in and around the villages and the value placed on education (as it is currently available and accessible) by different sections of the society. Because of these reasons, education as significance of electricity and the low carbon assemblages do not work for everyone. Two sub-sections on caste and gender explain this.

6.3.1.1 Electricity, education and caste

An overwhelming dedication towards education is generally only found among higher castes. *Dalits*, especially in Sahariya, see education as a part of their future plans.However, unlike the higher castes, they do not see their future mainly dependent on education.As a consequence, they do not make the connection between education and sustainable livelihoods in the same way as their higher caste counterparts. They explain:

> We think that if our children get a bit educated then they won't have to rely on anyone if they go somewhere. If there would be some work at home, then they would be able to take care of it. That's it?!
> […]
> Sir, we do not have the capability to educate (our children) much. But at least they (the children) would succeed in calculating (wages).

(Groups discussion, *Dalits*, daily wagers, *Musahri*, Sahariya)

In this group discussion, *dalits* explain that they want their children to have a basic education so that they are self-reliant when it came to calculating wages or reading documents[84](See also Corbridge et al. 2005: 99). The same discussion reveals that their lower aspirations for educating their children stems from two reinforcing factors.

> It came up that the education level in the village school was dismal. Some people of the *harijan (dalit) tola* (colony) also added that they did not have enough money to send their kids to the private schools in town and were forced to send them to the village school or not send them at all.

(Field notes after group discussion with *Dalits*, Sahariya, 08/12/2012)

The first factor is the dismal standard of education in government schools in the villages (Banerji 2013: 176). The argument about diminishing standards of education in the government schools was made consistently across all villages visited during this research. Higher caste farmers are also disenchanted by the government schools. They send their children to private schools and tuitions in nearby towns(see also Jeffrey, P. Jeffery, et al.

[84] In Berangpur, Bindeshwari Sao, an illiterate *dalit,* man told me that his land was duped away by his brother by getting him to sign a piece of paper he couldn't read. Mr. Sao did not want this to happen to his children. He wanted them to get educated solely for this reason.

2004: 967). The second factor for lower *dalit* aspiration – based on their arguments – is financial weakness.They cannot afford to send their children to private schools or tuitions (see also Corbridge et al. 2005). Again, this argument was made consistently across all research villages. *Dalits* have either accepted the options available to them,either to send their children to government schools, or not to send them to school at all due to dissatisfaction with the education system.

In addition to this, unlike their higher caste farmer counterparts, the mostly landless *dalit* labourers argue that due to the lack of material and financial strength they cannot think of sending their children for higher education. This involves considerable expense and the farmer families often either mortgage or sell their material possessions – primarily land – to educate their children (Kishore 2013: 45). Most *dalits*lack any such material possessions. In all research villages most *dalits* lack material assets and continue work in the fields of the higher castes and gain other employment from them (see also Jeffrey, R. Jeffery, et al. 2004: 968 for a similar discussion about the neighbouring state of Utter Pradesh).

In the absence of higher education, gaining white-collar jobs – either in the government or the private sector – is a distant possibility. Jeffrey, R. Jeffery, et al. (2004: 982) add social capital to material capital as defining factors for the link between education and alternate future for *dalits*.Jeffrey, R. Jeffery, et al. (2004: 968 refering to Dube 1998)emphasise that in the absence of a capacity to pay bribes for jobs, *dalits* get "excluded from secure white collar employment". In the research villages, *dalits* bring this argument to a preceding step.They contest that due to a lack of material possessions, they are even unable to pay donations – a form of institutional bribe –and exorbitant fees to private colleges to get their children access to quality higher education. *Dalits* are dependent on the quality of government education, and even an improvement in government education will not work in a silo unless the material and social capacities of *dalits* grow(Jeffrey, R. Jeffery, et al. 2004: 982). These factors break the link between education and a better future for *dalits*.

Due to these multiple entangled reasons, *dalits,* in these villages, do not attach as much value to education as their higher caste counterparts and unlike them, do not see education as a significance of electricity from the low carbon assemblages. Among *dalits* in Bijuriya and Sahariya the solar lanterns are not very popular. This is because they are already paying for a light source – kerosene. While they acknowledge that lights from the solar lanterns are ‘better’ (brighter light with wider illumination that makes studying easier), they do not see much sense in paying for an additional electricity source that provides only lights, better or worse. However, *dalits* pay for electricity connections from HPS or other micro-grids.They bring additional services – like mobile charging – that are critical and that only electricity can provide (section 7.2).

6.3.1.2 Electricity, education and gender

The ‘politics of home’ eluded to at the end of section 6.2 raises the need for further problematisation of education as a significance of electricity, one based on gender.

> A: Right now you must be using kerosene everywhere?
> Yes!! Everywhere!!
> A: The children study under kerosene lamps?
> [….]
> S: See, now there is no light. The children do not study at home. There, you see the light (pointing to a solar street light) at the *bangla,* all of them go there to study.
> [….]
> W: No, my children do not go to study there. I mean, the boys go. But how would the girls go? *After cooking*, they would study here a little bit.
> A: *Bachiya* (girl child) studies here?
> W: Yes! Here.
> A: *Bachiya* would not go to study there (pointing to the *bangla*)?
> W: No! It’s all men there.
> S: Boys are there.
> W: Boys are there….The girls will study here, under the kerosene lamp. *They would cook and then* light a lamp to study. (Emphasis added)

(Wife (W) and Son (S) of Devendra Manjhi household, *Dalits*, Bijuriya)

As the conversation above continues, the girl seen studying in fig 6-7 is busy filling and lighting a kerosene lamp to study.The older girl (on the right side) is still cooking. This *dalit* colony in Bijuriya has a community meeting place where men gather to socialise. Since, most *dalits* are landless or own very little land, they do not have individual *banglas* (section 4.4.2.4). They refer to their community place as the *bangla.* This is an 'outside' space and is dictated by the same social and cultural norms discussed with reference to *dalaan, bangla and baithaka*[85] (sections 3.3.1 and 6.2). The *bangla* in the *dalit* colony in Bijuriya has a solar street light (SSL) near it, which has been funded under a government scheme[86]. The SSL lights up the whole *bangla* at night and the boys of the colony use it as a study space.

Figure 6-7: The girl child studies under a kerosene lamp in the Manjhi household as the conversation goes on.

[85] In fact the sense of this *bangla* being 'outside' is reinforced because it is physically separated from most people's homes and hence is even more distant for females.

[86] During the research it was found that solar street lights (SSLs) installed to light public areas in the villages, were funded under various schemes of the central and state governments. Funding goes to *panchayats* (the local governing council), which decides how many SSLs need to be erected and where. It was observed that, to keep various social groups in the village happy, SSLs were often erected at gathering places such as the *bangla* in the Bijuriya *dalit* colony.

However, due to the presence of boys Manjhi's do not allow the girls to go to the *bangla* to study. The social and cultural notions dictate the separation of spaces occupied by the two genders. In addition to this, Manjhi's are concerned about the safety of the girls (see Jeffrey et al. 2005: 2089). As a result, the boys get access to the 'better' lights from the SSL while the girls have to compromise with kerosene lamps. Although, scholars argue that public lighting benifts women (Wong 2010: 4; Reddy et al. 2013: 208), this case is contrary. Social and cultural norms often also dictate that girls do not go to 'other's' homes or 'outside' their own homes to study, especially in tuition classes which mostly happen after school hours, in the dark. For their safety, parents prefer that girls avoid venturing out after dark. In addition to this, the domination of boys in tuition (fig. 6-8) is another deterrent for girls' parents.

Figure 6-8: A tuition class under electric lights in Berangpur. It is full of boys with a solitary girl child at the far end.

In families that prioritise lights or 'better' lights in *dalaan, bangla or baithaka,* rather than inside the house, boys, young men and very young girls can inhabit these spaces and study under these lights. However, girls (young and old), who cannot inhabit these spaces, have to either compromise by discontinuing their studies or studying under the inferior, polluting and hazardous kerosene lamps. It is worth noting that in Bihar the share of women students in colleges and universities is only 30%(Mishra 2013: 295-297).Only 2% of working-age women (compared to 7% men) have higher education (Mishra 2013: 295-297). During this research, many children (both male and female) and young men were observed and recorded (through the camera) studying under the LaBL lanterns. However, no young woman was recorded studying under these lights. Very young girls, mostly pre-pubescent, were seen studying under the solar lanterns along with boys (fig. 6-9). The inside – outside concern is lessened in HPS.People are able to light multiple spaces –inside and outside – at the same time allowing young women to study inside.

Figure 6-9: Children studying under LaBL lanterns. Young men can be seen but no young women.

However, it is important to note (in the quote in the beginning of this section) that every time Mr. Devendra Manjhi'swife talks about the girls studying, she precedes it with a mention of them cooking. This emphasises most households'priorities for girls. Since, both studying and cooking dinner take place at the same time – in the evenings – in most households, girls cook while boys study. Fig 6-10 shows one such higher caste farmer household in Rangpur. Fig. 6-11 from a *dalit* home in near by Berangpur clearly depicts the domestic politics of energy access. The household has access to electric lights through the

Figure 6-10: A girl child (right) in Mr. Rohit Singh's household in Rangpur cooks dinner while her brothers (right) study.

Figure 6-11: Gender politics of energy access: male child studies under electric light while female child (at the far end) cooks on an earthen hearth.

diesel generator micro-grid. It is used by children to study. However, it is the male child who is studying beside his father, while the female child (at the far end) is cooking dinner for the family. This discrimination between the male and female children stems from the fact that most families do not see any alternate future emerging from education for the girls.

Similar to *dalits*, education for females is not seen as leading to future economic benefits (Kingdon 1998: 58-59; see also Borooah & Iyer 2005: 1391). This is because women are not expected to take up jobs (Jeffrey, P. Jeffery, et al. 2004: 963). This is certainly true for *dalits* in the research villages but also partially true for higher caste families. Jobs for girls are also often not relevant for parents because they do not stay with parents in the long term and contribute to their household financially. For the parents, finding a suitable groom, and marrying the girls in a good family takes precedence. Motivated by this, most families – from all castes – do not focus of girl's education and instead 'train' them to carry out household tasks like cooking, cleaning and child care to prepare them for "their role as civilized home makers[87]" (Jeffrey et al. 2005: 2088). Just like *dalits,* school education is seen as neither needed nor affordable for girls.

Most families send girls to schools only up to primary levels, so that they can read, calculate and become self-reliant. In addition to this, in Bihari villages, most wedding expenses, including the burden of the dowry, fall on the shoulders of the girls' parents. Gifts, voluntary and often forced, in the form of a dowry are an integral part of a Bihari wedding. These are related to notions of honour (section 6.2). Marrying girls off without dowry is almost impossible in Bihari villages. Parents start saving as soon as a girl is born in order to gradually accumulateher wedding dowry. Norris (2004: 16) explains that everyday household items like utensils are often collected for long periods and gifted as dowry. Similarly, money,which would have otherwise been invested in girl's education, is saved over long term to gift as dowry. Because of these reasons, in pure economic terms Bersier (2008: 20) argues that investing in education for "sons would be then seen as 'assets' and girls as 'liabilities'".

[87] Although Jeffrey et al. (2005) argue that education has started becoming important for females for their "role as civilised home makers", they also argue that this concerns only primary and basic education. This does not involve any higher aspirations for female education.

Jeffrey et al. (2005: 2088) report that more recently girl's education has grown in importance as many grooms now demand educated girls who can teach their prospective children (child care) or to take up jobs like teaching and contribute to the household finances. However, neither of these require expensive private school or higher education. By providing a basis and crucial certificates for parents' claims during marriage negotiations, lower quality government school education often does the job. This socially and financially 'manageable' level of education in some cases also helps negotiate a lower level of dowry (Corbridge et al. 2005: 99). Basic levels of knowledge and degrees are considered more important in the case of girls in comparison to a higher level of knowledge and education. As a consequence, most post-pubescent girls do not study after school, at home.Thus, parents do not feel the need to arrange 'better' lights for them.

During the research it was observed that most working women came from the lower castes and generally worked as unskilled workers in agriculture or households. Most higher caste women worked only as housewives. A few higher caste women worked as teachers in schools while also working as housewives (See Datta et al. 2014: 1202 who discuss similar trends in their study of two other Bihari villages). Many of these 'teachers' acquired jobs under new Bihar Government schemes.These have been widely criticised for preferring quantity over quality and rampant corruption.People have gained jobs based on fake degrees[88] and bribes. Many people have tried to get their wives and daughter-in-laws into these jobs to gain extra and 'easy' income for the household. These do not require much investment and interest in girls' education, and can continue along with their 'real' education – to become 'civilised homemakers'. Thus, although scholars (Reddy & Nathan 2013; Valunjkar 1968; Gurung et al. 2011) argue that electricity is beneficial for female education, evidence here suggests that the situation is much more complicated.

Progressing Li's (2007c: 7) argument that experts overlook "structures of political-economic relations", this section argues that they also ignore the social and cultural landscapes that

---

[88] http://www.thehindu.com/news/national/other-states/dm-tests-bihar-teachers-gk-president-pratibha-state-governor-smriti-irani/article6229092.ece
http://indianexpress.com/article/india/india-others/meet-bihar-teachers-who-got-their-b-ed-before-they-were-born/

have been reproduced for centuries.They make it impossible for any ‘scheme of improvement’ to work outside an existing, and highly entangled, assemblage of notions, rules, structures and spaces. The low carbon assemblages through their significances of electricity (section 5.2.1) focus only on the “capacities of the poor” – education in this case (Li 2007c: 7). They overlook the quality of accessible education, redistribution of material and social resources, cultural notions that give differential access to different social groups and create different priorities for different groups. By providing lights in multiple spaces of the home, HPS provides an opportunity for education to continue even when culture dictates gender separation. By providing mobile charging facilities, it also gives *dalits* a financial reason to participate (section 7.2). Mobile charging brings light along with it for children to study at home. These address some concerns raised above. However, culture still dictates alternate jobs for women and *dalits* still do not value education as much.

The claims of LaBL and HPS about mobilising education are true, but only for some sections of the society. Thus, the low carbon assemblages, by getting embedded in the existing social, cultural, political and economic landscapes of the villages end up supporting education, but primarily for those who already have a better access to education.

6.3.2 Livelihoods and economies

Raju[89] has a small shop near Berangpur (fig. 6-12). He is not connected to any electricity source and depends only on kerosene lanterns. Because of quotas, those getting kerosene from the government receive only a limited amount at subsidised rates (see Morris et al. 2006; Rehman et al. 2005). Almost all the participants of this research find it very difficult to manage within the limited quota and end up buying from the market to fulfil their surplus needs. Kerosene has a marginal cost. Raju pays extra for every extra minute that he uses the kerosene lantern. After a period of time, if there is no sale, he prefers to save his constantly depleting energy source and with it his money. He shuts down the shop. Instead, if he has access to an energy source with a fixed cost, he could keep the shop lit and open for as long

[89] I never asked his real name, as this was not part of the formal research interviews. This was more of a serendipitous encounter that happened one night while returning from the village. Raju made the arguments of fixed and marginal cost.

as he wants (hoping for sale), even if there is no sale. Until now,electricity from the central grid, in these villages, has had a fixed cost. People who formally connect to the grid pay a fixed monthly rental.This eliminates the marginal costs and gives them the option of using electricity for as long as they need or want. For Raju, this would open up opportunities of customer interactions and potentially also sale. Chaurey et al. (2004: 1700 with reference to Kaufman 2000) argue that “electric lights….enable families to extend their days after sunset productively”. Electric lights could help Raju extend his working day and improve his livelihood opportunities.

Figure 6-12: Raju's shop near Berangpur lighted by a kerosene lantern.

> It is 10 pm. Too late in the night by village standards. But the four benches around Mote Singh’s tea stall are occupied. People are chatting while sipping tea. More than a year ago, the stall in Sahebganj village of Bihar’s Muzaffarpur district used to be empty by 6 pm. Singh’s fortune has been illuminated by a 15 Watt CFL.
>
> **(Ankur Paliwal (2012), Down to Earth Magazine)**

The 15W Compact Florescent Lamp (CFL) that Mr. Paliwal refers to is powered by a HPS micro-grid. This quote is reflective of the ‘extension of days’ that Chaurey et al. (2004) argue for. Both HPS and LaBL work on fixed monthly or daily[90] rentals. Within standardised limits of time and wattage of HPS (section 5.3.3), and battery capacity of LaBL, electricity can be used for as long, or as brief a period as required. They eliminate marginal costs associated with kerosene lanterns and help in the 'extension of the working day'.

This section argues that while the low carbon assemblages help to extend working hours, the gains for people are not about livelihood benefits like additional income, but rather about savings of more expensive fuels that they would otherwise have used (see Reddy et al. 2006; Bastakoti 2006; Clancy et al. 2003; Chakrabarti & Chakrabarti 2002 for arguments on the generation of additional income). The benefits are also of creating a more hospitable space for the extended socialisation of men.

Markets matter for HPS

The incubation of commercial activities is a key target for HPS. On being asked what changes he has observed in the villages where HPS is working, Mr. Ravi Kumar explains that the villagers now have extended working days and commercial activities are thriving. He states:

> In a nutshell I am telling you, markets have flourished.
>
> **(Mr. Ravi Kumar, HPS Deputy Director)**

[90] LaBL lanterns are sometimes rented on daily basis. HPS rental is monthly.

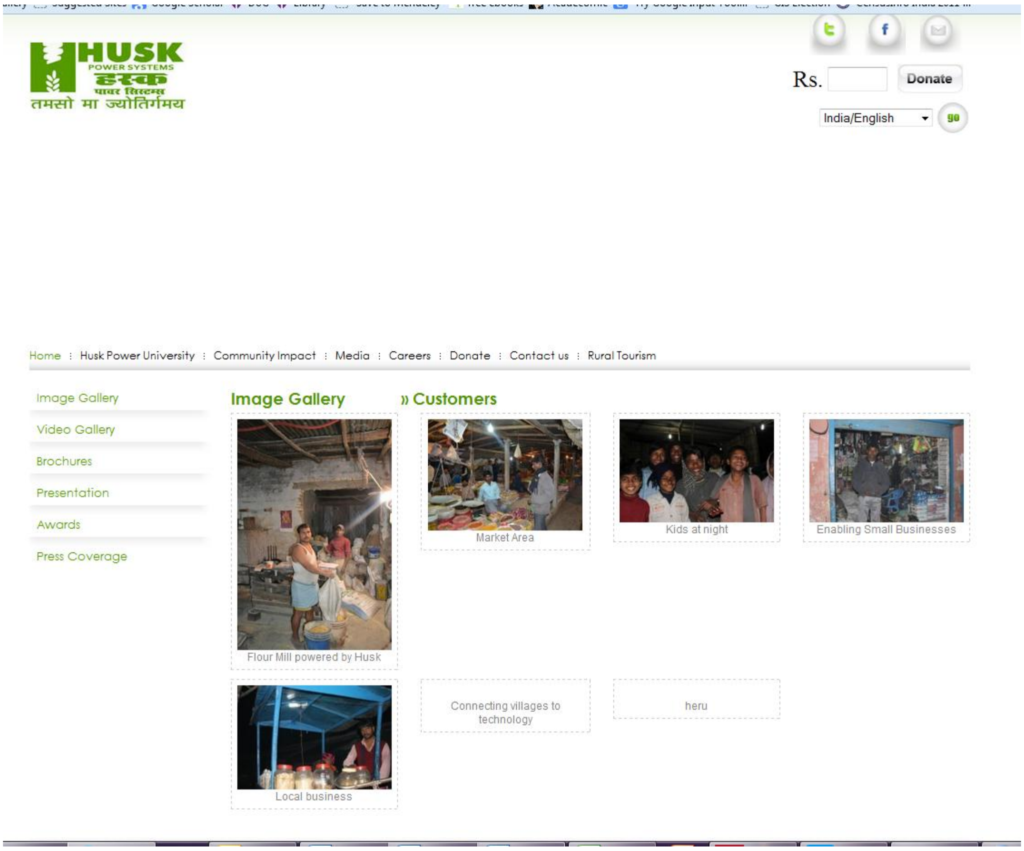

Figure 6-14: A screenshot of the customers section of the image gallery of HPS website (taken on 23/10/2014). First, second, fourth and fifth images are of commercial activities.

Figure 6-13: Commercial activities and market place in Mirpur. HPS supplies electricity for 12 hours. A quack doctor's shop with an operation theatre behind it (bottom right).

Whether the presence of a market in the village is the main criterion for establishing HPS micro-grids is unclear. However, Mr. Bimlesh Gupta, who in the past operated the micro-grid in Hardiya, claims that markets are critical for the success of micro-grids[91]. He explains that shopkeepers promptly pay bills whereas farmers stall payments until they receive money from crop harvests. Mr. Brij Kumar, the LaBL entrepreneur in Sahariya[92] makes similar arguments. This seems logical as shopkeepers have a constant, daily flow of income as opposed to farmers, who acquire their yearly income only after they sell their harvest (section 3.5.1). A look at the customer section of HPS website's image gallery (fig. 6-13) also reveals the importance of markets. In the gallery 4 out of 5 images are of commercial activities. All the three working HPS micro-grids visited during this research are in villages with sizable markets. One of these is a semi urban area – Mirpur –which also has the block[93] headquarters (fig. 6-14). Considering the importance, and extent of commercial activities here, HPS supplies this market electricity for 12 hours. In Haridya however, supply is limited to 6 hours. This is because Haridya has a more modest village market which only requires electricity for lights in the evenings. There is a very high density of shops and various commercial activities in Mirpur, such as quack doctors[94] who run operation theatres and other small activities like photocopying and photography.Due to their dark interiors, theyneed lights even during the day time.

Social networks matter more than electricity networks

Some people in Hardiya agree that the HPS electricity supply is helping the market to stay open for longer.However, most argue that the electric lights and their comparative advantage over kerosene lights or the extension of the working day do not lead to any direct livelihood benefits. The longer hours or brighter lights do not result in a rise in the number of customers or sales.

---

[91] From Mr. Gupta's perspective, success means continued operation, and the biggest barriers in this, for him, are non-payment of bills and over usage of electricity by the customers.

[92] Mr. Kumar has now shifted some of his lanterns to a market place in the nearby town where he rents them to vegetable vendors and shopkeepers. He argues this brings in more money without the tension of dealing with the villagers.

[93] Block is an administrative unit, smaller than a district. A district generally consists of several blocks.

[94] These doctors, however, keep a generator sets to light up their bigger operation table lights which need much more electricity.

A: Now that you have better lights in your shop, has the number of customers increased?
No, nothing like that has happened.
A: or do you keep your shop open for longer?
No, not even that. During winters we keep the shop open until 7pm. It's a rural area. How much would we sell in a rural area? This is the main thing.
A: All customers are from the village?
Yes, people from outside the village won't come here!
[...]
This is a village. Here, even if you light a (kerosene) lantern you would have the same sale. Whether you decorate the shop (*chaar chaand laga dijiye* – add 4 moons to the shop) or you light 10 (electric) bulbs, you would have the same sale.

(Mr. Inder Shah, Shopkeeper, Hardiya)

Mr. Shah informs that the electric lights, due to their brightness and wider coverage area, make iteasier to work in the shop (fig. 6-16). However, they donot result in any incremental income. He explains that the number of customers and income are based on the limited pool of customers in the village.They visit his shop for their daily needs independent of his lighting arrangements. People running commercial establishments in other villages make the same argument. The villagers often depend on one or two shops and tea stalls and

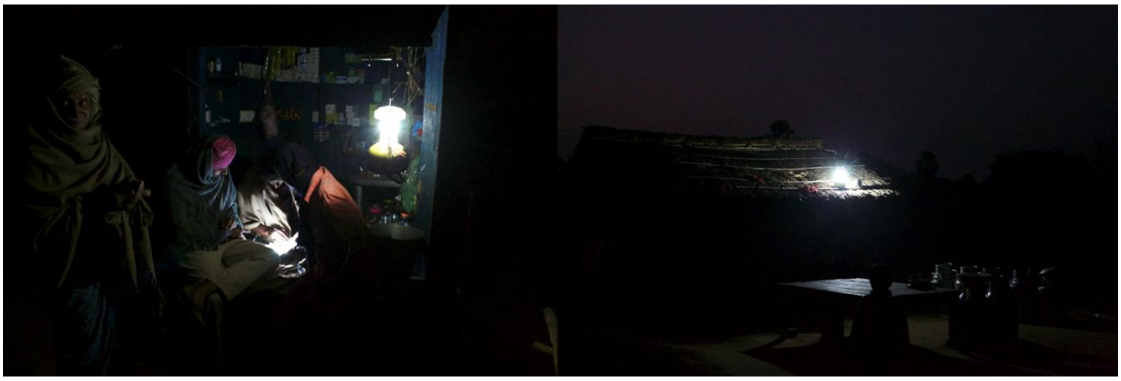

Figure 6-15: Commercial activities in Sahariya. A general store (left) and dairy cooperative centre(right).

generally do not travel outside the village for their daily needs (fig. 6-15 & 6-17). Since these small village establishments differ substantially in their scale of activities from urban establishments[95], they do not emerge as business centres and see very little commerce from people outside the village. The market in Hardiya gets business from people from nearby

[95] An ideal comparison could be between Hardiya where HPS supplies electricity only for 6 hours and Mirpur where they supply electricity for 12 hours.

villages.However, it is very limited and this pool of customers visits the market irrespective of electric lights. They visit the market because it is the only proximate option for their everyday requirements, not because it has electric lights. There are no markets in other villages covered during this research and the small commercial activities in them depend mostly on local customers.

Figure 6-16: Market place in Hardiya on the left and Mr. Shah's shop on the right.

While the people running commercial establishments rule out the possibility of an additional customer base due to better lighting, they explain that the current customers choose one shop in the market over the other based on social behaviours and networks.Lights play a very small role in this.

> It (a petromax) would obviously give more light because it needs more expense.
> A: so, now that you have less light (due to the solar lanterns) compared to more lights earlier, have you had any reduction in the number of customers?
> No, why would it reduce? It is the same as before.
> […]
> (Slightly agitated) Do you think new customers would be born if I get new lights (referring to the solar lights)?!
> […]
> There is something called behaviour. The shop runs on our behaviour too. And if you give good quality product, then people would even drink (tea) in the dark, even if there is less light…

(Mr. Pyare Mandal, Tea Stall owner, Bijuriya)

Figure 6-17: Commercial activities in Bijuriya. Mr. Mandal's tea stall on the left.

Mr. Shah's argument about an easier and safer environment and Mr. Mandal's argument about sociality can be tied together to understand a deeper social need for lighting. Light plays a role in signifying the sociality of people and it situates itself in the culture of hospitality (Kumar 2015; see also section 6.2). By creating a safer and easier environment it also creates a more hospitable environment, which shows the shopkeepers' behaviour or conduct towards their customers. If the shopkeepers do not have light in their shops, which are often attached to their homes[96], customers will often nag them and say – you earn so much money and can't even have a proper light in the shop. This reflects on their honour in the village.

Most shops running in the villages can also be seen as spaces of socialisation. Being outside homes, these are mostly occupied only by men.Just like *dalaans, banglas* and *baithakas*men gather at shops for evening chit-chat. Electric lights help extend these gathering times and help men socialise. Since, the shopkeepers are also from the same village, the culture of hospitality dictates that they provide an environment conducive for these gatherings. The use of light here is more social and cultural. The extension of days is for an extended social interaction amongstvillage men.

No direct monetary benefits, no solar lanterns

The use of light is also for material purposes.However, as Mr. Mandal explains, this does not relate to increased income through higher sales. Like many other domestic and commercial

[96] Mr. Shah's shop and home are in the same building. The ground floor houses the shop and the upper floors are residential.

users, Mr. Mandal has joined the new energy assemblages because they are less costly. He points out that LaBL solar lanterns, for him, turn out to be cheaper than his other alternative, the Liquefied Petroleum Gas (LPG) based petromax which gives more light. Table 6-2 shows the big cost difference in different energy sources for the daily lighting of Mr. Mandal's shop. Mr. Mandal compromises with less light but the solar lanterns make financial sense as he saves money earlier spent on LPG. The low lights are not an issue for Mr. Mandal.Like most other commercial enterprises in the research villages, he does not correlate the level of light directly with his income. When lights do not connect to income at all, he finds 'better' lights a luxury. Mr. Mandal points out that he does not use solar lanterns athome, as there is no direct monetary benefit – neither savings nor additional income – from them. On being asked if those at home would live in the dark (or less light compared to solar lanterns) he remarks (slightly agitated):

> "Of course they would live in dark....*this is not London*....they use kerosene lamps" (emphasis added).

(Mr. Pyare Mandal, Tea Stall owner, Bijuriya)

By invoking London Mr. Mandal refers to a place inhabited by wealthier people who can afford provisions – like better domestic lighting – that, due to their associated costs, are a luxury rather than a need. For him costly domestic solar lanterns areluxuries.

Table 6-2: Daily expense calculation for lighting Mr. Mandal's shop.

LPG lighting (petromax / gas light)	**Amounts**	**Solar lighting**	**Amounts**
Amount of LPG used per evening	0.5 kg	No. of LaBL lanterns rented by Mr. Mandal	2
Cost of LPG	INR 100/kg	Cost of each lantern per day	INR 3
Total cost per evening	INR 50	Total cost per evening	INR 6

LaBL and HPS are helping people save money previously spent on expensive fuels like kerosene or LPG. Although kerosene is subsidised by the government in India, the quota allotted to each household is limited to 2.75l. In addition to this, entryinto the government's kerosene network is very difficult and contingent on several factors[97]. Many people are often forced to purchase kerosene from the black-market where it is often two to three times more expensive than the subsidised kerosene. Participation in the low carbon assemblages helps many people limit their use to 2.75l and enables them to avoid buying more expensive kerosene. Through this, the lights from the low carbon assemblages create direct monetary benefits for their users. However, this is not for everyone. Poor people with limited sources of income – like Mr. Mandal – often try to avoid investing in additional light sources and manage in their quota of kerosene oil. They do not see an economic justification for LaBL because it only provides light. However, many still participate in HPS as it provides other electricity services in addition to light and gives them an economic justification. This is a critical distinction between LaBL and HPS that contributes, not only to how the low carbon assemblages act in people's everyday lives, but also why they face resistances (section 7.2).

LaBL entrepreneurs get most benefits

Lights are critical for saving and accentuating honour during special occasions like weddings and funerals (section 6.2). Solar lanterns are now finding a role within these lighting provisions. As explained further, this has emerged as a new income source for LaBL entrepreneurs.

> During special occasions, now no one uses gas lights (petromax) in our village. If there is a special function, people quickly come and get the solar lights. I take INR20 for each light.
> [….]

[97] There are limited quotas of kerosene allotted to various villages and the list of beneficiaries is hugely influenced by village head men. Getting onto the list is often contingent on village social networks and local politics. It takes a lot of time and sometimes money as bribes. However, if people stop taking their quota of kerosene for a few months, their names may be stuck off the list. Then if they need kerosene in future they will have to go through the difficult and expensive process of enrolment again. Thus, constantly investing in kerosene is a necessity for most people. Due to this, most people withdraw their quota of kerosene consistently and pay for it even if they have access to electric lights. However, some, who do not need their quota of kerosene, sell it to shopkeepers who in turn black-market it.

> People find is cheap even for INR20. For one gas light it would cost them INR100 plus mantel.
> [….]
> If suddenly 3-4 *kutumb* (guests from the in-law's side) arrive, people quickly come and get solar lights.
> [….]
> During the wedding season, I sometimes fall short of lanterns. People take 5-10 at a time.
> [….]
> I have eliminated gas lights from my village.

(Rakesh Kumar, LaBL entrepreneur, Bijuriya)

People often use diesel generators during special occasions for lighting. Those who cannot afford diesel generators opt for gas lights. Also, if the occasion is smaller or less significant, people try to avoid spending money on diesel generators andchoose gas lightsinstead. However, some people still rent diesel generators during smaller occasions in order to provide lighting that correlates with their honour levels. LaBL solar lanterns have made a place for themselves in the space between diesel generators and gas lights. People who want electric lights but do not want to spend money on a diesel generator, because either the occasion is less significant or they have limited funds, have started opting for solar lanterns in Bijuriya and Sahariya. Even people from neighbouring villages rent solar lanterns during special occasions. Table 6-3 details the cost of various light sources used during special occasions. This has created new and better livelihood opportunitiesfor LaBL entrepreneurs. By renting solar lanterns out during special occasions, entrepreneurs are able to make more money than they do from everyday rentals. In both Bijuriya and Sahariya, the solar lanterns are rented to regular customers (those who use them in their everyday lives) for INR90/month. If they rent out all 50 lanterns, the LaBL entrepreneursmake INR4500/month i.e. INR54,000/year. Against this, if they rent all their lanterns out forspecial occasions for INR20/day[98], they make INR1000/day. In a month they make more than 50% of what they make from everyday rentals. This is not only a much profitable proposition for the entrepreneurs but also requires less effort. In Bijuriya, the

[98] Rental costs for one off customers are much higher than the rents the regular customers have to pay.

entrepreneur is now keeping some better performing lanterns (brighter lights and longer lasting batteries) aside for rental use on special occasions.

Table 6-3: Daily expense for various light sources used during special occasions[99].

Lights	Costs (INR/day)
Diesel generator micro-grid	1000
Gas lights – generally people use 2-3	200 – 300 (100/light)
Solar lanterns – generally people rent 5 -10	100 – 200 (20/light)

However, this means that everyday users of LaBL lanterns get low performing in Bijuriya. While keeping the 'better' lanterns for useon special occasions improves the entrepreneur's economy, having to manage with lower grade lanterns has a negative effect on people's everyday economies. People complain that lanterns (battery backups) do not last as long as they should and need to be supplemented by kerosene. In addition to this, during particular days of the wedding season[100], demand is intense and the entrepreneurs do not have spare lanterns. Atsuch times, everyday users are asked to sacrifice their solar lanterns for a day or two, to fulfil the wedding demand. People are happy to do this because weddings are major occasions and the whole village cooperates in making them a success. Since, guests from other villages also visit during the weddings, they become a matter of honour for the whole village and cooperation comes naturally[101]. However, again, everyday users are forced to compromise with kerosene on these days.

In addition to this, the entrepreneur in Bijuriya has multiple sources of income – agriculture and teaching jobs for himself and his wife – and is less interested in renting out solar lanterns. Rather than renting the higher grade lanterns, he keeps many aside for himself to

[99] Based on data collected during fieldwork.

[100] Weddings are a seasonal affair in India. Most people look for auspicious dates for weddings, which often fall during particular months of the year.

[101] During weddings people generally collect pots, pans, serving spoons, jugs for serving water, gas lights and other necessary items from various households in the village to fulfil the wedding demand. People from the village contribute labour by helping serve the guests during the wedding. Cooperation comes naturally during these occasions.

light various parts of his home (fig. 6-18).His even usesone solar panel (as he reported) from the charging station for powering electronic equipment for personal use. Thus, the entrepreneurs seem to gain most from LaBL in terms of both livelihood benefits and lighting benefits.

Figure 6-18: Various spaces of the entrepreneur's household lit with LaBL solar lanterns.

6.3.3 Health and well-being

Peck et al. (2008: 307) argue that kerosene lighting is a major cause of health hazards in developing countries. Children are especially vulnerable to burns in households reliant onkerosene lamps and open areas for cooking (Mashreky et al. 2010: 228-229). By replacing kerosene lamps and gas lights the low carbon assemblages create healthier and safer conditions for those involved in studying and commercial activities (sections 6.3.1 and 6.3.2). However, what about people not involved in these activities, and what about everyday activities other than studying and commerce?

> We had a fire in our house.
> [....]

A: how did you have the fire?
From the kerosene lamp.
A: This incident is from the same time as husk power?
Yes! Yes!
A: Why did you light a lamp when you had husk power?
Electricity (from HPS) was gone….this was at 1am.

(Women of Devendra Manjhi household, *Dalits*, Bijuriya)

Even with a HPS connection, Mr. Devendra Manjhi’s house (fig. 6-19) was burned down due to a fire caused by a kerosene lamp. The Manjhi family had a new born baby which often needed to be fed late atnight – 1am in the above quote. As this was out of HPS supply hours, they had to rely on a kerosene lamp (which caused the fire). Even with their participation in a low carbon assemblage, their health and safety was jeopardised.In the Manjhi household, women and children are most at risk. On the night of the fire, women[102] and children inhabited the enclosed spaces while the men slept out in the open, a common practice followed in these villages (section 6.2). The children’s bedroomwall had to be broken down to save them from the fire. They were found unconscious and had to stay in hospital for more than a week. During this time, Manjhi’s were asked to purchase expensive medicine which they were able to get for free, after a petition to the district magistrate (DM[103]). However, an unsuccessful petition would have meant spending about INR500-600 (£5-6) for the treatment. This was a considerable expenditure and would have caused a substantial dent in their finances. The Manjhi’s had to rebuild their house and reported that the government support they were promised never materialised.

[102] Social and cultural rules dictate the limitation of females to enclosed spaces (section3.4.1).
[103] The DM is the highest administrative official in a district and is responsible for all the development work including the health services.

Figure 6-19: Multiple kerosene lamps being used in Mr. Devendra Manjhi's household in Bijuriya to light multiple spaces at the same time. Top right photograph shows the simultaneous use of multiple energy sources – a battery operated torch and multiple kerosene lamps.

Low carbon assemblages do not provide clean cooking

Women and children are more vulnerable to injuries from kerosene lamps because they mostly inhabit indoor spaces. This makes their encounters with kerosene lamps closer thus exposing them to more pollution.It also puts them in a closed environment from which escape in case of an accident is more difficult – as seen in Manjhi's case. Even with low carbon assemblages, the prioritisation of the 'better' lights outside the house (section 6.2) leaves those inhabiting the inside spaces – women and children –vulnerable to kerosene lamps. However, it is not just kerosene lamps that increase women and children's vulnerability. Dictated by social and cultural norms, women in these villages are mostly involved in household works like cooking (sections 6.2 and 6.3.1.2). Cooking is mostly carried out on earthen hearths fuelled by wood, agricultural waste, coal and kerosene (fig. 6-20). During the winter months, most hearths are kept in closed spaces as it is hard to cook outside in the cold weather. This leads to serious indoor pollution, the health hazards of which are well established.

Figure 6-20: A woman in Berangpur who has access to electric lights is cooking on biomass while also carrying out child care. She has two children sitting on the side and an infant in her lap.

Expired air in households using biomass fuels for cooking has higher levels of particulate matters (PM_{10} and $PM_{2.5}$) and Carbon Monoxide (CO) which, according to Banerjee et al. (2012: 570), connect “chronic biomass smoke inhalation” and depression among rural women. Constant exposure to indoor air pollution from biomass may cause “oxidative stress, systemic inflammation, hypertension and tachycardia” leading to cardiovascular diseases (CVDs) (Dutta, Ray, et al. 2012: 261) and alterations in immune defence among women (Dutta, Bhattacharya, et al. 2012; see also Haines et al. 2007; Singh et al. 2014). Smith et al. (2000) argue that there are fairly strong risks of acute lower respiratory infection (ALRI) among children due to indoor air pollution in households using biomass fuels(see also Bruce et al. 2000; Bruce 2008). ALRI causes most deaths among children under the age of 5 years (Saiyed et al. 2001: 3 referring to Stansfield & Shepherd 1993).

It was observed during the research that due to childcare responsibilities, some children ended up sharing the kitchen space while studying. Even with access to LaBL lanterns, they were exposed to indoorpollution (fig. 6-21). In addition to this, poor people who can afford only a limited number of solar lights manage these in ways such that different stakeholders of the household can co-habit the lighted space and perform different activities. However, in this case, the health and internal environment argument of the low carbon assemblages becomes contentious and problematic (section 5.2). Here, children are safe from the harmful fumes of kerosene lamps but they are exposed to dangerous pollutants from solid fuels used for cooking.

Cooking on biomass in open hearths also causes fires. In India, female mortality where burns are the cause of death is more than four times higher than males. It is the only unnatural cause in which female deathsoutnumber those of males – probably due to cooking with wood and kerosene (Batra 2003: 273). Most females in Bihari villages wear *saari* – long pieces of cloth wrapped around the body, parts of which hang down. As women move around during cooking, these pieces often fall into the flames in open hearths (fig. 6-22). Women's vulnerability to fire repeatedly came up during the research, even in villages which had electricity through either the central grid or the low carbon assemblages.

Figure 6-21: In Sahariya, children study in the kitchen under a LaBL lantern while the mother cooks.

Figure 6-22: Mr. Manohar Manjhi's daughter-in-law in Berangpur shows her *saari* that caught fire in the hearth. I met her after Berangpur was electrified. She told me (thinking that I was instrumental in bringing electricity), "Now that you have done something about this (pointing to the light bulb), please do something about this too (pointing to the hearth). Then she told me about her *saari* and showed it to me.

Low carbon assemblages do not provide heating

During winters mothers keep their infants in their laps while cooking also in order to keep them warm. This exposes the children to the pollutants from burning wood, agricultural waste or charcoal (fig. 2-16). Heating during the winter months (November to March) when the temperature often falls to 5^{o}C also affects the indoor environment in village homes. Spaceheating in all homes is done by burning agricultural waste, wood or coal. Wood and agricultural wastes are most often burned as open fires or slow smouldering ambers called *ghura,* around which people sit to keep warm (fig. 6-23). Charcoal and agricultural wastes are also burned as small and mobile ambers in earthen pots called *borsi.*These are most often used indoors and left under the beds or in the rooms all night to keep the space warm (fig. 6-24). This puts people at risk of carbon monoxide poisoning (Schare & Smith 1995: 35). Indoor air pollution leads to the death of half a million women and children annually in India (Saiyed et al. 2001: 1).

Figure 6-23: On a winter morning, a group of men sit around a *ghura* in Berangpur.

Due to separation of space, men spend most of their time outside homes, in open spaces, whereas women, girls and small children, spend most of their time inside homes, in closed environments. This reflects in their heating spaces and as a consequence, the concentration of pollution that they are exposed to is higher (see Mehta & Shahpar 2004; Ezzati & Kammen 2001). It was observed during the research that, keeping to the social norms, men used open spaces for their *ghuras* where other men could join them for socialisation[104] in a warm space. Contrary to this, women and children used closed spaces for their *ghuras* or used *borsies*, when they were away from the hearths. This makes them more vulnerable to indoor air pollution, not only from cooking, but also heating.

Since, neither LaBL nor HPS provide cooking or heating services, people who participate in them are still left dependent on other energy sources like wood and live in precarious situations in their everyday life. Wood fired hearths, *ghuras* and *borsies* share household and commercial spaces with LaBL solar lanterns (fig. 6-24) and HPS light bulbs. The vulnerability to health and life due to these, and the real and perceived costs that they result in, negate the benefits that the low carbon assemblages claim.

Figure 6-24: women and children use *borsi* in Sahariya while a LaBL lantern lights the space.

[104] These *ghuras* are not just spaces of warmth but also spaces in which people exchange news, views, ideas and debates about the village and the world. Often important decisions about the village are made in these spaces. The separation of male and female *ghura* also means the separation of females from important decisions and a separation of world views.

6.4 Adding more complexity to an already complex energy landscape

All energy projects studied during this research have certain limitations.These open up spaces for the coexistence of multiple energy assemblages in people's everyday lives. Not everyone is connected to the central grid and most connected people face highly erratic supplies. These spaces are occupied by kerosene oil. Access to kerosene oil, like the central grid, is limited.Those without access have to purchase more expensive black-marketed kerosene.

The low carbon assemblages have entered the spaces left open by the highly erratic central grid and highly expensive or limited kerosene oil. Most people participating in LaBL are able to afford only one or in some cases two lanterns. These can be used to light up only a limited number of spaces. Section 6.3.1 discussed howMr. Ranjeet Singh's family rents only one solar lantern exclusively for studying in their *dalaan*. Inside the house kerosene lanterns and lamps are used (sections 6.3.1.2 and 6.3.3). A solar lantern's inability to light up multiple spaces at the same time is another reason for the disenchantment of *dalits* towards LaBL in Sahariya. They argue that they can distribute kerosene oil in multiple lamps and use them to light multiple spaces (fig. 6-19) (See also Wong 2010).

In HPS, within the cap on wattage[105], people can use as many bulbs as possible. Most people use 5W or 10W CFL bulbs to light up multiple spaces at the same time. This makes it more attractive compared to LaBL. However, due to the costs associated with bulbs and wiring of the house, people seldom light up all spaces. In addition to this, HPS supplies electricity for a limited time period, generally until 11pm. This is based on the assumption that people in the villages sleep by 10 or 11pm. If one needs lights after this time, one has to rely on kerosene lamps or torches – as in Manjhi's case (section 6.3.3).

The low carbon assemblages are not able to provide a 'complete' solution and people cannot entirely depend on them. Because of constrains of time, space, capacities and services associated with LaBL and HPS, people need to constantly participate in, invest in,

[105] Generally 15W or 30W.

manage and maintain multiple energy assemblages. These multiple arrangements represent the complex energy landscapes of these villages. As electricity from the low carbon assemblages is limited in space and time, its significances, even for the people it works for, becomelimited in these spaces and to these times. This problematises the solutions of the low carbon assemblages.

Although Mr. Shah (quoted in section 6.3.2) argues that his income is not affected by the quality or the quantity of lights in his shop, the importance of lights is not lost on him. He has several contingency plans for lighting. Mr. Shah's shop is connected to the central grid but due to its erratic supply, he is also connected to HPS which promises stable supply in the evenings. He has a diesel generator for the days on which both, the grid and HPS, fail[106]. Although, HPS has a fixed supply times, there are days on which it is delayed or fails to function at all (section 7.3). Duringsuch interim periods, Mr. Shah has a battery-operated torch that he also sells in his shop (fig.6-25). In addition to these, he useshis monthly quota of subsidised kerosene to light other spaces aroundhis home.

Figure 6-25: Mr. Shah's brother using a torch while waiting for the HPS supply.

[106] With supply from the diesel generator the shop looks the same as with HPS supply.

Since batteries in LaBL lanterns do not last for the whole evening, Mr. Shah's counterpart in Bijuriya, Mr. Mandal owns solar panels (fig. 6-26). He charges a battery with the solar panel during the day and uses it to light his shop in the evening. But these are for his teashop. He has made no special provisions for his home where kerosene oil is still the source of light (section 6.3.2). In the shop he uses the lights from the solar panel batteries during the regular hours and saves the solar lanterns for closing time. This is because the lantern's mobility allows him to take the lights to the backside of his shop and clean the utensils used during the day. As the wires connected with the battery constrain mobility, this is not possible with the solar panel lights.

Figure 6-26: Mr. Mandal's shop in Bijuriya lit up by his solar home system.

Both Mr. Shah's and Mr. Mandal's participation with the various energy assemblages are also spatially and temporally contingent. They seldom come into play at the same time and or in the same space. They are used either on different days or at different times of the same day. This involves a lot of informal, but complex, everyday calculations – of money, time, extent of necessity of the activity, duration of various energy supplies etc. This is almost never accounted in for financial terms. The question then is, with an aim to improving people's conditions, whether the low carbon assemblages end up simplifying people everyday lives or making them more complex by adding another source of calculation? The co-presence of several sources of energy and people's constant negotiations with them often negate the advantages of the low carbon assemblages (some of these related to health are discussed in section 6.3.3).

6.5 Conclusions

This chapter has followed the significances of electricity – education, livelihoods and health – that matter for the trustees. It has explained how culture often mediates the use of energy in different spaces, at different times, and for different people. This has a bearing on how and which significances of electricity work for different people. By becomingembedded into the cultural, social, political and economic landscape of these villages, rather than embedding these conditions, the low carbon assemblages regenerate and propagate existing biases, structures, roles and rules (see Li 2007c). Like the central grid or kerosene assemblage, they support those already in a privileged position and leave out those that are not.

Electricity does not symbolise education for everyone because education does not hold equal importance in everyone's life. *Dalits,*in these villages, do not see as much benefit from the current education system and as a result do not feel the needfor'better' lights for education (section 6.3.1.1). However, they participate in HPS because it provides a critical significance of electricity – mobile phone charging (section 7.2.1). The effects and spaces of the low carbon assemblages also become gendered. Social and cultural norms dictate certain roles – like cooking – and certain spaces – indoors – for females in these villages.Electricity from the low carbon assemblages does not signify lower pollution or higher safety in these activities or these spaces (sections 6.3.1.1 and 6.3.3). As withother energy assemblages like kerosene, femalesaremore exposed to pollution and fire hazards, and much of the benefits of the low carbon assemblages are restricted to males. Electricity from these assemblages does not signify health and safety for females. Like other energy assemblages, they support those already in a privileged position and leave out those that are not.

Due to their limitations of time, space, capacities and services, the low carbon assemblagesleave spaces open for other energy assemblages. This leaves people still exposed to the conditions – like health and safety – that these assemblages claim to improve. Thus, the contribution of the low carbon assemblages to healthier conditions in the households is partial.

People's participation in the low carbon assemblages is highly contingent on how they shape their economies – whether domestic or commercial. When people engage with better lights for education, this is because they look at education as a pathway to alternate livelihood opportunities. In most commercial scenarios in the villages, lights from the low carbon assemblages help reduce expenditure onmore expensive fuels like kerosene, LPG or diesel and make economic sense to people running commercial activities (section 6.3.2). The low carbon assemblages help extend the working day for some, but this extension is mostly used for social, rather than commercial purposes. Lights from the low carbon assemblages do not raise incomes for people running commercial establishments because their incomes are rooted in the villages' limited pool of customers. Their relationships with their customers are primarily based on social networks, rather than electricity networks. However, entrepreneurs who rent out solar lanterns on special occasions and modify the LaBL 'model' to their advantage seem to make the greatest livelihood gains.

7 Resistances and Reassembling

7.1 Introduction

This chapter looks at the resistances in the low carbon assemblages, their impacts on the assemblages and their controls by the dispositif.It also looks at the process of reassembling. There are two key sources of resistances in the low carbon assemblages – resistances due to conflicting significances of electricity and resistances towards the technologies of conduct (section 2.3.3).

Section 7.2 deals with the things that electricity signifies for some people but not the trustees.These are significances that people expect but the low carbon assemblages do not accommodate. These different significances, and the failures to accommodate them, are the reasons why some people prefer one energy assemblage over the other. As one assemblage does not fulfil people's requirements, they resist it.

The trustees expect people to use electricity within particular limits, in particular ways, in particular spaces and at particular times. However, because of different significances of electricity people resist these limits, ways, spaces and times.This results in various 'improper' and 'unauthorised' conducts. These give the trustees reasons to reinforce the technologies of control. Experts deploy various socio-material techniques to conduct people's conducts, which many people resist.A cycle of 'unauthorised' conducts,their control and resistances emerges. This sometimes leads to disruptions and breakdowns in the assemblages (section 7.3).

Frequent disruptions and sometimes breakdowns caused by the continuous conflicts and power struggles sometimes lead to the withdrawal of some actors – sometimes some people and at others the trustees – from some spaces of the assemblages. Breakdowns lead to reassemblings of the energy assemblages and people's lives, with introduction of new actors and the exploration of new pathways (section 7.4).

7.2 Other significances of electricity: the first source of resistance

Some people's significances match the trustees' and others' do not. Some people have alternate significances of electricity. From his research in India, McFarlane (2011c: 658) argues for a focus on the "possibilities that assemblage opens but which are not part of its current alignment". These alternate significances are the possibilities that assemblages open up and sometimes close down and that are not part of their current alignment (section 2.3.3.1).

This section deals with the alternate significances of electricity that cause resistances, raise the need for reinforced technologies of control and sometimes result in breakdowns in the low carbon assemblages. It discusses the role of mobile phones and other significances of electricity like entertainment and irrigation. It argues that because it can accommodate these significances, the central grid emerges as the most desirable energy assemblage for the people.

7.2.1 More than lights:mobile phones

Berangpur predominantly consists of lower castes and *dalit* families.It is an unelectrified village[107]. A diesel generator micro-grid, which started a few years earlier, operates in the village. The connections costs INR90[108] and most people are connected to the micro-grid[109]. A young woman told me that she joined the micro-grid simplyto charge a mobile phone.She needed it to stay connected with that her husband, a migrant worker living in a city. Otherwise she would not have bothered spending money on the micro-grid rental. This was after my fieldwork in Bijuriya where *dalits* had joined HPS but not LaBL. This unnamed woman's argument resonates with other people's arguments and draws a bridge between *dalits'* reluctance to join LaBL but not HPS.

[107] However, the central grid was being extended to the village and by the end of fieldwork, it was electrified.
[108] Prices are similar to renting one LaBL lantern or a 15W HPS connection.
[109] However, not everyone is connected. Some people who live on the fringes of the village are 'too far' and their numbers 'too few' for the micro-grid owner to invest in extending wires.

7.2.1.1 Mobile phones bring electricity

> We had to take (the diesel generator micro-grid connection) due to mobile phones.
> [….]
> Mobile is in every home now! Mainly mobile is charged with it (the micro-grid connection) and a bulb is also lighted along with it.
> A: You mean mobile is more important and there is light along with it!?
> Yes, Yes!
> […]
> We could eat in the dark but how would mobile be charged! We will have to go to Baliya (the nearby town) to charge the mobile.

(Bindeshri Yadav, Farmer, Lower caste, Berangpur)

Mobile phones have increasedpeople's need for electricity.Most people in Berangpur argue that they have taken a micro-grid connection due to the increasing number of mobile phones[110]. Mr. Yadav above makes a critical argument that while other activities like eating can be carried out without electricity or lights, mobile phones can be charged *only with electricity*. Many people in all the other research villages extend this argument further. They explain that, as opposed to lights – which can be provided through other energy sources like kerosene – mobile phones need electricity to function. Compared to lighting, mobile charging is a more important significance of electricity for them.

This has made mobile phones a catalyst for energy assemblages that provide charging facilities. The residents of Berangpur, who until a few years ago did not invest in micro-grid connections, are now doing so because of mobile phones.This is also bringing along electric lights for children to study and other household chores[111]. Similarly, in neighbouring Rangpur, mobile phones have catalysed repairs of the central grid network. Villagers here inform that people from all sections of the society collect and contribute money to fix transformers and wires because everyone needs to charge mobile phones.

---

[110] The rising importance of mobile phones has been discussed in chapter 1.

[111] During my search for an unelectrified village, I travelled widely through the villages on the banks of the Ganges near Rangpur and Berangpur. I found that most of these villages were unelectrified. However, in most villages diesel generator micro-grids were functioning. People in these villages argued that mobile phones were the main catalysis for the micro-grids.

M1: These people (young men) are always involved in it (fixing the central grid in the village). They collect contributions (*chanda)* from the village and pay for transformers due to mobiles.
[….]
M2: Otherwise this (the central grid network in the village) would have been defunct…if there was no mobile.
M3: No one would have bothered.

(Group Discussion 3, Elderly, Educated, Higher caste Men, Rangpur)

However, due to the central grid's failures, often there is no electricity supply for several days in Rangpur. Although expensive and time consuming, people are forced to resort to travelling several miles to the nearest town to get their phones charged.

Charging mobiles is expensive

Mr. Sevak Gupta runs a mobile phone charging shop in Hardiya (fig. 7-1). A diesel generator powers the panel on the wall[112] during the day and a battery bank during the evening.It can charge 80-90 mobile phones at a time. Mr. Gupta's shop caters to Hardiya and several non-grid connected villages around it. He explains that people from the surrounding villages often visit Hardiya for shopping (section 6.3.2). People leave their mobile phones at his shop while shopping and take them back when returning home. Mr. Gupta charges INR5 for charging one mobile phone. Other than those visiting the village, Mr. Gupta he has a steady flow of customers from his own village. Many people need to charge their phones twice or three times a day as they use them primarily for listening to songs or watching films (section 1.4.2).This drains the battery faster. He also informs that many people who own mobile phones have no sim cards.These phones are used only for entertainment, a fact that has come up in all research villages.

[112] The diesel generator supplies electricity to a nearby bank.

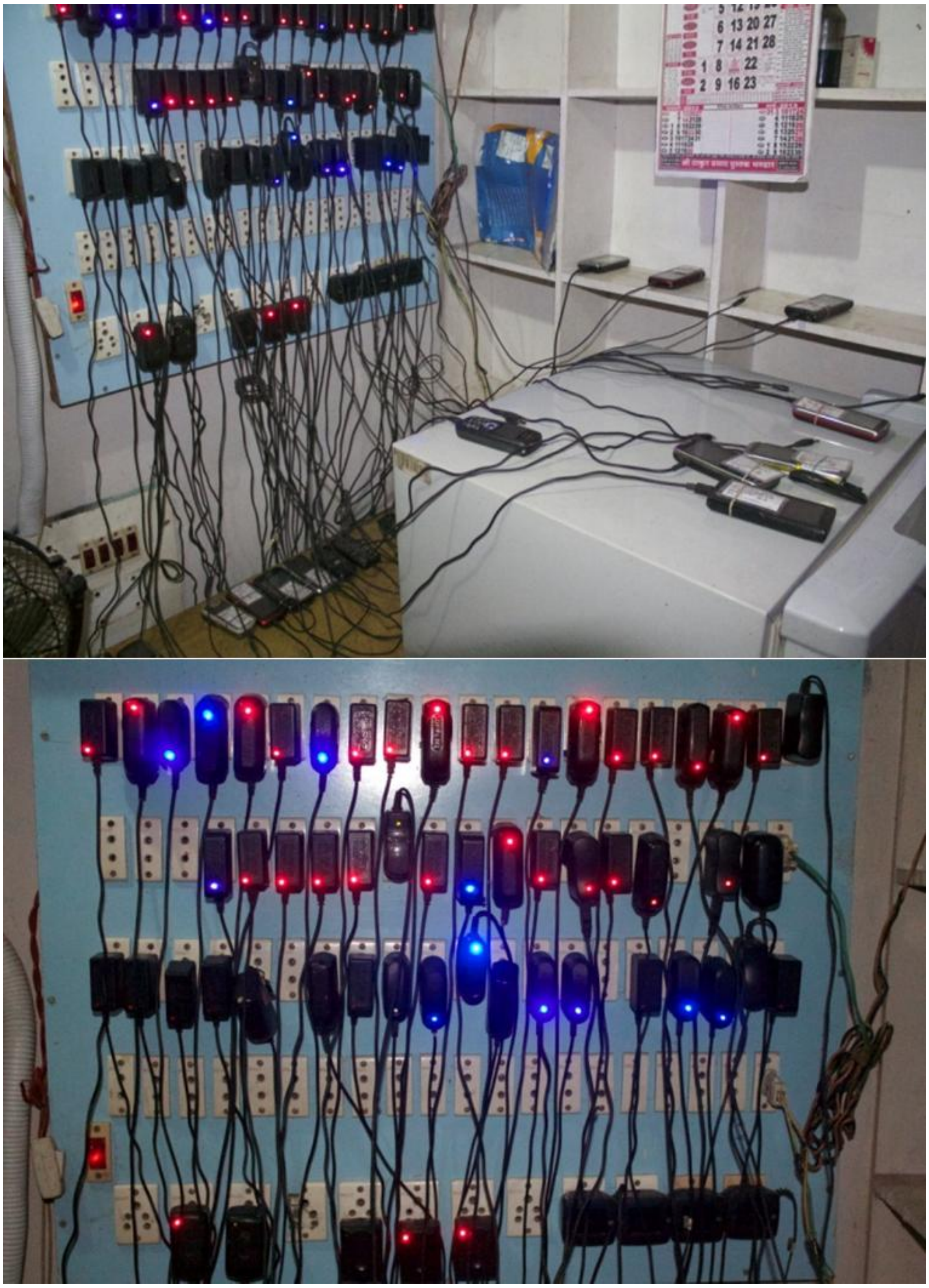

Figure 7-1: Mr. Sevek Gupta's mobile charging shop in Hardiya.

The fourother research villages are smaller than Hardiya and do not have a market. In the absence of electricity, the villagers visit nearby towns to charge their mobile phones. These towns are often connected to the central grid and have shops similar to Mr. Gupta's. At a rate of INR5/per day, many people end up paying a minimum of INR150/month for charging one mobile phone. Most households (visited during the research) have more than one phone. This further raises the cost of mobile charging for each household. Because of all this, an energy assemblage that helps reduce costs of mobile charging is logical for most people.

Energy assemblages with mobile charging are logical

In Bijuriya HPS has ceased its operations. However, rather than participating more in LaBL (section 3.2.1) – which can provide 'better' lights but no mobile charging – most people are using kerosene for lights. They are either going to the nearest town everyday or have started buying solar panels to charge their mobile phones (section 7.4.1). During the fieldwork in Bijuriya, it was observed that compared to LaBL, HPS had a more prominent space in the electricity discourse of the village. Due to the opportunity to charge mobile phones, more people participated in HPS compared to LaBL[113].

Mr. Rajesh Kumar, the LaBL entrepreneur in Bijuriya explains that the capability to charge mobile phones gives HPS a distinct advantage over LaBL. Like Mr. Yadav in Berangpur, Mr. Kumar also feels that when it comes to electricity, people give "more importance to mobiles".

> The reason is that today every system has become an electronic system. In that (HPS) mobiles used to get charged….Or when I used to run the diesel generator micro-grid, mobiles were charged in that too. In this (LaBL), nothing like that happens. Today in electronics, mobile is what people need the most.
> […]
> As I feel it, people are giving more importance to mobiles than light.

(Rajesh Kumar, LaBL entrepreneur, higher caste, Bijuriya)

The presence of mobile charging facilitiesmeans that HPS electricity, like the diesel generator micro-grid in Berangpur, signifies something that *only* electricity can provide. This, along with its ability to light up different spaces at the same time, makes HPS a good solution for the people in Bijuriya and Hardiya.It creates the critical mass of customers

[113] Also important was HPS's ability to light multiple spaces at the same time and at the same cost.

needed for its operation. In Sahariya too, where LaBL is running 'successfully'[114], some people renting solar lanterns complain about the lack of a mobile charging facility[115]. However, this does not emerge as a barrier for LaBL in Sahariya.

> The market place (in the big town) is very near for us (repeats 3 times). So when we go to the market, we just plug it (the mobile phone) somewhere
> [….]
> A: So you don't face problems charging mobile phones here? You somehow do it?
> Yes

(Group Discussion, *Dalit* men, Sahariya)

Many people in Sahariya – both higher castes and *dalits* – explain that the proximity to a big town[116] and their daily interactions with it provides an alternate mobile charging facility. Many people travel to Lakhisarai everyday for work and are able to charge their phones at their workplaces. Sahariya is also connected to the central grid. Due to these factors, here mobile phones have a lower running cost. This lowers their expectations from the low carbon assemblages and facilitates a more ready acceptance of solar lanterns (see also section 6.3.1 for education as a reason for acceptance of solar lanterns).

As opposed to this, after the breakdown of central grid transformers in Bijuriya (section 3.2.1), the villagers have no option for charging mobile phones. They expect the electricity from any new energy assemblages to fulfil this critical need and are not ready to participate in one that does not. In addition to this, micro-grids helpsave more kerosene and hence more money than a solitary LaBL solar lantern that lights only one space at a time[117]. Electricity from micro-grids signifies more critical – mobile charging – and multiple activities – mobile, multiple lights – at the same time and the same cost.This has resulted in a higher

[114] Running successfully from the various trustees' perspective. For them, success is continued operation and renting of most lanterns. However, success has different meanings for different people. Chapter 6 discusses some of these.
[115] Specifically mentioned by Bilas Thakur's mother and wife (lower caste) and Jeetendra Singh (higher caste)
[116] Sahariya was only a couple of miles away from the district headquarter town, Lakhisarai which in comparison to the other towns – proximate to other research villages – is much bigger and has a much more stable electricity supply.
[117] One of the reasons argued by the *dalits* in Sahariya for choosing kerosene over LaBL was kerosene's ability to light multiple spaces at the same time (section 6.4).

acceptance and less resistance for HPS and lower acceptance and higher resistance for LaBL in Bijuriya.

7.2.1.2 Electricity brings mobile phones

The relationship between mobiles and electricity is mutual and bidirectional.While mobile phones catalyse electricity access, electricity also acts as a catalyst for mobile phones. Mr. Binay Singh, who runs the diesel generator micro-grid in Berangpur, argues that the number of mobile phones in the village went up substantially after the operation of the micro-grid started. While the number of customers for the micro-grid has stayed constant, he has had to increase his generation capacity to support the increase in the number of mobile phones. A similar rise in the number of mobile phones was seen in Bijuriya after the HPS micro-grid started operation.

> A: So, once the Husk project started, because of that, did something change in your everyday life?
> There was change sir! The number of mobiles increased.
> [….]
> Yes Sir! Because, otherwise the villagers were paying INR10 per day. So, some people were not buying. To charge mobiles from a battery, it costs INR10. After taking the Husk electricity, in my house, for INR100, 2 bulbs are lighted and mobile is also charging. Because of this, there was some progress in mobiles.

(Jagjeevan Yadav, Farmer, lower caste, Bijuriya)

The move from variable costs – paying for multiple mobile phones, multiple times a day – associated with mobile charging to fixed cost of micro-grid rental meant that people could now charge as many mobile phones, as many times they wanted for a fixed cost (section 6.3.2). This makes more financial sense. Table 7.1 explains that with micro-grid connections people are now paying only INR110 in HPS and INR90 in diesel generator as opposed to the INR150 or INR300 they paid earlier.

Table 7-1: Variable costs of charging mobile phones vs fixed cost of the micro-grids.

Mode of charging	Number of mobile phones and number of times they are charged	Monthly cost (INR)
Shop's like Mr. Gupta's	One mobile charged once everyday	150
	One mobile charged twice everyday or two mobiles charged everyday	300
Diesel Generator micro-grid in Berangpur	Multiple mobiles, any number of times within limited hours of supply	90
HPS in Bijuriya and Haridya	Multiple mobiles, any number of times within limited hours of supply	110

Considering this reduction in recurrent costs, most people buy more mobile phones. This leads to a cycle where the availability of electricity creates a further need for electricity. After the shutdown of the HPS micro-grid in Bijuriya the increased mobile charging need is fuelling purchases of solar home systems and collections of contributions in the village to repair the central grid network (section 7.4.1).

Dalits do not see much sense in paying for additional energy sources that provide only lights, better or worse (section 6.3.1.1). However, HPS, by going beyond lighting and providing the other significances of electricity, gives people an economic and cultural (they can light outside and inside) justification to participate in another energy assemblage (section 7.2.1.1). Similarly, mobile phones, their critical role in people's lives (chapter 1) and the costs associated with charging them give *dalits* enough economic justification to join an energy assemblage – whether low or high carbon – that provides mobile charging facility. This certainly makes HPS a better option for a wider number of people. However, it is still not the ideal solution, as the following section explains.

7.2.2 More than mobile phones: fluidity of energy access

IEA (2011:12), while defining energy access, stresses on "increasing electricity consumption over-time" indicating that 'access' is dynamic. However, as low carbon assemblages bring standardisation and control to develop their 'models', they remove any uncertainties, contingencies and chances of modification according to local needs. Of course the whole idea behind building a 'model' is to make the low carbon assemblages more general and universal rather than specific and local (section 5.2.2).

7.2.2.1 HPS is inadequate

The basic services – lighting and mobile charging – provided by HPS are a step further than solar lanterns. However, as people becomeconnected[118] to the micro-grid, the dynamism of energy access comes into play and the lack of dynamism of HPS becomes apparent.

> We don't need much electricity right now. Right now there is no electricity[119] and we even have problems charging mobile phones. But, after it (electricity through the HPS micro-grid) came, bulbs were lighted. After bulbs we thought we could have fans too. After fans we wanted (water) pumps. It (the micro-grid) did not have enough electricity.
>
> **(Biswajeet Yadav, line hotel[120] owner, lower caste, Bijuriya)**

Mr. Yadav explains that in absence of electricity most people stay limited to one or two electricity services and manage these through various means. Once people get electricity, they need, want, and aspire for, more services and therefore, more electricity (see also Ulsrud et al. 2011: 301). Ulsrud et al. (2011: 302)argue that situations in which "people's access to basic electricity services turns to increased demand must also be expected to occur in other contexts". However, most of these needs, wants and aspirations are not new. They are the significances that have been supressed, postponed or improvised in the absence of electricity. Because of what Amin (2014: 143) refers to as "rudimentary conditions" of the infrastructure, people have been limited to meeting basic needs.

Non-availability of electricity or adequate amounts of electricity means that people in these villages cannot use television sets for entertainment. Some people own televisions and run them on batteries charged by electricity from nearby towns. However, buying batteries and

---

[118] The use of 'access' is purposefully avoided here.

[119] All energy assemblages are dysfunctional in Bijuriya, except kerosene oil and LaBL.

[120] Highway restaurants in Bihar are known as line hotels.

periodically charging them is an expensive affair and not affordable for everyone. In Berangpur, many people own television sets that they have either bought – to run on batteries – or received as dowry[121]. However, these are stored in their boxes (fig. 7-2), waiting for electricity to arrive. Similar cases were observed in all research villages – fig. 7-3 shows a television set in Mr. Kedar Singh's household. It was initially run on batteries charged from the nearby town, then on HPS electricity, then on central grid electricity, and is currently being run on solar panels[122]. This need for entertainment (visual and audio), in the absence of electricity, is fulfilled by mobile phones (section 1.4.2).

Figure 7-2: A television set and DVD player in storage in a household in Berangpur. The items were received as dowry and never used.

Also, with the arrival of a new electricity assemblage, people start buying electronic instruments like TVs and fans as they see the possibilities for their own significances of electricity. This often leads to a "deepening electric-electronic nexus"[123](Graham & Thrift

[121] The importance of material gifts in weddings is discussed in section 6.2.
[122]Section 7.4.1.2 further discusses the case of solar panels.
[123]Graham & Thrift 2007 use this to signify increasing use of electronic controls in electricity systems (like the grid) which in turn also makes these systems dependent on electricity itself. However, this phrase is equally useful to signify the role of electricity and electronic gadges in catalysing each other's demand.

2007: 13) as both electricity and electronic instruments become causes for and effects of growing requirements of each other (as seen in case of mobile phones in section 7.2.1).

The subsequent emergence or unravelling of needs, wants and aspirations in HPS points to the temporal fluidity of 'access' and the need to accommodate increasing energy requirements in the low carbon assemblages. However the HPS 'model' does not allow for this.

Figure 7-3: Television set in Mr. Kedar Singh's household in Bijuriya.

7.2.2.2 National grid promises adequacy

> Husk plant is not a solution for us. We can only get provision of light (from it). Imagine if I want to run a fan! Or I need the motor for some work. That will not happen (with HPS). There are lot of problems due to the lack of *line* (electricity from the central grid).
> [….]
> Husk plant is a compromise (*majboori*)!
> *Line* is, you must understand, 100% better. I tell the government (*sarkaar*) if it gives us *line* properly, even 18 hours out of 24 hours, then, even if it charges us INR1000 monthly, then also it is better. But we will not get it!
> A: (If you get *line*) Then you will leave all this (HPS)?
> Absolutely! We will leave it!

(**Mr. Inder Shah, Shopkeeper, lower caste, Hardiya**)

Mr. Shah explains that HPS electricity is not enough for them.Their participation in HPS is a compromise because of a lack of options. Like most other people in all the research villages, he argues that the central grid, if it provides electricity 'properly', is the ideal option. It is perceived as most superior and desirable by the research participants in terms of its capabilities because, theoretically, it can provide the wide range of services that the people need, want or aspire for (see also Mceachern & Hanson 2008; Wong 2010).

As opposed to the standardised limits of HPS, the central grid is seen as a source of unlimited electricity.People can potentially use it for whatever they require – to create a habitable environment by running fans, for entertainment by watching television, for agriculture by running water pumps, to run motors for commercial purposes or for coil heaters for cooking. However, the reality is often different, which the people of Rangpur, Hardiya and Sahariya, from their experiences with the central grid understand well (section 3.2). This reality produces the *majboori* or compromise and people have to make do with HPS. If given 'proper' access to this unlimited source of electricity – for which he is willing to pay multiple times the current cost of grid electricity[124] – Mr. Shah claims that he will "absolutely" leave HPS.Everyone in all the research villages, with respect to the two low carbon assemblages, agrees with this.

It is also important to point out that in Bihar electricity is known as '*line*'.This is synonymous to grid wires or lines that bring electricity. Electricity from the central grid is seen as the 'real electricity' and clearly distinguished from other energy assemblages. In Berangpur, when I argued with people who were connected to the diesel generator micro-grid that they had *line*, they contested, "this is not *line,* this is diesel generator" (rephrased). When I took photographs of people's homes in Berangpur, they argued that *sarkaar* (government) by seeing a lit lightbulb (from the diesel generator micro-grid) might think that they already have *line* and then they may never get *line* – the central grid supply. In Bijuriya, people with solar panels made similar arguments. They did not consider electricity from solar as *line* or

[124] However not everyone is willing to do this. In Bijuriya a *dalit* man says grid is best because it's free.

electricity – they were solar panels. Electrification itself is seen as synonymous to joining the central grid. However, the importance ofthe grid is not just about the quantity of electricity. It is also about legitimacy and citizenship. Getting connected to a state network produces documentary evidence. People often use thisevidence as proof of address to claim other state benefits. A claim on the electricity network is also a claim on the state (Prakash 1999: 160). A non-state electricity network cannot provide this legitimacy.

As the central grid electricity supply becomes better, people start resisting HPS.They do not want to compromise anymore. Many customers of HPS in Hardiya are already leaving because the supply of grid electricity in the village has become better[125] than before. In Bijuriya also both, people and the 'local' experts, explain that the arrival of central grid electricity played a big part in the shutdown of HPS.The 'key' experts[126] do not agree with this. They explain that due its instable supply, the central grid has no substantial impact on HPS. They also argue that people currently do not need more than what HPS provides. When they need more, HPS will be able to modify its 'model' to provide more electricity. However, the experts contradict themselves by arguing that one of the main problems for them is disciplining 'unauthorised' use of electricity.By withdrawing more electricity than it can produce, 'unauthorised' uses overload the micro-grids (section 7.3).

What emerges here is a need to acknowledge the existence of multiple significances of electricity, that exist and that people make to "lead fuller lives" (Amin 2014: 151). It is also clear that people are constantly looking for energy assemblages that can accommodate their multiple and varied significances. In absence of these, they resist the low carbon assemblage.They either do not participate – like in LaBL – or use electricity for things that itsignifies for them even when participating – like in HPSs. The resistances often cause disruption and breakdowns in the assemblages and raise the need for further "control and management" (Rabinow & Rose 2003: 10-11) (section 7.3).

[125] A new transformer has been installed and now the village receives stable voltage of electricity for longer durations (chapter 3).
[126] Mr. Ravi Kumar, HPS Deputy Director interviewed during the research.

7.3 Resisting the dispositif: the second source of resistance

> (We tell people) How it should be lighted, how to use it. Still as I feel, only 50% of the LaBL (lanterns) are working properly. 50%....this, after 2-3 meetings every month (in each village), for the last 3 years. We tell people that they should use it (solar lantern) properly. The more you save/protect it, the more benefits you would get. Still people misuse it, even after telling them repeatedly.
>
> **(Mr. Anand Jha, Owner and Manager, LaBL network NGO, Lakhisarai)**

With the standardised capacities of the low carbon assemblages, experts foster standard conducts and expect standard subjects (section 5.3.3). The local experts – LaBL entrepreneurs and HPS operators – train people in 'proper' uses of solar lanterns and make them aware of the 'rules of engagement'. In the quote above, Mr. Jha refers to these processes.He points out that even after repeated trainings and discussions, people 'misuse[127]' the LaBL lanterns.

'Unauthorised' and 'improper' conducts

LaBL recommends that the lanterns should be used for a maximum of four hours a day and should not be allowed to discharge completely (first and third points respectively in the don'ts section in fig. 7-4). LaBL lanterns have three light settings and recommended 'proper' usages for them (section 5.3.3). The dos and don'ts poster recommends that the high setting of the light should be used only in exceptional circumstances (fifth point in dos section).However, the village entrepreneurs and the LaBL NGO report that people often use the high setting for everything.They even leave the lanterns turned on all night on the high setting.In most cases, people use solar lanterns for as long as the charge in the batteries last and bring them back to the entrepreneur with the "*laal batti*" on – a red LED light in front of the lantern, which indicates that the lantern should be turned off because the battery has no more charge. This is an 'improper' use of the solar lantern from the experts' perspective.For the people this is about 'managing' the energy source and getting the most out of what they pay for.

---

[127] Misuse according to him and other 'experts' is wavering away from the 'standard' uses that match the standardised capacities of the low carbon assemblages.

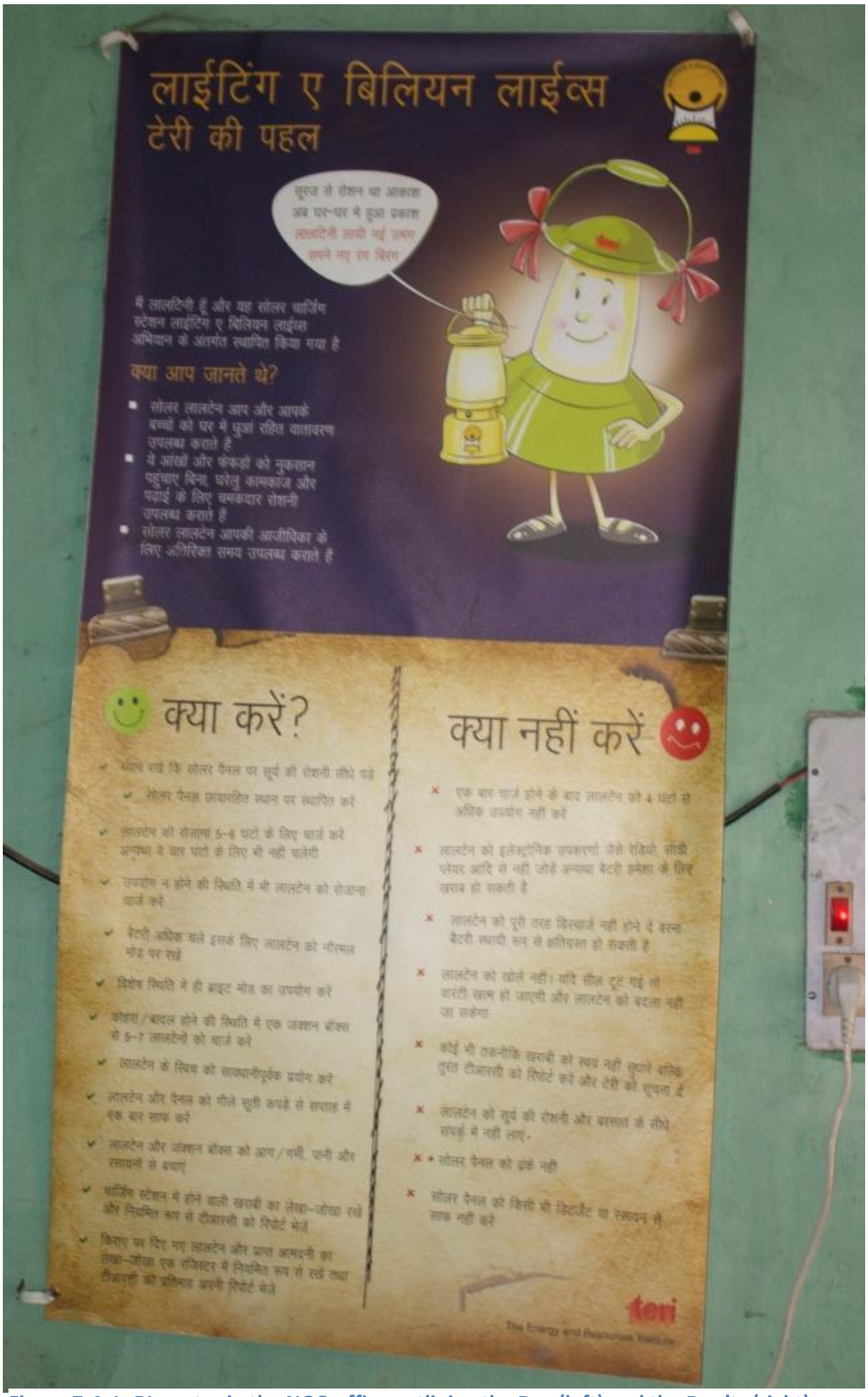

Figure 7-4: LaBL poster in the NGO office outlining the Dos (left) and the Don'ts (right).

By turning off kerosene lamps, people can save oil for next day. However, if they turn the solar lanterns off after the 'proper' use hours, they will not save any rental for next day. In the same way, if people switch the solar lanterns from high to low settings after studying, saving energy/charge in the lanterns battery, they will not save money for the next day's rental. If they burn a kerosene lantern at a low flame or use lamps instead of lanterns, they will save kerosene for next day. In villages, it is common to dim the lanterns after studying or using a lamp instead of lantern for activities that require less light.The different light setting of LaBL lanterns seem to be based on these practices. During fieldwork, my hosts always left a kerosene lantern in my bedroom, so that I had light if I needed to get up at night to go to the toilet. However, the lanterns were always left at a very low flame.

Many people leave the solar lanterns on all night for the convenience of those getting up through the night for a trip to the toilet. In a similar fashion, many poor people using kerosene lampsin Rangpur informed that they leave a lamp lit all night to drive away dangerous animals like snakes or rats. This is critical as they often sleep on the floor, which makes them vulnerable to animal attacks. LaBL's domestic users do not make this argument.However, in Sahariya, Mr. Sheel Kumar, who uses the lantern when he stays in the fields to take care of his cattle, reports that the light drives away animals like snakes and wild hogs and keeps him safe[128]. The sense of safety, without any extra cost, is another reason behind the all night use of LaBL lanterns. Since there are no savings in LaBL lanterns, 'proper' use does not make economic or cultural sense to the people. They employ the solar lanterns in various ways – leaving them on all night, using the high setting all the time – to use the daily charge/energy to its fullest.

This also problematises the significances of electricity. Here, people's significance of electricity is consistent with the trustees' significance (chapters 5 and 6) – health and safety. However, the mode through which the people make this significance is not consistent with the trustees'. From the LaBL trustees' perspective, electricity from solar lanternssignifies health and safety through the high light mode *only* when it relates to 'saving' children who study from harmful fumes and dangers of kerosene. For other health and safety significances – leaving the lamp on all night to go to the toilet or driving away animals – low or night light mode must be used. The trustees' significances of electricity from their low carbon assemblages are not straightforward. Significances of different modes of electricity

[128] LaBL also mentions instances of reduced man animal conflicts due to its lanterns (http://labl.teriin.org/increase_in_solar_lanterns_decrease_in_carbon_emissions.php).

from LaBL become different in different situations, in different spaces, and at different times. They are subject to modes – which are used – and moments – in which they are used.

Similar to LaBL, HPS has standard and explicit 'authorised' limits and implicit 'authorised' uses of electricity (section 5.3.3). However, in both Bijuriya and Hardiya, everyone – experts and people – connected to HPS report that is very common for people to use more than 'authorised' electricity, often to run fans or television sets. This is more common for higher caste families.Due to their higher material capacities, they own more electronic equipment and therefore need more electricity. Due to their higher social and political power, they are also less afraid of sanctions (see also Winther 2008; Winther 2012). Although, HPS makes it possible to have lights in multiple spaces at the same time, due to the cap on consumption, people are forced to use CFL lights as opposed to their preferred choice, incandescent lights. Even if only light is used, in only one space at a time, using CFL is a requirement because most incandescent bulbs come in wattages of 60 or 100, well above the 'authorised' limit of 15W or 30W. This creates a problem for the people as they are now forced to purchase more expensive CFL lights[129].

[129] A normal CFL bulb costs between INR80 to INR100, as opposed to incandescent bulbs, which typically cost INR10.

Most people make initial investments in wires, switches and CFL lights when they join HPS. However, once a CFL light fuses, they find it difficult to replace it with another CFL. It is also important to mention that bulbs sometimes fuse when collective penalisation is done by HPS[130]and this is seen as HPS's fault (section 7.3.2). Many people end up replacing CFLs with less expensive and 'unauthorised' incandescent bulbs. The politics of lighting equipment then leads to resistances against the standardisations of the low carbon assemblage – while people try to 'manage' with cheaper light bulbs, the incandescent bulbs end up withdrawing 'unauthorised' levels of electricity (see section 5.3 for discussion on standardisations as part of dispositif and section 2.3.3.2 for discussion on resistance to dispositif).

In LaBL people are in direct contact with electricity generation equipment – the solar lanterns – and have considerable control over generation.In HPS, people have no control over the generation equipment – biomass gasifiers and engines (fig. 7-5) (see also García & Bartolomé 2010: 307). However, they are in control of equipment that generates electricity services – light bulbs or mobile phone chargers.These are critical for the upkeep of the assemblage. The inherent properties of certain materials and the socio-material organisations of the assemblages create "choke points" which become the loci of power struggles(Mitchell 2009: 404). They are used to control and conduct people but also used by people to resist control (section 2.3.4). It is important to understand and delineate how and why different actors have more control over different parts of the assemblages. It is also important to understand which parts different actors have more control over, and how this leads to the emergence of 'choke points' which affect the upkeep of the assemblages. It is through these processes of identification of choke points that 'trustees' of the low carbon assemblages later decide to reassemble – modify the assemblage (section 7.4.2) – to either extend control over or to withdraw from spaces of conflict.

[130] This happens due to other reasons too like fluctuation of voltage due to malfunctioning of micro-grid equipment.

Figure 7-5: In LaBL (top), part of generation equipment is in people's hands. In HPS (bottom) people are away from the generation equipment.

Problems of upkeep

‘Improper’ and ‘unauthorised’ uses affect the low carbon assemblages and create problems of upkeep. The LaBL NGO and village entrepreneurs explain that ‘improper’ uses impact the solar lantern batteries. They provide only a few hours backup after a year, compared to all night when they are new. However, people using the lanterns do not correlate these reasons together. They observea fall in the number of hours and complain about them.

From their perspective, even though they are paying the same rental[131], they are now getting less out of the lanterns. People are ‘used to’ the all night lighting capacity of solar lanterns. This is the ‘proper’ quantity that they have come to expect.The drastic fall in the number of hours, many argue, signifies ‘improper’ quantity[132] of electricity – ‘improper’ conduct on part of LaBL. Many people in Bijuriya and Sahariya argue that the fall in the number of hours is one reason for their resistance to LaBL.They have not rented or have stopped renting the LaBL lanterns.

Similarly, HPS experts – the micro-grid operators and the deputy director interviewed during the research – argue that ‘unauthorised’ uses of electricity create problems of upkeep. Withdrawal of more electricity than what is produced puts pressure on electricity generating machines. This results in frequent failures of machines causing disruptions in electricity supply. During fieldwork in Bijuriya, people complained that the micro-grid (when it was supplying electricity) did not function for 5-10 days every month[133]. During a week of fieldwork in Hardiya, the micro-grid did not supply the ‘authorised’ quality or quantity of electricity on at least four days.It did not supply electricity one day, ran late on another, frequently turned on and off the next day (people kept other sources of light on, even with the micro-grid supply – fig. 7-6) and ran with very low voltage on the following day. Within the ‘authorised’ limits of 15W or 30W, people expect an ‘authorised’ quality and quantity of electricity supply – for full 5-6 hours, at a stable and ‘proper’ voltage, constant and on time. As, Legg (2005: 143) argues, “numbers need not just be tools of rule, but can be mobilised against” the trustees “to demand justification, explanation or provision”. Similarly, Appadurai (2001: 33-35) explains the use of self-generated numbers and statistics (along with other tactics) by slum dwellers in Mumbai to establish their legitimacy or counter the state, calling these “governmentality from below” or “counter-governmentality”. People keep track of hours and days of ‘authorised’ supply and see the swaying away from these by the micro-grid as ‘unauthorised’ conduct by HPS. They use these to justify their resistances,

[131] In fact, in both Bijuriya and Sahariya, the rentals of the solar lanterns have increased. In both villages people paid INR60/month in the beginning. Now they pay INR90/month.

[132] In addition to non-availability of high option and faulty lighting (section 7.3.1).

[133] There were other reasons as well that contributed to the shutdown, like the irregular upkeep of the equipment and lack of fuel (husk) supply.

either as ‘unauthorised’ conduct or as non-participation in the assemblage. To control ‘unauthorised’ conduct on both sides, various actors – ‘experts’ and people –use various techniques. Two specific types of techniques – discipline and penalisation – are discussed in the two following sub-sections.

Figure 7-6: In Hardiya, one day during fieldwork, the micro-grid frequently turned on and off. Unsure of supply, Mr. Harish Gupta’s son, like many others, used candles along with HPS electricity to do his homework.

7.3.1 Disciplining disruptions and resisting disciplining

For the low carbon assemblages, identification and holding people accountable are important techniques to conduct people’s conducts (section 5.3.3). To stop people from unexpected, non-standard, ‘improper’ and ‘unauthorised’ conducts the ‘experts’ use several disciplining techniques. These are part of efforts to maintain and promote the presupposed identities of subjects (Dean 2010: 43).

7.3.1.1 Disciplining ‘improper’ and ‘unauthorised’ conducts

> I have got all of them disconnected, all wires cut. Because I get lot of complaints (of falling performance).
> […]

> The maintenance staff told me (how to disconnect high setting). He came from Delhi, from the company[134]. All the lanterns that he fixed, I got them (the high setting) cut.

(Brij Kumar, LaBL entrepreneur, Sahariya)

One solution adopted by Mr. Kumar, is to disconnect the high light mode of the lanterns. The solar lanterns and their individualistic designs in LaBL make them 'choke points'. Since people take solar lanterns home, they are out of the control of trustees and in a position to use them as they like. However, by cutting wires of certain light settings, trustees use the same solar lanterns, to control particular people's use (choking them) while not affecting others.

By cutting wires and controlling the amountof light people get from solar lanterns, the entrepreneur ensures that the charge in the batteries last for longer periods of time everyday. However, this reduces people's freedom.They can no longer exercise the brighter light option for studying. During fieldwork, many children were found studying with the low light mode of LaBL lanterns. Since, LaBL recommends the use of high light for studying, this control mechanism exercised by the entrepreneur forces users to engage in an 'improper' use of lanterns – using low lights for studying. However, this is acceptable for the local expert (sections 5.3.1 and 5.3.2) – the entrepreneur – and is not seen as 'improper', because it helps him in the upkeep of the lanterns. In addition to this, even the low light settings produces 'better' lights – brighter, safer and less polluting than kerosene (section 6.3.1) – and therefore fewerpeople complain.

Although this seems like a locally devised control mechanism, Mr. Kumar, in the quote above,statesthat he learnt it from the technology partner's maintenance staff – a more central expert in the LaBL assemblage. All trustees of this assemblage[135] – entrepreneur, NGO and technology partners –, except TERI, are aware of this and are involved in legitimising this control mechanism. 'Improper' conducts generated by technologies of

[134] See sections 5.3.1 and 5.3.2 for the technology partners.

[135] One technology partner approached for an interview initially agreed, but did not respond for the final interview. However, the entrepreneur confirmed its involvement in this control mechanism.

control which help in the upkeep of the low carbon assemblage are considered legitimate by the experts. However, 'improper' conducts generated by people for their ends and may destabilise the assemblage are illegitimate and must be controlled.

The reason for legitimising this kind of control mechanism, that generates 'improper' conducts, lies in *how* various actors in this assemblage are connected. Entrepreneurs and NGOs in LaBL have relative autonomy but are still dependent on more central actors – TERI or technology partners[136] – for flows of material and knowledge (section 5.3.2). On the other hand, the people are 'beneficiaries' who should be *passive* recipients and thankful to the trustees. Only NGOs, and sometimes entrepreneurs, due to their more direct contacts with TERI can take grievances about technology partners to TERI. The technology partners prioritise the satisfaction of their primary clients – the NGO or the entrepreneur – and help them run the LaBL service 'smoothly' and 'effectively'. However, this 'smooth' and 'effective' service is contingent on the experts' perspective – continuous, non-disrupted renting of lanterns – rather than the people's. The technology partner, the NGOs and the entrepreneurs, in this case, form a nexus for upkeep of the low carbon assemblage.This nexus is more about controlling the users and their uses than providing a service that is 'smooth' and 'effective' from the users' perspective i.e. availability of all light options and long battery backup.

Li (2005: 384) argues that "experts…define what counts…and *how it can be achieved*". If their ideas of what 'counts' do not work with existing techniques of achievement, trustees employ new techniques as part of *how it can be achieved.*Dillon (2015: 47)explains that there is always a "partial realisation of designs" and "in the process, there are slippages and breakages, shifts and revisions". The dispositifs never remain the same, they mutate in response to new problems, concerns and issues of conduct. New technologies are added and old are made redundant. In the dispositifs of the low carbon assemblages, as Foucault (1991b: 80-81) argues, "there are different strategies which…produce…effects which can perfectly well be understood in terms of their rationality, even though they don't conform to the initial programming".

---

[136] TERI in fact is more central to LaBL and has more power than the technology partners (section 5.3.2).

HPS employs fuses and checks as control mechanisms (section 5.3.3). It uses a fuse mechanism for every connection to regulate the electricity flowing to the household. In most cases, an incandescent bulb is attached outside the house, in series, so that any electricity going to the household passes through it[137] (fig. 7-7). If the household uses more electricity than allotted the bulb outside starts glowing bright. This helps the experts – HPS micro-grid operators, managers or entrepreneurs –identify and delineate 'unauthorised' use and police them (see Scott 1998: 65). In extreme cases, the light bulb outside fuses anddisconnects the electricity supply to the household. This is not only a form of automatic disciplining but also penalisation. This form of control, through delineation and disconnection or identification and accountability (section 5.3.3), is characteristic of both low carbon assemblages. Here again both the socio-material organisation – putting a light bulb at the front ofthe house which allows socio-material control through identification – and the material itself –a light bulb whichfuseswhen 'unauthorised' use occurs –, create 'choke points' for controlling people.

In HPS, the relationships and the flows of knowledges and materials are simpler. HPS is responsible for the operation and upkeep of most of its micro-grids. It also provides services for upkeep and spare parts for micro-grids that are operated by a village entrepreneur (section 5.3.2). The primary client for maintenance services in LaBL is the village entrepreneur who is motivated by his profits[138]. HPS operates on a for-profit basis and reducing costs and increasing revenues is important for it. The primary client for upkeep of the assemblage then becomes HPS, the actor itself rather than the people. Thus, controlling people and 'conducting their conduct', to keep them within 'authorised' limits so that they do not use what they have not paid for, takes precedence.

---

[137] This mechanism has been in use by diesel generator micro-grid operators for decades and could be seen as another example of local knowledge being made into a 'model' by HPS (section 5.2.2).

[138] Although LaBL is managed on a non-profit basis by TERI, different actors within the assemblage have their own motivations. The technology suppliers, like the entrepreneur, are also motivated by profits.

Figure 7-7: Bulbs used as 'choke points' by HPS.

7.3.1.2 Resisting disciplining

Many people find ways to resist these mechanisms. The bulb used as a ‘choke point’ by experts becomes a site of resistance. People with required knowledge put a coin in the holder before installing the light bulb outside the house. The coin maintains electricity flow and prevents the bulb from glowing bright or fusing even if ‘unauthorised’ use is carried out. They avoid identification and ultimately disconnection by experts. A constant struggle between HPS and the people is going on and HPS is constantly searching for new means to police and control 'unauthorised' uses. For Mr. Ravi Kumar, HPS manager interviewed during the research, use of technology is the main solution for local problems of 'unauthorised' conduct (quoted in section 7.4.2). They are now looking into new materials like prepaid meters[139] to control the users and their uses.

The low carbon assemblages deliberately ignore the socio-cultural landscapes and focus on technical and scientific methods in an attempt to foster standardised subjectivities and better conduct (chapter 5). However, as the assemblages becomeembedded in the wider socio-cultural landscape, the 'plans for improvement' do not always work and disruptions and problems of upkeep follow (chapter 6). Trustees attempt to govern people based on their "promoted and presupposed" subjectivities but in reality "regimes of government do not determine forms of subjectivity" (Dean 2010: 43).

HPS staff carries out regular surprise checks of people's houses to identify customers indulging in 'unauthorised' conduct. Although all customers are made aware of this procedure before joining the micro-grid, some find it objectionable.

> I did not like this. I left it (the micro-grid). Yadavs and other castes were able to open the doors to my house at night. I was not ready to suffer (*bardaast*) this.
> […]
> A Yadav will come into my house, to check, at night time?! It would have been ok if it were day time. This was not acceptable to me.

(Mr. Kedar Singh, Male, farmer, higher caste, Bijuriya)

Mr. Singh outlines two problems with HPS checks. The first is related to 'other' men coming into the household, especially at night, which is a highly unusual practice (section 6.2). Everyday interactions of men are limited to spaces outside the houses. This practice stems from the *purdah* (veil) tradition which dictates a curtain or separation between men and women. Since HPS supplies electricity only after 6pm, the checks need to be conducted after

[139] A brief informal discussion with a HPS cluster manager however revealed that HPS installed these meters in one village but the users started hacking and bypassing the meters so that it no longer controlled their electricity usage.

dark. This further exacerbates the idea of ‘other’ men visiting a household. While most men seldom see the inside of other people’s houses, they go inside after dark only in extreme circumstances[140] and certainly not on an everyday basis. In an everyday situation, entry into the household by ‘other’ men and violation of *purdah,* especially after dark, is considered dishonourable for the household (Amin 1997: 215 on violation of *purdah* and loss of status). Following this, Mr. Singh explains that he may have been ok with the surprise visits during the day time but night time is highly unacceptable.

Mr. Singh’s situation is further aggravated because as a higher caste man he is not used to accepting this kind of control and authorityfrom a lower caste man (a Yadav). This second problem is due to the power relations between various caste groups that have been established historically[141]. HPS is a private company that situates itself outside village society and theoretically does not subscribe to its rules and traditions. Low carbon assemblages are trying to ignore and in some places challenge[142] these power relations to “build on a clean slate” for standard improved conducts (Li 2005: 387). They expect people to move out of the existing power relations – caste, class, gender, age – so that their conduct is only conducted by the socio-material dispositif put in place as part of the low carbon assemblages. However, as Legg (2007: 12) argues, “government…does not decimate previous types of power relations”. When a micro-grid or a solar charging station is set up in a village, it becomesembedded in the socio-cultural landscape of the village. This creates a new kind of politics.Social and cultural norms and biases lead to resistances and disrupt access for, and control of, people from different sections of the society (see also chapter 5). This leads to resistances in the low carbon assemblages themselves and problems of conducting conduct.It also results in the exit or non-participation of particular actors – in this case a ‘beneficiary’.

[140] Example: To help in case of fire, death, illness.
[141] Various castes and their relationships have been explained further in section 3.4.2.
[142] Chapter 5 (Boyle and Krishnamurthy 2010:15).

7.3.2 Punishing disruptions and rewarding compliance

The standardisations created by the low carbon assemblages are designed to “reward those who comply” and “penalize those who ignore it” (Scott 1998: 73; see also section 5.3.3). This stands true for both low carbon assemblage case studies in this thesis. This section explains how the low carbon assemblages use particular techniques to penalise and reward different conducts.

Different socio-material configurations of the two low carbon assemblages create different configurations of power. LaBL consists of a shared charging station and several individual lanterns. How one household uses its lantern on a particular day does not impact the other household’s everyday use, neither does it impact the charging station. Owing to this, individual rewards and penalties can be deployed. In HPS, the people are always bound together directly bysharing of wires and the micro-grid engine and gasifier. ‘Unauthorised’ conduct by some has an impact on the whole micro-grid.This results in disruptions in the form of low voltages or outages for everyone. This puts everyone’s electricity supply at stake and creates incentives for a community consensus. It also makes collective punishments against ‘unauthorised’ uses possible. It must be pointed out that, in LaBL also, long term ‘improper’ conduct by one person affects the others, as the battery life of most lanterns reduce substantially. However, in everyday life, this does not provide enough incentive for community consensus.

7.3.2.1 Punishing ‘improper’ and ‘unauthorised’ conducts

Seeing ‘unauthorised’ use of incandescent bulbs in place of CFL as a threat, HPS penalises those indulging in it (section 7.3.1). It is a common practice to confiscate any incandescent bulbs being used (Schnitzer et al. 2014: 70). In addition to this, HPS imposes monetary fines and discontinues supply for ‘unauthorised’ conduct. In Hardiya, every time the fuse (light bulb) outside a house blows up, the household is charged INR20 for a new fuse. Electricity supply to the household stays disrupted unless they pay the cost of the new fuse. These instruments make people literally pay for lack of compliance. They lose money invested in the incandescent bulbs that are confiscated, pay for new CFL bulbs and additionallypay fines. Most people participating in HPS in Hardiya find this provision a genuine deterrent for ‘unauthorised’ use.Due to the shared stakes, some even argue for its increase[143].

However, the micro-grid is expansive.This makes the identification and exclusion of non-complying individuals difficult (see Li 2014b: 591 for a similar explanation about the materiality of land). Due to the increasing number of deviators, the HPS experts often use collective punishment. Due to its shared socio-material organisation, collective punishment can be deployed for two ends. It incentivises individuals to comply (as they have individual losses) and also motivates the community to undertake collective action against individuals who deviate.This is a powerful incentive for ‘conducting the self’ where self is both, individual and the community.

> You tell me, if they connect two boxes (music systems) and start withdrawing 240 (voltage) and I am supplying 200….my machine suffers.
> But I also used to play dangerous games….at once I used to put both (phases) together, no matter how many fuses burn, how many CFLs fuse (laughs). It’s not that I have not done anything.
> [….]
> I had problems so what could I have done? I use to put both (phases) together two-three times to give shocks.
> [….]
> At once they used to get 400 volts (electricity voltage) in a single phase. CFLs used to fuse.
> [….]
> I have tried every formula before.
>
> **(Mr. Bimlesh Gupta, Operated HPS micro-grid on lease in the past in Hardiya)**

Mr. Bimlesh Gupta explains that often, to ‘retaliate back’ or to ‘teach people a lesson’, he deployed collective punishments by increasingsupply voltage of the micro-grid. In Bijuriya also, many people complain of substantial voltage surges in the micro-grid and claim that the operator did this purposefully. The operator there, Mr. Suresh Sharma, however, denies this. HPS also executes collective punishments by shutting down the micro-grid for a few

[143] Mr. Inder Shah of Hardiya argues that the payment (fine) for new fuses should be raised to INR50 as it would be a stronger deterrent for these involved in ‘unauthorised’ use.

days (Schnitzer et al. 2014: 71). Schnitzer et al. (2014: 71) argue that “withholding electricity from the entire village demonstrates that the micro-grid is a collective resource that can only operate if everyone cooperates”. Of course communities, which largely comply with HPS rule and regulations, are rewarded with continuous supply and mostly stable voltages. This also gives communities incentives to sanction those who indulge in ‘unauthorised’ conduct.If some people are disciplined or penalised it is forthe greater good as it rewards everyone with ‘better’ service.

However, the disciplining and punishing mechanisms of the low carbon assemblages do not always “work out as planned” (Foucault 1991b: 80). Sometimes people find their own ways to ‘retaliate back’, and at other times the communities respond to collective punishments inunexpected ways. Mr. Gupta explains that people who were disconnected due to their non-conformity often fiddled with the micro-grid with intent of causing disruptions[144]. Similar problems were faced by HPS in Bijuriya.All thisultimately contributed to the breakdown of the micro-grid as collective punishments were not fully effective.

Such provisions for fines or a consensus among people for imposition of fines, and collective punishments do not exist in LaBL[145]. However, due to its individualistic configuration, a different kind of ‘reward for compliance’ mechanism – working at the individual level – is at play in LaBL. Although, this was created to penalise ‘improper’ conduct, as is explained further, it also rewards people for compliance.

[144] In one instance, some unhappy ex-consumers connected a micro-grid distribution wire to a solar street light in Hardiya market place. This resulted in the flow of electricity in the pole which was dangerous not only for the people around but also for the micro-grid.
[145] However, most people agree that those involved in breaking solar lanterns should pay for repairs.

Identification and accountability are two important tools that the low carbon assemblages use to discipline people (Section 7.3.1). However, the same tools are also useful for punishing people. In Sahariya, an ex-beneficiary complained to me that she had to leave LaBL because she was falsely accused of damaging a solar lantern. This was in the early period of LaBL operation here and a lantern with a molten and disfigured body was thought to have been brought back by this beneficiary. The entrepreneur blamed her but clear ownership of 'improper' use was not assigned. This controversy led to numbers being added to the lanterns from then on, so that people using lanterns in 'improper' ways and damaging them could be clearly identified and penalised (fig. 7-8).

Figure 7-8: LaBL lanterns with numbers in Bijuriya.

7.3.2.2 Rewarding 'proper' and 'authorised' conducts

The main motive behind numbering the lanterns is to identify "deviant" conducts and "normalise any non-self-regulating" users(Legg 2007: 8-11; see also section 5.3.3). However, numbering also creates self-regulation through a feeling of ownership so that some people care for the lanterns. Experts "rewards those who comply" (Scott 1998: 73) by arguing that those who take 'care' of 'their' lanterns experience abetter output and more benefits. By care they mean 'proper' use and abiding by the 'rules of engagement'.

If you need the high setting for an hour or two and you use it for that then that it's ok.
[….]
If you don't think of it (solar lantern) as *your own*, how long would it last? There will be complaints until you think of it as your own.
[….]
When there is no electricity, you would get more service out of it.
[….]
Those who are intelligent/intellectual (*budhijeewi*) will use it in the middle (low) setting. They will get more benefits (*maza)*.

(Brij Kumar, LaBL entrepreneur, Sahariya)

What Mr. Kumar explains seems largely the perspectives of all LaBL trustees[146]. He argues that self-regulation by people – using appropriate settings for anappropriate number of hours andkeeping lanterns in appropriate places – will remove all the problems for both the people and the trustees. People will get better output and battery life and trustees will face fewerproblems of upkeep. Many people in Sahariya agree that the sense of ownership gives them a reason to care for solar lanterns and use them 'judiciously'. When the lantern becomes 'own', self-regulation and "care of the self" also become regulation of own lantern use and care of the lantern (Ferguson & Gupta 2002: 989 refering to Foucault 1991). However, the trustees also report that this feeling of 'their own' does not resonate widely.

It was observed during the fieldwork that lantern numbers were instrumental in creating this sense of ownership. Every lantern has a number on it, which helps people identify 'their lanterns'[147] (fig. 7-8). Most people in Sahariya associate a particular lantern number withtheir household and call the number 'my lantern'. They also often make identification marks or write their names on the lanterns (fig. 7-9). Although these are considered 'improper' conducts (disfiguring the lantern) by the 'experts', these are technologies of control that people attempt to use against the 'improper' conducts of the trustees – like giving 'their lantern' to someone else. Methods of identification are also used against the trustees "to demand justification, explanation or provision" (Legg 2005: 143). Many people

[146] Similar arguments were made by the entrepreneur in Bijuriya and the local NGO.
[147] Section 5.3.3 explains how lantern numbers are similar to Scott's (1998: 65) explanation of patronyms which helped designate ownership and obligations.

identify lanterns with better battery backup and insist on taking them everyday. Taking the same lantern everyday makes them familiar with the lantern's 'behaviour'. Some modify their behaviour according to the lantern's behaviour with an expectation of getting 'more' – in terms of battery backup – out of it. In some senses, and for some people, rewards do come for compliance and self-regulation.These ultimately help in upkeep of the assemblage.

Figure 7-9: Solar lantern in Sahariya with names and identification marks put by people to identify 'their' lanterns.

These reward mechanisms are the "ideology of equality" (Corbridge et al. 2005: 31-32) that the trustees attempt to progress as part of their plan to foster standardised subjectivities (section 5.3.3). Corbridge et al. (2005: 32) argue that "self-regulation of conduct" is critical for the "ideology of equality". However, again as the low carbon assemblages becomeembedded in the socio-cultural landscapes of the villages, these reward mechanisms get disrupted for some people. This is when pre-existing identities come into play to problematise the trustees' "promoted and presupposed" subjectivities (Dean 2010: 43).

> We used to bring number 22 and now they have given us number 7.
> [….]

> We did not go for two days (to take the lantern) and now the beetle shop guy takes it (number 22). I went one day (to the entrepreneur) and asked why they don't give us 22 anymore when it is in the name of their (points to her children) father. We used to keep it (number 22) with responsibility, take care of it.

(Women of Bilas Thakur's family, lower caste, Sahariya)

There are two reasons that disrupt the 'rewards for compliance' for Mr. Thakur's family – caste solidarity and power relations between various castes (Jeffrey 2001; See also Srinivas 1957; Jha & Pushpendra 2012 and section 3.4.2). Mr. Thakur's is a lower caste family whereas Mr. Kumar, the LaBL village entrepreneur, and the 'beetle shop guy' (in the quote above) belong to the same higher caste. Most people from the same caste in a village trace their lineage to the same forefathers and see themselves as related to each other. Due to their caste connections and shared lineage, they generally feelmore responsibility towards each other than towards other castes in the village[148]. Even though both – Mr. Thakur and the beetle shop guy – pay the same rental for solar lanterns, Mr. Kumar's solidarity towards the beetle shop guy prompts him to give lantern no. 22 (which is in a better condition because it has been taken care of by the Thakurs) to the beetle shop guy. On the other hand, the existing dependency of Thakurs, who are landless and sometimes work on the land of higher castes (including the Kumars), puts them in a weaker position in the relationships of power. Being customers of LaBL they do argue for and attempt to claim no. 22, but ultimately settle for no. 7.They need to maintain their larger socio-economic relationshipswith the Kumars – work and access to land for cultivation(see Scott 1985). Mr. Kumar is well aware of this and knows that he can 'afford' to take no. 22 away from the Thakurs without much protest from them.

Scott (1985: 261-278) explains that "the dull compulsions of economic relations" lead to "deference and conformity" at the same time so resistances often manifest as open grumbles but not as "open confrontation"[149]. Due to the greater social, material and political capacities of higher castes, lower castes in most Bihari villages avoid direct

[148] Many of these relationships and connections are now getting disrupted by disputes over land or inter-caste connections of livelihoods like business ownerships.

[149] The ex-beneficiary who triggered the numbering of lanterns in Sahariya also indulged in open grumble but not in confrontation.

confrontation and conflicts with them.They try to nurture conflict-freesocio-economic relationships with the higher castes (see Corbridge et al. 2005: 252). Castes, classes and genders are identities that the key trustees ignore.However, those who are trained to be trustees (and are also subjects) on the peripheries of the assemblages are also motivated by these other, pre-existing identities. In relation to the Indian state, Corbridge et al. (2005: 36) argue that the lower level, ground officials often act within the “cellular structures of the Indian social life – a life structured by family, kin, caste and community”. Here too, wider dynamics playing out in the socio-cultural landscapes of the villages problematise the “promoted and presupposed” subjectivities (Dean 2010: 43).They disrupt the “ideology of equality” and as a consequence, also the ‘reward mechanisms’ of the low carbon assemblages(Corbridge et al. 2005: 31-32).

This section has explained how various forms of resistances from people and technologies of control from trustees emerge. Some of these technologies are planned (at various levels) and some devised in the moment. Similarly, resistances of different kind exist. As Scott (1985: 299) argues, it is important “to distinguish between various levels and forms of resistance: formal-informal, individual-collective, public-anonymous” – resistance that are at the same time material and ideological. Similarly, different forms of powers are delineated – that act on the collective, that act on the individual, that act from a distance, that are governmental, that are disciplinary and that are punitive.

Resistances by people in different ways give trustees justifications for further application of power – sometimes through the cutting of wires or voltage fluctuations (‘improper’ and unauthorised’ conducts).These give people further justification for resistances. This creates a cycle in which non-ideal conduct by the trustees leads to non-ideal conduct by the people which in turn causes non-ideal conduct by the trustees. These cycles result in breakdown of the assemblages in certain spaces – particular villages – and people are forced to reassemble their lives, habits and practices. At other times, trustees decide to reassemble the low carbon assemblages to either eliminate some choke points, extend their powers or to withdraw from spaces of conflict. These are discussed in section 7.4.

7.4 Reassembling: Reorganising lives and the assemblages

Reassembling, the last out of the six practices of assemblage that Li (2007b: 265) outlines, is about “grafting on new elements and reworking old ones” (see section 2.3.2 for a summary of Li’s practices of assemblages). Since, assemblages are also about “compositional alignment and realignment” (McFarlane 2011a: 24 refering to Phillips 2006), there is a constant and ongoing process of assembling and reassembling. However, as Bennett (2005: 448) explainsusing the American national grid as an example,in specific circumstances, parts of the assemblage disconnect when “they are threatened”.As one part after the other separates (electricity generating plants in her example), there is “more and more stress on the remaining participants”(Bennett 2005: 449). As Bennett’s example, the national grid, ended in a breakdown, assemblages breakdown and then reassemble when resistances and disruptions exceed the trustees’ expectations.

The pushes, pulls, continuous conflicts and power struggles within the assemblages (intra) and between the assemblages[150] (inter), lead to the withdrawal of some actors from some spaces. Sometimes some people withdraw and at other times particular trustees withdraw. In the process of reassembling, based on their material, knowledge and social capabilities, some peoplechoose to join other energy assemblages and form new sets of relations. The disruptions sometimes lead to breakdowns and at others to transformations in the low carbon assemblages.New actors are introduced and new pathways explored. It is important to focus on “what people are ‘left with’: what remains, the aftershocks…the material and social afterlife of structures, sensibilities, and things” and how breakdowns and transformations lead to “different futures” (Stoler 2008: 194-195). Dittmer (2013: 388 refering to Deleuze and Guattari's (1987) ‘lines of flight’) argues that “the dynamism of assemblages means that a range of contingent futures is always possible”.

Li (2007b: 265) fourth practice of assemblages, “managing failures and contradictions”, is about representing failures as deficiencis that can be corrected, simplifying them and rendering them technical. “Resistance, or failure to achieve a programme’s stated aims” is a

---

[150] Contestations between LaBL and HPS, LaBL and kerosene oil and HPS and the central grid.

problem that, from the trustees' perspective, can be solved by reinforceing and extending "the power of experts"(Li 2007c: 10 reffering to Dreyfus and Rabinow 1982). LaBLis reassembling to extend trustees' power and control. HPS is choosing to withraw from spaces in which it is more exposed to other actors' powers.Instead it is training and introducing other trustees and relationships (chapter 5). Various new futures of control and power relations are being formulated to "close(ed), self-reference(ing) and secure", in the relm of expertise, "what essentially are political problems" (Li 2007c: 10) – a characteristic of Li's (2007b: 265) fifth practice of assemblage, anti-politics (see also Ferguson 1990).

7.4.1 Reorganising lives

Low carbon assemblages often end up changing people's habits and practices – studying, hospitality and commerce (chapter 6). When they breakdown, or aredisrupted, people struggle to realign their lives, re-adapt their habits and change their practices. People who have used micro-grids or solar lanterns have grown used to 'better' lights.After the breakdown of these projects they find it more difficult to see under the'inferior' lights of kerosene lamps. This raises the question, are the programmes of improvement 'improving' people's lives or ending up making them more difficult (see also section 6.4)?

After the breakdown of the low carbon assemblages, or after leaving these assemblages, people employ two coping mechanisms. Some people try to adapt to old habits and practices which work with the old energy assemblages like kerosene.They also move from dependenceon electricity networks to social networks. Others join other electricity assemblages – central grid, solar home systems.

7.4.1.1 Getting 'used to' electricity

The first time I met Mr. Ramesh Singh was when I had just finished interviewing some women in a higher caste farmer household in Bijuriya. He had come to charge his mobile phone from the solar home system here because the village did not have electricity and he did not own a solar home system. He did this everyday. Mr. Singh argued that he did not like this but had no option.

HPS catalysed an increase in the number of mobile phones in Bijuriya (section 7.2.1.2). However, its breakdown means that now, with a higher number of mobile phones, people have a bigger economic burden of charging these phones. They either renew their practice of visiting shops, like Mr. Gupta's, to charge their phones (section 7.2.1.1) or, like Mr. Singh, tap into their social network. Where the low carbon assemblages end, new kinds of electricity assemblages, based on social networks take over.In these, for most people, the social takes precedence over the material. However, this unwanted dependency on social networks creates an unwanted feeling of indebtedness towards others[151].This becomes embarrassing for many people like Mr. Singh. This also means that often people must find others within their own kin groups – castes – to charge their phones.Those who cannot must pay for the expensive charging facilities. In addition to this, due to their limited mobility, women now have to depend on male members of the household to charge their phones[152] (see also section 6.2). With HPS they could charge their phones by themselves inside their homes. Later on, when I visited Mr. Ramesh Singh's home and interviewed his family he explained how HPS made them realise the importance of electric lights and got them 'used to' it.

> Since, husk, generator micro-grid and (central grid) electricity[153] have gone…we feel that the presence of (electric) light is very necessary.
> [….]
> A: But before electricity came, you did not feel the need?
> W: We were satisfied…satisfied….(that)there is no facility (*vyavastha*) (of electricity) here.
> [….]
> (A: asks the son, studying nearby under a kerosene lantern (fig. 7-10) if it is more difficult to study under kerosene light after having experienced electric light)
> S: You tell me?! Someone was poor. Suddenly they became rich. Then they became poor again. So, they would obviously feel the pain.

---

[151] A similar embarrassment had led Mr. Kedar Singh (at whose house I met Mr. Ramesh Singh) to buy his solar plate. One day he went to his aunt's house in the same village to charge his mobile phone. His aunt refused. She worried that this would encourage others also to come to her home to charge phones (she had to manage her own energy). This refusal provoked Mr. Kedar Singh to buy a solar plate the very next day.

[152] This is certainly true in case of Mr. Singh. He had actually come to charge his wife's mobile phone when I met him.

[153] Note that Mr. Singh makes a distinction between HPS and electricity (section 7.2.2).

(Mr. Ramesh Singh (M), His wife (W) and Son (S), higher caste, farmer, Bijuriya)

Figure 7-10: Electrification debris in Mr. Ramesh Singh's house. His son studies under kerosene lantern (top left).

Most people in Bijuriya explain that they have become ‘used to’ better lights due to HPS and now find it difficult to work under kerosene lights. Morris (2011: 316) argues that due to their high dependence on vision, humans have a hard time in conditions of low light. Connected to this, like most other people in Bijuriya, Mr. Singh’s son explains (in the last part of the quote above) that the disadvantage of vision under lower illumination is accentuated further when one becomes ‘used to’ electric lights – comparing it to becoming rich – and then has to go back to kerosene lanterns – comparing it to becoming poor again. The problems associated with lack of electricity – ‘better’ lights, mobile charging – are exacerbated when people are forced to readapt to a lack of electricity(section 7.2).

> A: What do you do when it (LaBL lantern) turns off early? Then, again kerosene oil…?
> Yes
> [….]
> A: So, these people (looking at the children) study under kerosene lanterns sometimes?

Yes! But they have become used to (*aadat*) to this (pointing at the solar lantern)….so…in that (kerosene lantern)….
S: ….(We) can't see properly
A: ….they don't feel like studying under it (kerosene lantern)?
Yes, they don't like it so much
S: The vision is yellowish, unclear….
You know, you get used to some things….
W: They don't study under that (kerosene lantern) at all. I keep telling them to study under the kerosene lantern but they say, "Can't see (under kerosene lantern)".
A: So, when this (solar lantern) stops early, studying also stops early?
(Everyone laughs) Yes!!!

(Mr. Jyoti Nath, his wife (W) and Son (S), higher caste, farmer, Sahariya)

Becoming 'used to' better lights, followed by disruptions or the ultimate breakdown of the low carbon assemblages, also leads to the disruption or breakdown of the 'fixed study times' and 'modified study habits' through which the low carbon assemblages help parents control and conduct studying (section 6.3.1). Mr. Nath and his wife explain that due to LaBL solar lanterns, children have become 'used to' 'better' lights.They now resist studying under kerosene lanterns. On the other hand, children argue that now they are not able to see properly under kerosene lights.

The low carbon assemblages, and their fixed timings and durations, set timings and create a 'signal' for children to study. However, if the solar lantern does not last for the 'appropriate' duration, the activity of studying also does not last for the 'appropriate' duration. The disruptions of LaBL create a signal for the disruption or discontinuation of the studies. Similarly, the breakdown of HPS in Bijuriya breaks down the 'signal', study timings and the durations it created.

7.4.1.2 Joining other energy assemblages

The disruptions in LaBL and more importantly breakdown of HPS have also opened the gates for another low carbon assemblage like solar home systems (SHS).

When our problems increased then we started searching….for new alternatives (*wikalp*). There has been some progress (*pragati*) since it (HPS) came. We started searching for means to fulfil our need for electricity (*line*).
[….]

And in that process, this light is now lit (pointing towards the LED light by the window powered by a solar home system – fig. 7-11, top left)
A: So, then (before HPS) you used to use kerosene lamps? How was it then? I mean were there any problems with that?
Major problems (emphatically)! We couldn't see. But we were used to (*abhiyast*).
[….]
A: So you mean you were accustomed to the kind of facility (*vyavastha*) you had?
We were used to….but now we are not ready to get used to….

(Mr. Rajendra Singh, Farmer, higher caste, Bijuriya)

Mr. Singh makes a key argument. 'Getting used' to electricity has forced the people in Bijuriya to look for other energy assemblages. Mr. Singh's argument about getting 'used to' and not being ready to return to the earlier situation also indicates that requirements or the urgency of requirementsand electricity are co-constituted. As people come out of "rudimentary conditions" of infrastructure (Amin 2014: 143), a deepening of "electric-electronic nexus" takes place (Graham & Thrift 2007: 13) (section 7.2.2).This continues even after the infrastructure breaks down. Mr. Singh informs that his household already had a television set which they received as dowry in his brother's wedding[154] (fig. 7-11). When HPS was operational in the village, unlike most people[155], he acquired a connection to run a television and fans too. Although, most Bijuriya villagers are looking for alternate energy assemblages – because they are 'used to' certain electricity services, many are also taking in account their supressed, postponed or improvised needs, wants and aspirations.

This is leading many villagers to SHSs, commonly known as solar plates in Bihar. Most people in Bijuriya report that the solar plate numbershave substantially increased sincethe arrival and subsequent shutdown of HPS. This has been partly driven by the need to charge mobile phones cheaply (section 7.2.1.2). Many people using solar plates in Bijuriya now prefer them to HPS. Like HPS, solar plates produce electricity and not oneparticular electricity service. As opposed to this, LaBL produces a particular electricity service – light. However, within the limits of electricity and timings specified by HPS, most people can only use CFL lights and chargemobiles (section 5.3.3). With solar plates people are not bound by

[154] Section 6.2 discusses the importance of material gifts in weddings.
[155] Due to the associated costs, most people stay limited to lower level connections (section 5.3.3).

time limits, service limits or limits of electricity supply created in LaBL and HPS 'models'. They do not need to modify or adapt their conducts according to the 'standards' created by the LaBL or HPS experts. People can turn on lights, fans or television sets as and when, and for as long as they choose. They can charge as many mobile phones, as many times and at any time they choose.

Figure 7-11: Mr. Rajendra Singh's house in Bijuriya lit by his solar plate. Clockwise from top left - the light he pointed to during the interview. A room with the television set received as dowry which, and a fan next to the bed, finally runs regularly. The common space of the house lighted. Light in the kitchen. Most of these lights, except the one in the common space, were turned off. They were turned on to demonstrate to me. Solar plates give users the flexibility to turn electricity on and off anytime.

However, based on people's material, social and knowledge capabilities, solar plates also create standardisations like the other low carbon assemblages. They also raise the need for the management of different sources of energy, in different spaces and at different times. However, most people in Bijuriya argue that they find it easier to manage their electricity requirements because solar plates offer more control. The plate and the charging capacity of the batteries are limited but people have the choice of switching off everything else and using the capacity for fans, watching television, only lighting or a combination of all of these.

They also provide flexibility of space and time.They can be switched on or off any time and or at any place people require.This can help reduce the risk of accidental fires, like the one in Manjhi household (section 6.3.3).

Solar plates do not provide solutions for cooking or heating at affordable costs for people in these villages.Most health and internal environment problems, which particularly affect females, continue to exist. In addition this, it is important to point out that the 'self' in this freedom and 'control over the self' provided by solar plates refers to the household.The power relations within the household still dictate the control and 'access' to energy that various individuals have, specifically on the basis of gender and age.

7.4.2 Reassembling the low carbon assemblages

> We can only reduce local problems through technology. For this we do regular R&D. Now we are bringing prepaid meters.
> [….]
> Only through technology we can eliminate all the irregularities.

(Mr. Ravi Kumar, HPS Deputy Director)

Both LaBL and HPS use several socio-material techniques to stop people's 'unauthorised' and 'improper' conducts (section 7.3). This is because, from the experts' perspective, when people sway away from the expected, standard, 'proper' and 'authorised' conducts, disruptions and problems of upkeep of the low carbon assemblages occur. In some cases, like HPS in Bijuriya, these also cause breakdowns. However, when the 'models' frequently breakdown or are frequently disrupted, the low carbon assemblages reassemble in different ways. Trustees, like Mr. Kumar above, see increased socio-material control as the way forward.

The struggle for socio-material control is at the heart of the reassembling of the two low carbon assemblages (sections 2.3.4 and 7.3). LaBL is reassembling its model to gain more control by eliminating its 'choke point', the solar lantern. HPS is withdrawing from the spaces of everyday operation and upkeep of the micro-grid. This is where it faces problems of control.

Because of too many technical problems we are moving to that (micro-grid model).
A: Oh! Because of the problems with the lanterns….
[….]
Yes! This (lanterns) has more technical problems, because of which….This is a hundred, thousand times better because after we give this, it can be used anytime. There, the time will be fixed in the micro-grid. If the evening falls at 5pm then up to 10pm (the micro-grid would supply). After that you cannot use it for anything. Because the *control is in my hands*. Where there is micro-grid the *beneficiaries do not have control*. In (solar) lantern, there is control of beneficiary. They have the control so they use it any time. [….] In that (micro-grid), they cannot use (anytime). There is limited use in that. So, this (lantern) is better (for people), not that….
[….]
A: So, in that (micro-grid) only one bulb will be given?
Yes, that is fixed. If we give 3W (bulb) then we will give one. Or if we give 1-2W then we will give 2.

(Mr. Anand Jha, Owner and Manager, LaBL network NGO, Lakhisarai)

Mr. Jha explains that micro-grids are a worse option for people because they reduce the flexibility of space and time that lanterns give. However, he argues that HPS is moving to micro-grids due to the technical problems with solar lanterns[156]. Experts constantly blame, try to identify and hold people accountable for frequent technical problems (section 7.3.1). They also constantly try to apply different techniques to control the people, the assemblages and the disruptions.

Mr. Jha explains above that in micro-grids there will be fixed supply timings. In addition to this, LED bulbs of limited capacity – 1 to 3W – will be installed in the households. Eliminating the 'choke point' – the lantern – will eliminate the problem of 'inappropriately' leaving solar lanterns on all night or using the high light settings and complete discharging of batteries. This is a much stronger material control than HPS. By taking the standardisation of HPS – standard electricity levels – a step further – standard light bulbs and fittings – LaBL is trying to further limit 'inappropriate' uses in the name of making its model more efficient[157]. Like its solar lantern and charging station model, LaBL is focusing on providing particular

[156] Mr. Brij Kumar, the LaBL entrepreneur in Sahariya also informs that LaBL is moving away from solar lanterns and towards micro-grids.
[157] On its website LaBL mentions, "By utilizing LED lights, power consumption per connection is reduced, thus reducing the requirements to distribute large quantities of power".

electricity services rather than electricity. This forecloses the possibility of other significances of electricity (section 7.2).

HPS as an actor, which is part of the bigger HPS assemblage, is choosing to withdraw from spaces where control is contested. It works on various business models – Build Own Operate Maintain (BOOM), Build Own Maintain (BOM) and Build Maintain (BM) (section 5.3.2). In BM, where HPS is not involved in the everyday operations and upkeep of the micro-grids, it completely withdraws from spaces of contention of power and control. Since, in BM, it has no stake in the profits from everyday operations, it does not need to spend energy trying to control and conduct people's 'unauthorised' conducts. Schnitzer et al. (2014: 68) with reference to the BM model argue that "as the owner-operator, the local entrepreneur has a full profit incentive to operate his plant efficiently, collect tariffs, enforce load management rules and operate according to schedule HPS". On the other hand HPS has stepped away from all these activities. Schnitzer et al. (2014: 68) report that "HPS has recently begun to move away from this (BOOM) model due to overhead costs being high and with difficulties in managing a large number of plants" and "intends to massively scale their portfolio under this (BM) model". Mr. Ravi Kumar, the HPS Deputy Director interviewed during fieldwork, argues that BOOM is a better model as it allows HPS to fix electricity tariffs taking into account the social well-being.However, he concedes that the company is now moving to BM as they "have to manage their losses too". Thus, HPS is reassembling to withdraw from the spaces where it faces most problems of control and conduct and consequently monetary losses.

7.5 Conclusions

This chapter followed the resistances that the low carbon assemblages face in everyday life. It explained that there are two key sources of resistances – resistances due to alternate significances of electricity and resistances to the dispositifs put in place to conduct people's conducts.

Mobile phones emerge as an actor that mobilises the requirements of a specific kind of energy – electricity. As opposed to lighting, charging of mobiles cannot be done without electricity.It emerges as a more important significance of electricity for many people. In addition to this, the financial aspects associated with mobile charging (section 7.2.1) provide people a better justification to pay for and participate in HPS compared to LaBL. However, even in HPS, people look for other significances of electricity like comfort through fans and entertainment through televisions. An acknowledgement of these multiple existing and emerging significances of electricity is critical. People resist the low carbon assemblages that do not accommodate these significances and look for assemblages that can – like the central grid. Resistances emerge either, as non-participation – as in LaBL –, or as ‘unauthorised’ significances – as in HPS. These resistances and negotiations are disruptive for the low carbon assemblages. For the trustees, they raise the need for control and conduct.

The inherent properties of certain materials and their socio-material organisations create loci of power struggle.These are not only used to control and conduct people but also used by people to resist control (section 7.3). Both experts and people constantly try to increase their control over these parts of the assemblage. These struggles for control lead to ‘unauthorised’ and ‘improper’ conducts on both sides and both trustees and people use various techniques to discipline and penalise these. However, the technologies of control – whether for disciplining ‘improper’ conduct (section 7.3.1) or for rewarding ‘proper’ conduct (section 7.3.2) – aredisrupted as the low carbon assemblages becomeembedded in the wider socio-cultural landscapes of the villages. The socio-cultural landscapes problematise the imagined and attempted identities of trustees and subjects. These cause resistance against particular forms of surveillance (section 7.3.1) and self-conduct (section 7.3.2).

The resistances lead to disruptions in, and sometimes breakdowns of, the low carbon assemblages.These cause reassembling of the assemblages. The struggle over socio-material control is at the heart of these reassemblings. Trustees either extend their powers or withdraw from the spaces in which they face a greater struggle for power (section 7.4.2). New technologies of conduct and new designs are introduced.In LaBL this involves moving from solar lanterns to micro-grids.In HPS it involves putting more focus on BM model.

As the assemblages breakdown, people who become ‘used to’ electricity are forced to reassemble their lives by either going back to old energy assemblages,such askerosene, or participating in new energy assemblages like solar home systems (section 7.4.1). They cope by trying to reassemble old practices and habits like studying under kerosene lamps. People find reassembling old habits and practices more difficult which leads to the question: are the programmes of improvement ‘improving’ people’s lives or ending up making them more difficult?

8 Conclusions

8.1 Introduction

This thesis has attempted to understand and critique how development and energy transition projects constitute each other in people's everyday lives. With the central objective of exploring the micro politics of energy access, the thesis has traced power, politics and resistance in the activities of the elite, the activities of the people and the socio-material configurations of the low carbon assemblages. The thesis draws on governmentality and assemblage theories to critically analyse energy and development projects.

Electricity access has been defined as the ability to connect to and secure affordable, adequate and reliable electricity supply for basic needs (Winkler et al. 2011; Pachauri 2011). Although the notions of adequacy, affordability and needs make 'energy access' seems non-quantifiable, attempts to standardise and quantify it are often made (Pachauri 2011; IEA 2011). Quantification makes planning and implementation of large-scale electrification projects easier. However, this thesis attempts to rethink what access involves. It argues that 'energy access' should be seen as a fluid and heterogeneous concept to which concrete numbers should not be accorded. Access is both a geographically and socially differentiated notion that needs to be explored in a more ethnographic manner.

The findings of this thesis will be of interest for two groups of people – those working in policy and practice domains of energy access and transitions and those conducting research on energy access and transitions. It presents evidence that projects based on fixed models and fixed numbers do not benefit every social group. Their maintenance and upkeep also becomes difficult as project managers attempt to control people to keep them to these fixed numbers rather than responding to their energy requirements. A qualitative understanding of energy access which goes beyond numbers to understand, acknowledge and respond to the heterogeneous requirements of various social groups in different spaces will help project planners and policy makers develop projects that are contextual, flexible and improvisational. This will make projects more sustainable. In addition, the thesis contributes to literature on culture, energy and development by providing evidence that culture tailors the effects of energy access projects in people's everyday lives. It also adds to the growing literature on the use of poststructural theories in energy transitions research. The thesis argues for a need for more ethnographic studies of energy to understand the long term impacts that energy projects have in people's lives.

This chapter presents a summary of the key findings of this research and discusses their relevance for the fields of energy and development. It addresses the three research questions outlined in Chapter 2:

1. How do particular actors seek to assemble and govern low carbon assemblages in order to achieve specific outcomes?
2. How do low carbon energy interventions work in order to achieve particular goals of development in different spaces of the everyday life?
3. How and to what consequences do everyday resistances emerge in low carbon energy transitions?

These research questions are discussed one by one.

8.2 How do particular actors seek to assemble and govern low carbon assemblages in order to achieve specific outcomes?

8.2.1 Trusteeship

Following Li (2007c), the actors who seek to assemble and govern low carbon assemblages have been termed as trustees in this thesis. Due to the State's failures to utilise resources such as solar power and agricultural waste , reduce greenhouse gas emissions and environmental degradation, and provide people access to energy, actors other than the State (sometimes supported and shared by the state), claim trusteeship – the capacity to decide the good of people – through their "will to improve" (Li 2007c).

The trustees invite other actors to join the trusteeship and "forge alignments" (Li 2007b) in the low carbon assemblages (chapter 5). Since many low carbon energy projects are funded by multilateral and bilateral donor agencies or international humanitarian finance organisations[158](trustees attempt to forge alignments with these actors), often the 'development' concerns of these organisations take precedence. To join a shared agenda, the trustees connect to particular discourses – in this case the global goals of sustainable development (UNDP 2007; Legros et al. 2009; AGECC 2010). To do this, the low carbon assemblages prioritise particular significances of electricity – education, health, livelihoods and environment – and claim to 'enlighten' people's lives. Through these significances their electricity comes to symbolise development in general and these development activities in particular. Many low carbon projects, like HPS, and the finance organisations funding them, are also concerned with profits. In their projects, they attempt to bring together ethical concerns with commercial interests (See Cross & Street 2009; Cross 2013).

At the same time, since several low carbon assemblages compete with each other to forge alignments with the same actors, they need to distinguish themselves from each other. For this, they claim *innovation* in their 'models' and *appropriateness* of their solutions (See Smith et al. 2010; Cherp et al. 2011; Byrne 2011; Wong 2010). Both LaBL and HPS claim to learn from the ground and developsolutions that are contextual and particular for places that they are being implemented in. However, to align with actors focused on a large-scale problem (globally 1.4 billion people lack access to electricity (IEA 2011)), trustees need large-scale solutions (LaBL attempts to light a billion lives and HPS 10 million by 2017). To make their efforts scaleable, they convert the local, contextual and particular knowledges into standard 'models' that are general and universal (See Scott 1998). As a result, these models end up lacking context and particularity and their implemetation becomes problematic.

Another key point to note is that, although many actors join the trusteeship, they have varied identities and positions. These multiple actors are driven by varied aims, goals and expectations. Electricity signifies different things to them. Thus, there exists a plurality of

---

[158] Some initiatives of LaBL are funded by DFID and of HPS by USAID, Ashden foundation and Shell Foundation.

trustees and a plurality of what trusteeship means for these trustees (section 2.3.2.1). In addition, to maintain centralised control while also giving certain levels of local autonomy, key trustees put in place a chain to trustees through which knowledges, power and materials flow (sections 2.3.2.1, 5.3.2 and 8.2.2). Trustees at different levels in this chain have different levels of power and control depending on their location, social standing and political stance. While it is widely recognised that communities that schemes of improvement target i.e. 'the people' are heterogeneous, it is also critical to recognise that 'the trustees' and trusteeship are also heterogeneous phenomena. Due to this plurality and heterogeneity of trustees with varied aims, resistance often comes from inside the low carbon assemblages. Transitions literature talks about resistances to sustainable innovations from the existing regime(see Geels 2014; Raven & Verbong 2009). However, it is also critical to look at the resistances from various actors who come together in these sustainable innovations (section 7.3.2).

8.2.2 Standardisations: creating model projects and people

Since trustees focus on specific significances of electricity, they structure the assemblages to enable these, and disable other significances. To do this, trustees attempt to standardise, stabilise, operationalise and securitise the low carbon assemblages through dispositifs within the assemblages.

To enable their specific significances, trustees focus on specific electricity services – in this case light. Through electric lights, they attempt to enable education by removing low quality lights of kerosene lamps, make home a healthier and safer place by removing fumes and fires of kerosene lamps, make commercial activities more productive by extending working hours, and reduce greenhouse gas emissions from fossil fuels (like kerosene, diesel and national grid powered by coal). By structuring the assemblages to produce only lights, trustees also attempt to disable other things that electricity signifies like entertainment, comfort and irrigation. The importance of light for the trustees is further discussed in section 8.3.

To operationalise their standard models, trustees train more 'experts' who can manage the projects and also attempt to foster standard subjectivities in people who can benefit from the projects. These are done through particular techniques of government (see Rose 1999). Both LaBL and HPS train other experts for the everyday operation and upkeep of projects. These new experts become local trustees of the low carbon assemblages and are expected to practice neutrality regardless of their own, or the 'beneficiaries'', caste, class and gender. While the local experts have certain levels of autonomy, they are still bound by central control. To make centralised control possible, trustees put particular relationships in place to legitimise and delegitimise actors. Different actors, due to their different levels of expertise, are authorised to take some decisions and de-authorised to take others. When disruptions and problems of upkeep of different levels occur, these relationships of expertise authorise and de-authorise different actors to attend to these.

In addition, for their standard models, trustees imagine standard subjects who are defined by a singular identity – their lack of access to energy (section 5.3.3; see also Kumar 2015) – regardless of their caste, class, gender and age. Trustees connect this presupposed identity to their own definitions of energy access which relate to operationalising things that electricity signifies to them (see Dean 2010: 43). To operationalise their standard significances, through their standard energy models, trustees attempt to foster standard conducts in the people. Local experts train and inform the people about 'proper' and 'authorised' conducts. They use techniques like numbering the lanterns and installing fuses that indicate over-use, to identify and curtail 'improper' and 'unauthorised' conducts. These standard subjectivities are imagined and promoted because the trustees expect people to move out of their existing relationships of power – caste, class, gender and age – so that their conduct is conducted only by the dispositifs of the low carbon assemblages (chapter 5).

However, both, the beneficiaries and the trustees, have multiple subjectivities. Motivated by their multiple identities, they reinterpret the will to improve electricity access, use electricity in different ways and resist the dispositifs of the low carbon assemblages (section 8.4).

8.3 How do low carbon energy interventions work in order to achieve particular goals of development in different spaces of everyday life?

As the low carbon assemblages are standardised, not just specific development activities (significances of electricity) – education, livelihoods and health – are enabled, but they are enabled only in specific modes, at specific moments, and for specific people. This makes what, when, and how development goals can be achieved, complex.

8.3.1 Which goals are achieved and in what ways?

From the trustees' perspective, through a focus on lights, education is facilitated by enabling children to study in the evenings. Health and safety are facilitated by eliminating dangerous and harmful flames and fumes of kerosene lamps. Livelihoods are facilitated by enabling shops to stay open longer or by enabling people to carry out other commercial activities in the evening like stitching cloths at home. Better environment is facilitated by reducing greenhouse gas emissions from fossil fuels.

However, due to the focus on lights, education is not facilitated by creating comfortable classrooms or homes as the low carbon assemblages do not power fans or provide space heating. Education is also not facilitated by powering modern equipment like computers. Health and safety are not facilitated by eliminating the earthen hearths and wood fires used for cooking and heating. In addition to these, solar lanterns are not supposed to facilitate health and safety when they are used in 'improper' ways i.e. in 'improper' modes and moments (section 7.3). Micro-grids do not support health and safety, if electricity is needed outside their supply hours (section 6.3.3). Livelihoods are not facilitated by providing electricity for irrigation or for post-harvest grain processing.

For trustees, a focus on light, however, is important for three reasons.

Firstly, light helps centralise the multiple development concerns that trustees target (chapter 5). Powering fans or computers, powering cook stoves or facilitating irrigation are difficult to link with multiple conditions of education, health and livelihoods. Connecting to multiple concerns is important, not only to create a wider "emotional appeal" (Gent 2014: 179 refering to Kumar 2013), but also to forge alignments with multiple actors focusing on different development concerns (See also Cross 2013). Through this, funds for the projects can be channelled from multiple actors. Fig. 8-1 shows a screenshot from the LaBL website. By connecting to various development concerns (aligning government programmes with LaBL), LaBL forges alignments with, and receive funds from, various state agencies and programmes (linkages with different government agencies and their programmes).

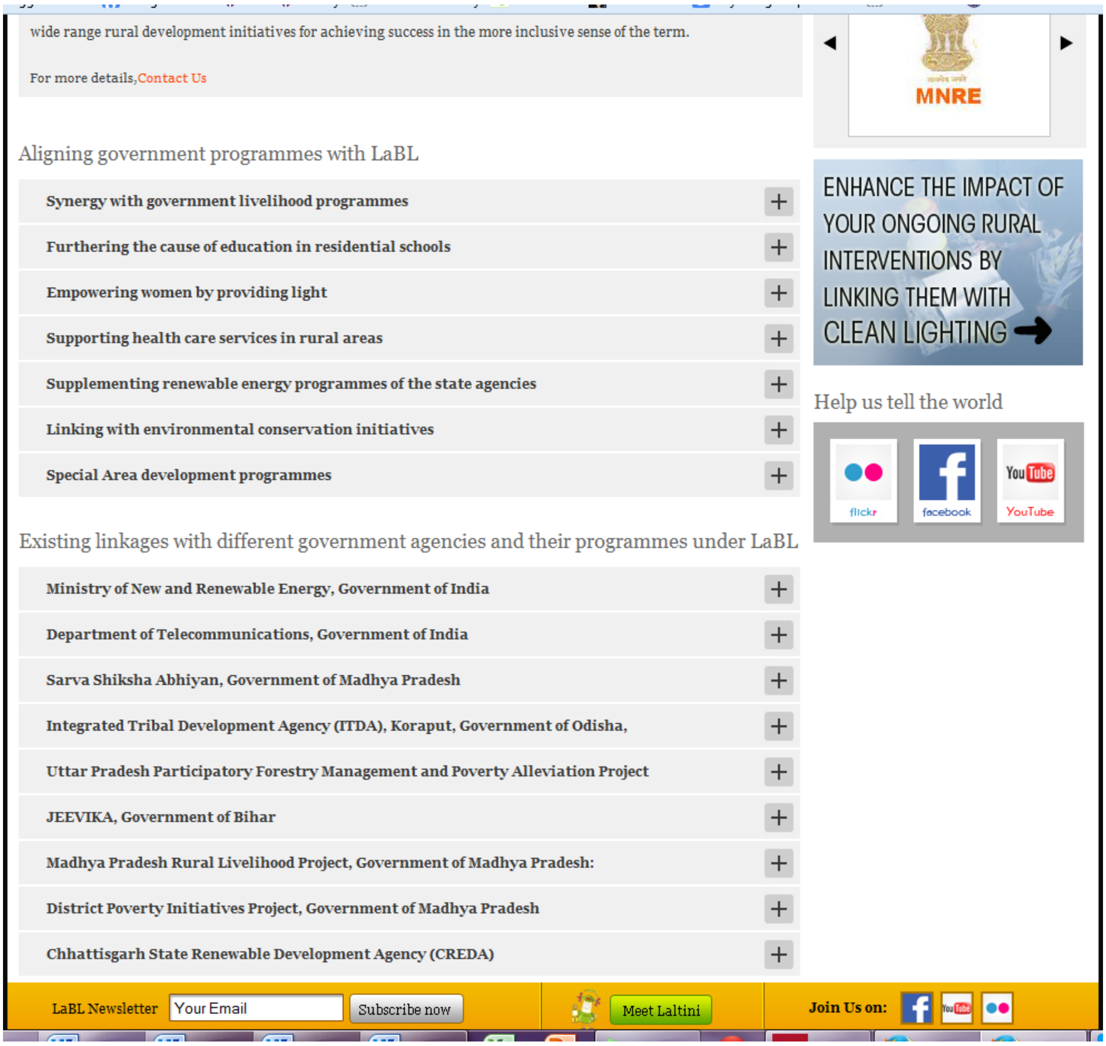

Figure 8-1: LaBL forging alignments by centralising multiple development concerns (LaBL Website: 01/07/2015).

Secondly, from the trustees' perspective, light is a low cost, high impact electricity service that makes planning and execution of large scale projects possible (chapter 5). The impact of projects is often measured in terms of numbers and lighting helps reach highest numbers for lowest cost (See Johnson 2013 for a discussion on numbers as a measurment of success of energy projects). Since the problem of energy access is big, every actor who joins the trusteeship looks to make a big impact. The actors who fund the low carbon projects expect them to make the biggest impact with the limited funds available. Producing light requires less energy than fans, computers, cookers or irrigation pumps. A HPS micro-grid of 32kW capacity costs £20,000 (HPS Brochure). At 15W per household (for bulbs and mobile charging), HPS can 'electrify' 2,130 households. Ceiling fans typically need about 50W[159] and will reduce the HPS impact to 640 households. Irrigation pumps of 1HP[160] (0.75kW) will reduce the HPS impact to 43 households. Similarly, LaBL requires £1500 investment for each charging station which consists of 5 solar panels of 70W each. Currently, each station 'electrifies' 50-60 households with its solar lanterns. If it powers fans and irrigation pumps, its impact will reduce to 7 households and 1 household respectively. Thus, a focus on light helps reach the highest numbers and establish the greatest impact.

Thirdly, light makes the impact of low carbon energy interventions on development visible. By connecting to one of the most important of human senses – vision – light produces more "intimate and intuitive" methods for bringing development work to light (Cross 2013: 10). Light provides an opportunity to photograph, capture, and demonstrate the changing situation of the subjects (fig. 8-2). With light, before and after – the energy intervention – or with and without – the energy intervention – pictures can easily be compared and demonstrated to other actors. For trustees, it helps create images of development (chapters 5 and 6) in the literal sense. Metaphorically light connects to the ideas of enlightenment and modernism that still very much drive development work, even in its new avatar of sustainable development (see Power 2003; Escobar 2012; Visvanathan 1991).

[159] http://www.orientelectric.com/fans/ceiling_fans/energy_savers.aspx
[160] http://www.fao.org/docrep/w7314e/w7314e0r.htm

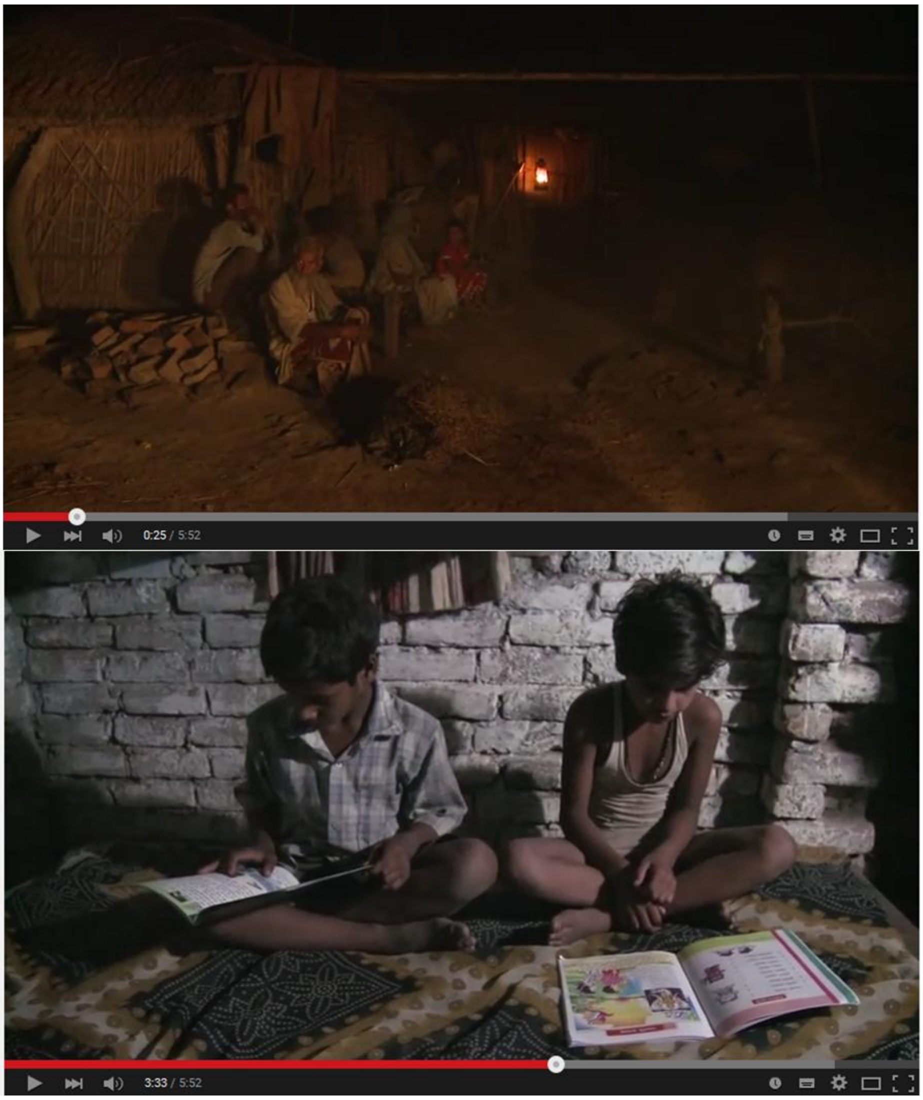

Figure 8-2: Before and after HPS (Ashden Awards YouTube Channel) (see also section 5.2).

8.3.2 Who benefits from the projects?

The focus on particular modes through which, and moments in which, various development activities are enabled has a bearing on the people for whom these activities are enabled.

Culture, by dictating rules and roles for various people in the villages, mediates the work of low carbon interventions. Experts ignore the social and cultural landscapes that have been reproduced for centuries, making it impossible for any 'scheme of improvement' to work outside an existing and highly entangled assemblage of notions, rules, structures and spaces (see Li 2007c). This makes the effects and spaces of the low carbon assemblages gendered and casted (different castes having differential access) (chapter 6).

Social and cultural rules dictate that men inhabit the outside spaces and women inhabit the inside spaces of the house. Since lights contribute to notions of honour and hospitality, these rules also dictate the prioritisation of 'better' lights from the low carbon projects in the outside spaces. In the inside spaces, kerosene lamps continue to be used. This makes the spaces of the low carbon assemblages gendered. While males have access to 'better' lights, females have to manage with kerosene. They are still exposed to conditions that the low carbon projects claim to improve – inferior lights, air pollution and danger of fire.

Due to existing social, cultural, economic and political conditions, education is largely limited to the higher caste male members of society. As a result of their connection to particular modes of education, lights from the low carbon projects are also predominantly limited to higher caste males (section 6.3.1). Dictated by social and cultural norms, females in these villages are mostly involved in cooking on wood-fired earthen hearths. Electricity from the low carbon projects does not make these activities less polluting, healthier or safer (section 6.3.3).

Although electric lights help save money on expensive fuels, they do not raise the income of people running commercial establishments by directly fostering more business. This is because their incomes are rooted in the limited pools of customers that villages have. The relationship of these establishments, with their customers, is primarily based on social networks rather than electricity networks. However, again, the electric lights benefit the male members of the society by temporally extending their social interactions (section 6.3.2).

This thesis argues that any initiative which is standardised, and targets 'subjects' that are imagined as homogenous, will not work for everyone (see Li 2005; Li 2007c). In fact, the losing parties are often the weaker sections of the society: women, lower castes and lower classes (see also Graham & Marvin 2001). The presence of winners and losers, and the reasons and conditions that lead to this, need to be acknowledged. It is essential to understand the politics and power relations behind them. It is also important to understand how, in presence of these relationships of power and politics, the freedoms of those losing out could be mobilised.

8.4 How and to what consequences do everyday resistances emerge in low carbon energy transitions?

There are “various levels and forms of resistance: formal-informal, individual-collective, public-anonymous” – resistance that are at the same time material and ideological (Scott 1985: 299). In this thesis, these resistances have been categorised into two sources – first, against the improvement of particular conditions, and second, against the improvement of conducts.

8.4.1 Resistances against improvement of particular conditions and not others

Different people have different priorities and one idea of development “irrespective of geography, time, environment or social conditions” cannot work for everyone (Chatterjee 1997: 8; see also, Kaviraj 2000: 138-140, Escobar 2012). Different people having different ideas of development prioritise different “practical conditions”, and electricity therefore signifies different things to different people(Legg 2007: 13).

As opposed to lights, electronic equipment like mobile phones cannot be used without electricity (chapters 1 and 7). For many people, this makes electricity more significant for running electronic equipment. As people connect to electricity networks, their supressed, postponed or improvised requirements of electricity emerge – for example, connectivity and entertainment through mobiles and television and comfort through fans (see Amin 2014: 143, Ulsrud et.al. 2011). The result is a “deepening electric-electronic nexus” (Graham & Thrift 2007: 13). Electronic goods raise the requirements of electricity, which in turn increasesthe requirements of electronic goods (section 7.2.2). Since, electricity signifies multiple and different things and electricity connections often lead to increased demands (See Ulsrud et al. 2011: 302; IEA 2011: 12), rather than fixing numbers, values and specific ‘practical conditions’, ‘energy access’ should be understood as a fluid, dynamic and heterogeneous concept (see Kumar 2015).

However, from the trustees' perspective, these significances are not legitimate. Aligned to the global project of sustainable development, they pay more attention to improvements of education, health, livelihoods and the environment. They also assume that these conditions are equally important for everyone. After all, sustainable development is about 'our common future', not 'futures' (Visvanathan 1991). Entertainment, connectivity[161] and comfort, for them, are secondary.

Scholars maintain that electricity can help women save time spent collecting fuel for the household (Reddy & Nathan 2013; Oparaocha & Dutta 2011). However, it is typically argued that this saved time can be used for education or alternate livelihood opportunities, not for rest, recreation and entertainment. UNDP/WB (2004: 7) acknowledge that women often use free time to watch television but find it "striking" that they manage to do this "despite their many responsibilities". They especially stress the fact that television can be used for "continuing education or information dissemination". Similarly, while making claims for electricity's role in extending people's days, scholars argue that they provide extra hours for education and livelihoods rather than, rest, socialisation and entertainment (Chaurey et al. 2004; Kaygusuz 2012). However, this research has provided evidence that often people value extended days for rest and socialisation, not for commerce (section 6.3.2; see also García & Bartolomé 2010; Gurung et al. 2011).

The standardisations, particularity,andlack of fluidity of the low carbon projects do not accommodate these significances of electricity. However, people resist the low carbon projects by either not participating in them (in case of LaBL) or by continuing to use electricity for things that are more important for them – entertainment (by using televisions) or comfort (by using fans) (in case of HPS). By non-participation people show resistance to the trustees' definitions of electricity access, and to their significances of electricity (Winther 2012). They look for assemblages – like the central grid – that can accommodate their multiple and varied significances, and often leave the low carbon assemblages to join the high carbon central grid.

[161] Connectivity is given importance when it is connected to commerce and livelihoods but not when it is for connecting with family and friends for socialisation.

An attempt by people to operationalise the significances of electricity that do not match the trustees' significances sometimes destabilises[162] the assemblages. These acts are sometimes seen as treason by the trustees (Callon 1986)[163]. Trustees, who are trying to address the 'more important' conditions and improve people's lives, feel betrayed by the people, when their activities destabilises the assemblage.

8.4.2 Resistances against improvement of conduct

As the low carbon energy projects move from one place to another, their techniques of control and conduct face new conducts and counter conducts (section 2.3.3.2; See also Legg 2007: 16). They encounter multiple subjectivities (class, caste, gender and age) of the people, which often clash with the standard subjectivities[164] imagined by trustees. This problematises the dispositifs.

To operationalise their own significances or to operationalise the trustees' significances in different modes or at different moments, people resist the dispositifs meant to foster standard conducts. They use solar lanterns in ways, and at times, that they are 'not meant to'. They override the fuses of HPS to use as much electricity as they require or to use incandescent light bulbs.

Using both, the inherent properties of certain materials – a bulb that burns bright and ultimately fuses when electricity passing through it exceeds a limit – and their socio-material organisations – the bulb is installed in a way that any electricity going to a household passes through it – trustees configure "choke points" (Mitchell 2009: 404) in the low carbon assemblages (sectionand 7.3). However, these choke points are not only used by trustees to

---

[162] Televisions and fans require more electricity and often put extra load on the materials like the electricity generators leading to disruptions. Since, they need more electricity, they also cost more and the 'unauthorised' use of these services results in monetary loss for the projects. This sometimes results in a lack of money for upkeep and leads to disruptions.

[163]Callon (1986) explains that the efforts by scientists to repopulate St. Brieuc bay with Scallops for the long term benefits of the fishermen was met with dissidence and betrayals by the fishermen (and the Scallops) who prematurely extracted the scallops for immediate rather than long term benefits.

[164] For the projects, everyone has the same needs, regardless of their class, caste, gender or age. They are defined only by their lack of access to electricity (see Kumar 2015).

control and conduct people, but also used by people to resist control. They are the loci of power struggle, which often destabilise the low carbon assemblages.

Some techniques used by the trustees to control people's 'unauthorised' and 'improper' conducts – cutting of high light settings of solar lanterns, raising voltage of the micro-grid – result in further 'unauthorised' and 'improper' conducts (section 7.3.1). However, from the point of view of the trustees, 'improper' conducts generated by technologies of control, which help in the upkeep of the low carbon assemblage, are considered legitimate. However, 'improper' conducts generated by people for their ends, and may destabilise the assemblage, are considered illegitimate and must be controlled. This is because, trustees are more "rational" and "reasonable" than the people (Li 2007b: 280). They, due to their higher knowledge and power, are the deciding, defining and legitimising authorities in the low carbon assemblages (see Li 2005: 384).

Resistances also happen because the trustees ignore the socio-cultural landscapes of villages. If a lower caste man attempts to enter a higher caste household to check for 'unauthorised' use, the higher caste household resists. Similarly, the benefits meant to foster standardised conducts aredisrupted because the trustees on the fringes of the low carbon assemblages do not always behave in an unbiased manner. Their own subjectivities create biases towards particular social groups (chapter 7).

8.4.3 Entertainment as a driver for low carbon projects

Although, trustees prioritise lights, this research finds that mobile phones are one of the biggest drivers for people participating in the low carbon projects (section 7.2.1). By centralising, and at the same time making mobile, various energy services, such ascommunication, lighting and entertainment, mobile phones have emerged as anextremelyimportant part of people's everyday lives in these villages (chapter 1). In Bihar about 82% of households own a mobile phone[165]. However, only 16% of households have

[165] Based on the Socioeconomic and caste census, provisional data (http://www.secc.gov.in/staticReportData?getReportId=S_22).

electricity[166](Census of India 2011b). People either depend on their social networks, or visit nearby electrified towns and villages and pay money, to charge their phones.

The critical nature and high costs of charging mobile phones are the reasons behind people's more enthusiastic participation in HPS (section 7.2.1). It can be concluded that, compared to solar lanterns which provide only lights, micro-grids, which provide both lights and mobile charging, and can potentially provide other electricity services too, are more acceptable to people looking for electricity. Because of this, after the shutdown of the HPS micro-grid in Bijuriya, people have started buying solar panels. Similar trends of mobile phones driving the uptake of solar home systems have also been observed in Kenya (Jacobson 2007) and Bangladesh (Komatsu et al. 2011).

Increasingly, the importance of mobile phones is being recognised. They have been found useful primarily for communication, market access for farmers, livelihoods and economic development (Duncombe 2014; Beuermann et al. 2012; Lee & Bellemare 2013; Thompson 2009). However, the entertainment potential of mobile phones, which most people in the research villages argue is themain reason for their spread, has not been recognised yet (chapter 1 and section 7.2.1). This is because entertainment, rest and recreation are not considered as valid development activities or indeed sometimes not activities that poorer people should be involved in (section 8.4.1). To pull themselves out of poverty, poorer people are expected to always engage themselves gainfully (see Chaurey et al. 2004; Kaygusuz 2012 on how electricty can provide extra hours for education and livelihoods). Similarly, if women have free time, they are expected to engage themselves in education or livelihood opportunities because these are seen as the paths to empowerment. Even when mediums of entertainment, like television, are discussed, it is primarily in reference to education and empowerment (UNDP/WB 2004; Kanagawa & Nakata 2005).

This is because, development is seen as a move towards modernity and reason, which comes from the "achievement of those conditions that characterise rich societies: industrialisation, agricultural modernisation, and urbanisation" (Escobar 1992: 25; see also

[166] Measured in the census by electricity as a source of light.

Escobar 2012). For these, education, and more economically gainful opportunities are required, rather than rest and recreation (Corbridge et al. 2005: 48). Rest, recreation and entertainment are unreasonable as it is often assumed that any ‘rational’ human being will first want to come out of poverty and ignorance (lack of knowledge) and then think of other things. This form of development is also important for the trustees, because it helps turn poor people into “objects of knowledge and management” and helps maintain the rule of experts (Escobar 2012: 23).

8.5 Challenges and limitations

This section discusses two challenges faced during the research which shaped the thesis. These are the complexities of everyday life and access to different genders.

8.5.1 Too many things to account for

Everyday life has a “complex temporal organisation” (Shove et al. 2009: 1). It is, at the same time, about the fast and the slow, the past, present and the future, and it contains “a diversity in ordering, sequencing and frequency” (Shove et al. 2009: 4). There are different “habits, routines, rhythms and norms” which vary spatially and temporally (Powells et al. 2014: 45). The everyday life throws to a researcher, too many things to account for. It is difficult to focus on all these elements. Therefore, particular elements of the everyday life based on the development activities that the trustees prioritise – education, livelihoods and health – were chosen for analysis.

Assemblage thinking itself throws unlimited things to think aboutto a researcher. Since assemblage is an “open whole where both the membership changes over time and the members themselves undergo internal alteration” (Bennett 2005: 461), it is difficult to decide where the analysis should begin and where it should end (see also Allen 2011). However, as McFarlane (2011b: 380) explains, following actors and “close study of particular sites” with reference to “multiple space-times” can help methodologically operationalise assemblage thinking. In addition to this, assemblage derives its “meaning and function in relation to other concepts and conceptual problems” (Anderson & McFarlane 2011: 125). The focus on particular problems helps limit the analysis. Taking both these ideas together, the thesis concentrates on particular problems around power, politics and culture. It follows the projects and key actors involved in them from assembling, through acting, to reassembling. The analysis is derived from focused work in five villages through thick descriptions of different historical and contemporary processes (McFarlane 2011b: 376).

8.5.2 Accessing gendered spaces

In most household tours and interviews, care was taken to speak to women, either separately or along with men. In the combined interviews, men often took over the discussions. The separate interviews were often brief as the researcher was 'expected' by the community to conform to social rules and not spend too much time 'inside' with the women. In addition to this, being a male 'other', the researcher was sometimes hesitant in asking people's permission for home tours. Although interviews with females and observations of their interactions with energy sources were conducted, the data on female experiences was limited.

In these situations, a female researcher would have had better access, resulting in more data on the female experiences. However, it is important to mention that due to the separation of genders and the notions of patriarchy, the female researcher's access to male groups may have been partial[167]. In energy and development research, where gender is an important strand of analysis, it might be ideal to have a team of male and female researchers to conduct separate interviews and focus groups. The presence of a female researcher may also give easier access to the 'insides' of homes.

8.6 Areas of future research

This section discusses two areas of future research that emerge out of this thesis. Firstly, it argues that future research on energy and development needs to explore how local cultures mediate the effects of projects. Secondly, specific gendered analysis needs to be carried out and some focus needs to be put on energy sources that are most relevant for women.

[167] Being a male, the researcher was able to spend time with male groups, often at late in the evenings, a practice that may have not been as readily acceptable by the local community in case of a female researcher.

8.6.1 Mediation of culture

This thesis has argued and presented evidence to demonstrate that the work that low carbon interventions do in achieving particular goals of development is mediated by culture (chapter 5). The exiting social, cultural, economic and political landscapes of the villages shape the participation of, and benefits for, different social groups. In India, development interventions designed without acknowledging these often work differently for different people depending on their caste, class, religion and gender (see Prakash 1999; Corbridge et al. 2005; Chatterjee 2004; Khilnani 1999).

However, these arguments come with a caveat. They emerge from the analysis of energy projects situated in a specific geographical location. A question for future research is, whether similar mediation of culture can be seen in the case of other energy projects, other development projects and in other places? If so, then, from these local lessons, can suitably malleable projects, that can be consistently redesigned based on local contexts and particularities, be conceived? Finally, can energy access be understood "from the perspective of the multiplicity of place-based practices of culture, nature and economy" (Escobar 2001: 171)?

8.6.2 Focus on females

This thesis has put emphasis on how, often, low carbon energy projects focusing on lights, fail to create a major impact on the practical conditions concerning women and girls. These projects cannot be expected to completely transform the social and cultural conditions through which one social group deprives the other (see Li 2007c). However, within these social and cultural conditions, specific focus can be put on improving female conditions.

Women and girls are involved in collecting fuel for cooking on wood fired hearths. They spend considerable time and energy in collecting these fuels (Reddy & Nathan 2013; Oparaocha & Dutta 2011). This has been acknowledged widely but detailed studies and assessments of how much of their own energy females spend to secure energy for the household, and in what ways does this affect their health, are lacking. This raises questions for the understandings of energy equity.

In addition to this, due to their involvement in cooking and limitation to the indoor spaces, the pollution from cooking fuels affects females most. Although several studies have been conducted on this (Dutta, Ray, et al. 2012; Banerjee et al. 2012; Dutta, Bhattacharya, et al. 2012), they approach it from a medical perspective. This area of research still lacks social scientific interventions to understand what the everyday lived experiences of females are. Going beyond medical perspectives, it is important to understand how, and in what ways, do indoor pollution and the consequent health problems affect females, and what everyday tactics do they employ against these.

8.7 Implications for doing energy research

This section outlines three implications of this thesis for energy research. Firstly, new ways of thinking about energy transitions, that accommodate the fluidity and internal politics of the low carbon projects, need to be developed. Secondly, attention needs to be given to how different people's experiences with energy and development project vary according to the physical and social spaces they inhabit. Finally, to understand how changing forms of energy and changing lifestyles interact with each other on an everyday level, more engagement with the ethnographic route of enquiry is needed.

8.7.1 New ways of thinking about energy transitions

Until now, most work on energy transitions has taken a macro perspective. Neither socio-technical transitions approaches nor political economy approaches focus on how energy transition projects unravel in people's everyday lives (section 2.2.2). They fall short in their analysis of how power, politics and resistances play out in everyday life. In addition to this, energy transition projects are often seen as monoliths and their internal dynamics not problematised.

This thesis argues that looking at low carbon projects as low carbon assemblages can provide the required language and analytical ideas to understand the heterogeneous, fluid and contingent nature of energy for development projects. Through this approach, attention can be paid not only to projects as a whole but also on their frequently aligning and realigning parts. This, in addition to governmentality studies, can help infuse an understanding of the unequal relationships of power that exist in the projects and the everyday micro politics that takes place within the projects, between the various actors involved. This can help recognise that transition projects face resistance not just from regime actors but also from actors that are part of these projects.

8.7.2 Attention to space

This thesis has demonstrated that attention to space is critical for research on energy and development in people's everyday lives. Social, economic, cultural and political spaces, in addition to physical spaces, their influences on, and relationships with each other, deeply affect people's everyday lives. These shape the interactions that different social groups have, with each other, and with the energy projects. The reduced mobility of females and requirement to occupy inside spaces mould their interactions with different forms of energy. Different caste groups often occupy different spaces in Bihari villages. This shapes their interactions. Similarly, as energy and development projects move from one village to the other, one state to the other, and one country to the other, they encounter different spaces – both physical and cultural. In addition to this, different project logics unravel differently in the same spaces. Still, studies of energy transition have not given much attention to space (Bridge et al. 2013; see also Bulkeley 2005 for a discussion on the importance of space and scale in environmental governance).

Therefore, to gain a deeper understanding of the issues around energy and development, and how these issues change with space, a multi sited research becomes important (Coe et al. 2013; McFarlane 2011b; McFarlane 2011a). In addition to this, looking at multiple energy and development projects – micro-grid, solar lanterns, solar home systems and national grid – in same, and different, spaces helps bring nuanced understanding of the impacts of these interventions. What is often overlooked is the existence of different social, cultural, economic and political spaces within the same site – a village, a locality or a city. Different caste colonies in a village need to be looked at differently and the inside of a home needs to be looked at differently from the outside. Women, men, different castes and different ages have their own different spaces. These need to be enquired differently while also keeping in mind that there are commonalities, overlaps and seepages between these spaces.

8.7.3 Doing ethnographic research

Searches for 'ethnography' in three main journals publishing energy research – Energy Policy, Energy for Sustainable Development and Renewable and Sustainable Energy Reviews – reveal only 7, 4 and 1 articles respectively. Ethnography, although a popular and well established method of doing development research (see Ferguson & Gupta 2002; Li 2014a; Li 2007c), is not very common in energy research. However, more recently scholars doing energy research in geography, anthropology and sociology have started engaging with ethnography (see Mackley & Pink 2013; Silvast & Virtanen 2014; Shove et al. 2009; Cross 2013).

To understand how, with changing forms of energy and changing lifestyles of people, energy and development constitute each other in people's everyday lives, it is important to understand the "geographies of producing, living, and working with energy" (Bridge et al. 2013: 333). Ethnography involves spending long periods of time with the research participants in the contexts that their lives are embedded in. It includes experiencing, observing, enquiring about, and recording people's everyday interactions with energy and development interventions. Through these long-term studies, a more nuanced understanding of the impacts of projects, which goes beyond just statistics and numbers, can be gained. Further engagement with ethnography, not just in academic research, but also in practice, can help develop new frameworks for assessing, understanding and designing energy and development projects.

8.8 Implications for energy and development policy

This final section outlines three implications of this research for energy and development policy. It argues that policy and planning needs to move beyond standardised models to more fluid and modifiable ideas. In addition to this, interventions need to be critically planned and assessed to understand which social groups benefit from them, which do not and why.

Going beyond 'models': focus on modifiable projects

This research argues for a need to move beyond standardised 'models' of energy delivery. Since, people's requirements vary, as models move from one place to another, their operation becomes problematic. Energy access is a heterogeneous and fluid concept to which accordance of concrete numbers should be avoided. There are variations in people's energy requirements over space – both physical and social – and time (current evidence suggests it raises once people get electricity) (section 8.4.1).

Energy and development projects need to respond to these various requirements and project planners and policy makers need to modify them accordingly. This could be done by organising periodic 'status updates' meetings with the communities. Keeping social and cultural rules and power dynamics in mind, separate meetings might be needed with various social groups based on caste, class, gender, age and their various combinations (see Corbridge et al. 2005: 251). If this does not happen, projects face problems of overuse of electricity which affect their performance and long term sustainability. Problematic performance and lack of long-term sustainability undermines people's trust in low carbon energy.

Critical planning: why and how certain projects are beneficial only to dominant social groups?

Project planners and policy makers need to think critically about the differences between various social groups and how the effects of the projects vary for them. This thesis provides evidence that particular projects are only beneficial for specific social groups. For example, when only lights are provided through a solar lantern, *dalits* do not participate in the project. However, they participate when, through a micro-grid, they are able to charge mobile phones. This helps bring electric lights to the homes too. Critical planning will help bring benefits of the projects to a wider group of people, even if limited electricity services are provided.

Project assessments beyond numbers

Critical planning needs to be followed up with critical assessment of the projects. The assessment needs to move from a singular focus on quantity to focus on people's lived experiences with energy and development projects. Having electrified 2,222 villages with 100,000 houses and 300 villages affecting over 200,000 people respectively, both LaBL and HPS are considered as successful 'models' for replication. However, this thesis questions the successes of these projects. It reveals the subjective experiences of different groups of people. This subjectivity of experiences can be revealed through ethnographic studies of the projects. Such qualitative assessments which look into how projects work in people's everyday lives can be informative, not just to understand the successes and failures of the projects, but also to feed back into project and policy designs. Project planners and policy makers could actively involve independent researchers inconducting detailed and regular ethnographic enquiry to trace the divergent and changing impacts of the projects in people's everyday lives. This could be done through partnerships with universities which would progress the goals of both the research and policy communities of understanding energy and development projects better.

References

AGECC, 2010. *Energy for a Sustainable Future*, New York. Available at: http://www.un.org/wcm/webdav/site/climatechange/shared/Documents/AGECC summary report[1].pdf.

Ahmed, W., 2012. From Militant Particularism to Anti-neoliberalism? The Anti-Enron Movement in India. *Antipode*, 44(4), pp.1059–1080.

Ahmed, W., 2010. Neoliberalism, Corporations, and Power: Enron in India. *Annals of the Association of American Geographers*, 100(March 2015), pp.621–639.

Ailawadi, V.S. & Bhattacharyya, S.C., 2006. Access to energy services by the poor in India: Current situation and need for alternative strategies. *Natural Resources Forum*, 30(1), pp.2–14. Available at: http://doi.wiley.com/10.1111/j.1477-8947.2006.00153.x.

Akella, A., Saini, R. & Sharma, M., 2009. Social, economical and environmental impacts of renewable energy systems. *Renewable Energy*, 34(2), pp.390–396. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0960148108002073 [Accessed July 27, 2011].

Alanne, K. & Saari, A., 2006. Distributed energy generation and sustainable development. *Renewable and Sustainable Energy Reviews*, 10(6), pp.539–558. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1364032105000043 [Accessed November 9, 2013].

Allen, J., 2011. Powerful assemblages? *Area*, 43(2), pp.154–157. Available at: http://doi.wiley.com/10.1111/j.1475-4762.2011.01005.x [Accessed October 11, 2014].

Amin, A., 2014. Lively Infrastructure. *Theory, Culture & Society*, 31(7-8), pp.137–161. Available at: http://tcs.sagepub.com/content/early/2014/10/06/0263276414548490.abstract [Accessed December 3, 2014].

Amin, S., 1997. Socioeconomic change and the demand for children in rural Bangladesh. *Development and Change*, 28, pp.213–233.

Anderson, B. & McFarlane, C., 2011. Assemblage and geography. *Area*, 43(2), pp.124–127. Available at: http://doi.wiley.com/10.1111/j.1475-4762.2011.01004.x [Accessed May 26, 2013].

Appadurai, A., 2001. Deep democracy: urban governmentality and the horizon of politics. *Environment and Urbanization*, 13(2), pp.23–43. Available at: http://eau.sagepub.com/cgi/doi/10.1177/095624780101300203 [Accessed June 18, 2014].

Appadurai, A., 1986. The Thing Itself. *Public Culture*, 18(1), pp.15–22.

Arora, S. & Romijn, H., 2009. *Innovation for the base of the pyramid: Critical perspectives from development studies on heterogeneity and participation*, Maastricht. Available at: http://www.globe-expert.eu/quixplorer/filestorage/Interfocus/3-Economie/34-Places_Financieres/34-SRCNL-UNU-MERIT/200909/Innovation_for_the_base_of_the_pyramid_Critical_perspectives_from_development_studies_on_heterogeneity_and_participation.pdf [Accessed April 16,

2012].

Bairiganjan, S. et al., 2010. *Power to the People. Investing in Clean Energy for the Base of the Pyramid in India*,

Baker, L., Newell, P. & Phillips, J., 2014. The Political Economy of Energy Transitions: The Case of South Africa. *New Political Economy*, (August 2014), pp.1–28. Available at: http://www.tandfonline.com/doi/abs/10.1080/13563467.2013.849674.

Balachandra, P., 2011. Dynamics of rural energy access in India: An assessment. *Energy*, 36(9), pp.5556–5567. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0360544211004658 [Accessed August 26, 2011].

Banerjee, M. et al., 2012. Cooking with biomass increases the risk of depression in pre-menopausal women in India. *Social science & medicine (1982)*, 75(3), pp.565–72. Available at: http://www.ncbi.nlm.nih.gov/pubmed/22580071 [Accessed November 7, 2014].

Banerji, R., 2013. Elementary Education: Learning the Hard Way. In N. Singh & N. Stern, eds. *The New Bihar: Rekindling Governance and Development*. Noida/London: HarperCollings Publishers India, p. 387.

Bastakoti, B.P., 2006. The electricity-livelihood nexus: some highlights from the Andhikhola Hydroelectric and Rural Electrification Centre (AHREC). *Energy for Sustainable Development*, 10(3), pp.26–35. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082608605414 [Accessed March 27, 2012].

Batra, A.K., 2003. Burn mortality: recent trends and sociocultural determinants in rural India. *Burns*, 29(3), pp.270–275. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0305417902003066 [Accessed November 5, 2014].

Bazilian, M. et al., 2010. More heat and light. *Energy Policy*, 38(10), pp.5409–5412. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421510004702 [Accessed August 8, 2013].

Bebbington, A., 2010. Trusteeship, Ethnography, and the Challenge of Critique in/of Development. *Annals of the Association of American Geographers*, 100(1), pp.229–232. Available at: http://www.tandfonline.com/doi/abs/10.1080/00045600903423782 [Accessed July 25, 2014].

Bennett, J., 2010. The agency of Assemblages. In *Vibrant Matter: A Political Ecology of Things*. Durham, NC: Duke University Press, p. 200.

Bennett, J., 2005. The Agency of Assemblages and the North American Blackout. *Public Culture*, 17(3), pp.445–466.

Berkhout, F., Smith, A. & Stirling, A., 2004. Socio-technological regimes and transition contexts. *System Innovation and the Transition to Sustainability: Theory, Evidence and Policy. Edward Elgar, Cheltenham*, 44(106), pp.48–75. Available at: http://books.google.com/books?hl=en&lr=&id=lEb7LWOcQXsC&oi=fnd&pg=PA48&dq=Socio-technological+regimes+and+transition+contexts&ots=tJUOKl7nzM&sig=cviY

UPA0VfeH4sudMpAtsGJm9d0 [Accessed February 3, 2012].

Bersier, F., 2008. Education in Rural India: Perspective from a North Indian Village. *Available at SSRN 1614954*, (August), pp.1–53. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1614954 [Accessed November 11, 2014].

Beuermann, D.W., McKelvey, C. & Vakis, R., 2012. Mobile Phones and Economic Development in Rural Peru. *Journal of Development Studies*, 48(11), pp.1617–1628. Available at: http://www.tandfonline.com/doi/abs/10.1080/00220388.2012.709615 [Accessed December 5, 2014].

Bickerstaff, K., Walker, G. & Bulkeley, H., 2013. Introduction: making sense of energy justice. In K. Bickerstaff, G. Walker, & H. Bulkeley, eds. *Energy Justice in a Changing Climate: Social equity implications of the energy and low-carbon relationship*. London/New York, pp. 1–13.

Bille, M. & Sorensen, T.F., 2007. An Anthropology of Luminosity: The Agency of Light. *Journal of Material Culture*, 12(3), pp.263–284. Available at: http://mcu.sagepub.com/cgi/doi/10.1177/1359183507081894 [Accessed June 27, 2013].

Birtchnell, T., 2012. Elites, elements and events: Practice theory and scale. *Journal of Transport Geography*, 24, pp.1–6. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0966692312000257 [Accessed March 10, 2012].

Bloch, F., Rao, V. & Desai, S., 2004. Wedding celebrations as conspicuous consumption signaling social status in rural India. *Journal of Human Resources*, XXXIX(3), pp.675–695. Available at: http://jhr.uwpress.org/content/XXXIX/3/675.short.

Borooah, V.K. & Iyer, S., 2005. Vidya , Veda , and Varna : The influence of religion and caste on education in rural India. *Journal of Development Studies*, 41(8), pp.1369–1404. Available at: http://www.tandfonline.com/doi/abs/10.1080/00220380500186960 [Accessed November 11, 2014].

Boschmann, E.E., 2011. Job access, location decision, and the working poor: A qualitative study in the Columbus, Ohio metropolitan area. *Geoforum*, 42(6), pp.671–682. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0016718511000881 [Accessed December 2, 2014].

Bouzarovski, S., 2009a. East-Central Europe's changing energy landscapes: A place for geography. *Area*, 41(4), pp.452–463.

Bouzarovski, S., 2009b. Landscapes of flexibility: Negotiating the everyday; an introduction. *GeoJournal*, 74, pp.503–506.

Bouzarovski, S. et al., 2013. Precarious domesticities: energy vulnerability among urban young adults. In K. Bickerstaff, G. Walker, & H. Bulkeley, eds. *Energy Justice in a Changing Climate: Social equity implications of the energy and low-carbon relationship*. London/New York: Zed Books, pp. 30–45.

Boyle, G. & Krishnamurthy, A., 2010. *empowering bihar: case studies for bridging the energy deficit and driving change*, Patna. Available at: http://www.greenpeace.org/india/Global/india/report/Empowering-Bihar.pdf.

Bradshaw, M.J., 2010. Global energy dilemmas: A geographical perspective. *Geographical Journal*, 176(4), pp.275–290.

Bradshaw, M.J., 2009. The geopolitics of global energy security. *Geography Compass*, 3, pp.1920–1937.

Brass, P., 1986. The political uses of crisis: The Bihar famine of 1966-1967. *Journal of Asian Studies*, 45(2), pp.245–267. Available at: http://journals.cambridge.org/production/action/cjoGetFulltext?fulltextid=6917668 [Accessed October 21, 2013].

Brenner, N., Madden, D.J. & Wachsmuth, D., 2011. Assemblage urbanism and the challenges of critical urban theory. , (March 2015), pp.37–41. Available at: http://rsa.tandfonline.com/loi/ccit20.

Bridge, G. et al., 2013. Geographies of energy transition: Space, place and the low-carbon economy. *Energy Policy*, 53, pp.331–340. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421512009512 [Accessed November 9, 2013].

Bruce, N., 2008. Indoor air pollution from unprocessed solid fuel use and pneumonia risk in children aged under five years: a systematic review and meta-analysis. *Bulletin of the World Health Organization*, 86(5), pp.390–398. Available at: http://www.who.int/bulletin/volumes/86/5/07-044529.pdf [Accessed November 11, 2014].

Bruce, N., Perez-Padilla, R. & Albalak, R., 2000. Indoor air pollution in developing countries: a major environmental and public health challenge. *Bulletin of the World Health Organization*, 78(9), pp.1078–1092.

Bulkeley, H. et al., 2013. Governing sustainability: Rio+20 and the road beyond. *Environment and Planning C: Government and Policy*, 31(6), pp.958–970.

Bulkeley, H., 2005. Reconfiguring environmental governance: Towards a politics of scales and networks. *Political Geography*, 24(8), pp.875–902. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0962629805000880 [Accessed November 8, 2013].

Bulkeley, H. & Castán Broto, V., 2013. Government by experiment? Global cities and the governing of climate change. *Transactions of the Institute of British Geographers*, 38(3), pp.361–375. Available at: http://doi.wiley.com/10.1111/j.1475-5661.2012.00535.x [Accessed July 9, 2014].

Bulkeley, H. & Schroeder, H., 2011. Beyond State/non-State Divides: Global Cities and the Governing of Climate Change. *European Journal of International Relations*, 18(4), pp.743–776.

Bumpus, A.G. & Man, D.M.L., 2008. Accumulation by Decarbonization and the Governance of Carbon Offsets. *Economic Geography*, 84, pp.127–155. Available at: http://dx.doi.org/10.1111/j.1944-8287.2008.tb00401.x.

Byrne, R.P., 2009. *Learning drivers: rural electrification regime building in Kenya and Tanzania*. University of Sussex. Available at: http://sro.sussex.ac.uk/6963/ [Accessed April 3, 2012].

Callon, M., 1986. Some elements in the sociology of translation: domestication of the scallops and the fishermen of St. Brieuc Bay. *Power, action and Belief: A New Sociology of Knowledge*, pp.196–223.

Census of India, 2001. *MIGRATION TABLES*, New Delhi. Available at: http://censusindia.gov.in/Data_Products/Data_Highlights/Data_Highlights_link/data_highlights_D1D2D3.pdf.

Census of India, 2011a. *Provisional Population Tables: Rural-Urban Distribution*,

Census of India, 2011b. *Source of Lighting*,

Chakrabarti, S. & Chakrabarti, S., 2002. Rural electrification programme with solar energy in remote region–a case study in an island. *Energy Policy*, 30(1), pp.33–42. Available at: http://linkinghub.elsevier.com/retrieve/pii/S030142150100057X.

Chakrabarty, D., 1992. Of garbage, modernity and the citizen's gaze. *Economic and Political Weekly*, 27(10), pp.541–547. Available at: http://www.jstor.org/stable/4397699 [Accessed July 5, 2014].

Chari, S. & Gidwani, V., 2005. Introduction: Grounds for a spatial ethnography of labor. *Ethnography*, 6(3), pp.267–281. Available at: http://eprints.lse.ac.uk/36046/.

Chatterjee, P., 1998. Introduction. In P. Chatterjee, ed. *Wages of Freedom*. Delhi: Oxford University Press.

Chatterjee, P., 1997. *Our modernity*, Rotterdam/Dakar: South-South Exchange Programme for Research on the History of Development/ the Council for the Development of Social Sciences in Africa. Available at: http://www.ukzn.ac.za/CCS/files/partha1.pdf [Accessed November 14, 2013].

Chatterjee, P., 2004. *The Politics of the Governed: Reflections on Popular Politics in Most of the World*, New York: Columbia University Press. Available at: http://books.google.co.uk/books/about/The_Politics_of_the_Governed.html?id=Jx6M2TQTC54C&pgis=1 [Accessed November 26, 2013].

Chaurey, a. & Kandpal, T.C.C., 2009. Solar lanterns for domestic lighting in India: Viability of central charging station model. *Energy Policy*, 37(11), pp.4910–4918. Available at: http://dx.doi.org/10.1016/j.enpol.2009.06.047 [Accessed March 27, 2012].

Chaurey, A. & Kandpal, T.C., 2010. Assessment and evaluation of PV based decentralized rural electrification: An overview. *Renewable and Sustainable Energy Reviews*, 14(8), pp.2266–2278. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1364032110001164 [Accessed March 5, 2012].

Chaurey, A., Ranganathana, M. & Mohanty, P., 2004. Electricity access for geographically disadvantaged rural communities—technology and policy insights. *Energy Policy*, 32(15), pp.1693–1705. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421503001605 [Accessed July 27, 2011].

Cherp, A., Jewell, J. & Goldthau, A., 2011. Governing Global Energy: Systems, Transitions, Complexity. *Global Policy*, 2(1), pp.75–88. Available at: http://doi.wiley.com/10.1111/j.1758-5899.2010.00059.x [Accessed April 23, 2013].

Clancy, J., Skutsch, M. & Batchelor, S., 2003. *The gender-energy-poverty nexus: finding the* *energy to address gender concerns in development*,

Clifford, J., 1983. On ethnographic authority. *Representations*, 2(2), pp.118–146. Available at: http://www.jstor.org/stable/10.2307/2928386 [Accessed September 8, 2013].

Clinton Foundation, 2008. Press Release: First Clinton Global Initiative Commitment of 2008 | Clinton Foundation. Available at: http://www.clintonfoundation.org/main/news-and-media/press-releases-and-statements/press-release-first-clinton-global-initiative-commitment-of-2008.html [Accessed October 28, 2013].

Coe, N.M. et al., 2013. Book Review Forum — Learning the City with Colin Mcfarlane. *Urban Geography*, 34(1), pp.37–41.

Cook, P., 2011. Infrastructure, rural electrification and development. *Energy for Sustainable Development*, 15(3), pp.304–313. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082611000548 [Accessed September 8, 2011].

Corbridge, S., 2001. Beyond developmentalism: The turn to cultural anthropology. *New political economy*, 6(April 2012), pp.37–41. Available at: http://www.tandfonline.com/doi/abs/10.1080/13563460020027768 [Accessed April 16, 2012].

Corbridge, S. et al., 2005. *Seeing the state: Governance and governmentality in India*, Cambridge, UK: Cambridge University Press. Available at: http://books.google.com/books?hl=en&lr=&id=fZzaep_Bqp4C&oi=fnd&pg=PR7&dq=Seeing+the+State+Governance+and+Governmentality+in+India&ots=o5xbxRhL25&sig=EikmwBoOffNF-tvaBbTBxnx7JKw [Accessed November 18, 2013].

Corbridge, S., 2010. The political economy of development in India since independence. In P. Brass, ed. *Routledge Handbook of South Asian Politics: India, Pakistan, Bangladesh, Sri Lanka, and Nepal*. Abingdon, UK/New York: Routledge, pp. 305–320. Available at: http://eprints.lse.ac.uk/20381/1/The_political_economy_of_development_in_India_since_independence_(author_final).pdf [Accessed April 16, 2012].

Cowen, M.P. & Shenton, R.W., 1996. *Doctrines of Development*, Abingdon, UK: Taylor & Francis. Available at: http://www.tandfebooks.com/action/showBook?doi=10.4324/9780203392607.

Crampton, J. & Elden, S., 2007. *Space, Knowledge and Power: Foucault and Geography* J. Crampton & S. Elden, eds.,

Crang, M., 2003. Telling Materials. In M. Pryke, G. Rose, & S. Whatmore, eds. *Using Social Theory: Thinking through research*. London: SAGE, pp. 127–144.

Crang, M. & Cook, I., 2007. *Doing ethnographies*, London: SAGE Publications Ltd. Available at: http://books.google.com/books?hl=en&lr=&id=cPSWSdtuxRMC&oi=fnd&pg=PP1&dq=Doing+ethnographies&ots=MVuqID7kK4&sig=KdR45IWjimYMuCjVT9b8Wwcz7pA [Accessed May 30, 2012].

Cross, J., 2013. The 100th object: Solar lighting technology and humanitarian goods. *Journal of Material Culture*, 18(August), pp.367–387. Available at: http://mcu.sagepub.com/cgi/doi/10.1177/1359183513498959 [Accessed September 7, 2013].

Cross, J. & Street, A., 2009. Anthropology at the Bottom of the Pyramid. *Anthropology Today*, 25(4), pp.4–9. Available at: http://doi.wiley.com/10.1111/j.1467-8322.2009.00675.x.

Cupples, J., 2011. Shifting Networks of Power in Nicaragua: Relational Materialisms in the Consumption of Privatized Electricity. *Annals of the Association of American Geographers*, 101(March 2015), pp.939–948.

Cupples, J. & Kindon, S., 2003. Far From Being " Home Alone ": the Dynamics of Accompanied Fieldwork. *Singapore Journal of Tropical Geography*, 24(2), pp.211–228.

Datta, A. et al., 2014. Contrasts in Development in Bihar: A Tale of Two Villages. *The Journal of Development Studies*, 50(9), pp.1197–1208. Available at: http://www.tandfonline.com/doi/abs/10.1080/00220388.2014.925539 [Accessed December 5, 2014].

Day, R. & Hitchings, R., 2009. *Older people and their winter warmth behaviours: Understanding the contextual dynamics*, Birmingham/London. Available at: http://discovery.ucl.ac.uk/1370274/ [Accessed July 5, 2014].

Day, R. & Walker, G., 2013. Household energy vulnerability as "assemblage." In K. Bickerstaff, G. Walker, & H. Bulkeley, eds. *Energy Justice in a Changing Climate: Social equity implications of the energy and low-carbon relationship*. London/New York: Zed Books, pp. 14–29.

Dean, M., 2010. *Governmentality: Power and Rule in Modern Society* Second., London/Thousand Oaks/New Delhi: SAGE Publications. Available at: http://books.google.co.uk/books/about/Governmentality.html?id=QALg1A0yS3UC&pgis=1 [Accessed July 1, 2014].

Derrida, J., 2005. The Principle of Hospitality. *Parallax*, 11(1), pp.6–9. Available at: http://www.tandfonline.com/doi/abs/10.1080/1353464052000321056 [Accessed April 1, 2014].

DeSilvey, C. & Edensor, T., 2012. Reckoning with ruins. *Progress in Human Geography*, 37(4), pp.465–485. Available at: http://phg.sagepub.com/cgi/doi/10.1177/0309132512462271 [Accessed August 12, 2013].

Dewsbury, J.-D., 2011. The Deleuze-Guattarian assemblage: plastic habits. *Area*, 43(2), pp.148–153. Available at: http://doi.wiley.com/10.1111/j.1475-4762.2011.01006.x [Accessed October 16, 2014].

DFID India, 2011. *Operational Plan 2011-2015 DFID INDIA*, New Delhi/London. Available at: http://www.dfid.gov.uk/Documents/publications1/op/india-2011.pdf.

Dillon, M., 2015. *Biopolitics of Security: A political analytic of finitude*, Oxon/New York: Routledge.

Dittmer, J., 2013. Geopolitical assemblages and complexity. *Progress in Human Geography*, 38(3), pp.385–401. Available at: http://phg.sagepub.com/cgi/doi/10.1177/0309132513501405.

Doll, C.N.H. & Pachauri, S., 2010. Estimating rural populations without access to electricity in developing countries through night-time light satellite imagery. *Energy Policy*, 38(10), pp.5661–5670. Available at:

http://linkinghub.elsevier.com/retrieve/pii/S030142151000385X [Accessed December 12, 2011].

Dubas, N.K. & Rajan, S.C.S., 2001. Power politics: Process of power sector reform in India. *Economic and Political Weekly*, 36(35), pp.3367–3387. Available at: http://www.jstor.org/stable/10.2307/4411059 [Accessed January 8, 2012].

Dubash, N., 2003. Revisiting electricity reform: The case for a sustainable development approach. *Utilities Policy*, 11(3), pp.143–154. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0957178703000444 [Accessed January 8, 2012].

Dubash, N.K., 2007. The electricity-groundwater conundrum: Case for a political solution to a political problem. *Economic and Political Weekly*, 42(52), pp.45–55. Available at: http://www.jstor.org/stable/10.2307/40277126 [Accessed October 10, 2013].

Duncombe, R. a., 2014. Understanding the Impact of Mobile Phones on Livelihoods in Developing Countries. *Development Policy Review*, 32(5), pp.567–588. Available at: http://doi.wiley.com/10.1111/dpr.12073.

Dutta, A., Bhattacharya, P., et al., 2012. Immune cells and cardiovascular health in premenopausal women of rural India chronically exposed to biomass smoke during daily household cooking. *The Science of the total environment*, 438, pp.293–8. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23010103 [Accessed November 4, 2014].

Dutta, A., Ray, M.R. & Banerjee, A., 2012. Systemic inflammatory changes and increased oxidative stress in rural Indian women cooking with biomass fuels. *Toxicology and applied pharmacology*, 261(3), pp.255–62. Available at: http://www.ncbi.nlm.nih.gov/pubmed/22521606 [Accessed November 7, 2014].

Eames, M. & Miriam, H., 2013. Energy Justice in Sustainability Transition Research. In K. Bickerstaff, G. Walker, & H. Bulkeley, eds. *Energy Justice in a Changing Climate: Social equity implications of the energy and low-carbon relationship*. London/New York: Zed Books, pp. 46–60.

Edensor, T. & Millington, S., 2009. Illuminations, Class Identities and the Contested Landscapes of Christmas. *Sociology*, 43(1), pp.103–121. Available at: http://soc.sagepub.com/cgi/doi/10.1177/0038038508099100 [Accessed August 20, 2013].

EPW, 1969a. Making Power Pay for Itself. *Economic And Political Weekly*, 4(38), p.1501.

EPW, 1969b. Power to the Farmer. *Economic And Political Weekly*, 4(31), pp.1256–1257. Available at: http://www.epw.in/system/files/pdf/1969_4/31/power_to_the_farmer.pdf.

EPW, 1971. REC Discovers Its Constraints. *Economic And Political Weekly*, 6(2), pp.72–73.

Escobar, A., 2001. Culture sits in places: reflections on globalism and subaltern strategies of localization. *Political Geography*, 20(2), pp.139–174. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0962629800000640.

Escobar, A., 2012. *Encountering Development: The Making and Unmaking of the Third World*, Princeton: Princeton University Press. Available at: http://books.google.com/books?id=Y35aclb012YC&pgis=1 [Accessed August 20, 2013].

Escobar, A., 1992. Imagining a Post-Development Era? Critical Thought, Development and Social Movements. *Social Text*, 31/32(31), pp.20–56. Available at: http://www.jstor.org/stable/10.2307/466217 [Accessed September 3, 2013].

Ezzati, M. & Kammen, D.M., 2001. Indoor air pollution from biomass combustion and acute respiratory infections in Kenya: an exposure-response study. *The Lancet*, 358(9282), pp.619–624. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0140673601057774.

Ferguson, J., 1990. *The Anti-politics Machine: "development," Depoliticization, and Bureaucratic Power in Lesotho*, Minneapolis: University of Minnesota Press. Available at: http://books.google.com/books?id=vfg8AAAAIAAJ&pgis=1 [Accessed August 4, 2014].

Ferguson, J. & Gupta, A., 2002. Spatializing States: Toward an Ethnography of Neoliberal Governmentality. *American Ethnologist*, 29(4), pp.981–1002. Available at: http://doi.wiley.com/10.1525/ae.2002.29.4.981.

Foucault, M., 1991a. Governmentality. In G. Burchell, C. Gordon, & P. Miller, eds. *The Foucault Effect: Studies in Governmentality*. Chicago: The University of Chicago Press, pp. 87–104.

Foucault, M., 1994. *Power: essential works of Foucault 1954-1984 Volume 3* J. Faubion, ed., London: Panguin Books.

Foucault, M., 1991b. Questions of Method. In G. Burchell, C. Gordon, & P. Miller, eds. *The Foucault Effect: Studies in Governmentality*. Chicago: The University of Chicago Press, pp. 73–86.

Fressoli, M., Smith, A. & Spru, Q., 2012. Grassroots innovation movements : enduring dilemmas as sources of knowledge production. *Network*, pp.1–22.

García, V.G. & Bartolomé, M.M., 2010. Rural electrification systems based on renewable energy: The social dimensions of an innovative technology. *Technology in Society*, 32(4), pp.303–311. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0160791X10000746 [Accessed July 30, 2011].

Garrett, B.L., 2011. Videographic geographies: Using digital video for geographic research. *Progress in Human Geography*, 35(4), pp.521–541.

Garvey, P., 2005. Domestic Boundaries: Privacy, Visibility and the Norwegian Window. *Journal of Material Culture*, 10(2), pp.157–176. Available at: http://mcu.sagepub.com/cgi/doi/10.1177/1359183505053073 [Accessed August 20, 2013].

Gaurav, 2011. Husk Power Systems.

Geels, F., 2004. From sectoral systems of innovation to socio-technical systems Insights about dynamics and change from sociology and institutional theory. *Research Policy*, 33(6-7), pp.897–920. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0048733304000496 [Accessed July 7, 2011].

Geels, F.W., 2011. The multi-level perspective on sustainability transitions: Responses to seven criticisms. *Environmental Innovation and Societal Transitions*, 1(1), pp.24–40.

Available at: http://linkinghub.elsevier.com/retrieve/pii/S2210422411000050 [Accessed June 20, 2011].

Geels, F.W. & Kemp, R., 2007. Dynamics in socio-technical systems: Typology of change processes and contrasting case studies. *Technology in Society*, 29(4), pp.441–455. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0160791X07000516 [Accessed August 30, 2011].

Gent, D., 2014. *Governing energy in Nicaragua: the practices and experiences of off-grid solar energy technologies solar energy technologies*.

Gidwani, V., 2008. *Capital, Interrupted: Agrarian Development and the Politics of Work in India*, Minneapolis: the University of Minnesota Press.

Gidwani, V., 2013. Six theses on waste, value, and commons. *Social & Cultural Geography*, 14(7), pp.773–783. Available at: http://www.tandfonline.com/doi/abs/10.1080/14649365.2013.800222.

Gidwani, V. & Sivaramakrishnan, K., 2003. Circular migration and the spaces of cultural assertion. *Annals of the Association of American Geographers*, 93(1), pp.186–213.

Gill, N.M., 2010. New state-theoretic approaches to asylum and refugee geographies. , 34(5), pp.626–645. Available at: http://phg.sagepub.com/content/34/5/626.abstract.

GoB, 2012a. *Agriculture Road Map*, Patna. Available at: http://energy.bih.nic.in/docs/agriculture-road-map-energy.pdf.

GoB, 2012b. *Bihar Saur Kranti Sichai Yojna*, Patna. Available at: http://energy.bih.nic.in/docs/Schemes-SolarRevolution.pdf.

GoB, 2012c. *Economic Survey 2011 - 12*, Patna. Available at: http://finance.bih.nic.in/Documents/Reports/Economic-Survey-2012-EN.pdf.

GoB, 2012d. *Government of Bihar (Energy Department) Proposed Annual Plan for 2012-13*, Patna. Available at: http://energy.bih.nic.in/docs/Proposed-Annual-Plan-2012-13.pdf.

Governance Knowledge Centre, 2011. *Husk Power Systems*, New Delhi. Available at: http://indiagovernance.gov.in/files/gkc_oneworld_husk_power_system.pdf.

Graham, S. & Marvin, S., 2001. *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*, London/New York: Routledge. Available at: http://books.google.co.uk/books/about/Splintering_Urbanism.html?id=zCKNS5Yn4pkC&pgis=1 [Accessed August 23, 2013].

Graham, S. & Thrift, N.J., 2007. Out of Order: Understanding Repair and Maintenance. *Theory, Culture & Society*, 24(3), pp.1–25. Available at: http://dx.doi.org/10.1177/0263276407075954 [Accessed March 23, 2014].

Guha, R., 2008. *India After Gandhi: The History of the World's Largest Democracy*, New Delhi: Pan Macmillan. Available at: http://books.google.co.uk/books/about/India_After_Gandhi.html?id=29lXtwoeA44C&pgis=1 [Accessed November 20, 2013].

Gupta, D., 2013. Whither the Indian Village: Culture and Agriculture in "Rural" India. In S. S. Jodhika, ed. *Village Society*. New Delhi: Orient BlackSwan, pp. 197–209.

Gupta, R. & Jain, K., 2012. Diffusion of mobile telephony in India: An empirical study.

Technological Forecasting and Social Change, 79(4), pp.709–715. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0040162511001703 [Accessed February 18, 2014].

Gurung, A., Gurung, O.P. & Oh, S.E., 2011. The potential of a renewable energy technology for rural electrification in Nepal: A case study from Tangting. *Renewable Energy*, 36(11), pp.3203–3210. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0960148111001261 [Accessed August 2, 2011].

Haas, R., Watson, J. & Eichhammer, W., 2008. Transitions to sustainable energy systems—Introduction to the energy policy special issue. *Energy Policy*, 36(11), pp.4009–4011. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421508003005 [Accessed December 8, 2011].

Haines, A. et al., 2007. Policies for accelerating access to clean energy, improving health, advancing development, and mitigating climate change. *Lancet*, 370(9594), pp.1264–81. Available at: http://www.ncbi.nlm.nih.gov/pubmed/17868819 [Accessed March 5, 2012].

Hall, D., Hirsch, P. & Li, T.M., 2011. *Powers of Exclusion: Land Dilemmas in Southeast Asia*, Singapore/Honolilu: NUS Press.

Hannah, M.G., 2011. Biopower, Life and Left Politics. *Antipode*, 43(4), pp.1034–1055. Available at: http://doi.wiley.com/10.1111/j.1467-8330.2010.00840.x [Accessed December 18, 2013].

Hannerz, U., 1997. Flows, boundaries and hybrids: keywords in transnational Anthropology. *Mana*, 3(1), pp.7–39.

Hardwick, S.W., 2009. Case Study Approach. *Methods*, pp.441–445.

Harish, S.M. et al., 2013. Assessing the impact of the transition to Light Emitting Diodes based solar lighting systems in India. *Energy for Sustainable Development*, 17(4), pp.363–370. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082613000240 [Accessed August 12, 2013].

Harrison, C. & Popke, J., 2011. “Because You Got to Have Heat”: The Networked Assemblage of Energy Poverty in Eastern North Carolina. *Annals of the Association of American Geographers*, 101(March 2015), pp.949–961.

Hawkins, H., 2015. Creative geographic methods: knowing, representing, intervening. On composing place and page. *Cultural Geographies*, 22(2), pp.247–268. Available at: http://cgj.sagepub.com/cgi/doi/10.1177/1474474015569995.

Herbert, S., 2000. For ethnography. *Progress in Human Geography*, 4(4), pp.550–568.

Hopkins, P.E., 2007. Thinking critically and creatively about focus groups. *Area*, 39(4), pp.528–535. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1475-4762.2007.00766.x/full [Accessed April 18, 2012].

Hopwood, B., Mellor, M. & O’Brien, G., 2005. Sustainable development: mapping different approaches. *Sustainable Development*, 13(1), pp.38–52. Available at: http://doi.wiley.com/10.1002/sd.244.

HPS, 2013. About Us. *Husk Power Systems website*. Available at: http://www.huskpowersystems.com/innerPage.php?pageT=About Us&page_id=76 [Accessed October 29, 2013].

Huber, M.T., 2009. Energizing historical materialism: Fossil fuels, space and the capitalist mode of production. *Geoforum*, 40(1), pp.105–115. Available at: http://dx.doi.org/10.1016/j.geoforum.2008.08.004.

Hunt, M. a., 2014. Urban Photography/Cultural Geography: Spaces, Objects, Events. *Geography Compass*, 8(3), pp.151–168. Available at: http://doi.wiley.com/10.1111/gec3.12120.

IEA, 2014. Energy access database. *World Energy Outlook*. Available at: http://www.worldenergyoutlook.org/resources/energydevelopment/energyaccessdatabase/ [Accessed January 31, 2015].

IEA, 2015. *Energy and climate change: World Energy Outlook Special Report*, Paris. Available at: http://www.iea.org/publications/freepublications/publication/WEO2015SpecialReportonEnergyandClimateChange.pdf.

IEA, 2011. Energy for All: Financing access for the poor (Special early excerpt of the World Energy Outlook 2011). In *World Energy Outlook 2011*. Paris: International Energy Institute, pp. 469–506. Available at: http://www.iea.org/papers/2011/weo2011_energy_for_all.pdf.

IFC, 2012. *From Gap to Opportunity : Business Models for Scaling Up Energy Access*,

IRENA, 2013. *International Standardisation in the Field of Renewable Energy*, Abu Dhabi. Available at: http://dev.ecowrex.org/pt-pt/system/files/repository/international_standardisation_in_the_field_of_renewable_energy.pdf [Accessed September 3, 2013].

Ishikawa, E. et al., 2012. *Being the Change: Inspiring the Next Generation of Inclusive Business Entrepreneurs Impacting the Base of the Pyramid*,

Jacobson, A., 2007. Connective Power: Solar Electrification and Social Change in Kenya. *World Development*, 35(1), pp.144–162. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0305750X06001860 [Accessed September 16, 2011].

Jarvie, I.C., 1969. The problem of ethical integrity in participant observation. *Current Anthropology*, 10(5), pp.505–508. Available at: http://www.jstor.org/stable/10.2307/2740620 [Accessed April 18, 2012].

Jasanoff, S., 2004. Heaven and Earth: : The Politics of Environmental Images. In S. Jasanoff & M. Long Martello, eds. *Earthly Politics: Local and Global in Environmental Governance*. Cambridge, Mass. [u.a.]: The MIT Press, pp. 31–54.

Jeffery, R. & Jeffery, P., 1997. *Population, Gender and Politics: Demographic Change in Rural North India*, Cambridge: Cambridge University Press. Available at: http://ebooks.cambridge.org/ref/id/CBO9780511621550.

Jeffrey, C., 2001. ’ A fist is stronger than five fingers ': caste and dominance in rural north India. *Transitions of the Institute of British Geographers*.

Jeffrey, C., 2002. Caste, Class, and Clientalism: A Political Economy of Everyday Corruption in Rural North India. *Economic Geography*, 78(1), pp.21–41. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1944-8287.2002.tb00174.x/abstract.

Jeffrey, C., Jeffery, P. & Jeffery, R., 2004. "'A Useless Thing!'" or "'Nectar of the Gods?'" The Cultural Production of Education and Young Men's Struggles for Respect in Liberalizing North India. *Annals of the Association of American Geographers*, 94(4), pp.961–981. Available at: http://www.tandfonline.com/doi/abs/10.1111/j.1467-8306.2004.00443.x [Accessed October 21, 2014].

Jeffrey, C., Jeffery, P. & Jeffery, R., 2005. Reproducing Difference? Schooling, Jobs, and Empowerment in Uttar Pradesh, India. *World Development*, 33(12), pp.2085–2101. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0305750X05001592 [Accessed October 21, 2014].

Jeffrey, C., Jeffery, R. & Jeffery, P., 2004. Degrees without Freedom: The Impact of Formal Education on Dalit Young Men in North India. *Development and Change*, 35(5), pp.963–986. Available at: http://doi.wiley.com/10.1111/j.1467-7660.2004.00388.x.

Jha, M.K. & Pushpendra, 2012. *Governing Caste and Managing Conflicts: Bihar, 1990-2011*, Kolkata: Mahanirban Calcutta Research Group.

Johnson, O., 2013. *Universal Energy Access : Moving from Technological Fix to Poverty Reduction*,

Jolly, S., Raven, R. & Romijn, H., 2012. Upscaling of business model experiments in off-grid PV solar energy in India. *Sustainability Science*, 7(2), pp.199–212. Available at: http://www.springerlink.com/index/10.1007/s11625-012-0163-7 [Accessed July 16, 2012].

Jones, A.M. & Murphy, J.T., 2011. Theorizing practice in economic geography: foundations, challenges, and possibilities. *Progress in Human Geography*, 35(3), pp.366–392. Available at: http://dx.doi.org/10.1177/0309132510375585.

Kanagawa, M. & Nakata, T., 2005. Analysis of the Energy Access Improvement in Developing Countries through Rural Electrification Background and purpose Regression analysis Model analysis Result Conclusion.

Kanagawa, M. & Nakata, T., 2008. Assessment of access to electricity and the socio-economic impacts in rural areas of developing countries. *Energy Policy*, 36(6), pp.2016–2029. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421508000608 [Accessed January 6, 2011].

Kaundinya, D.P., Balachandra, P. & Ravindranath, N.H., 2009. Grid-connected versus stand-alone energy systems for decentralized power—A review of literature. *Renewable and Sustainable Energy Reviews*, 13(8), pp.2041–2050. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1364032109000483 [Accessed April 3, 2012].

Kaviraj, S., 2000. Modernity and politics in India. *Daedalus*, 129(1), pp.137–162. Available at: http://www.jstor.org/stable/10.2307/20027618 [Accessed July 2, 2013].

Kaviraj, S., 1984. On the crisis of political institutions in India. *Contributions to Indian Sociology*, 18(2), pp.223–243. Available at: http://cis.sagepub.com/cgi/doi/10.1177/006996678401800205 [Accessed November

10, 2013].

Kaygusuz, K., 2012. Energy for sustainable development: A case of developing countries. *Renewable and Sustainable Energy Reviews*, 16(2), pp.1116–1126. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1364032111005491 [Accessed March 2, 2012].

Khandker, S.R. et al., 2012. *Who Benefits Most from Rural Electrification? Evidence in India*, Washington, D.C. Available at: http://elibrary.worldbank.org/doi/book/10.1596/1813-9450-6095.

Khilnani, S., 2004. *The idea of India* 3rd ed., New Delhi: Penguin Books India. Available at: http://books.google.com/books?hl=en&lr=&id=RvcDkAbk7hAC&oi=fnd&pg=PR9&dq=The+idea+of+India&ots=YxrIzymBHb&sig=KZsdIe8-CPAx6CFtwdfGUzo4hus [Accessed November 21, 2013].

Kimmich, C., 2013. Incentives for energy-efficient irrigation: Empirical evidence of technology adoption in Andhra Pradesh, India. *Energy for Sustainable Development*, 17(3), pp.261–269. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082613000100 [Accessed October 16, 2013].

Kingdon, G.G., 1998. Does the labour market explain lower female schooling in India? *Journal of Development Studies*, 35(1), pp.39–65. Available at: http://www.tandfonline.com/doi/abs/10.1080/00220389808422554 [Accessed November 4, 2014].

Kishore, A., 2013. The Paradox of Agrarian Stagnation in Bihar, India. *The IFFCO Foundation Bulletin*, 1(1), pp.1–16. Available at: http://iffcofoundation.net/Bulletin/The IFFCO Foundation Bulletin.pdf#page=3 [Accessed October 17, 2013].

Koh, H., Karamchandani, A. & Katz, R., 2012. *From Blueprint to Scale: The case for Philanthropy in Impact Investing*, Mumbai. Available at: http://acumen.org/content/uploads/2013/03/From-Blueprint-to-Scale-Case-for-Philanthropy-in-Impact-Investing_Full-report.pdf.

Komatsu, S. et al., 2011. Nonincome factors behind the purchase decisions of solar home systems in rural Bangladesh. *Energy for Sustainable Development*, 15(3), pp.284–292. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082611000196 [Accessed March 27, 2012].

Kreft, S. et al., 2010. *The Millennium Development Goals and Climate Change: Taking stock and looking ahead*, Berlin/Bonn. Available at: http://www.germanwatch.org/klima/klimdg10e.pdf.

Kuby, M. et al., 2011. The Changing Structure of Energy Supply, Demand, and CO2 Emissions in China. *Annals of the Association of American Geographers*, 101(March 2015), pp.795–805.

Kumar, A. et al., 2009. Approach for standardization of off-grid electrification projects. *Renewable and Sustainable Energy Reviews*, 13(8), pp.1946–1956. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1364032109000641 [Accessed October 24, 2011].

Kumar, A., 2015a. Cultures of lights. *Geoforum*, 65, pp.59–68. Available at:

http://dx.doi.org/10.1016/j.geoforum.2015.07.012.

Kumar, A., 2015b. Sustainable energy for all: can we take care of the “all”? In J. Tomei & D. Gent, eds. *Equity and the energy trilemma Delivering sustainable energy access in low-income communities*. London: IIED, pp. 8–16. Available at: http://pubs.iied.org/16046IIED.html?c=energy.

Kumar, R. et al., 2013. Indoor Air Pollution and Respiratory Illness in Children from Rural India : A Pilot Study. *The Indian Journal of Chest Diseases & Allied Sciences*, 56, pp.79–83.

Kumar, S., Alam, M. & Joshi, D., 2008. Caste Dynamic and Political Process in Bihar. *Journal of Indian School of Political Economy*, Jan-June, pp.1–32. Available at: http://www.ispepune.org.in/jis108pdf/Bihar.pdf [Accessed May 30, 2012].

Kumbhare, A.R., 2009. *Women of India: Their Status Since the Vedic Times*, Bloomington: iUniverse. Available at: https://books.google.co.uk/books?id=A2dUR4mwBBAC&pg=PA76&lpg=PA76&dq=%22cultured+women%22+india&source=bl&ots=jSPa_tjmt5&sig=y8_iuDyu-8ohN1Ihk5EURtYHHDU&hl=en&sa=X&ei=GG4cVerJBNPWaqbggdAF&ved=0CCwQ6AEwAg#v=onepage&q=%22cultured women%22 india&f=false.

LaBL, 2014. Lighting a Billion Lives - About us. Available at: http://labl.teriin.org/index.php?option=com_content&view=article&id=6&Itemid=137 [Accessed August 7, 2014].

de Laet, M. & Mol, A., 2000. The Zimbabwe bush pump: mechanics of a fluid technology. *Social Studies of Science*, 30(2), pp.225–263. Available at: http://en.scientificcommons.org/17570011 [Accessed January 2, 2012].

Lam, N.L. et al., 2012. Kerosene: a review of household uses and their hazards in low- and middle-income countries. *Journal of toxicology and environmental health. Part B, Critical reviews*, 15(6), pp.396–432. Available at: http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3664014&tool=pmcentrez&rendertype=abstract [Accessed October 3, 2014].

Latour, B., 2005. *Reassembling the Social*, Oxford/NewYork: Oxford University Press. Available at: http://books.google.com/books?hl=en&lr=&id=DlgNiBaYo-YC&oi=fnd&pg=PR7&dq=Reassembling+the+Social&ots=HM9xW281J1&sig=u4QZFhQZ0RcJZXKSEULgVlf-8Ss [Accessed January 1, 2012].

Laufer, D. & Schäfer, M., 2011. The implementation of Solar Home Systems as a poverty reduction strategy—A case study in Sri Lanka. *Energy for Sustainable Development*, 15(3), pp.330–336. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082611000482 [Accessed March 27, 2012].

Laurier, E., 2010. Participant Observation. In N. Clifford, S. French, & G. Valentine, eds. *Key Methods in Geography*. London: SAGE Publications Ltd, pp. 116–140.

Law, J., 2006. Traduction / Trahison: Notes on ANT. *Convergencia. Revista de Ciencias Sociales*, 13(42), pp.47–72. Available at: http://www.redalyc.org/pdf/105/10504204.pdf [Accessed October 16, 2014].

Lawhon, M. & Murphy, J.T., 2011. Socio-technical regimes and sustainability transitions:

Insights from political ecology. *Progress in Human Geography*, 36(3), pp.354–378. Available at: http://phg.sagepub.com/cgi/doi/10.1177/0309132511427960 [Accessed July 16, 2012].

Lawhon, M. & Patel, Z., 2013. Scalar politics and local sustainability: Rethinking governance and justice in an era of political and environmental change. *Environment and Planning C: Government and Policy*, 31(6), pp.1048–1062.

Leach, M. et al., 2007. *Understanding Governance: pathways to sustainability*, Btighton. Available at: https://www.ids.ac.uk/files/governance.pdf [Accessed April 17, 2012].

Lee, K.H. & Bellemare, M.F., 2013. Look Who's Talking: The Impacts of the Intrahousehold Allocation of Mobile Phones on Agricultural Prices. *Journal of Development Studies*, 49(5), pp.624–640. Available at: http://www.tandfonline.com/doi/abs/10.1080/00220388.2012.740014 [Accessed December 5, 2014].

Legg, S., 2011. Assemblage/apparatus: using Deleuze and Foucault. *Area*, 43(2), pp.128–133. Available at: http://doi.wiley.com/10.1111/j.1475-4762.2011.01010.x.

Legg, S., 2005. Foucault's population geographies: classifications, biopolitics and governmental spaces. *Population, Space and Place*, 11(3), pp.137–156. Available at: http://doi.wiley.com/10.1002/psp.357.

Legg, S., 2007. *Spaces of Colonialism: Delhi's Urban Governmentalities*,

Legros, G. et al., 2009. *THE ENERGY ACCESS SITUATION IN DEVELOPING COUNTRIES: A Review Focusing on the Least Developed Countries and Sub-Saharan Africa*,

Li, T.M., 2005. Beyond "the State" and Failed Schemes. *American Anthropologist*, 107(3), pp.383–394. Available at: http://onlinelibrary.wiley.com/doi/10.1525/aa.2005.107.3.383/full [Accessed June 30, 2014].

Li, T.M., 1999. Compromising Power: Development, Culture, and Rule in Indonesia. *Cultural Anthropology*, 14(3), pp.295–322.

Li, T.M., 2014a. Fixing Non market Subjects : Governing Land and Population in the Global South. , (18), pp.34–48.

Li, T.M., 2007a. Governmentality. *Anthropologica*, 49(2), pp.275–281.

Li, T.M., 2007b. Practices of assemblage and community forest management. *Economy and Society*, 36(2), pp.263–293. Available at: http://www.tandfonline.com/doi/abs/10.1080/03085140701254308 [Accessed August 8, 2014].

Li, T.M., 2003. Situating Concepts Resource for Analysis. *Economic and Political Weekly*, 38(48), pp.5120–5128.

Li, T.M., 2007c. *The Will to Improve*, Duke/London: Duke University Press.

Li, T.M., 2014b. What is land? Assembling a resource for global investment. *Transactions of the Institute of British Geographers*, 39(4), pp.589–602. Available at: http://doi.wiley.com/10.1111/tran.12065 [Accessed December 2, 2014].

Longhurst, R., 2010. Semi-structured interviews and Focus Groups. In N. Clifford, S. French, & G. Valentine, eds. *Key Methods in Geography*. London/Thousand Oaks/New Delhi:

SAGE Publications, pp. 103–115.

Lovell, H., Bulkeley, H. & Owens, S., 2009. Converging agendas? Energy and climate change policies in the UK. *Environment and Planning C: Government and Policy*, 27, pp.90–109.

Maassen, A., 2009. Social science perspectives on energy transitions. *Proceedings of the ICE - Energy*, 162(November), pp.161–167.

MacKinnon, D., 2010. Reconstructing scale: towards a new scalar politics. *Progress in Human Geography*, 35(1), pp.21–36. Available at: http://eprints.gla.ac.uk/44592/.

Mackley, K.L. & Pink, S., 2013. From emplaced knowing to interdisciplinary knowledge: Sensory ethnography in energy research. *Senses and Society*, 8(3), pp.335–353.

MacLean, J., 2012. Mainstreaming Environmental Finance Markets (I) – Small-Scale Energy Efficiency and Renewable Energy Finance. *Greening the Financial Sector SE - 3*, (November), pp.53–110. Available at: http://dx.doi.org/10.1007/978-3-642-05087-9_3.

Mahapatra, S. & Dasappa, S., 2012. Rural electrification: Optimising the choice between decentralised renewable energy sources and grid extension. *Energy for Sustainable Development*, 16(2), pp.146–154. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082612000087 [Accessed April 3, 2012].

Marcus, G.E. & Saka, E., 2006. Assemblage. *Theory, Culture & Society*, 23(2-3), pp.101–106.

Martinot, E. et al., 2002. Renewable Energy Markets in Developing Countries*. *Annual Review of Energy and the Environment*, 27(1), pp.309–348. Available at: http://arjournals.annualreviews.org/doi/abs/10.1146/annurev.energy.27.122001.083444 [Accessed July 11, 2011].

Mashreky, S.R. et al., 2010. Determinants of childhood burns in rural Bangladesh: A nested case-control study. *Health policy (Amsterdam, Netherlands)*, 96(3), pp.226–30. Available at: http://www.ncbi.nlm.nih.gov/pubmed/20202714 [Accessed November 5, 2014].

McCann, E., 2011. Veritable inventions: cities, policies and assemblage. *Area*, 43(2), pp.143–147. Available at: http://doi.wiley.com/10.1111/j.1475-4762.2011.01011.x [Accessed September 30, 2014].

McCarthy, C., 2005. Toward a Definition of Interiority. *Space and Culture*, 8(2), pp.112–125. Available at: http://sac.sagepub.com/cgi/doi/10.1177/1206331205275020 [Accessed August 20, 2013].

Mceachern, M. & Hanson, S., 2008. Socio-geographic perception in the diffusion of innovation: Solar energy technology in Sri Lanka. *Energy Policy*, 36(7), pp.2578–2590. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421508001389 [Accessed July 25, 2011].

McFarlane, C., 2010. Infrastructure, Interruption, and inequality: Urban Life in the Global South. In S. Graham, ed. *Disrupted Cities: When Infrastructure Fails*. New York/Oxon: Routledge, pp. 131–144.

McFarlane, C., 2011a. *Learning the City: Knowledge and Translocal Assemblage*, Oxford: John Wiley & Sons. Available at: http://books.google.com/books?id=p6g-r6gC23AC&pgis=1 [Accessed September 16, 2014].

McFarlane, C., 2011b. On context: Assemblage, political economy and structure. *City*, 15(3-4), pp.375–388. Available at: http://www.tandfonline.com/doi/abs/10.1080/13604813.2011.595111 [Accessed September 7, 2013].

McFarlane, C., 2011c. The city as assemblage: dwelling and urban space. *Environment and Planning D: Society and Space*, 29(4), pp.649–671. Available at: http://www.envplan.com/abstract.cgi?id=d4710 [Accessed July 28, 2014].

McFarlane, C., 2009. Translocal assemblages: Space, power and social movements. *Geoforum*, 40(4), pp.561–567. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0016718509000682 [Accessed August 15, 2013].

Mclaren, D., Krieger, K. & Bickerstaff, K., 2013. Justice in energy transitions: the case of carbon capture and storage. In K. Bickerstaff, G. Walker, & H. Bulkeley, eds. *Energy Justice in a Changing Climate: Social equity implications of the energy and low-carbon relationship*. London/New York: Zed Books, pp. 158–181.

Mehta, S. & Shahpar, C., 2004. The health benefits of interventions to reduce indoor air pollution from solid fuel use: a cost-effectiveness analysis. *Energy for Sustainable Development*, VIII(3), pp.53–59. Available at: http://www.sciencedirect.com/science/article/pii/S0973082608604664 [Accessed November 17, 2014].

Mills, E., 2012. *Health Impacts of Fuel-based Lighting*,

Mills, E., 2005. The specter of fuel-based lighting. *Science(Washington)*, 308(May), pp.1263–1264. Available at: http://energy.lbl.gov/EA/mills/_archive/EMills-4-2-09/PRESENTATIONS/Fuel-Based-Lighting.pdf [Accessed November 20, 2014].

Mishra, P., 2013. Higher Education in Bihar: Inputs and Outcomes. In N. Singh & N. Stern, eds. *The New Bihar: Rekindling Governance and Development*. Noida: HarperCollings Publishers India, p. 387.

Mitchell, T., 2009. Carbon democracy. *Economy and Society*, 38(3), pp.399–432. Available at: http://www.tandfonline.com/doi/abs/10.1080/03085140903020598 [Accessed November 9, 2014].

Mitra, K.S., 2006. *The Puzzle of India's Governance. Culture, context and comparative theory.*, London/New York: Routledge. Available at: http://www.tandfebooks.com/isbn/9780203640852.

MoP, 2005. *National Electricity Policy*, India. Available at: http://www.powermin.nic.in/whats_new/national_electricity_policy.htm.

Morris, N.J., 2011. Night walking: darkness and sensory perception in a night-time landscape installation. *Cultural Geographies*, 18(3), pp.315–342. Available at: http://cgj.sagepub.com/cgi/doi/10.1177/1474474011410277 [Accessed August 20, 2013].

Morris, S., Pandey, A. & Barua, S.K., 2006. *A Scheme for Efficient Subsidisation of Kerosene in India*, Ahmedabad. Available at: http://vslir.iimahd.ernet.in:8080/xmlui/handle/123456789/34 [Accessed December 8, 2014].

Mullings, B., 1999. Insider or outsider, both or neither: Some dilemmas of interviewing in a cross-cultural setting. *Geoforum*, 30(4), pp.337–350.

Nayyar, D., 2006. India's Unfinished Journey Transforming Growth into Development. *Modern Asian Studies*, 40(03), p.797. Available at: http://www.journals.cambridge.org/abstract_S0026749X06002393 [Accessed March 14, 2012].

NCSRH, 2013. *IMPACT ASSESSMENT OF A PROJECT ON SOLAR LANTERNS UNDER THE AEGIS OF LIGHT A BILLION LIVES IMPLEMENTED BY THE ENERGY RESOURCE INSTITUTE (TERI)*, Mumbai. Available at: http://www.csr.tiss.edu/research/PFCIlluminatinglives.pdf.

Nelson, I.L., 2013. The allure and privileging of danger over everyday practice in field research. *Area*, 45(4), pp.419–425. Available at: http://doi.wiley.com/10.1111/area.12036 [Accessed November 11, 2013].

Newell, P. et al., 2014. *The Political Economy of Low Carbon Energy in Kenya*, London. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.2040-0209.2014.00445.x/pdf.

Newell, P., 2014. The politics and political economy of the Clean Development Mechanism in Argentina. *Environmental Politics*, (March 2015), pp.1–18. Available at: http://dx.doi.org/10.1080/09644016.2013.821827.

Newell, P. & Bumpus, A., 2012. The Global Political Ecology of the Clean Development Mechanism. *Global Environmental Politics*, 12(4), pp.49–67.

Nganga, J. et al., 2013. *POWERING AFRICA THROUGH FEED-IN TARIFFS: Advancing Renewable Energy to Meet the Continents Needs*,

Norris, L., 2004. Shedding skins: the materiality of divestment in India. *Journal of Material Culture*, 9(1), pp.59–71. Available at: http://discovery.ucl.ac.uk/42636/.

Nouni, M., Mullick, S. & Kandpal, T., 2009. Providing electricity access to remote areas in India: Niche areas for decentralized electricity supply☆. *Renewable Energy*, 34(2), pp.430–434. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0960148108002127 [Accessed October 15, 2010].

NSO, 2013. *Energy Statistics*, New Delhi. Available at: http://mospi.nic.in/mospi_new/upload/Energy_Statistics_2013.pdf.

Obeng, G.Y., Akuffo, F.O., et al., 2008. Impact of solar photovoltaic lighting on indoor air smoke in off-grid rural Ghana. *Energy for Sustainable Development*, 12(1), pp.55–61. Available at: http://dx.doi.org/10.1016/S0973-0826(08)60419-6.

Obeng, G.Y., Evers, H.D., et al., 2008. Solar photovoltaic electrification and rural energy-poverty in Ghana. *Energy for Sustainable Development*, 12(1), pp.43–54. Available at: http://dx.doi.org/10.1016/S0973-0826(08)60418-4.

Oda, H. & Tsujita, Y., 2010. *The Determinants of Rural Electrification in Bihar , India*, Chiba. Available at: http://hdl.handle.net/2344/916.

Oparaocha, S. & Dutta, S., 2011. Gender and energy for sustainable development. *Current Opinion in Environmental Sustainability*, 3(4), pp.265–271. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1877343511000601 [Accessed June 27,

2013].

Pachauri, S. et al., 2009. Energy Access for Development. In *EarthTrends Update*. pp. 1401–1458. Available at: http://www.homeofgeography.org/uk/news_2009/EarTrend_May09.pdf [Accessed September 3, 2013].

Pachauri, S. et al., 2004. On Measuring Energy Poverty in Indian Households. *World Development*, 32(12), pp.2083–2104. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0305750X04001500 [Accessed February 12, 2011].

Pachauri, S., 2011. Reaching an international consensus on defining modern energy access. *Current Opinion in Environmental Sustainability*, 3(4), pp.235–240. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1877343511000625 [Accessed October 4, 2011].

Pachauri, S., Scott, A. & Scott, L., 2013. *Energy Policy Guide*,

Palit, D., 2013a. Regional Training Workshop on Widening Access to Energy Partnership Experiences - Lighting a Billion Lives Program. , (September), p.23. Available at: http://www.unescap.org/esd/Energy-Security-and-Water-Resources/meetings_energy/meeting-5Ps-RTWS/Presentations_PDF/Day2/Session_6_Debajit_Palit_TERI.pdf.

Palit, D., 2011. Regional workshop on Women, energy & Enterprise Building: Lighting a Billion Lives. Available at: http://www.sari-energy.org/PageFiles/What_We_Do/activities/SAWIE/wiser/WomenEnergyEntBuildingApr2011/Apr5/LaBL-Debajit.pdf.

Palit, D., 2013b. Solar energy programs for rural electrification: Experiences and lessons from South Asia. *Energy for Sustainable Development*, 17(3), pp.270–279. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082613000045 [Accessed October 16, 2013].

Palit, D. & Sarangi, G.K., 2014. Renewable Energy based Mini-grids for Enhancing Electricity Access: Experiences and Lessons from India. In *International Conference and Utility Exhibition 2014 on Green Energy for Sustainable Development (ICUE 2014)*. Pattaya City, pp. 1–8. Available at: http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=6828955&tag=1.

Palit, D. & Singh, J., 2011. Lighting a Billion Lives -Empowering the rural poor. *Boiling Point*, (59), pp.42–45. Available at: http://www.hedon.info/LightingBillionLives TERI [Accessed August 7, 2014].

Paliwal, A., 2012. Powered by husk. *Down To Earth*. Available at: http://www.downtoearth.org.in/content/powered-husk [Accessed November 21, 2012].

Pandya, V., 1998. Hot Scorpions, Sweet Peacocks: Kachchhe Art, Architecture and Action. *Journal of Material Culture*, 3(1), pp.51–75. Available at: http://mcu.sagepub.com/cgi/doi/10.1177/135918359800300103 [Accessed August 20, 2013].

Pant, N., 1984. Community Tubewell: An Organisational Alternative to Small Farmers'

Irrigation. *Economic and Political Weekly*, 19(26), pp.A59–A66. Available at: http://www.jstor.org/stable/10.2307/4373350 [Accessed October 11, 2013].

Papachristos, G., Sofianos, A. & Adamides, E., 2013. System interactions in socio-technical transitions: Extending the multi-level perspective. *Environmental Innovation and Societal Transitions*, 7, pp.53–69. Available at: http://linkinghub.elsevier.com/retrieve/pii/S2210422413000269 [Accessed October 16, 2013].

Parikh, P., Chaturvedi, S. & George, G., 2012. Empowering change: The effects of energy provision on individual aspirations in slum communities. *Energy Policy*, 50, pp.477–485. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421512006404 [Accessed January 2, 2015].

Parkhill, K. & Pidgeon, N., 2010. From the familiar to the extraordinary: local residents' perceptions of risk when living with nuclear power in the UK. *Transactions of the Institute of British Geographers*, 35(1), pp.39–58. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1475-5661.2009.00364.x/full [Accessed December 2, 2014].

Peck, M.D. et al., 2008. Burns and fires from non-electric domestic appliances in low and middle income countries Part I. The scope of the problem. *Burns : journal of the International Society for Burn Injuries*, 34(3), pp.303–11. Available at: http://www.ncbi.nlm.nih.gov/pubmed/18206314 [Accessed November 5, 2014].

Perkins, R., 2013. Sustainable development and the making and unmaking of a developing world. *Environment and Planning C: Government and Policy*, 31(6), pp.1003–1022.

Petrova, S. et al., 2013. Discursive Framings of Low Carbon Urban Transitions: The Contested Geographies of "Satellite Settlements" in the Czech Republic. *Urban Studies*, 50(May), pp.1439–1455. Available at: <Go to ISI>://WOS:000319130400008\nhttp://usj.sagepub.com/content/50/7/1439.full.pdf.

Pfaff, J., 2010. A mobile phone: mobility, materiality and everyday Swahili trading practices. *Cultural Geographies*, 17(3), pp.341–357. Available at: http://cgj.sagepub.com/cgi/doi/10.1177/1474474010368606 [Accessed August 20, 2013].

Phillips, J. & Newell, P., 2013. The governance of clean energy in India: The clean development mechanism (CDM) and domestic energy politics. *Energy Policy*, 59, pp.654–662. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421513002589 [Accessed August 20, 2013].

Pink, S., 2007. *Doing Visual Ethnography* 1st ed., London/California/New Delhi: SAGE Publications Ltd.

Planning Commission, 2008. *BIHAR'S AGRICULTURE DEVELOPMENT : OPPORTUNITIES & CHALLENGES - A REPORT OF THE SPECIAL TASK FORCE ON BIHAR*, New Delhi. Available at: http://planningcommission.nic.in/aboutus/taskforce/tsk_adoc.pdf.

Powells, G. et al., 2014. Peak electricity demand and the flexibility of everyday life. *Geoforum*, 55, pp.43–52. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0016718514000931 [Accessed November

13, 2014].

Powells, G.D., 2009. Complexity, entanglement, and overflow in the new carbon economy: The case of the UK's energy efficiency commitment. *Environment and Planning A*, 41, pp.2342–2356.

Power, M., 2003. *Rethinking Development Geographies*, London/New York: Routledge. Available at: http://books.google.com/books?id=IA2AEAvciGYC&pgis=1 [Accessed April 7, 2012].

Prakash, G., 1999. *Another Reason: Science and the Imagination of Modern India*, Princeton: Princeton University Press. Available at: http://books.google.co.uk/books/p/princeton?id=oi0e2go8sxoC&pgis=1 [Accessed October 9, 2013].

Prasad, K.N., 1997. *Bihar Economy Through Plans*, New Delhi: Northern Book Centre.

Rabinow, P. & Rose, N., 2003. Foucault Today. In P. Rabinow & N. Rose, eds. *THE ESSENTIAL FOUCAULT: SELECTIONS FROM THE ESSENTIAL WORKS OF FOUCAULT, 1954-1984*. New York: New Press, pp. vii–xxxv. Available at: http://mail.www.anthropos-lab.net/wp/publications/2009/04/Rabinow-Rose-Intro-Essential.pdf [Accessed November 10, 2014].

Rajaraman, I., 1983. Economics of Bride-Price and Dowry. *Economic and Political Weekly*, 18(8), pp.275–279. Available at: http://www.jstor.org/stable/4371875.

Rao, N.D., 2013. Does (better) electricity supply increase household enterprise income in India? *Energy Policy*, 57, pp.532–541. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421513001109 [Accessed October 16, 2013].

Raven, R., 2007. Co-evolution of waste and electricity regimes: Multi-regime dynamics in the Netherlands (1969–2003). *Energy Policy*, 35(4), pp.2197–2208. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421506002849 [Accessed February 3, 2012].

Reddy, B.S. & Nathan, H.S.K., 2013. Energy in the development strategy of Indian households—the missing half. *Renewable and Sustainable Energy Reviews*, 18, pp.203–210. Available at: http://dx.doi.org/10.1016/j.rser.2012.10.023.

Reddy, V.R. et al., 2006. Achieving global environmental benefits through local development of clean energy? The case of small hilly hydel in India. *Energy Policy*, 34(18), pp.4069–4080. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421505002703 [Accessed January 10, 2012].

Rehman, I.H. et al., 2005. Availability of kerosene to rural households: A case study from India. *Energy Policy*, 33(17), pp.2165–2174. Available at: http://www.sciencedirect.com/science/article/pii/S0301421504001235 [Accessed October 29, 2013].

Rehman, I.H. et al., 2011. Black carbon emissions from biomass and fossil fuels in rural India. *Atmospheric Chemistry and Physics*, 11(14), pp.7289–7299. Available at: http://www.atmos-chem-phys.net/11/7289/2011/ [Accessed March 16, 2013].

Rehman, I.H., 2013. Commentary. *Journey towards a Billion: A quarterly newsletter of the Lighting a Billion Lives©a Initiative*, 5(2), p.1.

Rehman, I.H. et al., 2010. Rural energy transitions in developing countries: A case of the Uttam Urja initiative in India. *Environmental Science and Policy*, 13(4), pp.303–311. Available at: http://dx.doi.org/10.1016/j.envsci.2010.03.012 [Accessed January 8, 2015].

RGGVY, 2011. Definition of Electrified Villages. *Rajeev Gandhi Grameen Vidyutikaran Yojna*. Available at: http://rggvy.gov.in/rggvy/rggvyportal/def_elect_vill.htm [Accessed January 2, 2012].

Rodgers, D. & Satija, S., 2012. *Understanding the Tipping Point of Urban Conflict: The Case of Patna, India*, Manchester. Available at: http://eprints.gla.ac.uk/70083/.

Romijn, H., Raven, R. & de Visser, I., 2010. Biomass energy experiments in rural India: Insights from learning-based development approaches and lessons for Strategic Niche Management. *Environmental Science & Policy*, 13(4), pp.326–338. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1462901110000249 [Accessed September 14, 2011].

Rose, N., 1999. *The Power of Freedom. Reframing Political Thought*, Cambridge, UK: Cambridge University Press. Available at: http://books.google.com/books?hl=en&lr=&id=0UmvRJkREtYC&oi=fnd&pg=PR9&dq=Powers+of+Freedom:+Reframing+Political+Thought&ots=B8tDKgs-ch&sig=aZ-5FAJ53SmkP-2JvHgM7IthaGo [Accessed October 28, 2014].

Roy, A., 1995. Industrialising Bihar: The Options. *Economic and Political Weekly*, 30(30), pp.1902–1903. Available at: http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Industrialising+Bihar+:+The+Options#0 [Accessed May 30, 2012].

Rutherford, J. & Coutard, O., 2014. Urban Energy Transitions: Places, Processes and Politics of Socio-technical Change. *Urban Studies*, 51(7), pp.1353–1377. Available at: http://usj.sagepub.com/cgi/doi/10.1177/0042098013500090.

Sagar, A., 2005. Alleviating energy poverty for the world's poor. *Energy Policy*, 33(11), pp.1367–1372. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421504000096 [Accessed February 18, 2011].

Saiyed, H., Patel, T. & Gokani, V., 2001. Indoor air pollution in India: a major environmental and public health concern. *Indian Council of Medical Research Bulletin*, 31(5). Available at: http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:INDOOR+AIR+POLLUTION+IN+INDIA+–+A+MAJOR+ENVIRONMENTAL+AND+PUBLIC+HEALTH+CONCERN#6 [Accessed November 11, 2014].

Schäfer, M., Kebir, N. & Neumann, K., 2011. Research needs for meeting the challenge of decentralized energy supply in developing countries. *Energy for Sustainable Development*, 15(3), pp.324–329. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082611000470 [Accessed March 27, 2012].

Schare, S. & Smith, K.R., 1995. Particulate emission rates of simple kerosene lamps. *Energy for Sustainable Development*, 2(2), pp.32–35. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082608601234 [Accessed October

22, 2014].

Schnitzer, D. et al., 2014. *Microgrids for Rural Electrification : A critical review of best practices based on seven case studies Microgrids for Rural Electrification : A critical review of best practices*, Berkeley. Available at: https://wpweb2.tepper.cmu.edu/ceic/pdfs_other/Micro-grids_for_Rural_Electrification-A_critical_review_of_best_practices_based_on_seven_case_studies.pdf.

Scott, D., 1995. Colonial governmentality. *Social Text*, 43(43), pp.191–220. Available at: http://www.jstor.org/stable/466631 [Accessed July 10, 2014].

Scott, J.C., 1998. *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, New Haven and London: Yale University. Available at: http://muse.jhu.edu/journals/journal_of_social_history/v033/33.4adas.html [Accessed August 13, 2014].

Scott, J.C., 1985. *Weapons of the Weak: Everyday Forms of Peasant Resistance*, New Haven/London: Yale University.

SEFA/UN, 2012. *Sustainable Energy for All - A Framework for Action*, New York. Available at: http://www.se4all.org/wp-content/uploads/2013/09/SE_for_All_-_Framework_for_Action_FINAL.pdf.

Sharma, A.N., 1995. Political Economy of Poverty in Bihar. *Economic and Political Weekly*, 30(41/42), pp.2587–2602. Available at: http://www.jstor.org/stable/4403334.

Shove, E., Trentmann, F. & Wilk, R., 2009. *Time, consumption, and everyday life: Practice, Materiality and Culture* E. Shove, F. Trentmann, & R. Wilk, eds., Oxford/NewYork: BERG. Available at: http://www.bergpublishers.com/?tabid=5154.

Shove, E. & Walker, G., 2007. CAUTION! Transitions ahead: politics, practice, and sustainable transition management. *Environment and Planning A*, 39(4), pp.763–770. Available at: http://www.envplan.com/abstract.cgi?id=a39310 [Accessed August 5, 2011].

Shove, E. & Walker, G., 2010. Governing transitions in the sustainability of everyday life. *Research Policy*, 39(4), pp.471–476. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0048733310000338 [Accessed June 22, 2011].

Shove, E. & Walker, G., 2014. What Is Energy For? Social Practice and Energy Demand. *Theory, Culture & Society*, 31(5), pp.41–58. Available at: http://tcs.sagepub.com/cgi/doi/10.1177/0263276414536746 [Accessed July 21, 2014].

Shove, E., Walker, G. & Brown, S., 2014. Material culture, room temperature and the social organisation of thermal energy. *Journal of Material Culture*, 19, pp.113–124. Available at: http://mcu.sagepub.com/cgi/doi/10.1177/1359183514525084.

Silvast, A. & Virtanen, M.J., 2014. Keeping Systems at Work : Electricity Infrastructure from Control Rooms to Household Practices. *Science & Technology Studies*, 27(2), pp.93–114.

Singh, S. et al., 2014. Comparative study of indoor air pollution using traditional and improved cooking stoves in rural households of Northern India. *Energy for Sustainable Development*, 19, pp.1–6. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082614000106 [Accessed March 26,

2014].

Singh, S., 2010. *Rural Market Insight Brief: Empowering Villages*, Chennai. Available at: http://cdf.ifmr.ac.in/wp-content/uploads/2011/03/Empowering-Villages.pdf.

Smith, A., 2007. Translating Sustainabilities between Green Niches and Socio-Technical Regimes. *Technology Analysis & Strategic Management*, 19(4), pp.427–450. Available at: http://www.tandfonline.com/doi/abs/10.1080/09537320701403334 [Accessed July 30, 2011].

Smith, A. & Raven, R., 2012. What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy*, 41(6), pp.1025–1036.

Smith, A. & Stirling, A., 2008. *Social-ecological resilience and socio-technical transitions: critical issues for sustainability governance*, Brighton. Available at: http://www.steps-centre.org/PDFs/STEPS Working Paper_Transitions.pdf [Accessed January 26, 2012].

Smith, A. & Stirling, A., 2010. The politics of social-ecological resilience and sustainable socio-technical transitions. *Ecology and Society*, 15(1), p.11. Available at: http://www.ibcperu.org/doc/isis/12146.pdf [Accessed January 19, 2012].

Smith, A., Stirling, A. & Berkhout, F., 2005. The governance of sustainable socio-technical transitions. *Research Policy*, 34(10), pp.1491–1510. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0048733305001721 [Accessed June 15, 2011].

Smith, A., Voß, J.-P. & Grin, J., 2010. Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges. *Research Policy*, 39(4), pp.435–448. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0048733310000375 [Accessed July 6, 2011].

Smith, K. et al., 2000. Indoor air pollution in developing countries and acute lower respiratory infections in children. *Thorax*, pp.518–532. Available at: http://thorax.bmj.com/content/55/6/518.short [Accessed November 26, 2014].

Sokona, Y., Mulugetta, Y. & Gujba, H., 2012. Widening energy access in Africa: Towards energy transition. *Energy Policy*, 47, pp.3–10. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421512002455 [Accessed May 31, 2013].

Sovacool, B.K., D’Agostino, A.L. & Jain Bambawale, M., 2011. The socio-technical barriers to Solar Home Systems (SHS) in Papua New Guinea: “Choosing pigs, prostitutes, and poker chips over panels.” *Energy Policy*, 39(3), pp.1532–1542. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421510009274 [Accessed August 31, 2011].

Spaargaren, G., 2011. Theories of practices: Agency, technology, and culture. *Global Environmental Change*, 21(3), pp.813–822. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0959378011000379 [Accessed June 10, 2011].

Srinivas, M., 1957. Caste in modern India. *The Journal of Asian Studies*, 16(4), pp.529–548. Available at: http://www.jstor.org/stable/10.2307/2941637 [Accessed November 29, 2013].

Srinivas, M., 1955. Castes: Can They Exist in India of Tomorrow? *The Economic Weekly*, VII(42), pp.1230–1232. Available at: http://www.epw.in/system/files/pdf/1955_7/42/castes_can_they_exist_in_india_of_tomorrow.pdf [Accessed August 19, 2014].

Srivastava, L. & Rehman, I., 2006. Energy for sustainable development in India: Linkages and strategic direction. *Energy Policy*, 34(5), pp.643–654. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421505003186 [Accessed February 18, 2011].

Stoler, A., 2008. Imperial debris: reflections on ruins and ruination. *Cultural Anthropology*, 23(2), pp.191–219. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1548-1360.2008.00007.x/full [Accessed September 3, 2013].

Sultana, F., 2007. Participatory Ethics : Negotiating Fieldwork Dilemmas in International Research. *Acme*, 6(3), pp.374–385. Available at: http://www.acme-journal.org/vol6/FS.pdf.

Taylor, B. & de Loë, R.C., 2012. Conceptualizations of local knowledge in collaborative environmental governance. *Geoforum*, 43(6), pp.1207–1217. Available at: http://linkinghub.elsevier.com/retrieve/pii/S001671851200067X [Accessed December 2, 2014].

Thakur, S., 2006. *Subaltern Saheb: Bihar and the Making of Laloo Yadav*, Picador. Available at: http://books.google.com/books?id=o3RuAAAAMAAJ&pgis=1 [Accessed November 29, 2013].

Thompson, E.C., 2009. Mobile phones, communities and social networks among foreign workers in Singapore. *Global Networks*, 9(3), pp.359–380. Available at: http://doi.wiley.com/10.1111/j.1471-0374.2009.00258.x.

ToI, 2011. Rural electrification scheme flawed: CM - Times Of India. *Times of India*. Available at: http://articles.timesofindia.indiatimes.com/2011-03-08/patna/28668128_1_rural-electrification-transformers-energy-minister [Accessed January 10, 2012].

Tolia-Kelly, D.P., 2012. The geographies of cultural geography III: Material geographies, vibrant matters and risking surface geographies. *Progress in Human Geography*, 37(1), pp.153–160. Available at: http://phg.sagepub.com/cgi/doi/10.1177/0309132512439154 [Accessed May 8, 2014].

Tomei, J. & Gent, D., 2015. *Equity and the energy trilemma: Delivering sustainable energy access in low-income communities*, London: International Institute for Environment and Development. Available at: http://pubs.iied.org/16046IIED.html.

Tully, S.R., 2006. The Contribution of Human Rights to Universal Energy Access. *Northwestern Journal of International Human Rights*, 4(3), pp.518–548. Available at: http://heinonlinebackup.com/hol-cgi-bin/get_pdf.cgi?handle=hein.journals/jihr4&section=29.

Ulsrud, K. et al., 2011. The Solar Transitions research on solar mini-grids in India: Learning from local cases of innovative socio-technical systems. *Energy for Sustainable Development*, 15(3), pp.293–303. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082611000433 [Accessed September 16, 2011].

UN, 2012. *Sustainable Energy for All: A Global Action Agenda*, New York. Available at:

http://www.un.org/wcm/webdav/site/sustainableenergyforall/shared/Documents/SEFA-Action Agenda-Final.pdf.

UN, 2015. *Zero draft of the outcome document for the UN Summit to adopt the Post-2015 Development Agenda*, New York. Available at: https://sustainabledevelopment.un.org/content/documents/7261Post-2015 Summit - 2 June 2015.pdf.

UNDP, 2007. *Delivering Energy Services for Poverty Reduction : Success Stories from Asia and the Pacific*,

UNDP/WB, 2004. *The Impact of Energy on Women's Lives in Rural India January 2004*, Washington, D.C. Available at: https://openknowledge.worldbank.org/bitstream/handle/10986/20269/ESM2760PAPER0Impact0of0Energy.pdf?sequence=1.

Valentine, G., 1999. Doing Household Couples Research: Interviewing together and apart. *Area*, 31(1), pp.67–74.

Valunjkar, T., 1968. Social Consequences of Rural Electrification. *Economic and Political Weekly*, 3(10), pp.431–434. Available at: http://www.jstor.org/stable/10.2307/4358345 [Accessed January 6, 2012].

Varshney, A., 1998. *Democracy, Development, and the Countryside: Urban-Rural Struggles in India*, Cambridge, UK: Cambridge University Press. Available at: http://books.google.co.uk/books/about/Democracy_Development_and_the_Countrysid.html?id=bnNPJKw9CDsC&pgis=1 [Accessed November 20, 2013].

Venn, C., 2006. A Note on Assemblage. *Theory, Culture & Society*, 23(2-3), pp.107–108.

Verbeek, P. & Kockelkoren, P., 1998. The things that matter. *Design Issues*, 14(3), pp.28–42. Available at: http://www.jstor.org/stable/1511892 [Accessed May 21, 2014].

Verbong, G. et al., 2010. Strategic Niche Management in an unstable regime: Biomass gasification in India. *Environmental Science & Policy*, 13(4), pp.272–281. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1462901110000067 [Accessed March 15, 2012].

Verbong, G. & Geels, F., 2007. The ongoing energy transition: Lessons from a socio-technical, multi-level analysis of the Dutch electricity system (1960–2004). *Energy Policy*, 35(2), pp.1025–1037. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421506000899 [Accessed July 6, 2011].

Visvanathan, S., 1991. Mrs. Bruntland's disenchanted cosmos. *Alternatives: Global, Local, Political*, 16(3), pp.377–384. Available at: http://www.jstor.org/stable/10.2307/40644721 [Accessed December 3, 2013].

Van Vliet, B., Chappells, H. & Shove, E., 2005. *Infrastructures of consumption: Environmental innovation in the utility industries*, London/Sterling, VA: Earthscan/James & James. Available at: http://books.google.com/books?hl=en&lr=&id=DCcv7a2BGNYC&oi=fnd&pg=PP5&dq=Infrastructures+of+Consumption&ots=bapbUNZYVV&sig=293pcYtZpp-qeu56Sp1ci8f4fqc [Accessed January 2, 2012].

Walker, G., 2014. The dynamics of energy demand: Change, rhythm and synchronicity.

Energy Research and Social Science, 1, pp.49–55. Available at: http://dx.doi.org/10.1016/j.erss.2014.03.012.

Walker, G. & Bulkeley, H., 2006. Geographies of environmental justice. *Geoforum*, 37(5), pp.655–659. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0016718505001399 [Accessed November 25, 2013].

Walker, G. & Cass, N., 2007. Carbon reduction , " the public " and renewable energy : engaging with socio-technical configurations. *Area*, 39(4), pp.458–469. Available at: http://onlinelibrary.wiley.com/doi/10.1111/j.1475-4762.2007.00772.x/full [Accessed January 26, 2012].

WII, 2011. *Access to Clean Energy: A Glimpse of off Grid Projects in India*, New Delhi. Available at: http://www.undp.org/content/dam/india/docs/access_to_clean_energy.pdf.

Winkler, H. et al., 2011. Access and Affordability of Electricity in Developing Countries. *World Development*, 39(6), pp.1037–1050. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0305750X11000623 [Accessed November 30, 2011].

Winther, T., 2012. Electricity theft as a relational issue: A comparative look at Zanzibar, Tanzania, and the Sunderban Islands, India. *Energy for Sustainable Development*, 16(1), pp.111–119. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0973082611001049 [Accessed March 14, 2012].

Winther, T., 2008. *The Impact of Electricity: Development, Desires and Dilemmas*, New York/Oxford: Berghahn Books. Available at: http://books.google.com/books?id=MakEyKgj-bIC&pgis=1 [Accessed August 20, 2013].

Witsoe, J., 2012. Caste and democratization in postcolonial India: an ethnographic examination of lower caste politics in Bihar. *Democratization*, 19(2), pp.312–333. Available at: http://www.tandfonline.com/doi/abs/10.1080/13510347.2011.593327 [Accessed July 2, 2013].

Wong, S., 2010. Overcoming obstacles against effective solar lighting interventions in South Asia. *Energy Policy*, pp.1–11. Available at: http://linkinghub.elsevier.com/retrieve/pii/S0301421510007160 [Accessed September 16, 2011].

World Bank, 2010. *Addressing the Electricity Access Gap*, Washington, D.C. Available at: http://siteresources.worldbank.org/EXTESC/Resources/Addressing_the_Electricity_Access_Gap.pdf.

World Bank, 1973. *BIHAR AGRICULTURAL CREDIT PROJECT: APPRAISAL REPORT*, New York. Available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2000/12/13/000178830_98101912425889/Rendered/PDF/multi_page.pdf.

World Bank, 2007. *Bihar Agriculture : Building on Emerging Models of "Success,"* New York. Available at: http://documents.worldbank.org/curated/en/2007/01/7749716/india-bihar-agriculture-building-emerging-models-success.

World Bank, 2005. *Bihar: Towards a Development Strategy*, New York. Available at: http://web.worldbank.org/archive/website01291/WEB/0__CO-65.HTM.

World Bank, 2008. *The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits An IEG Impact Evaluation*,

Zainal, Z., 2007. Case study as a research method. *Jurnal Kemanusiaan*, 9, pp.1–6. Available at: http://eprints.utm.my/8221/ [Accessed April 15, 2012].

Zavisca, J., 2007. Ethics in Ethnographic Fieldwork. *Forum for Anthropology and Culture*, (4), pp.127–146. Available at: http://anthropologie.kunstkamera.ru/files/pdf/eng004/eng4_zavisca.pdf.

Appendices

Appendix 1 – Questioners

Village Household interviews

Biography

1. Name
2. How long has the family been living here?
3. Does the whole family live in the village?
4. How do you earn a living?

LaBL/HPS

1. When did the project start?
2. Who brought this project? Why (according to you)?
3. What kind of services does/did the project provide?
4. Is/was there a limitation on the number of lanterns/connections you can/could get?
5. What did you use the light for?
6. What are/were the rules of the system (*vyavastha*)?
7. What do/did you like about the system (*vyavastha*)?
8. What do/did you dislike?

a. What are/were the problems?

9. What other uses/services would you like/have liked?
10. What do you think are/were the problems with the project (*vyavastha*)? Why is/was it not working well?
11. Did the project change your daily life (*dainik jeewan)*?

Before

12. Did you get by before?
13. How did you get these services before?
14. What happened during personal special events/festivals? What did people do for light?

About Light

15. What are the kinds of lights that are used?
16. What was light used for before?
17. Relation between light and different services?

Grid

18. Do you have grid electricity?
19. What services do you get?
20. What effect does this has on your life?
21. What other fuels are used to fulfill electricity services?
22. How are they accessed?

Practices

23. Where do you sit in the evening?
24. When do you eat? Where do you eat?
25. When do you sleep? Where do you sleep?
26. When do children study? Where do they study?
27. What do you do for entertainment (*mann bahlaane ke liye*)?

Village Group Discussions

Biography

1. How many households?
2. Economic activities?
3. Caste distribution?
4. APL-BPL distribution?
5. Crops?

History of electrification

1. Officially the village is unelectrified?
2. When did electricity come?
3. How did electricity come?
4. When did electricity go?
5. How did you get by before electrification?
6. How do you get by now?

Socio technical

1. Why education? Village going away from farms to jobs? Is education related to development?
2. Do even the families using LaBL/HPS (also inverters, chargeable lights) keep kerosene oil? Why?
3. People blame stealing electricity and heaters for bad electricity situation. Couldn't the villagers get together and regulate this?
4. Why use LaBL/HPS if the village is electrified? Is it better than electricity?
5. Goods and Bads of LaBL/HPS?
6. Why are some people not using it?
7. Does it fulfill needs or is it a stopgap arrangement?
8. What will happen of the project if there is stable electricity supply?
9. Is electricity = light? Does it mean more?
10. Mobile phones? Charge from solar panel doesn't last as long as electricity?

Governance

1. Very few kerosene cards?

Practices

1. Walking in dark? Everyone always has a torch in hand? Are people adapted to lack of light?
2. Eating, sleeping time early/late-something to do with education/electricity/light?
3. Light on *dalaan*? Why not use at other places or save?
4. Do more people sit on *dalaans*with light? Is there a role for the quality of light?
5. Sharing practices?
6. Does light change practices? Are there other criteria?
7. *"Saanjh dena"*?
8. Men and women in same space. Light a hindrance?
9. Social mobility curtailed or increased?
10. What happens on special occasions? Festivals/weddings?
11. Different questions depending on the observations

Society

1. Different questions depending on the observations

Light

2. Different questions depending on the observations

For LaBL NGO

1. Biography
2. How did you come to be involved with the project?
3. What is the role of the NGO?
4. What kind of benefits does the NGO get?
5. What did the project change in the villages?
6. What problems have you faced?
7. Has anything unexpected happened?
8. If you do this again would you change anything?

Governance

1. On what basis are the villages selected?
2. The contribution from the entrepreneurs?
3. What is the actual cost of the system?
4. Who does the system belong to – entrepreneurs/villagers?
5. Why two systems installed in ______?
6. Most entrepreneurs/villages don't know the name of the donors. Would knowing the donor's names affect the project?
7. TERI doesn't listen to the people on the ground (anyone)?
8. Planning to shift half of the lanterns to the market.

Socio-technical

1. Is it possible to maintain the gap between business and society? '*udhar*' is a reality in the Indian villages.
2. Not all lanterns seem to be rented out. 60-70%
3. What is the training for entrepreneurs?
4. Lanterns have to be monitored through the day.
5. Mobile charging seems more important for people?

Maintenance

1. Maintenance services within warrantee and after seems to be a problem?
2. Battery should be changed after 1 year. This seems too short a time.
3. Battery is very expensive?
4. Schemes for regular maintenance visits never took off. Why?
5. At least 10% or more lanterns faulty all the time?
6. Some lanterns are missing LEDs. Mechanic while repairing removed them. Why?
7. Why high settings disconnected rather than repaired?
8. Different levels of light.

Rules

1. Is rental fixed?
2. What is the duration for which light can & should be used?
3. The lanterns perform less during longer night periods and more during shorter night periods?
    a. Can grid charging be used to supplement and flatten the performance all over?

<u>Other questions</u>

1. Why is TERI changing its model from lanterns to mini grids? Advantages-disadvantages?
2. Why making technology more complex and more expensive?
3. Why can't material be sanctioned based on the requirement of the installations?
4. Why material lying around in entrepreneur's house?

For HPS Manager

9. Biography
10. How did you come to be involved with the project?
11. What were the problems and conditions before the project?
12. What did the project change (in the villages)?
13. What electricity services are you providing? Why?
14. What is the service missing? Why?
15. Mobile more important than light?
16. Goods and bads of the project?
17. What problems have you faced?
18. Has anything unexpected happened?
19. If you do this again would you change anything?
20. What do you think about the publicity that the project gets? Is it relevant what other people think? Good? Bad?

Research findings

1. No public consultation before the start of the project?
2. Bad management/ governance
3. Electricity theft big problem?
4. Can't village associations/co-operatives be formed to rein theft?
5. Non-payment by customers?
6. Smart meters: Who pays for them? How does the cost get internalized?
7. Can the electricity be metered or fixed monthly charge better? (Several people seemed to avoid HPS due to variable load)
8. Instable plant performance?
9. Grid supply adversely affects the project?
10. Grid electrification had already started in the village when project started?
    a. Was it not perceived earlier that grid would adversely affect the project?
    b. Is HPS not an alternative to the grid?
11. Do markets (shops) make better consumers than villagers? Why?
12. Is franchise (local stake in project's success) system better?
    a. Do franchises have to be economically, socially (dominant castes) strong?
13. The success of HPS seems to be limited to the Chamaparan area especially West Chamaparan?
14. Price of husk rising rapidly? Alternatives?
15. Why is the plant equipment not being relocated from the villages in which operations have seized a while ago (more than a year)?

Appendix 2 – Consent

Consent Form for Interviews

Please consider this information carefully before deciding whether to participate in this research.

Purpose of the research: To understand the role of micro-generation (renewable energy) in providing electricity access in rural India.

What you will do in this research: If you decide to volunteer, you will be asked to participate in one interview. You will be asked several questions. With your permission, I will tape record the interviews so I that I can focus on our conversation. You will not be asked to state your name on the recording.

Time required: The interview will take approximately 1 hour.

Risks: Some of the questions may cause discomfort or embarrassment.

Benefits: This is a chance for you to tell your story about your experiences concerning renewable energy and its role in providing electricity access in your village.

Confidentiality: Your responses to the interview questions will be kept confidential. At no time will your actual identity be revealed. You will be assigned a pseudonym. Anyone who helps me transcribe responses will only know you by the pseudonym. To keep you anonymous, the recording will be destroyed as soon as it has been transcribed. The transcript, without your original name, will be kept for a period of 7 years (2 years for completion of the PhD thesis and 5 years for the publication of papers, books etc.).
The code linking your name with your pseudonym will be kept in a locked file cabinet in a locked office, and no one else will have access to it. It will be destroyed soon after the completion of the PhD thesis. The data you give me will be used for my PhD thesis and may be used as the basis for articles, papers, books or presentations in the future. I won't use your name or information that would identify you in any publications or presentations.

Participation and withdrawal: Your participation is completely voluntary, and you may withdraw from the study at any time without penalty. You may withdraw by informing me that you no longer wish to participate (no questions will be asked). You may also skip any question during the interview, but continue to participate in the rest of the study.

To Contact the Researcher: If you have questions or concerns about this research, please contact: Ankit Kumar Phone: +44 7730154413, Department of Geography, Durham University, South Road, Durham, DH1 3LE. Email: ankit.kumar@durham.ac.uk.

Agreement:

The nature and purpose of this research have been sufficiently explained and I agree to participate in this study. I understand that I am free to withdraw at any time without incurring any penalty.

Signature: _______________________________________ Date: ___________________

Name (print): ____

Hindi – साक्षात्कारकेलिएसहमतिफॉर्म

यहजानकारीध्यानसेपढ़ेंऔरइसशोधमेंभागलेनेकेलिएविचारकरें.

अनुसंधानकाउद्देश्य: ग्रामीणभारतमेंबिजलीकेउपयोगऔरअक्षयऊर्जाकीभूमिकाकोसमझना.

आपइसशोधमेंक्याकरेंगे: यदिआपशोधमेंभागलेनेकेलिएतयकरतेहैंतोआपकोएकसाक्षात्कारमेंभागलेनेकेलिएकहाजाएगा. आपसे कईसवालपूछेजाएँगे. आपकीअनुमतिकेसाथ, मैंसाक्षात्कारको टेपमें रिकॉर्डकरूँगाताकि मैंहमारीबातचीतपरध्यानकेंद्रितकरसकूँ. रिकॉर्डिंगमेंआपसेआपकानाम नहींपुछाजाएगा.

समयकीआवश्यकता: साक्षात्कारमेंलगभग 1-1.5 घंटालगेगा.

जोखिम: सवालोंके कारण कुछअसुविधायाशर्मिंदगीहोसकतीहै.

लाभ: यहएकमौकाहैआपकेलिए, अपनेगांवमेंबिजलीकेउपयोगऔरअक्षयऊर्जाकीभूमिकाकेविषयमें अपनेअनुभवोंकेबारेमेंबतानेका.

गोपनीयता: साक्षात्कारकेसवालोंकेआपकेजवाबोंकोगोपनीयरखाजाएगा. किसीभीसमयअपनीवास्तविकपहचानकापतानहींचलेगा. आपएकझूठा/दूसरानामआवंटितकियाजाएगा.
कोईअगरमुझेइसरेकॉर्डिंगतोटाइपकरनेमेंमददकरताहैतोवोआपकोसिर्फआपकेझूठे/दूसरेनामसेजानेगा.
आपकानामगुप्तरखनेकेलिएरेकॉर्डिंगकोलिखितरूपमेंपरिवर्तितकरतेहीनष्टकरदियाजाएगा. इसकी प्रतिलिपि, अपनेमूलनामकेबिना, 7 साल (पीएचडीथीसिसपूराकरनेकेलिए२वर्षऔरपुस्तकोंइत्यादि केप्रकाशनकेलिए५वर्ष) कीअवधिकेलिएरखाजाएगा.
आपकेझूठे/नकलीनामकेसाथअपनाअसली नामजोड़नेकेकोडकोएकबंदकार्यालयमेंफाइलकैबिनेटमेंरखाजाएगा, जिसकाउपयोगकोईऔरनहींकरसकेगा. यहपीएचडीथीसिसकेपूराहोनेकेबादजल्दहीनष्टकरदियाजाएगा.
आपकेद्वारादीगईजानकारीमेरीपीएचडीथीसिसकेलिएइस्तेमालकियाजाएगाऔरभविष्यमेंलेख, किताबें, याप्रस्तुतियोंकेलिएआधारकेरूपमेंइस्तेमालकियाजासकताहै.
इनचीज़ोंमेंआपकेनामयाकिसीऐसीजानकारीकाइस्तेमालनहींकरूँगाजिससेआपकीपहचानहोसके.

भागीदारीऔरवापसी: आपकीभागीदारीपूरीतरहस्वैच्छिकहै, औरआपदंडकेबिनाशोधसेकिसीभीसमयअपनीभागीदारीकोवापसलेसकतेहैं. आपकिसीभीसमयमुझेजानकारीदेकरशोधसेअपनानामवापसलेसकतेहैं, आपसेकोईकारणनहींपुछाजाएगा.
आपसाक्षात्कारकेदौरानकिसीभीप्रश्नकोछोड़सकतेहैं, लेकिनबाकीप्रश्नोंकेजवाबदेसकतेहैं.

शोधकर्ताकासंपर्क: यदिइसशोधकेबारेआपकाकोईप्रश्न होतोकृपयासंपर्ककरें: अंकितकुमारदूरभाष: +44 7730154413 (भारत: 08809742066), भूगोलविभाग, डरहमविश्वविद्यालय, दक्षिणरोड, डरहम, DH1 3LE. ईमेल: ankit.kumar @ durham.ac.uk.

समझौता:

मुझेइस शोधकी प्रकृतिऔरइसकाउद्देश्यपर्याप्तरूपमेंसमझायागयाहैऔरमैंइसअध्ययनमेंभागलेनेकेलिएसहमतहै.
मैंसमझताहूँकिमैंकिसीभीजुर्मानेकीवसूलीकेबिनाकिसीभीसमयअपनीभागीदारी वापसलेनेकेलिएस्वतंत्रहूँ.

हस्ताक्षर: ____________________________________ तिथि: __________________

नाम: ____

Village Notice – गाँवमेंहोनेवालेशोधकेविषयमेंसूचना

यहगाँवकेसभीलोगोंकोसूचितकरनेकेलिएहैकिइंग्लैंडकेप्रतिष्ठितएवंप्रसिद्दविश्वविद्यालय, डरहमयूनिवर्सिटीकेशोधकर्ता, अंकितबिहारकेगाँवोंमेंविद्युतीकरण, बिजली, बिजलीकिव्यवस्थाऔरअक्षयउर्जा (जैसेकिसोलरलालटेन, सोलरपलते, धानकिभूसीसेबिजलीबनानाइत्यादि) केउपयोगपरशोधकररहेहैं. इसशोधकेअंतर्गतवेबिहारकेकुछगाँवोंमेंएक-डेढ़महीनेतकलोगोंसेमिलेंगे, उनसेउक्तविषयोंपरचर्चाकरेंगेऔरग्रामीणोंकेपक्षएवंजीवनकोसमझनेकाप्रयासकरेंगे. शोधकालक्ष्यहैबिजलीकिउपस्थितिऔरअनुपस्थितिमेंलोगोंकेजीवनएवंदिनचर्याकोसमझनाऔरबिजलीकेविकल्पों (जैसेकिअक्षयउर्जाकेस्रोत) केउपयोगकोसमझना. इसक्रममेंअंकितगाँवकेघरोंएवंपरिवारोंकिदिनचर्याकोदेखनाचाहेंगेऔरउनसेबात-चीतकरनाचाहेंगे. इसकेअलावाग्रामीणोंसेआमचर्चाएवंविचारविमर्शकरनाचाहेंगे. अंकितशोधकेअंतर्गतकुछग्रामीणोंकासाक्षात्कारभीकरेंगे. शोधमेंहरतबके, जाति, धर्मकिमहिलाओंएवंपुरुषोंकिभागीदारीवांछितहै. ग्रामीणोंसेअनुरोधहैकिवेकृपयाशोधमेंसहियोगदें.

धन्यवाद्

अंकित

डरहमयूनिवर्सिटी