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SELCO FOUNDATION

DEPLOYMENT OF DECENTRALISED RENEWABLE ENERGY SOLUTIONS

An Ecosystem Approach

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Project Team

SELCO Foundation
Project lead: Swathi Murali, Surabhi Rajagopal
Project team: Thomas Pullenkav, Juhi Chatterjee, Felix Varghese, Sarah Alexander, Huda Jaffer, Harish Hande

WWF-India
Jincy Joy, T. S. Panwar, Sejal Worah

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DEPLOYMENT OF DECENTRALISED RENEWABLE ENERGY SOLUTIONS

An Ecosystem Approach

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ABBREVIATIONS

ANDE	Aspen Network for Development Entrepreneurs
BDO	Block Development Officer
CDR	Crude Death Rate
CLEAN	Clean Energy Access Network
CSR	Corporate Social Responsibility
cumecs	cubic meter per second
DRE	Decentralised Renewable Energy
FGDs	Focused Group Discussions
GDP	Gross Domestic Product
HH	Households
ICS	Improved Cook Stove
IEA	International Energy Agency
IMR	Infant Mortality Rate
ITI	Industrial Training Institute
KBK	Kalahandi Balangir Koraput Region
KCC	Kissan Credit Card
km	Kilometre
km2	square kilometre
kW	Kilo Watt
kWh	Kilo Watt Hours
LPG	Liquefied Petroleum Gas
MFI	Micro Finance Institutions
Mg/ltr	Miligram per liter
MSME	Micro, Small and Medium Enterprises
MU	Million Units
MW	Mega Watt
NABARD	National Bank for Agriculture and Rural Development
NGO	Non Governmental Organisation
NRLM	National Rural Livelihood Mission
NTFP	Non-Timber Forest Produce
OREDA	Odisha Renewable Energy Development Agency
p.m.	Per Month
PDS	Public Distribution System
RBI	Reserve Bank of India
RE	Renewable Energy
RRB	Regional Rural Banks
RSETI	Rural Self Employment Training Institute
RVEP	Remote Village Electrification Program
SC	Scheduled Caste
SE4All	Sustainable Energy For All
SHG	Self Help Group
SHS	Solar Home Systems
SME	Small and Medium Enterprise
SRLM	State Rural Livelihood Mission
ST	Scheduled Tribe
UPNEDA	Uttar Pradesh New and Renewable Energy Development Agency

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EXECUTIVE SUMMARY

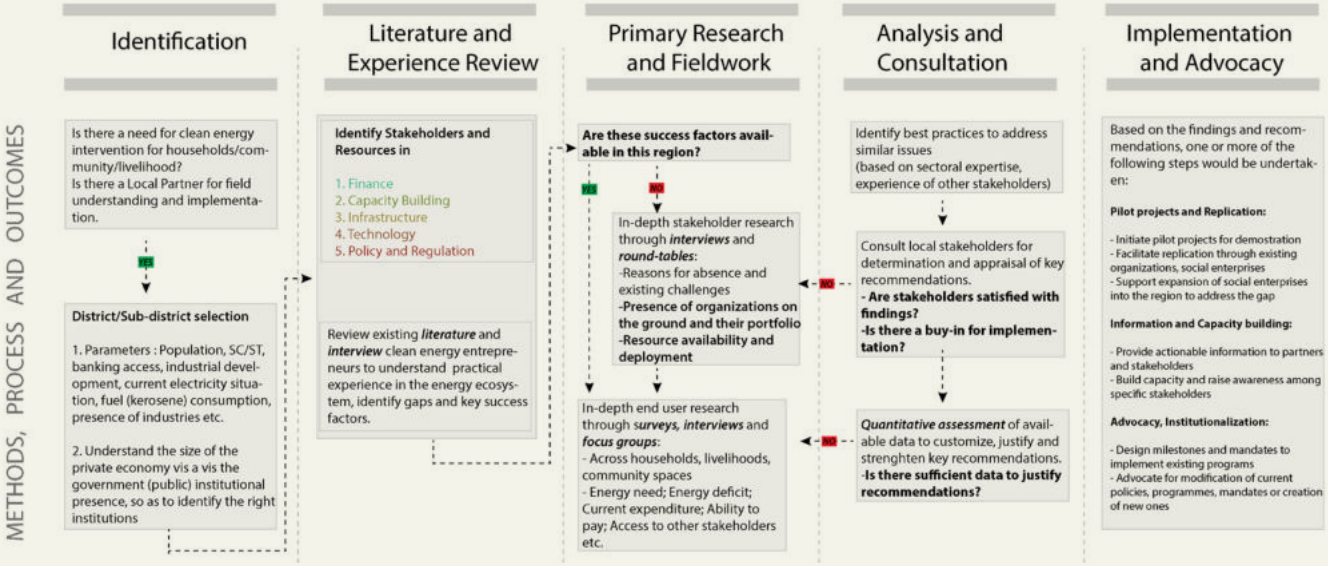
More than 80 million households across India — nearly 50 per cent of the country's population- have little or no access to grid-based electricity and rely on kerosene as their primary source for lighting (IFC, 2015). Nearly double that number continue to use firewood and biomass for cooking. Expenditure on fuel and light by the urban and rural poor is the third highest expenditure after food and health, to the extent that poorer households spend up to 20 per cent of their income on energy. These figures clearly highlight the developmental challenges that warrant significant improvements in India's energy access scenario. While developmental concerns are the core focus, it is worth taking cognisance of the environmental repercussions as well – the Indian energy sector already contributes to more than 70 per cent of the country's share of Green House Gas (GHG) emissions (WRI, 2012). Any attempt to address the energy access needs of the 300 million people without electricity, through centralised grid-based power production, with its transmission and distribution issues will only exacerbate the situation. With a number of social enterprises focusing their efforts on last mile delivery of energy solutions, there is an opportunity for this under-served population of the country to leapfrog the grid and adopt reliable, decentralised and clean energy solutions. In order to support the deployment of such solutions, however, the existence of a conducive and supportive ecosystem is imperative. Towards this effort, WWF-India and SELCO Foundation have partnered to develop an approach for analysing the energy access ecosystem to consequently plan interventions that bridge energy access gaps and promote large-scale replication of renewable energy (RE) applications/solutions.

Ecosystem Framework for Energy Access: The Methodology

This study combines literature reviews and the experiences of energy enterprises and other organisations presently engaged in successfully addressing developmental challenges, to develop a framework that provides an understanding of the challenges and opportunities, across relevant factors, in specific regions. The framework has been applied to two districts each in Uttar Pradesh and Odisha, to validate its applicability. The final framework document incorporates inputs from field research and other stakeholders to provide a structure and a process that can detail the energy scenario and the readiness for energy access solution deployment.

The process pertaining to framework document begins with identification of the need for clean energy interventions for households and subsequently proceeds to review existing literature, along with the experiences of energy enterprises/ organisation, essentially to capture the factors contributing to the success or failures of energy entrepreneurs and other organisations in delivering basic amenities. Based on the results of this review, primary research and fieldwork were undertaken on five basic factors, which are followed by analysis of the findings and consultation on possible solutions. The recommendations are arrived at during the Analysis and Consultation phase. In the Implementation and Advocacy phase, action on the recommendations are taken. The details of this process are articulated in the Figure ES.1.

Figure ES.1: Process Adopted in the Ecosystem based Approach



The framework consists of five key factors, viz., Finance, Capacity Building and Awareness, Infrastructure, Technology, and Policy and Regulation. It focuses on an analysis of the stakeholders relevant to each factor and the resources available to and deployed by them in the region. The energy solution deployment is considered at three units, viz., household, livelihoods and community. The framework is built on the premise that energy enterprises/organisations exist in the region and implement solutions. The framework is particularly useful for planning, design and implementation of context specific solutions, rather than mere evaluation of investment friendliness or the existence of supportive government policies. The drawback, however, is that it is time and resource intensive and is (currently) only able to describe the scenario in qualitative terms.

Energy Ecosystem in the Focus Regions

Field research was undertaken in the districts of Pilibhit and Lakhimpur Kheri in Uttar Pradesh and Koraput and Kalahandi in Odisha. In each of the districts, 50 per cent of the blocks were selected for the study based on multiple criteria including population, presence of tribal population, banking services, industrial development and forest cover. Within each of the chosen districts, villages were selected based on population (sex and scheduled caste and tribe classification), source of lighting for households (kerosene or electricity), work occupation of the population (cultivator, agriculture labourer or household worker) and access to banking among the households. A combination of focused group discussions with members of the community, local businesses at the village level, and interviews with key representatives from the local institutions at the block level were used to arrive at a better understanding of the current scenario.

The field survey indicates that energy access is a definite concern in both these regions, given the long hours of load shedding (roughly more than 10 hours in each of the regions) even for households having access to grid-based electricity and the high dependence on firewood for cooking. Table ES.1 below lists down the main concerns related to energy access under each factor in the districts of Uttar Pradesh and Odisha.

Table ES.1: Highlights of Key Concerns in the Ecosystem Factors

Factor	Uttar Pradesh	Odisha
Finance	Banker's fear of potential loan defaults restricts their lending to clean energy solutions.	Limited finance for MSMEs and little or no prior experience in financing DRE systems.
Capacity building	Despite high levels of awareness among end users about RE solutions, low levels of maintenance and repair for products in the market.	Low levels of end user, banker awareness about harms of firewood and utility of DRE, combined with low levels of maintenance and servicing of Government deployed systems
Infrastructure	High incidents of human-animal conflict in forest fringe areas.	Poor availability of power even in electrified regions Poor connectivity
Technology	Low quality products in the market with no warranties (particularly for solar) Defunct biogas plants in many homes	Absence of energy appliances for basic health care Defunct solar home systems provided free by government Dependence on firewood based cooking
Policy and Regulation	Tendering process affecting post-sales services Conflicting subsidy options for solar water pumps	Existence of Value Added Tax on all RE devices Limited role of energy related concerns in the current tribal development plans of the government

Conclusion: The Intervention Roadmap

Based on an understanding of the gaps in the ecosystem, an intervention roadmap, specific to each of the focus regions as well as for the sector as a whole, have been articulated. To strengthen financing, soft funding could be utilised to support collateral and guarantees against decentralised renewable energy (DRE) lending. This can be combined with improved collection and recovery mechanisms to support bankers in case of defaults and inclusion of energy in the micro credit planning of SHGs. Alternate funding models need to be developed for income-poor regions to address replacement/repair costs of RE products and appliances. Toolkits could facilitate an improved understanding among bankers about financial viability and could also act as a ready reference document on the technical aspects of various solutions.

In addition to creating a pool of technicians and electricians capable of maintaining RE systems, it is critical to invest in capacity building of bankers, NGOs and end users regarding the longevity and warranty of alternate RE products and models. There is also the possibility of capitalising on the existing ecosystem and market of diesel entrepreneurs, so as to convert them into clean energy entrepreneurs at the local level.

In terms of technology, there is some agreement that improvements in affordability and distribution around LPG could be a longer-term solution to clean cooking for households. In the interim period, the high dependence on firewood needs to be addressed through rigorous field testing of various improved cook-stove (ICS) product designs. The feedback of communities must be taken into account while developing region specific clean cooking strategies that combine use of ICS, biogas and improved LPG connections. Energy efficient technologies and applications, powered by DRE have been piloted to support local livelihoods and can be deployed to enhance the value add of small enterprises, particularly in unreliably electrified areas. In order for these to be effective, product testing and standardisation centres are critical with benchmarks on longevity and quality.

As a part of the infrastructure needs of forest fringe areas, DRE solutions for fencing, lighting, cooking can be explored by integrating these aspects into the existing activities/projects of the Forest Department. Integrated energy centres can be established to provide a host of energy services in under-electrified regions, while also serving as a community centre for education, health and livelihoods activities.

For many of these to be realised, a strong policy and regulatory structure is essential – one that facilitates tax exemptions for RE products and services; provides targets for bank financing; and supports institutionalisation of DRE lending, as well as restructures the tendering process to focus on quality of services and products, rather than the "lowest bid" model. Convergence of subsidies and incentives across schemes, combined with the introduction of energy as a metric of impact within the existing tribal, forest and rural development programmes, can go a long way in building the ideal structure for energy access.

1. INTRODUCTION

Background to the Study

It has been recognised that India's energy sector has had a major share in the country's GHG emission profile and is predominantly fossil fuel dependent. This, combined with India's increasing energy demand and the exploration of energy poverty reduction strategies, made WWF-India explore different paths for providing power to the un-served and underserved. The path adopted was one that focussed on decentralised renewable energy generation and the mechanism that provides energy access while operating in greater harmony with the environment.

However, for effective adoption of decentralised, clean and off-grid energy options, it is imperative to develop new business models to deliver energy services to the underserved and to understand the ecosystem within which these models will operate. In order to gain a deeper understanding of the ecosystem, WWF-India partnered with the SELCO Foundation to develop a framework for analysing the energy access ecosystem that would support and sustain the delivery of clean energy. This will benefit interventions, which promote large-scale replication of renewable energy applications through an innovative road map/business plan, and by viewing the problem from an ecosystem lens.

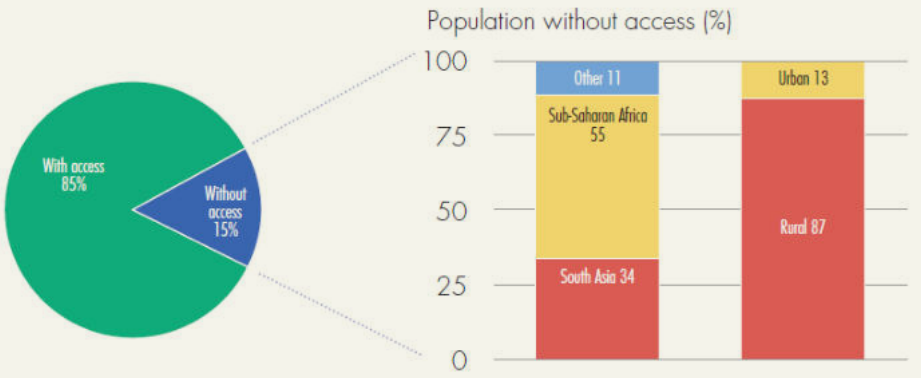
The Status of Energy Access

"ENDING POVERTY AND ENSURING SUSTAINABILITY ARE THE DEFINING CHALLENGES OF OUR TIME. ENERGY IS CENTRAL TO BOTH."
– JIM YONG KIM, PRESIDENT, WORLD BANK GROUP (SE4ALL 2015)

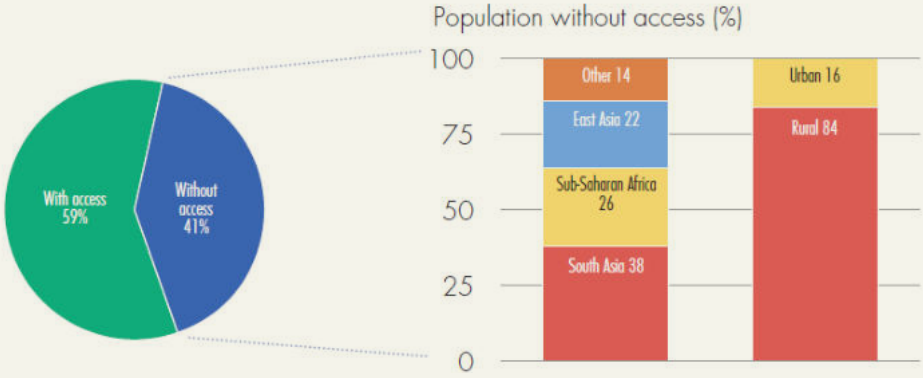
Despite the clear understanding that the goal of poverty eradication is directly linked to achieving universal energy access, there are immense challenges of ensuring access to clean, reliable and affordable sources of energy by the un-served and the underserved. Such access to energy is a critical enabler of development since it leads to lesser drudgery, better livelihood, improved productivity, better healthcare and educational facilities, etc. – all critical factors that lead to improved quality of life. Nearly one-third of humanity is still negatively affected by the lack of access to modern energy services. Approximately 1.1 billion people do not have access to electricity (SE4ALL 2015). More than twice as many, 2.9 billion people, rely on the traditional use of biomass and other solid fuels like wood and coal for cooking. Over 34 per cent of the population in South Asia and nearly 55 per cent of the people in sub-Saharan Africa lack access to electricity. About 41 per cent of the world population live without clean cooking facilities, of which 86 per cent are geographically concentrated in Sub-Saharan Africa and various parts of Asia (World Bank n.d.).

Figure 1.1: Electrification Access Deficit and Non-solid Fuel Access Deficit

Electrification Access Deficit



Non-solid Fuel Access Deficit



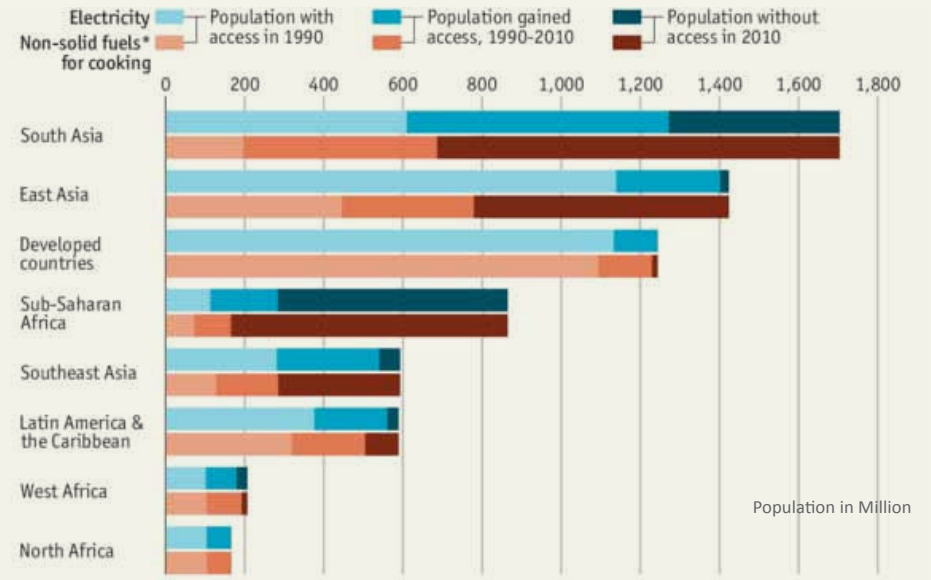
Source: SE4ALL 2015

Apart from the gap in the access to electricity and non-solid fuels among the developed and developing nations, there also exists high disparity in access within urban and rural regions in the developing nations itself. While over 87 per cent of the rural habitants are not facilitated with access to electricity only 13 per cent of the urban populace does not have access (SE4ALL 2015). Lack of access to electricity retards the development of small livelihoods, industries, employment, access to health, education and other basic amenities and negatively impacts economic development and standard of living. This in turn impacts the ability of the population to access energy, perpetuating the vicious cycle. Similar to electricity access, availability of non-solid fuels (including kerosene, ethanol, LPG, natural gas etc.) which enable clean cooking is also skewed within geographical pockets with 84per cent of the rural population not benefitting from its access, while only 16 per cent of the urban people lack access.

Figure 1.2 below shows the incremental electrification and non-solid fuel access in select regions between the last two decades, 1990 and 2010.Over this period there

has been an increase in the percentage of population with access to electricity and clean fuels but this growth has not managed to address the needs of all. This has been especially true in the regions of South Asia and Sub-Saharan Africa where the population with access has more than doubled in 2010 from the 1990 levels, but despite this a large section lacks electricity and non-solid fuel access (SE4ALL 2015).

Figure 1.2: Incremental Energy Access in Selected Regions between 1990 and 2010

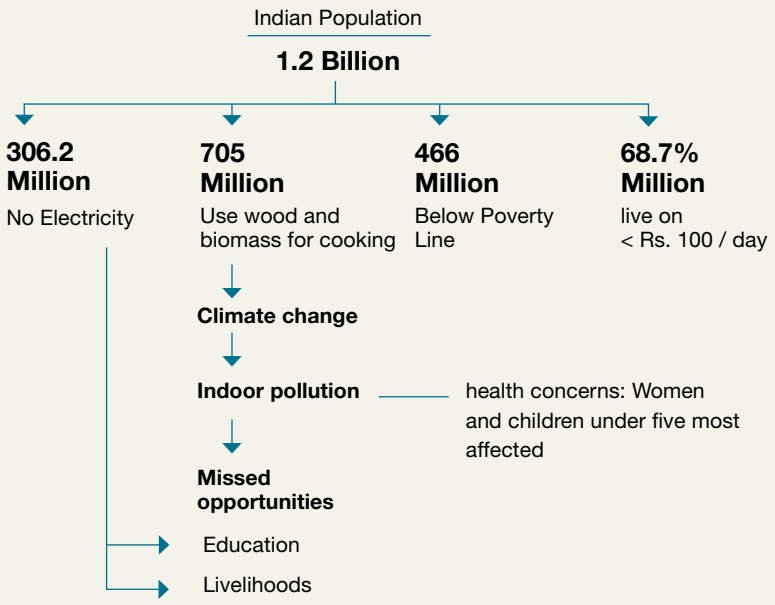


Source: SE4ALL 2013; Economist 2013

The situation in India too is pretty dismal. As per the 2011 census, 43 per cent of the rural households (approximately 75 million households) used a source other than electricity as their main source for lighting and approximately 85 per cent of the rural households (estimated to be 142 million households) in the country continue to use solid fuels as their primary source of cooking fuel (Census of India 2011).

According to the Central Electricity Authority, 17,906 villages in India remain unelectrified as on 31 May 2015 (CEA 2015b). This is matter of concern since expenditure on fuel and light by the urban and rural poor is their third highest expenditure after food and health, to the extent that poorer households spend up to 20 per cent of their incomes on energy (NSSO 2011; Cabraal, Barnes and Agarwal 2005; Hammond et al. 2007). The Government of India has formulated various programmes focused on rural electrification, e.g., the centrally driven Rajiv Gandhi Gramin Vidyutikaran Yojana (RGGVY) scheme (and its Decentralised Distributed Generation (DDG) component) of the Ministry of Power; the Remote Village Electrification Programme (RVEP) scheme of the Ministry of New and Renewable Energy (MNRE) for villages not covered under the RGGVY scheme. These programmes have fallen short of achieving their targets of electrifying all villages by 2012.

Figure 1.3: India Energy Access



Source: Worldometers n.d.; Agarwal 2015; Lavelle 2013

As per the rural electrification policy, a village is electrified if at least 10 per cent of its households have been electrified by the central grid or through the DDG programme (MoP n.d.). Also, the minimum power that must be provided is 6 to 8 hours per day. Both are not very compelling benchmarks in the context of providing quality electricity access to all. Field experiences have shown that most rural areas with access to grid-tied electricity face issues related to reliability, availability and quality of power supplied. Electricity distribution companies (DISCOMs) perceive rural households as non-revenue earners, due to issues of lower consumption, theft and the DISCOMs' own inability to install meters and collect electricity charges effectively. Hence, they provide power to rural areas on a rationed basis, so as to provide maximum power to urban households and the industries. This reveals that there is a gap in rural energy supply which could be addressed through decentralised, renewable sources of energy. This will facilitate improvements in basic quality of life as well as productivity at the household and village level (Cabraal, Barnes and Agarwal 2005). These alternative solutions will allow local energy generation and use, overcome demand for central grid-based electricity, lessen reliance on costly traditional fuels, and remove transmission losses and so on.

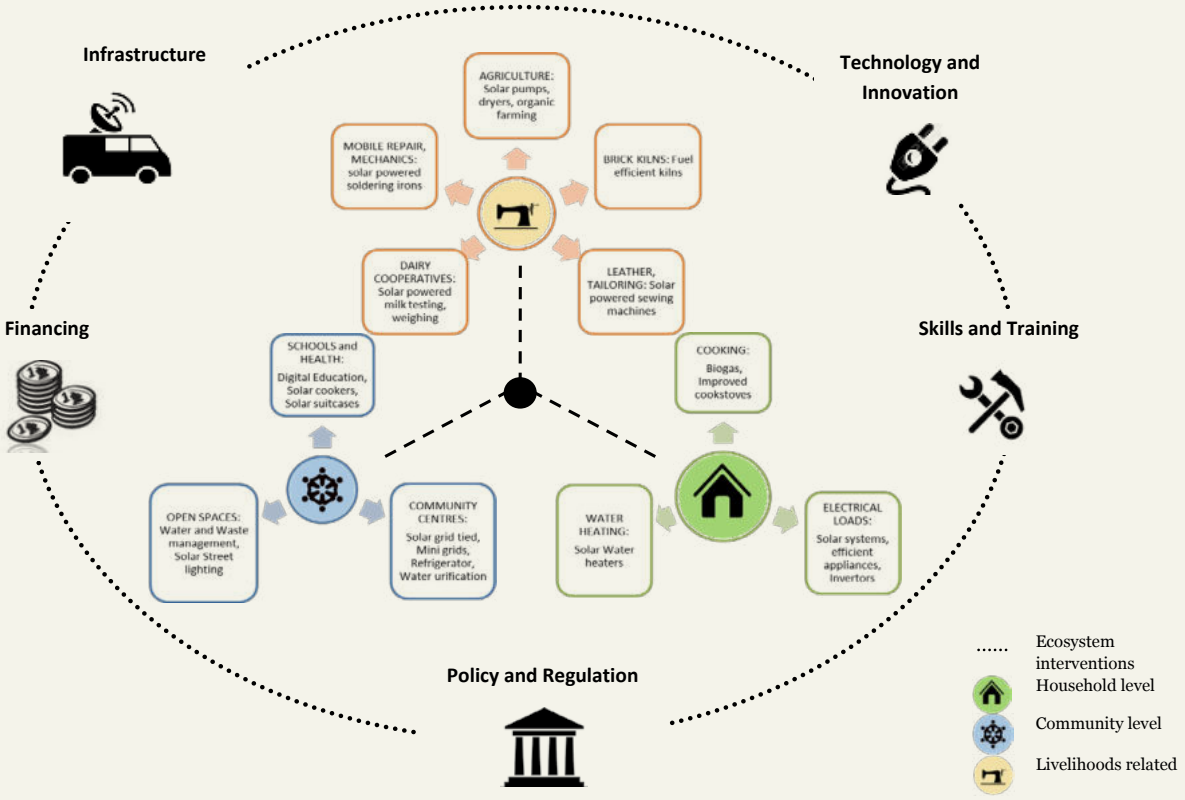
To bring modern energy services to all those who currently lack access, especially those in the rural areas, by the year 2030, as envisaged by The World Bank and IEA (SE4All 2015), policymakers and thought leaders in the energy access sector need to accept that conventional, grid-based energy cannot be the only solution to bridge the energy gap, and more decentralised, off-grid options need to be explored. However, the adoption of decentralised, off-grid options for energy calls for the development of new business models to deliver energy services to the underserved, along with an understanding of the ecosystem in which these new models will operate.

The Ecosystem Approach to Energy Access

All organisations and institutions, irrespective of whether they are government organisations, private enterprises, community-based organisations or NGOs, work within an environment that enables and/or constrains their work and ability to deliver. If an organisation or institution has to deliver to the peak of its ability, then the environment or the ecosystem that it works in has to be conducive to the goal of the organisation. The organisation has to work in tandem with other stakeholders in this ecosystem to succeed.

All organisations have to choose or innovate from a range of delivery models, across technologies and scales of operation. Organisations choose particular models depending on the ecosystem in which they operate, such as geography, population segmentation, socio-economic conditions, financial systems, infrastructure, etc. Figure 1.4 below depicts a schematic representation of the ecosystem factors in an Indian context.

Figure 1.4: Schematic Representation of Various Ecosystem Factors



By enabling these critical components, any delivery model should be able to sustain and flourish. Thus, for organisations working towards providing energy access to the poor, it becomes crucial to move beyond the technology paradigm to incorporate a holistic approach that looks at other factors in the ecosystem, such as combining customised technology with affordable financing, a sustainable dissemination and maintenance mechanism, a conducive policy framework, etc.

The Ecosystem Approach: The SELCO Model

SELCO Solar Light Private Limited (SELCO) is a social enterprise established in 1995 that makes energy services accessible to economically impoverished people. Right from the early days of its operations, SELCO realised that if the poor and the underserved have to access energy services, it would not suffice if the focus is exclusively on technology. The approach would require an energy solution that combines customised technology, affordable financing and efficient support. In order to achieve the objective, SELCO partnered with local financial institutions to provide requisite financing to the economically poor, while establishing a company-owned, company-operated service network to provide the pre-sales and post-sales support to the client. Realising the value that other stakeholders in the ecosystem had in helping the enterprise achieve its goals, SELCO invested significantly in developing awareness among the financial institutions about sustainable energy technologies and in skill development to ensure that the company had a pool of trained personnel for technical support and services.

The appreciation of the requirement of a conducive ecosystem for increasing energy access and the learnings from SELCO's experience in the field led to the genesis of the SELCO Foundation. The main objective of the Foundation is to foster development of a holistic thought process in the social sector that encompasses the entire energy ecosystem, viz., technology, finance, entrepreneurship and policy.

2. THE ECOSYSTEM FRAMEWORK FOR ENERGY ACCESS

Objectives of the Study

This study is based on the following objectives:

- To develop a broad ecosystem based approach for providing clean energy access and promoting productive uses of energy solutions that enhance livelihood opportunities using renewable energy solutions.
- To formulate an inclusive renewable energy implementation model that takes into account the complete ecosystem, i.e., technology, finance (capital and end user), capacity building, institutional framework, policies and livelihood aspects of renewable energy application(s).
- To identify two study regions and analyse the applicability of the ecosystem approach to arrive at current scenario, learnings and recommendations about energy solution deployment in the region.

Methodology of the Study

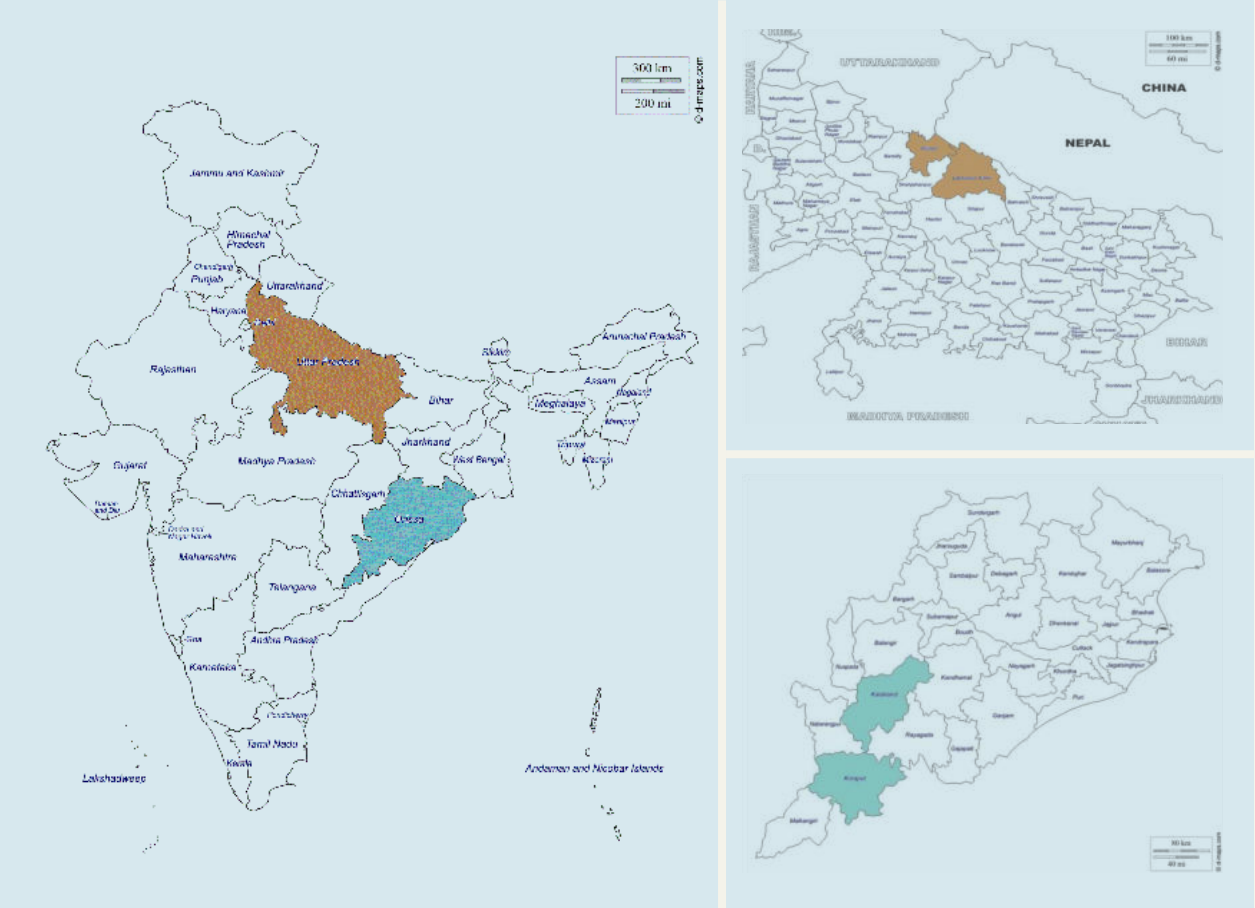
This study uses a combination of literature review of various ecosystem approaches and interviews with energy access entrepreneurs and organisations working in other socio-economic spheres, to create an ecosystem framework that will be useful to analyse the scenario for energy access provision (challenges and opportunities) in different regions. This ecosystem framework has then been applied in two states in India – Uttar Pradesh and Odisha – in an attempt to validate its utility and comprehensiveness.

The interviews were critical in understanding the operational models of social enterprises and organisations. Interviews were conducted with over fifteen energy service enterprises that dealt with solar home energy systems, micro grids, solar water pumping and so on. Similarly, the models of over five organisations were studies through interviews that worked in areas of low income housing, water and sanitation. The questions in the interview were open ended, which helped in understanding the current ecosystem under which these enterprises and organisations operate, and also provided an overview of the challenges they face. Annexure 1 contains the list of the enterprises and organizations interviewed or studied. These interviews complement the literature available on ecosystem development, particularly ecosystems for energy access and entrepreneurship.

In applying the framework to the two regions, two districts each were chosen in each state, based on the relevance and need for energy solutions and the presence of a

strong support structure to take any learning forward. For Uttar Pradesh, Lakhimpur Kheri and Pilibhit districts were chosen and in-depth field research undertaken on the five key ecosystem factors across household, livelihood and community levels. In Odisha, Koraput and Kalahandi districts were chosen for the study. Given below is a map that provides the locations of the districts in the two states.

Figure 2.1: Map of the Focus Regions



Note: From left to right (clockwise): States of UP and Odisha; Pilibhit and Lakhimpur Kheri along the Nepal border in UP (in brown); Kalahandi and Koraput in southern Odisha (in blue)

The field research combined focused group discussions (FGDs) with representative groups of the communities and local businesses, and interviews and discussions with key representatives of local institutions. These institutions include such as office of the Block Development Officers (BDOs) at the block level, State Rural Livelihood Missions (SRLMs) and other integrated development programmes, bank branches of Regional Rural Banks (RRBs) and Nationalised Banks, regional offices of National Bank for Agriculture and Rural Development (NABARD), NGOs, electricity utilities, district forest offices, district hospital, local post office, private/Grameen Bank, block education department, village anganwadi (or a subset of these, depending on the availability of the representative). The field research was followed by stakeholder consultations – one for each region – that brought together a set of 10-15 individuals

to provide feedback on the findings and the ecosystem framework. The entire exercise was undertaken over a period of six months.

The final framework builds on the work done so far by other entities, capitalises on learnings from the field and incorporates inputs from regional stakeholder consultations, to provide a structure that can detail the scenario and assess the readiness for energy access solution deployment in a particular region.

Ecosystem Approach: Review of Existing Literature and Experiences

The ecosystem in energy access is the base that ensure long-term sustainability of installed solutions. The 'ecosystem approach' has been adapted from the term 'business ecosystem' of management theory, while its origins lie in the natural ecosystem analogy (Practical Action 2013). While the ecological ecosystem approach emphasises the integration of environmental, economic and social sustainability of land, water and natural resources (Smith and Maltby 2003), the business ecosystem approach highlights the structures involved in sustaining and building businesses – governance, flow of money and skills (Practical Action 2013). This concept of 'business ecosystem' has been extended in recent times to better understand aspects of social entrepreneurship and specifically of energy access entrepreneurship (ANDE 2013; Practical Action 2012).

Today social enterprises, using largely market-based approaches, work to provide critical socio-economic services that are absent. Development of a healthy ecosystem, with strong business and policy related incentive structures, is essential for these enterprises to expand services to the under-served communities in a manner that can have perceivable impact (Tongia 2015; Practical Action 2013). ANDE through its analysis of entrepreneurial ecosystems identifies three sets of essential elements (ANDE 2013), viz.,

1. Entrepreneurship determinants in terms of broad themes or actors, include business support, human capital, policy, finance, culture, R&D and so on, and the associated institutions.
2. Entrepreneurial performance in terms of activities undertaken by the enterprises include employment and number of formal businesses
3. Impact or the value created by entrepreneurship in macroeconomic terms, such as GDP, income distribution and so on.

The energy access ecosystem, in particular, caters to the needs of under-served communities that are typically the economically weaker sections of rural and urban populace. The definition given below facilitates a better understanding of the energy access sector where social enterprises are typically providing decentralised renewable, sustainable energy solutions.

"[The Energy Access sector] offers a range of business models, across technologies and scales of operation, be they sales, leasing or rental models of individual home energy systems, portable products, community-based products or mini-grids with productive anchor base loads. There is a variety in the way organisations deliver services and the technologies depending on conditions related to the geography, socio-economic conditions, and supportive infrastructure in a particular region. This sector includes technology solutions that are electricity (such as solar, micro-hydro, biomass, wind) and non-electricity based (thermal technology – biogas, solar thermal) including those that use sustainable energy sources such as improved biomass cooking solutions."

(Tongia 2015: 56)

While discussing energy access, the approach considers the Total Energy Access concept, referred to by Practical Action, which takes note of the needs for energy services across household, productive activities and community requirements. The definition of a healthy energy access ecosystem as proposed by Practical Action focuses on three key aspects, viz., financing, policy and capacity (Practical Action 2012). Some indicators under each of these are:

1. Financing annual investments in energy access infrastructure; availability of microfinance for end users and entrepreneurs; and availability of government, donor and carbon funding for the sector on a per capita basis, etc.
2. Policy priority for energy access in national budget per capita; existence of a rural energy agency; availability of national standards on technical aspects and so on.
3. Capacity: number of firms; NGOs working on energy access; courses offered in educational institutions relating to energy access; awareness programmes, etc.

This analysis is undertaken at the macro level, primarily using national level data of agencies such as the International Energy Agency (IEA), World Bank and central ministries of energy, education, etc. This information is supplemented with statistics about the availability of energy. The weighted analysis of the three aspects, results in scores on a country-level to indicate the health of the ecosystem.

While these frameworks are able to capture factors and actors that are critical to the energy access ecosystem (that works in entrepreneurial mode), they largely rely on higher level indicators – all of which are measureable, but most are also restricted to the national level.

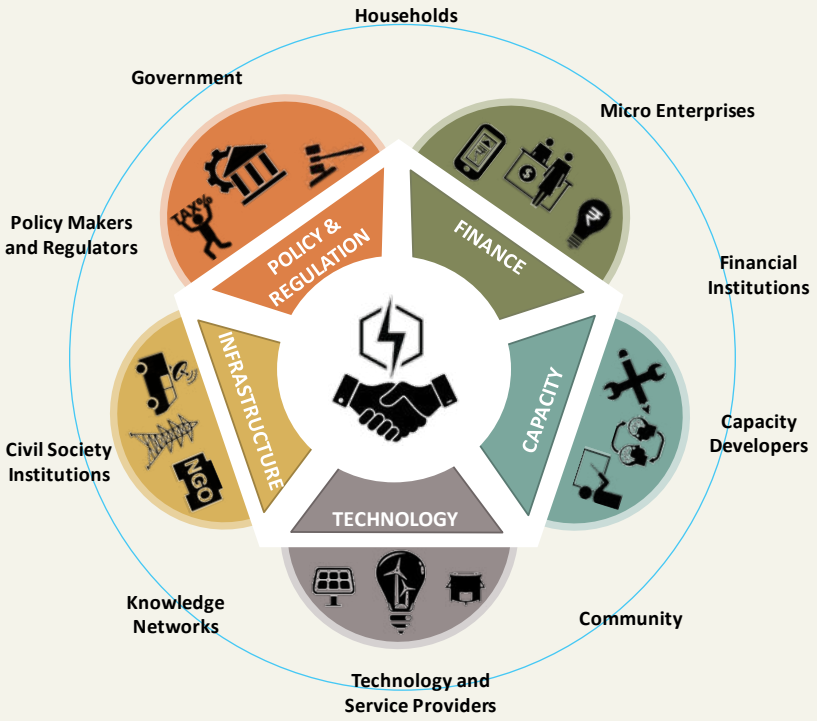
However, prior to planning, designing and implementing solutions, context specific customisations are essential. This revised framework becomes vital where diversity is higher and the next steps are closely linked to planning and implementation, rather than evaluating investment-friendliness or supportive governments.

Ecosystem Framework for Deployment of Energy Access Solutions

This study attempts to create a framework that address the needs of planning and designing context-specific solutions, while at the same time builds on the work of other entities – using relevant stakeholders and suggested indicators. As mentioned earlier, the framework builds on discussions with energy entrepreneurs, and incorporates inputs from field research and regional stakeholder consultations.

The framework, here, is a consolidation of questions and responses pertaining to the current status of a set of factors, the key stakeholders functioning within each factor and the resources available to them or deployed by them. This consolidated information provides a strong foundation to identify gaps, seek opportunities and determine possible next steps in the provision of energy solutions. The framework uses quantitative and qualitative information to draw conclusions on the scenario for deployment of energy access solutions, with a bias towards social enterprise models. Based on the interviews and literature review, a set of five ecosystem factors were selected that seemed to be most relevant to the local deployment of energy access solutions. These factors include finance, capacity building, infrastructure, technology and policy. This list is by no means an exhaustive one, but merely helps identify the most critical aspects in the readiness of a region for energy access solutions.

Figure 2.2: Representation of Ecosystem Factors and Relevant Stakeholders



Under each factor, a set of indicators have been presented that are most critical for ground level implementation, and thus would collectively provide a good understanding of the energy access scenario. The indicators used in assessing each of the ecosystem factors fall broadly under the following categories

- **Stakeholders:** This captures the key actors in each factor and comments on their presence and accessibility. For stakeholders whose physical presence in the geographical region is not mandatory (e.g., investors, funders), the analysis is restricted to the stakeholder's potential interest in engaging with the region, albeit remotely.
- **Resource availability and deployment:** Under this category, the emphasis is on the resources available to stakeholders as well as the possibilities and ease of deployment/ application of resources created by them in the region.
- **Assumption of the Framework:** The approach and the resulting framework is built on the premise that energy enterprises or some equivalent exist, even if they are not currently in the same region and may not have an extremely high level of reach or revenue. It also assumes that these enterprises/organisations interested in energy access provision will benefit from any incremental improvements in the ecosystem factors.

Given below is a brief overview of each of the factors and their relevance in the ecosystem framework for energy access. These are also summarised in a schematic representation, which is then used to map out the ecosystem of the focus regions.

Finance

This factor broadly covers access to end user and enterprise financing in the form of affordable debt, grants or equity. Through this factor, there is an attempt to gauge the presence and maturity level of financial structures to provide credit to end users and the suppliers of these energy services. The presence of entities such as self help groups (SHGs) and cooperative societies reflect the ability to borrow at a micro level and in turn explore accessible channels for end user financing or collection mechanisms. They are also connected to financial institutions upwards – reflecting that there is ability to get cash for further lending. In the case of banks and micro credit agencies, their physical presence in the region, current portfolio and capacity to disburse funds are important indicators of whether lending for energy access would be undertaken. However, in the case of bilateral agencies, investors and government sources of funding, physical presence in the same region as the energy solution provider is not a precursor for funding. Here, it may simply be the willingness of enterprise financing agencies to invest for a longer term, conducive for development with context to a particular region and take on the financial risk involved.

Capacity Building

This factor includes awareness, technical training, financier capacity building as well as operational support essential for organisations to disseminate information about energy solutions. Critical factors include government and private vocational or self employment training institutions, Post-training support centres, such as incubation centres working in the area, as well as NGOs involved in generating awareness about the need and usage of renewable energy across household, livelihood and community levels.

Infrastructure

This broadly refers to all forms of socio-economic infrastructure and includes entities that can provide soft support, such as business associations and civil society organisations (CSOs). While energy itself is essential for the improvement of schools, hospitals and similar infrastructure, the deployment of clean energy solutions can also be aided by the existence of communication networks, roads and soft support entities.

Technology

Here, technology is viewed independent of other forms of infrastructure in an attempt to bring more focus on specific challenges that can directly affect energy solution dissemination. The presence of reliable local suppliers or the existence of a strong supply network with quality products – RE technologies and spare parts as well as appliances and loads that run off RE – are needed. These, complemented with strong technical skills, can ensure operations and functioning of the products themselves. Given that the sector is in its nascent stages, standards for product performance provide confidence to end users and financiers, while also setting benchmarks for the quality of solutions being provided.

Policy and Regulation

This brings together current regulations that support deployment of RE in the region and also explores convergence between various developmental agencies of the government. It includes apex and decision making bodies across finance, capacity building and technology, in addition to those working solely on regulations. It attempts to capture any current or potential projects, guidelines, schemes etc., that aid the uptake of decentralised RE to address energy access.

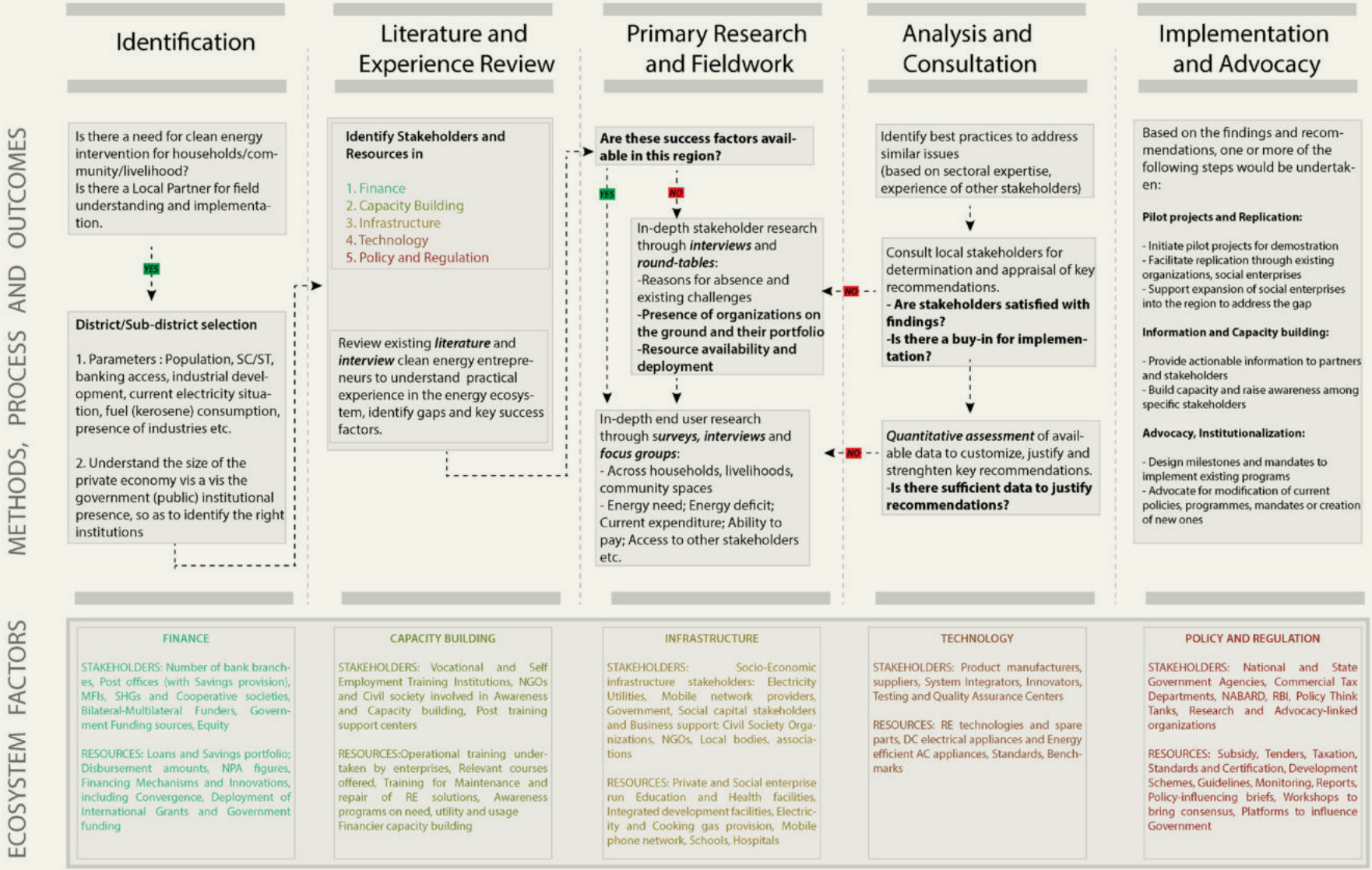
The schematic below indicates the inter-linkages between each of these ecosystem factors, the indicators and the three different levels of energy solution deployment – household, livelihood and the community.

Table 2.1: Framework for Energy Access Ecosystem with Indicators under Each Factor

	Households	Livelihoods	Community
FINANCE	Number of bank branches, Post offices (with Savings provision), MFIs	SHGs and cooperative societies	
	Loans and Savings portfolio; Disbursement amounts, NPA figures		
	Financing Mechanisms and Innovations, including Convergence		
		Bilateral/multilateral funders, government funding sources, equity Investors	
		Deployment of international grants and government funding in the region	
		Deployment of investment and R&D capital for enterprises in the region	
CAPACITY BUILDING	NGOs and civil society involved in awareness and capacity building		
	Awareness programmes on need, utility and usage		
		Vocational and self employment training institutions	
	Relevant courses offered, training for maintenance and repair of RE solutions		
		Post-training support centres	
			Financier capacity building
		Operational training undertaken by enterprises	
INFRASTRUCTURE	Socio-economic infrastructure, stakeholders, electricity utilities, mobile network providers, and government		
	Electricity and cooking gas provision, mobile network, schools, hospitals		
	Social capital stakeholders and business support, civil society organisations, NGOs, local bodies, associations		
	Private and social enterprise that run educational and health care facilities, integrated development facilities		
TECHNOLOGY	Product manufacturers, suppliers, system integrators, innovators		
	DC electrical appliances and energy-efficient AC appliances		
	RE technologies and spare parts		
		Testing and quality assurance centres	
		Standards, benchmarks	
POLICY	National and state government agencies, commercial tax departments, NABARD, RBI, MPs, MLAs		
	Subsidy, tenders, taxation, standards and certification, development schemes, guidelines, monitoring		
	Policy think tanks, research and advocacy-linked organisations		
	Reports, policy-influencing briefs, workshops to bring consensus, platforms to influence government		

Note: Stakeholders are represented by the boxes that are filled with colour, while resources are in boxes with outlines alone.

Table 2.2: Overview of the Process involved in Arriving at the Framework



Advantages and Limitations of the Framework

The advantages of the framework include the following:

- **Recognises diversity to enable planning and implementation:** Prior to planning, designing and implementing solutions, context specific customisations are essential. This includes recognising the diversity of the needs of communities and the condition of structures within a particular country, especially at a state/district/sub-district level.
- **Micro-level analysis to determine conduciveness:** Identifying the key actors on the ground, understanding their functioning and gauging their resource availability are fundamental to determining if the ecosystem in a certain region are conducive for deployment of energy access solutions. By undertaking this exercise at the ground level, any gaps present at a micro-level can also be identified and addressed. In this process, there is a greater potential to integrate and capitalise on region specific initiatives, so the impact may be larger than individual initiatives operating independently.

Thus, this revised framework becomes essential where diversity is higher and the next steps are closely linked to planning and implementation, rather than evaluating investment-friendliness or supportive governments. However, this approach does come with its set of limitations.

- **Time, resource and effort intensive:** It does require in-depth analysis of the institutions and structures that exist at the ground and is more relevant closer to the area of implementation.
- **Qualitative evaluation of indicators:** This approach results in a qualitative evaluation of indicators and is currently not convertible into a quantitative (more objective) comparison.

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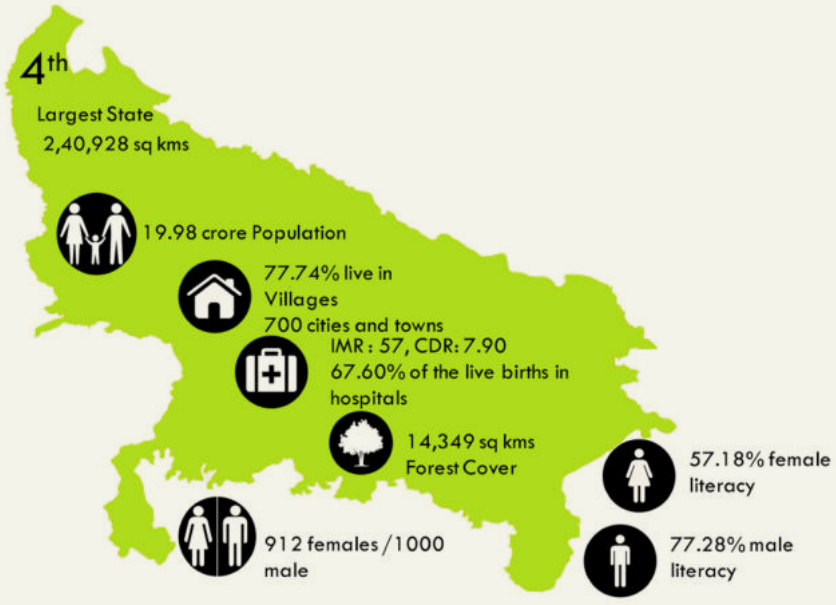
3. THE FOCUS REGIONS

Field research was undertaken in the districts of Pilibhit and Lakhimpur Kheri in Uttar Pradesh and Koraput and Kalahandi in Odisha. In each of the districts, 50 per cent of the blocks were selected for the study, based on multiple-criteria, and the factors considered were population size and diversity; presence of tribal population; banking services; industrial development; forest cover etc. Effort was made to ensure that each of the selected districts represented a unique attribute of the district. Within each of the chosen districts, villages were selected based on population (number of households, scheduled caste and tribe classification); source of lighting for households (kerosene, electricity); work status of the population (cultivators, agriculture labourers, household workers) and access to banks of the households.

Overview of Uttar Pradesh and the Focus Districts

DEMOGRAPHIC PROFILE OF THE STATE

Figure 3.1: Demographic Profile of Uttar Pradesh

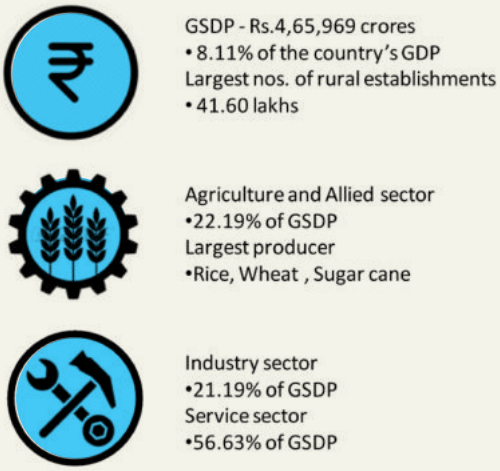


Note: *Crude Death Rate (CDR) = the total number of deaths per year per 1,000 people
Infant Mortality Rate (IMR) = number of deaths of infants below one year old per 1,000 live births

Source: Govt. of UP n.d.; Forest Survey of India. 2013; Census of India. 2011e; Planning Commission 2014b

Note: Installed Capacity refers to the Grid Interactive Renewable Power as on 30.03.2014

Figure 3.2: Economic Profile of Uttar Pradesh



Source: CSO 2014; Directorate of Economics and Statistics 2015; MoSPI, 2014

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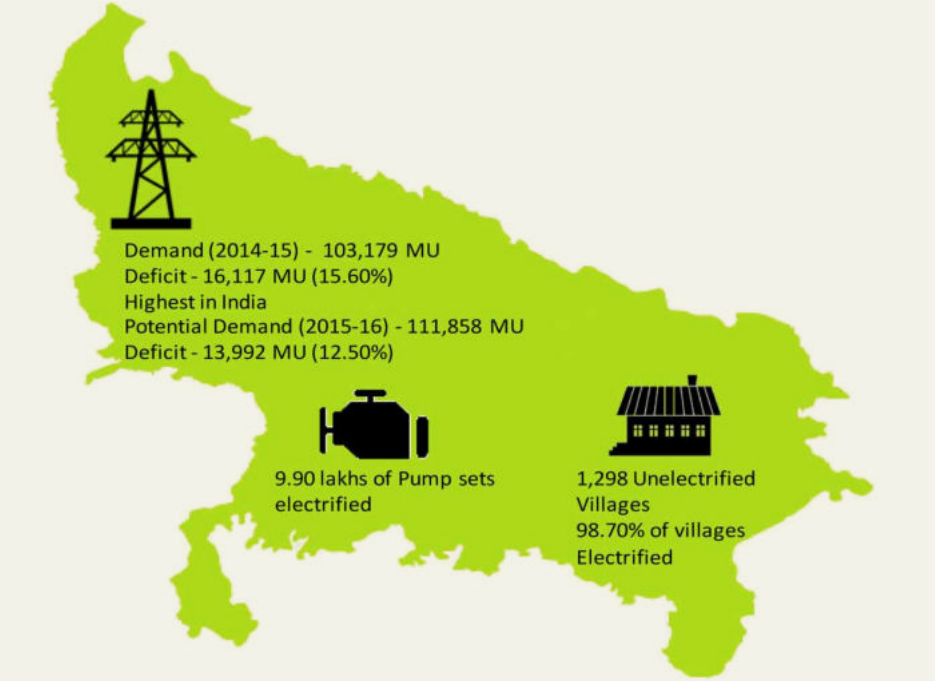
ENERGY PROFILE OF THE STATE

Figure 3.3: Energy Profile of Uttar Pradesh



Source: Central Electrification Authority, 2015; CEA 2015b

Table 3.1: Renewable Energy Potential (2014) and Achievement (2015) of Uttar Pradesh

Source	Potential	Installed Capacity	Achievement	Value
Biomass Power	1,617 MW	776.50 MW	Biogas Plant (Nos. in Lakh)	4.40
			Biomass Gasifier (kW)	23,702.00
			Biomass (non-bagasse) (MW)	150.90
Solar		21.08 MW	Solar Pump (Nos.)	575.00
			Solar Street Lighting (Nos. in Lakh)	1.20
			Solar Home System (Nos. in Lakh)	2.40
			Solar Lantern (Nos. in Lakh)	0.60
			Solar Power Plant kWp	3,491.50
			Solar Cooker (MW)	12.38
Waste to Energy	176 MW	-	(MW)	-
Small Hydro	461 MW	25.10	-	-
Remote Village Electrification Villages			Villages (Nos.)	113.00

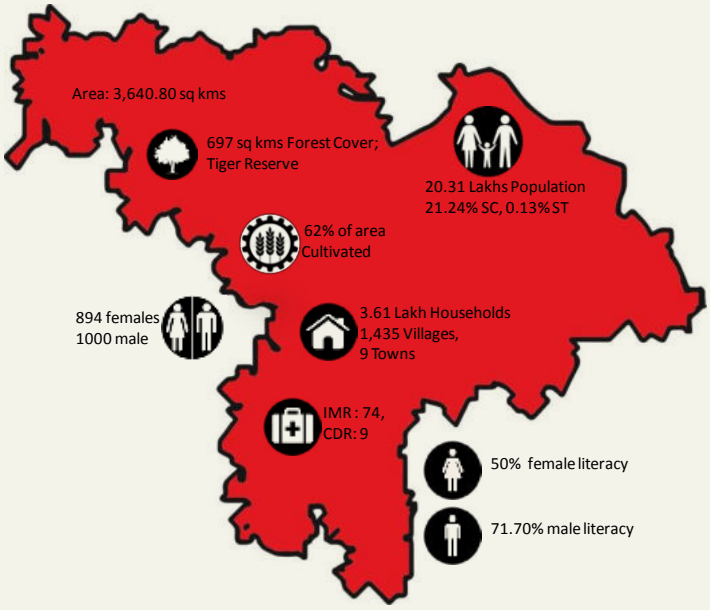
Source: CSO 2015

Note: Installed Capacity refers to the Grid Interactive Renewable Power as on 30.03.2014

Pilibhit

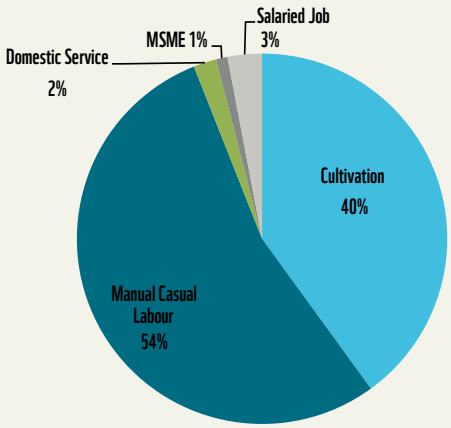
- Pilibhit is the north-eastern most district of Rohilkhand division which is situated in the sub Himalayan belt on the Nepal border.
- The district is divided into seven blocks – Amaria, Lalauri Khera, Marauri, Barkhera, Bilsanda, Bisalpur and Puranpur.
- In 2014, the Government of Uttar Pradesh notified Pilibhit Forest Division as a tiger reserve. The reserve supports a large tiger population (Chanchani 2015).

Figure 3.4: Demographic Profile of Pilibhit



Source: Census of India 2011d; Department of Planning 2015; Directorate of Economics and Statistics 2014; SECC 2011; Office of the Health Commissioner, 2012

Figure 3.5: Sources of Household Income in Pilibhit



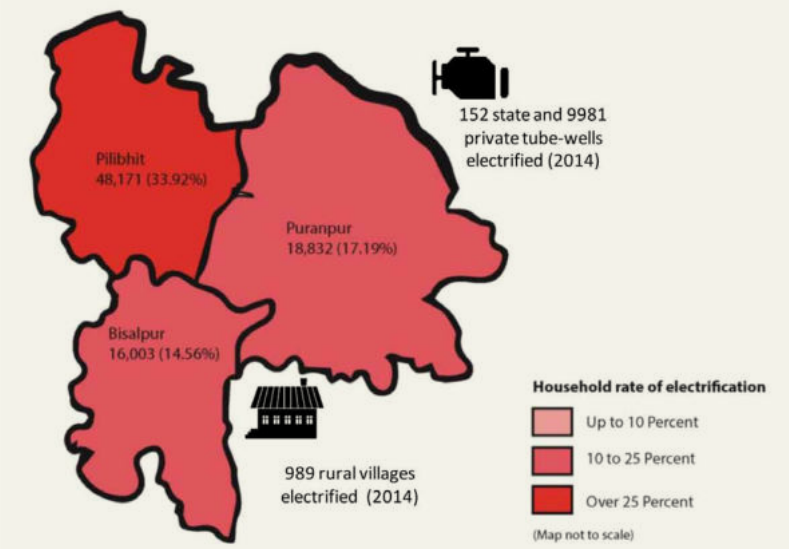
Source: SECC 2015

Main Source of Household Income: More than 41 per cent of the farmers have small holdings of less than half an acre, while 25.76 per cent have holdings which are close to one acre (Directorate of Economics and Statistics 2014).

As on 2011, there were 6,711 industrial units predominantly small ones such as rice mills, brick kilns, fabrication units, electrical repair units, handicrafts, and textile units. Medium or large units are very few and are mostly sugar processing units (MSME 2012a). Over 79.85 per cent of the households earn less than Rs. 5,000 per month (SECC 2015).

ENERGY PROFILE OF PILIBHIT

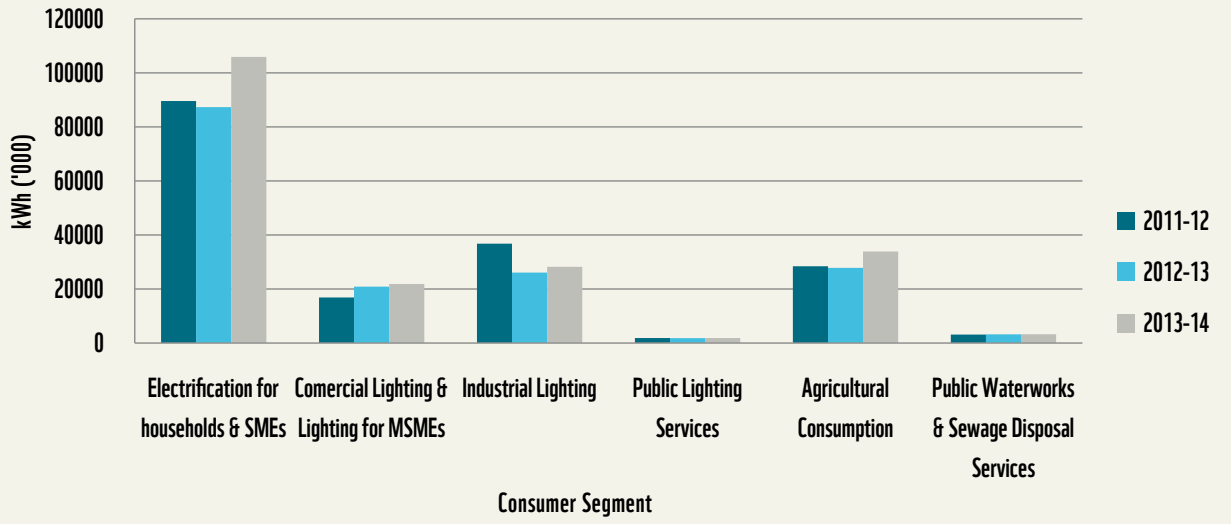
Figure 3.6: Electrification at Sub-District Level in Pilibhit



Source: UPPCL 2014; Directorate of Economics and Statistics 2014; Census of India 2011d

- Though a high number of villages are electrified, not all households are connected to the grid.
- The grid connectivity was provided to over one lakh consumers in the district during the period 2013-14. These consumers were connected to a load of 162 MW (UPPCL 2014). According to the district statistics manual, the dominant use of electricity in the region is for household electrification, followed by industrial lighting and agriculture. The electricity consumption profile of the district is presented in Figure 3.7.

Figure 3.7: Electricity Consumption Profile of Pilibhit



Source: Directorate of Economics and Statistics 2014

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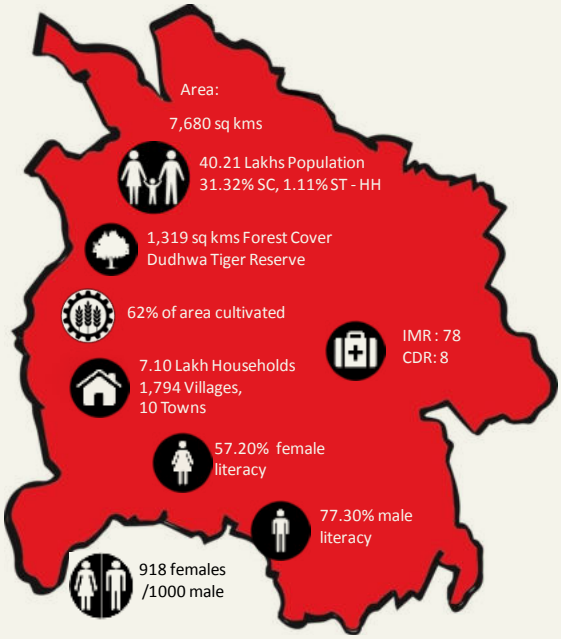
Lakhmipur Kheri

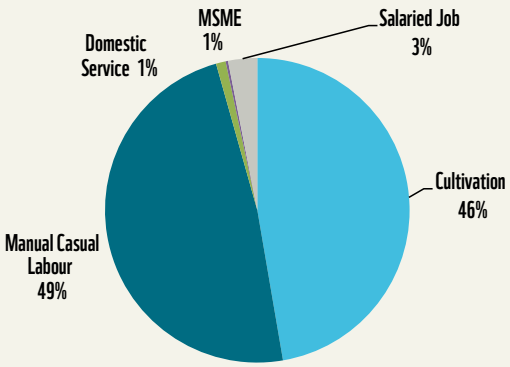
- Lakhmipur Kheri is the largest district in Uttar Pradesh on the border with Nepal. The district is located within the Terai lowlands at the base of the Himalayas.
- The district is divided in to 15 blocks, i.e., Behjam, Bankeyganj, Bijua, Dhaurehra, Isanagar, Kumbhigola, Lakhimpur, Mitauli, Mohammadi, Nakaha, Nighasan, Palia, Pasgawan, Phoolbehar and Ramia Behar. The Dhudhwa Tiger Reserve located in the district is home to several species of animals and birds.

Figure 3.8: Demographic Profile of Lakhimpur Kheri



Source: Department of Planning 2015; SECC 2011 and 2015; Census of India 2011b; Office of the Registrar General & Census Commissioner 2012

Figure 3.9: Sources of Household Income in Lakhimpur Kheri



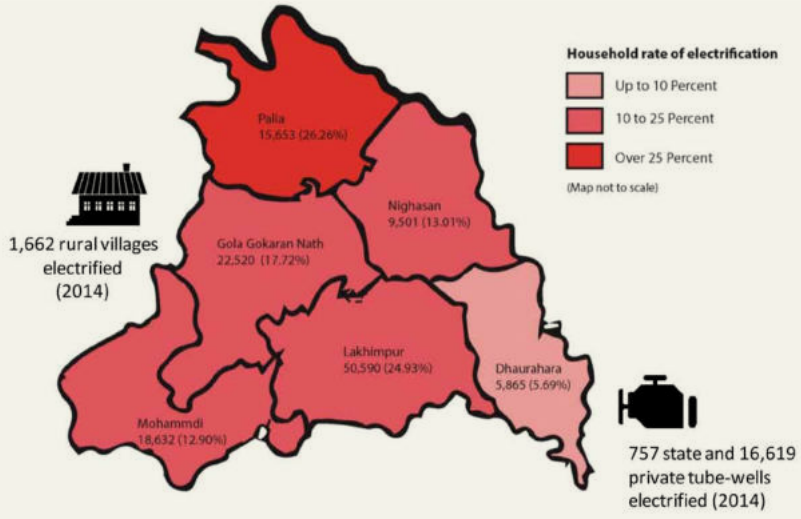
Source: SECC 2015

MAIN SOURCE OF HOUSEHOLD INCOME

- Almost 48 per cent of the farmers have small holdings of less than half an acre, while 25 per cent have holdings which are close to one acre (Economics and Statistics Division 2014).
- As on 2011, there were 2,500 industrial units that are predominantly small with only 15 medium or small units which are mostly sugar processing units or distilleries. (MSME 2012b)
- Over 82 per cent of the households earn less than Rs. 5,000 per month (SECC 2011 and 2015).

ENERGY PROFILE OF LAKHIMPUR KHERI

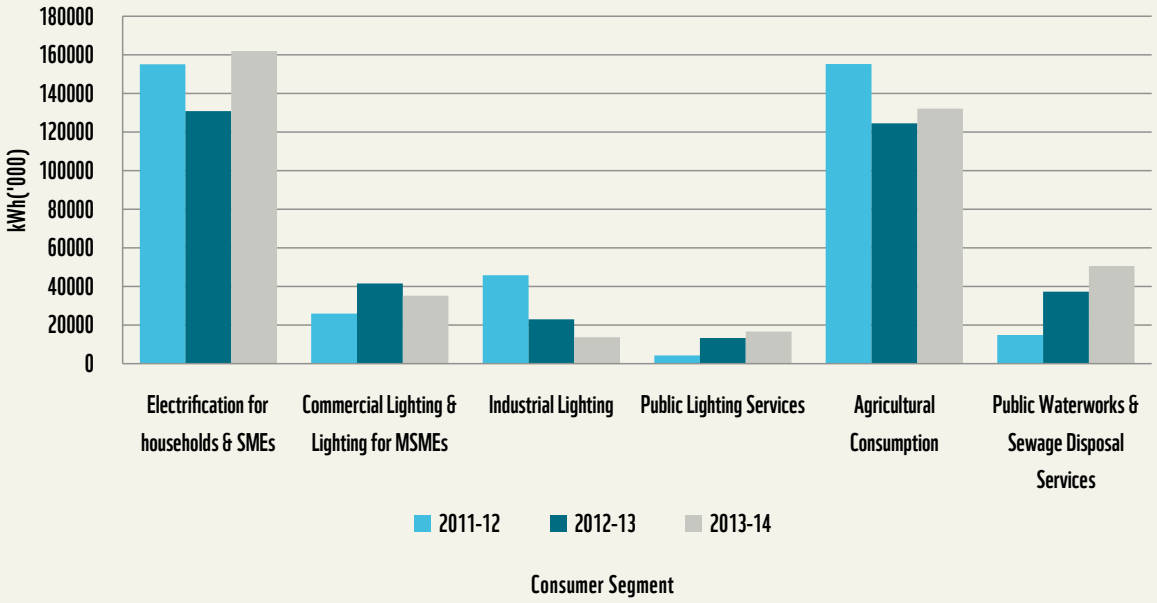
Figure 3.10: Electrification at Sub-District Level in Lakhimpur Kheri



Sources: UPPCL 2014; Planning Department 2014a; Census of India 2011b

- Grid connectivity was provided to over 1.60 lakh consumers in the district during the period 2013-14. There consumers were connected to a load of 298 MW (UPPCL 2014).
- The absence of separate agriculture feeder affects the availability and the reliability of power for agriculture forcing greater dependence on diesel.
- According to the district statistics manual, the dominant use of electricity in the region is for household and SME (small and medium enterprise) electrification needs, followed by agriculture. The electricity consumption profile of the district is presented in Figure 3.11.

Figure 3.11: Electricity Consumption Profile of Lakhimpur Kheri



Source: Planning Department 2014a

Field Survey Overview of Pilibhit and Lakhimpur Kheri

The field study was undertaken in 12 villages across the blocks of Amariya, Bisalpur, Marori and Puranpur in Pilibhit and 21 villages across the blocks of Dhaurhera, Kumbhi Gola, Lakhimpur Kheri, Mitauli, Nighasan, Palia, Phoolbehra and Ramiya Behar in Lakhimpur Kheri. The field study involved robust focused group discussions with two representative hamlets in each village and there were 729 respondents who participated in the study. The questionnaire used for the focus group discussions is attached in Appendix B.

In the field study it was revealed that of the total number of respondents, 91 per cent were connected to the grid, while 6 per cent were yet to be connected. The Table 3.12 lists the reasons put forward by individual respondents for not getting access to grid-based electricity.

Figure 3.12: Reasons for not Getting Grid-based Electricity in Pilibhit and Lakhimpur Kheri

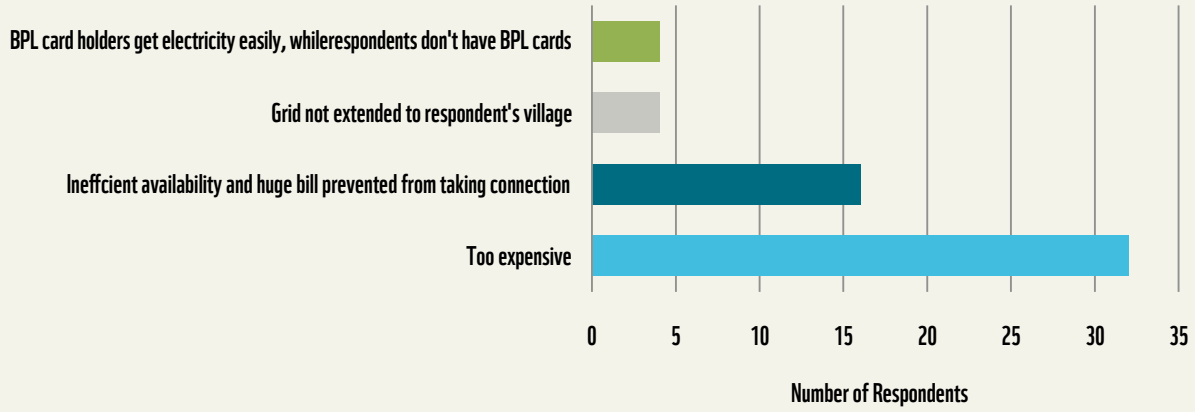


Figure 3.13 shows the number of hours of power cut across seasons. In the Figure it is clear that households in the villages surveyed in Pilibhit suffer a minimum of 15 hours of power cut everyday around the year.

Figure 3.13: Load Shedding Situation in Pilibhit

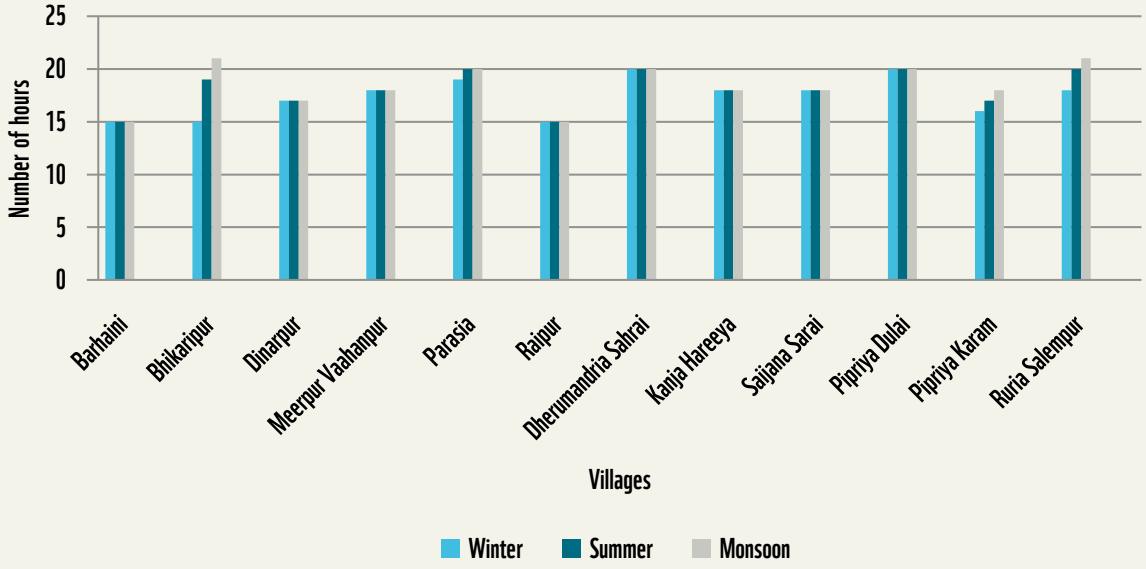
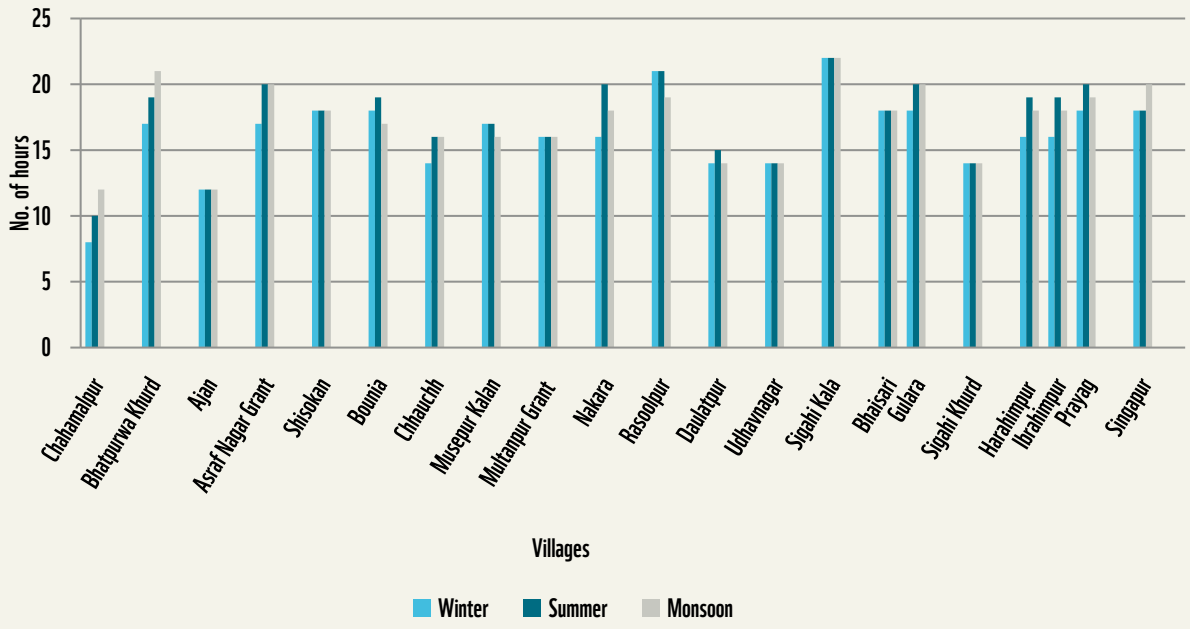


Figure 3.14 depicts the load shedding situation in Lakhimpur Kheri reveals that most villages suffer at the least 10 hours of power failure everyday across the year.

Figure 3.14: Load Shedding Situation in Lakhimpur Kheri



Households in the region not only face power outrages but they also lack access to three phase power which limits the appliances and machinery they can use. The availability of power is further challenged by the poor infrastructure, in particular, the insufficient maintenance of the poles and wiring.

In the absence of steady supply of electricity, households consume other fuels such as kerosene, diesel and firewood to meet their needs for lighting, cooking and electrical machinery. Figure 3.15 illustrates the fuel consumption and expense incurred for the same by households.

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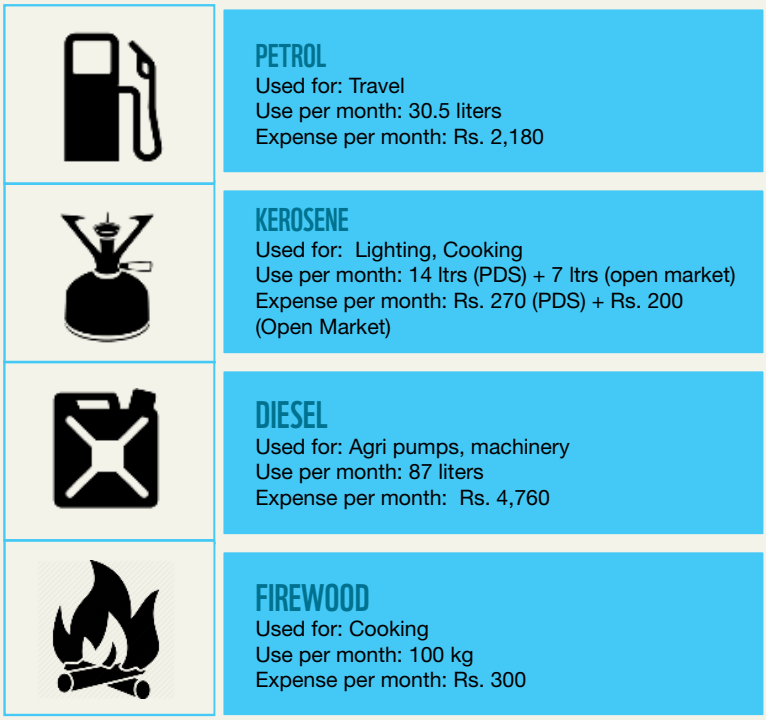
Figure 3.15: Fuel Consumption in Pilibhit and Lakhimpur Kheri



Respondents face challenges in getting kerosene from the PDS on time and have to spend exorbitant amounts to purchase from the open market the same product.

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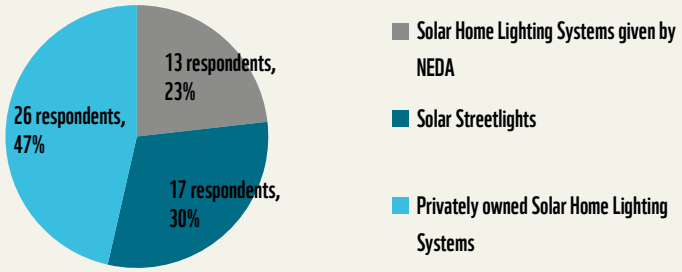
RENEWABLE ENERGY

With regard to renewable energy, 14 per cent of the 729 respondents had access to solar either in the form of home lighting or street lighting. Figure 3.16 presents the different sources of solar energy products accessed by the respondents. The solar systems are predominantly used for home lighting, street lighting and mobile charging. Of those surveyed 13 had solar home lighting systems given by the Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA n.d. (a)), 26 had purchased the system from local vendors and 17 had solar streetlights outside their homes.

Figure 3.16: Solar Systems Ownership in Pilibhit and Lakhimpur Kheri



The study revealed that the high initial costs of the system deter the purchase of solar products, especially, since bank finance for renewable energy appliances/solutions and pay-as-you go models are absent. Awareness of renewable energy technologies are also low, especially the knowledge of the products, its quality and names of reliable companies. None of the respondents surveyed had access to any other source of renewable energy such as biogas, pico-hydro or small wind.

FUEL FOR COOKING

Of the 729 respondents 214 had LPG (Liquefied Petroleum Gas) connection while the rest depended on fire wood and kerosene alternatively for cooking.

Households not only forage for firewood but also purchase the same. Apart from households some of the major consumers are commercial establishments, government mid-day meal scheme and anganwadis centres.

The government under the National Program for Improved Cookstoves (launched in 1983), the National Biomass Cookstoves Initiatives (launched in 2009) and the most recent Unnat Chulha Abhiyan (launched in 2014) have provided subsidised improved cook stoves (ICS). But the review of the programmes reveal that customer orientation is limited which curtail long-term adoption of these products. Presently lack of end-user finance, weak field testing and customisation of ICS, limited consumer training and awareness deter wider adoption of ICS (IGEN-RE 2013; GIZ 2013)

FINANCIAL ECOSYSTEM

Table 3.2: Finance Overview of Pilibhit and Lakhimpur Kheri

Region	Number of Bank Branches	Number of Post Offices	Bank Deposits (Rs in cr.)	Bank Advances (Rs in cr.)	Advance to Agriculture (in percentage)
Pilibhit	103	165	2,781.66	2,321.05	91
Lakhimpur Kheri	309	387	4,661.61	3,622.33	90

Sources: Directorate of Economics and Statistics 2014; SLBC 2015a

In conversations with the bankers it was revealed that, on an average, the default on agriculture lending is 40 per cent and the default on government scheme based lending is higher at 60 per cent.

Pilibhit

Over 237 of the 308 respondents to the focus group discussion in Pilibhit had bank accounts. The savings in the account was predominantly to keep the account active and has yet to instil a culture of saving in banks.

Of the total 1,054 villages in Pilibhit having a population of less than 2,000 people, only 15 villages have access to easy banking (SLBC 2015b).

- **MSME**
  Under the Credit Guarantee Trust for Micro and Small Enterprises Scheme, 175 beneficiaries in Pilibhit were approved a loan of over Rs. 9.12 crores during the financial year 2014-15 (SLBC 2015d).

- **Cooperatives**
  There were approximately 83 cooperative societies in Pilibhit with an enrolment of over 1.80 lakh farmers who have availed loans to the tune of Rs. 3.70 crores during the year 2013-14 (Directorate of Economics and Statistics 2014).

- **Microfinance**
  Under the National Rural Livelihood Mission and the state counterpart of the program, 656 women SHG's in Pilibhit were formed as on March 2015. Out of them 227 were provided with revolving fund and 51 were linked to banks (SLBC 2015d). Some of the activities take up by the SHGs are vegetable farming, horticulture, handicrafts using web grass, animal husbandry, poultry farming, food processing, dress making.

The Forest Department in Pilibhit is involved in the development of livelihood through creation of SHGs, Eco Development Committees, Joint Forest Management Committees, etc. The targets for these programmes are the populace living in the fringe of the forest and the aim is to reduce their dependence on Non-Timber Forest Produce and thereby reduce human-animal conflict.

Lakhimpur Kheri

Over 421 of the 477 respondents to the focus group discussion in Lakhimpur Kheri had bank accounts.

- **MSME**
  Under the Credit Guarantee Trust for Micro and Small Enterprises Scheme, 326 beneficiaries in Lakhimpur Kheri were approved a loan of over Rs. 12.84 crores during the financial year 2014-15 (SLBC 2015d).

- **Cooperatives**
  There were an approximate 132 cooperative societies in Lakhimpur Kheri with an enrolment of over 3 lakh farmers who have availed loans to the tune of Rs. 11.62 crores during the financial year 2013-14 (Directorate of Economics and Statistics 2014).

- **Microfinance**
  Under the National Rural Livelihood Mission and the state counterpart of the programme, 1,689 women SHG's in Lakhimpur Kheri were formed as on March 2015. Out of these, 739 SHGs were provided revolving fund and 139 were linked to banks (SLBC 2015d).

THE CAPACITY BUILDING ECOSYSTEM

Pilibhit

- **Education**
  There were 1,779 primary, 851 upper primary and 132 secondary schools in Pilibhit as on 2013-14. The enrolment in primary schools was over 2 lakhs with equal number of boys and girls. But the enrolment in the upper primary is half of primary and at the secondary level the number of girls' enrolled falls to one tenth of the girls enrolled at the primary level, the enrolment of boys in secondary is similar to the number of boys in upper primary. Most primary schools are located within the village itself, but upper primary and secondary are on an average of 3-5 km away from the village. (Directorate of Economics and Statistics 2014).

  There are nine under graduate colleges and five post graduate colleges which have a combined enrolment of 20,000 students. At the college level the number of women enrolled is greater than male students (Directorate of Economics and Statistics 2014).

- **ITI and Polytechnics**
  There are three government Industrial Training Institutes (ITIs) in Pilibhit located at Puranpur, Barkhera and Pilibhit Urban and two private ITIs at Narayanpur and Saidpur. The private ITIs have courses for electrician and fitter training with enrolment strength of close to 750 students. The government ITIs have courses on computer programming, welder, plumber, fashion design technology, dressmaking, electrician etc. The seats available in the government courses are limited and there are on an average only 40 seats per course (Rajya

Vyavasayik Pariksha Parishad. n.d.). There is a government polytechnic in Pilibhit with courses focusing on electronics and electrical engineering and with a capacity of 180 students (DTE n.d.).

- **RSETI**
  Under the Rural Self Employment Training Institute initiative that is operational since 2008, there is one RSETI in Pilibhit. There are over 15 courses covering activities such as computer hardware and software, beauty parlour management, mobile phone repairing, dairy farming, dress making, farmer skill development etc. During the year 2014-15 an estimated 433 students were trained. Since inception of the programme in Pilibhit, 12 entrepreneurs were supported through bank loan to set up their own ventures and 115 through training (SLBC 2015d)

Lakhimpur Kheri

- **Education**
  There are 2,724 primary, 1,233 upper primary and 218 secondary schools in Lakhimpur Kheri. A total of 5.34 lakh students were enrolled in primary schools during the 2013-14 academic year, but there is close to 50 per cent drop-out in enrolment at the upper primary level, which further gets reduced by 30 per cent at the secondary level. This trend can be observed during all the years starting from 2010. There are on an average two teaching staff per school in the primary and upper primary schools and more than 8 per school at the secondary level. Most primary schools are located within the village itself, but upper primary and secondary schools are 1 to 3 km away from the village. There are 15 undergraduate and 7 postgraduate colleges (Directorate of Economics and Statistics 2014).

- **ITI and Polytechnics**
  There is one private and three government managed Industrial Training Institutes (ITIs) in Lakhimpur Kheri located at Chandan Chauki, Patel Nagar, Mohammadi and Lakhimpur Urban. The government ITIs have courses on computer programming, cosmetology, mechanic, welder, plumber, fashion design technology, dressmaking, electrician etc. The seats available in the government ITIs are limited and on an average only 40 seats per course are available (Rajya Vyavasayik Pariksha Parishad. n.d.). There is a government polytechnic in Lakhimpur Kheri with courses focusing on pharmacy and chemical technology and with a capacity of 280 students (DTE n.d.)

- **RSETI**
  In Palia, the Allahabad bank operates a very successful, award winning RSETI that has hostel facility and encourages women entrepreneurship development. There are several courses covering activities such as computer hardware and software, mobile phone repairing, dairy farming, goat rearing, dress making and embroidery, motor cycle repairing etc. Since the inception of the programme in Lakhimpur Kheri, 591 entrepreneurs were supported through bank loan and 787 through training to set up their own ventures (SLBC 2015d).

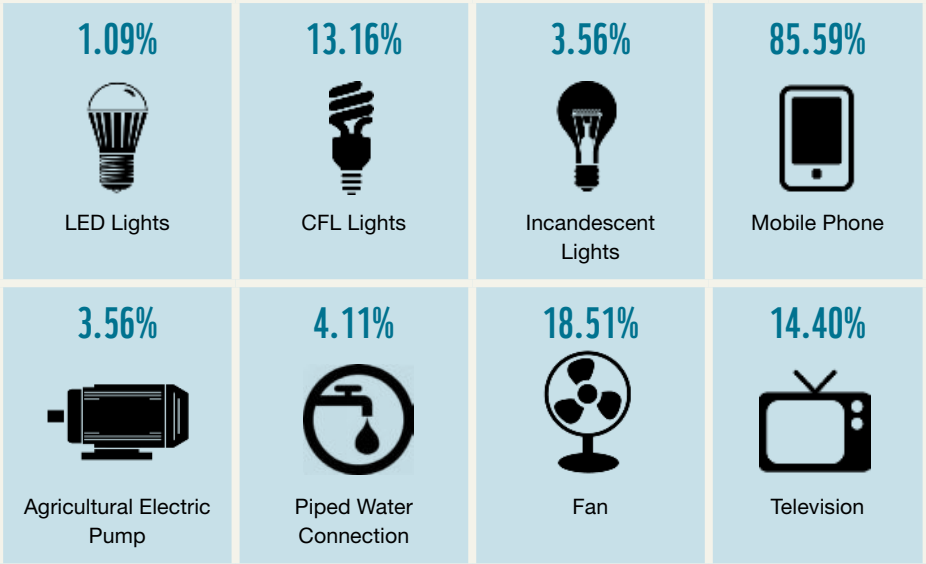
- **Renewable Energy in Education**
  UPNEDA under a pilot programme “Education for All” of the Government of Uttar Pradesh has installed solar photovoltaic (PV) technology-based systems to operate

the computers installed in ten selected primary schools of the district. Solar PV modules of 240 watt capacity and 12 V 150 AH batteries have been used in each system (EAI n.d.(b))

THE TECHNOLOGY ECOSYSTEM

In the districts of Pilibhit and Lakhimpur Kheri there are several solar system retailers at the block level and households are aware of the presence of the technology. There are also few system integrators in the region such as Minda, SIMPA, agents of TATA Power Solar, Jaiswal Batteries, Gautam Solar, EG Solar, UM Green, Luminous etc., who provide solar products for lighting, mobile charging and street lighting. There are also several retailers who customise systems for households and provide panels, batteries and DC fans and LED modules which are manufactured in Delhi, Gurgaon etc. Several households have purchased solar lanterns costing Rs. 200-300 per product. Figure 3.17 gives the number of respondents (of the total 729 in Philibit and Lakhimpur Kheri) who own specific appliances.

Figure 3.17: Ownership of Assets in Pilibhit and Lakhimpur Kheri (Percentage of Respondents)



The awareness among households of biogas is also high due to the government subsidy programmes. Despite the presence of renewable energy suppliers there are very few service providers in the region. Under the National Biogas and Manure Management Program over 636 beneficiaries in Pilibhit and 725 beneficiaries in Lakhimpur Kheri have been supported with subsidy amounts up to Rs. 11,000 during the period 2002-14. Households owning 4-8 cattle have benefitted from the programme. The relatively well to do households with better knowledge and ability to maintain the systems have gained the most from the scheme (UPNEDA n.d. (a)).

About 85 per cent of the households in Pilibhit district use biomass as cooking fuel. Firewood is consumed by over 60 per cent of the households followed by cow dung cake (19.50 per cent) and crop residue (6.20 per cent). Fossil fuels are used by 13.30

per cent of the households with 13.20 per cent using LPG and the rest coal/lignite etc. Urban households have greater access to LPG (49.20 per cent), but a large number of households still depend on fire wood (41.50 per cent) (Census of India 2011d).

In Lakhimpur Kheri close to 87 per cent of the households use biomass for cooking with firewood being the most common fuel used (65.20 per cent), followed by cow dung cake (13.80 per cent) and crop residue (8 per cent). Access to LPG is high among the urban households (53.80 per cent), but very low among the rural populace (7 per cent) (Census of India 2011b).

THE INFRASTRUCTURE ECOSYSTEM

- **Communication and Transportation**
  Mobile penetration is very high with 624 of the total 729 respondents to the survey possessing a mobile phone. But network access and internet connectivity is a problem. The absence of reliable energy supply creates difficulty in charging mobile phones and has limited the development of computers and internet access. The physical infrastructure in the region is poor with limited connectivity within villages and unmaintained roads. Though the block headquarters is connected with transportation and road, the absence of reliable bus connectivity among the villages is a gripping issue. Often roads get damaged during flood or heavy monsoon and repair takes a long time.

- **Health**
  In Pilibhit, there are 12 allopathic hospitals, six community health centres, 23 primary health centres with over 63 doctors and 472 paramedical staff. There are 206 family and mother–child welfare sub-centres (Directorate of Economics and Statistics 2014). On the other hand, in Lakhimpur Kheri, there are six allopathic hospitals, 14 community health centres, 56 primary health centres with over 179 doctors and 114 paramedical staff. There are 386 family and mother-child welfare sub-centres.

  The major challenge with regard to healthcare is the long distance between the villages and these institutions. The poor transport facility and the limited number of medical institutions coupled with the unavailability of medicines and lady doctors are some of the challenges faced by the villagers.

- **Water and Sanitation**
  Of the 1,443 villages in Pilibhit, 1,295 have access to water through hand-pumps. In Lakhimpur Kheri, out of 1,798 villages, 1,706 access water through hand-pumps. These pumps are mainly commissioned by government agencies (Directorate of Economics and Statistics 2014).

  Though the water table is high, the water quality at the higher strata of the water table has been polluted by the high use of fertilisers etc. The water in Lakhimpur Kheri is highly contaminated with nitrate (above 45mg/ltr), arsenic (above 0.05 mg/ltr) and iron (1mg/ltr) according to the Central Ground Water Board (CGWB 2012).

POLICY AND REGULATORY ECOSYSTEM

Under the off-grid solar programme, the state has several schemes under the aegis of UPNEDA implemented in collaboration with several government departments. Some of the popular programmes in Pilibhit and Lakhimpur Kheri are:

1. **Solar Home Systems:** Lohiya Awas Yojana (beneficiaries between 2012-14: Pilibhit – 355, Lakhimpur Kheri – 3,155) and Shri Janeshwar Mishra Yojna (proposed beneficiaries: Pilibhit – 80, Lakhimpur Kheri – 170) under which poor or BPL families are provided solar power pack capable of powering luminaries, DC fan and mobile charging points (UPNEDA n.d. (b)).
2. **Solar Street Lighting:** There are multiple schemes such as the Dr. Ram Manohar Lohia Samagra Gram Yojna, the Shri Janeshwar Mishra Yojna etc. These funds are routed through the gram panchayat (UPNEDA n.d. (b)).
3. **Solar Pumping:** MNRE launched a scheme in November of 2014 to encourage bank lending to solar pumping with a capital subsidy and have RBI and banking norms for contribution from the beneficiary. The state of Uttar Pradesh has been given a target of 6,600 solar pumps ranging from less than 2 HP to 10 HP (NABARD 2014).
4. **National Biogas and Manure Management Programme** where beneficiaries are supported with subsidy amounts ranging up to Rs. 11,000 for the setting up of household-level biogas plants.
5. **Under the Uttar Pradesh Electricity Regulatory Commission** (Promotion of Green Energy through Renewable Purchase Obligation) Regulations (2010), accreditation for cogeneration has been granted to three sugar mills in Pilibhit and five mills in Lakhimpur Kheri (UPNEDA n.d. (b)).
6. **To promote renewable energy in the state** the government has recently removed the VAT on solar and has approved the Solar Energy Policy in 2013. UPNEDA has also identified and investigated the following sites in Pilibhit and Lakimpur Kheri for small hydro projects.

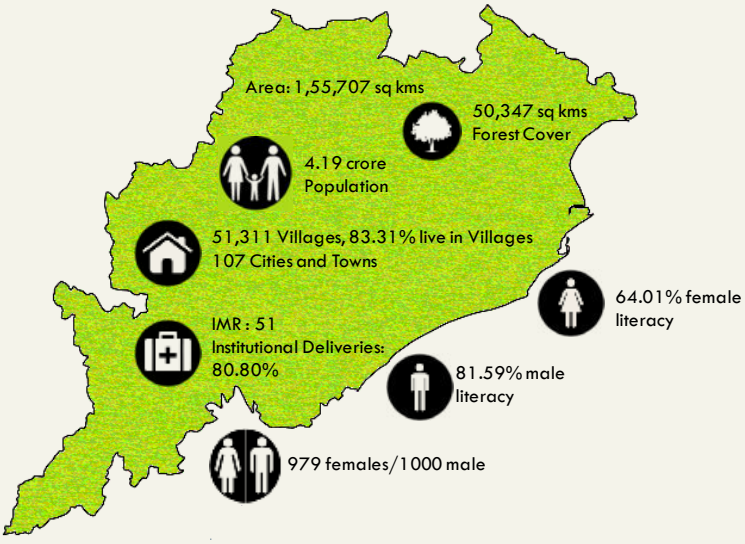
Table 3.3: Identified/Investigated Sites for Small Hydro projects by UPNEDA

Name of Project	District	River/Canal	Chanage/ Location	Discharge (cumecs)	HEAD (metre)	Capacity (kW)
Ghunchai	Pilibhit	Sharda Canal	121.4 km	124.64	1.61	600
Matena	Pilibhit	Sharda Canal	Matena Fall	175	1.37	500
Gudami	Pilibhit	Sharda Canal	4.36 km	0	1.83	500
Madho-I	Pilibhit	Sharda Canal	5.64 km	124	3.55	3,750
Bheera	Lakhimpur Kheri	Kheeri branch	8.00 km	102.8	4.61	3,000
Dunda	Lakhimpur Kheri	Hardoi branch	30.20 km	161.2	3.71	4,500
Pilibhit	Lakhimpur Kheri	Kheeri branch	23.60 km	102.8	3.09	2,000
Shahjpur	Lakhimpur Kheri	Kheeri branch	36.10 km	102.8	3.81	2,250
Lakhimpur	Lakhimpur	Lakhimpur	50.10 km	102.8	4.5	3,000
Shardasa-gar	Pilibhit	Dam toe	Dam toe	85	6.7	4,500

Source: UPNEDA n.d. (b)

Overview of Odisha and the Focus Districts

Figure 3.18: Demographic Profile of Odisha



Source: Census of India 2011c; Department of Statistics 2013; Shutterstock n.d.; Government of India 2015; Forest Survey of India 2013

Figure 3.19: Economic Profile of Odisha

GSDP - Rs.1,48,226 crores – 2.58% of the country's GDP
• No. rural establishments - 15.94 lakhs
Third Largest no. of handloom/handicraft establishments
• 1.36 lakhs

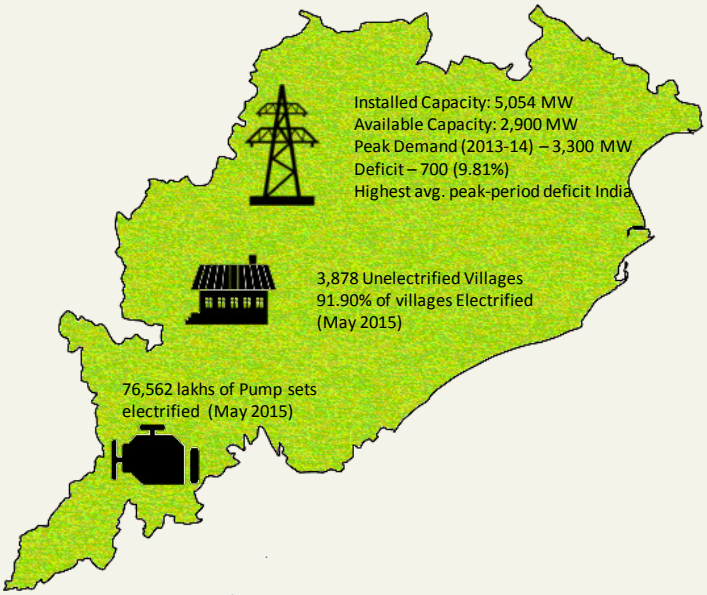
Agriculture and Allied sector
•15.40% of GSDP
Service sector
•51% of GSDP

Industry sector
•33.45% of GSDP
Mineral-based industry large
• Steel production 10% India's total capacity
• 25% of total iron-ore reserves

Source: CSO 2014; Directorate of Economics and Statistics 2015; MoSPI 2014

ENERGY PROFILE OF ODISHA

Figure 3.20: Energy Profile of Odisha



Source: Directorate of Economics and Statistics 2015; CEA 2015b

Table 3.4: Renewable Energy Potential (2014) and Achievement (2015) of Odisha

Source	Potential	Installed Capacity	Achievement	Value
Biomass Power	246 MW	20 MW	Biogas Plants (Nos. in Lakh)	2.60
			Biomass Gasifier (kW)	270.00
			Biomass (non-bagasse) (MW)	2.90
Solar	8,000 MW (feasible)	30.50 MW	Solar Pump (Nos.)	56.00
			Solar Street Lighting (Nos. in Lakh)	0.10
			Solar Home System (Nos. in Lakh)	0.10
			Solar Lantern (Nos. in Lakh)	0.10
			Solar Power Plant kWp	84.50
			Solar Cooker (MW)	13
Small Hydro	295 MW	64.63 MW	-	-
Remote Village Electrification Villages			Villages (Nos.)	1,495

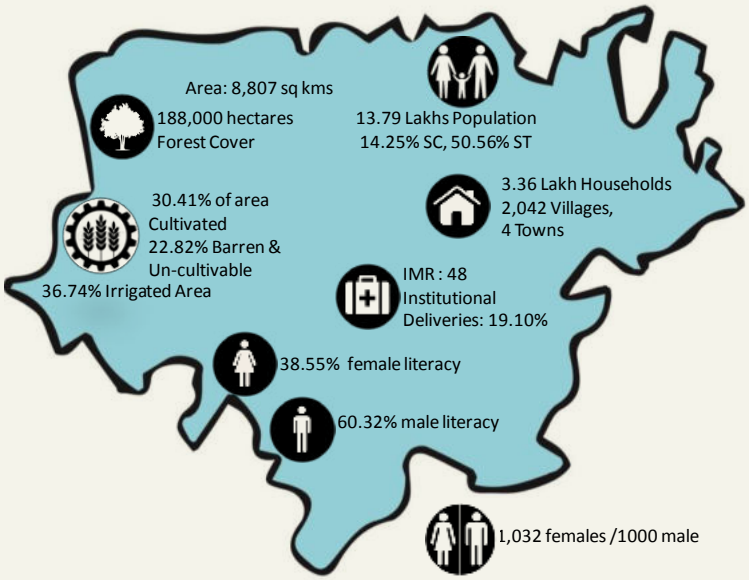
Source: CSO 2015

Note: Achievement is with regard to the Installation of Off-grid / Decentralized Renewable Energy Systems/ Devices as on 31.03.2014

Koraput

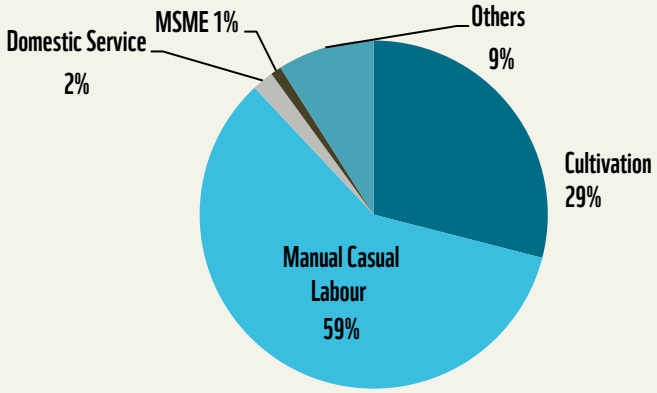
- Koraput is one of the southernmost districts of Odisha and bordering the state of Andhra Pradesh. This has led to the growth of agro-trade in the region. The district is divided into fourteen blocks Nandapur, Semiliguda, Lamtaput, Jeypore, Pottangi, Koraput, Bandhugaon, Kotpad, Narayanapatna, Boriguma, Boipariguda, Dasamanthpur, Laxmipur and Kundra.

Figure 3.21: Demographic Profile of Koraput



Source: Census of India 2011c; Department of Planning 2015; SECC 2011 and 2015; Government of India 2015

Figure 3.22: Sources of Household Income in Koraput



Source: SECC 2015

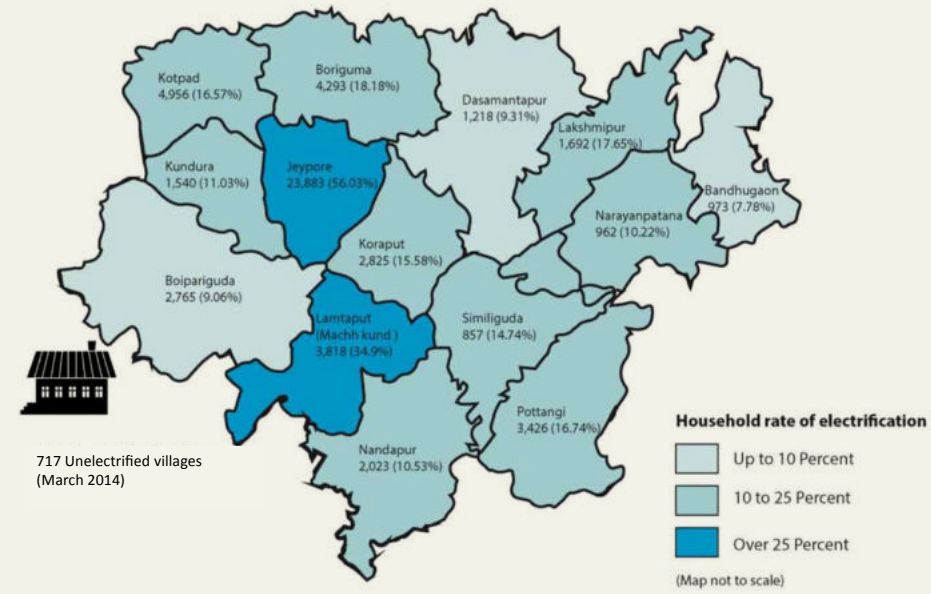
MAIN HOUSEHOLD INCOME

As on 2014, there were 5,288 micro, small and medium scale enterprises in Koraput employing 33,085 workers. Most units are linked to agro-processing such as rice/ pulse/oil/cashew mill, and service sector units in fabrication, machinery repair etc. There are also cottage industries linked to NTFP processing, small handicrafts units etc. (District Industries Center 2015). Over 93.34 per cent of the households earn less than Rs. 5,000 per month. Agriculture is predominantly subsistence based and paddy is the major crop. There is a recent but steady growth of horticulture sector in the region augmenting household income (SECC 2015).

ENERGY PROFILE

Figure 3.23 presents the electrification rate at the household level in each of the sub-districts of Koraput.

Figure 3.23: Electrification at the Sub-District Level in Koraput



Source: Census of India 2011c; Planning and Coordination Department 2015

- The percentage of electrified villages in Koraput as on March 2014 was only 62.70.
- Of the electrified villages not all households have been connected to the grid.
- The hydro power projects in Koraput are the Upper Kolab and Machhkund which together generated 1,003.25 MU of power during the financial year 2014-15, which accounts for around 15.38 per cent of the total hydro power generated in the state (OHPC 2015).
- Under the Remote Village Electrification Programme 3,406 households were covered. The programme covered 13 villages in Boipariguda, 6 villages in

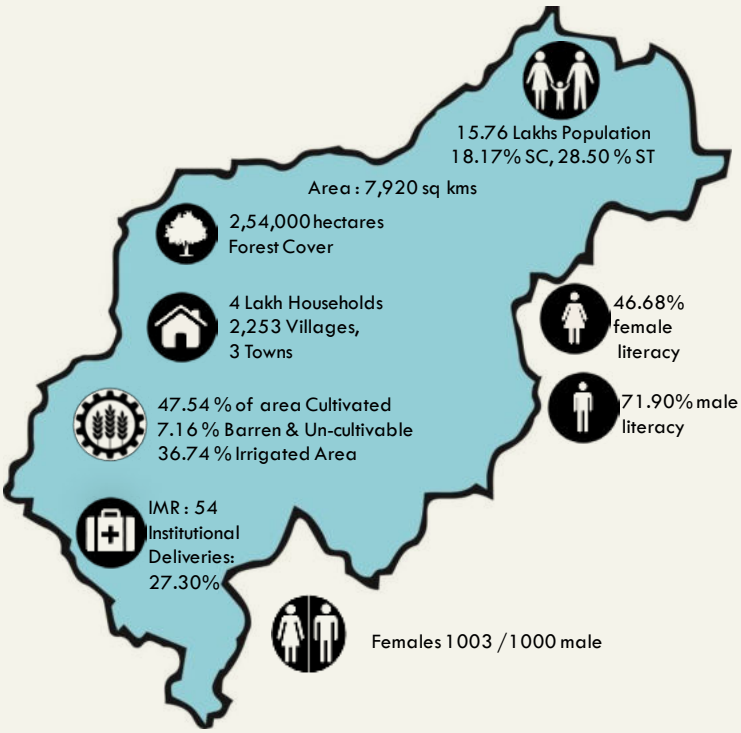
Boriguma, 5 villages in Dasmantpur, 3 villages in Jeypore, 1 village in Koraput, 5 villages in Similiguda, 16 villages in Pottangi, 5 villages in Narayanapatna, 8 villages in Kundra, 3 villages each in Laxmipur and Nandapur, with solar home systems or mini grids.

- Many of the systems under the RVEP are installed by companies that do not have the provision to provide servicing and local villagers are not trained or made aware of the basic maintenance or need for replacement of the components/ systems. Hence, operation and maintenance is a major issue and households sometimes sell off the defunct system to meet basic needs.

Kalahandi

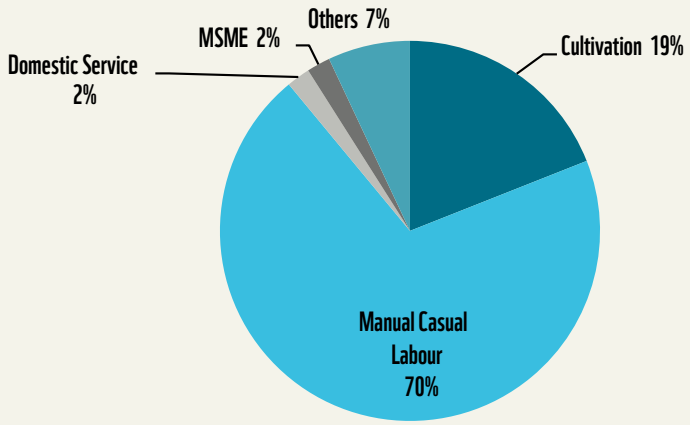
- Kalahandi belongs to the group of KBK districts and is located in the middle of Odisha.
- The district is divided into thirteen blocks, i.e., Junagarh, Bhawanipatna, Dharmagarh, Jaipatna, Golamunda, Narla, Koksara, Kesinga, Lanjigarh, Madanpur Rampur, Thuamul Rampur, Kalampur and Karlamunda.

Figure 3.24: Demographic Profile of Kalahandi



Source: Department of Planning 2015; SECC 2015; Census of India 2011a; Office of the Registrar General & Census Commissioner 2012

Figure 3.25: Sources of Household Income in Kalahandi



Source: SECC 2015

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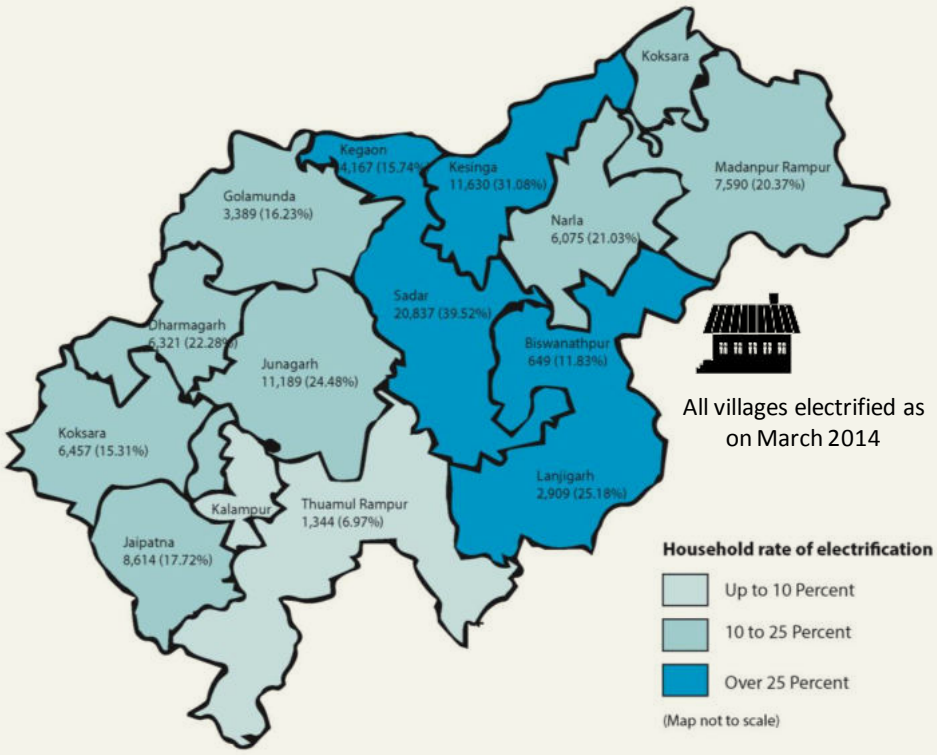
MAIN SOURCE OF HOUSEHOLD INCOME

As on 2014, there were 3,910 micro, small and medium scale enterprises in Koraput employing 25,568 workers. Most units are linked to agro-processing such as rice/ pulse/oil mill, and service sector units in fabrication, machinery repair, brick kilns etc. There are also cottage industries linked to non-timber forest produce processing, small handicrafts units etc. (District Industries Center 2015). Over 94.24 per cent of the households earn less than Rs.5,000 per month (SECC 2015).

ENERGY PROFILE

Figure 3.26 presents the electrification rate at the household level in each of the sub-districts in Kalahandi.

Figure 3.26: Electrification at the Sub-District Level in Kalahandi



Source: Census of India 2011a; Planning and Coordination Department 2015

- The Indravati dam in Kalahandi which houses one of the seven Hydro Power projects in Odisha generated 2,657.14 MU of power during the financial year 2014-15 (i.e., from April 2014 to March 2015) which accounts for 40 per cent of the total hydro power generated in the state (OHPC 2015).

- Electrification in the state has been taken up under the Rajiv Gandhi Grameen Vidyutikaran Yojana or under the state scheme Biju Saharanchala Vidyutikaran Yojana.
- The absence of separate agriculture feeder affects the availability and the reliability of power for agriculture forcing greater dependence on diesel.
- In Kalahandi under the Remote Village Electrification Programme, several villages have been provided with solar home systems or mini grids. Under the scheme 62 villages in Madan Rampur, 109 villages in Thuamul Rampur, 36 villages in Lanjigargh, 16 villages in Bhawanipatna and 7 villages in Junagargh have been covered under the scheme. A total of 7,724 households were covered which concluded in 2011-12.
- Gram Vikas, an NGO has installed five micro-hydro power generation systems in the Thaumal Rampur block of the district in Punjam Village (110 HH); Lanjigarh and Bijapada (50 HH); Karnivel (19 HH); Karlapat (112 HH); and Purnaguma (60 HH). The power generated supports home lighting and street lighting. Of the above villages, Karnivel was connected to the grid, but the micro-hydro was installed in the village since the village suffered from long periods without electricity supply.

Field Survey Overview of Koraput and Kalahandi

The field study was undertaken in 12 villages across the blocks of Boipariguda, Laxmipur, Similiguda, Dasamantpur, Jeypore, Nandapur, Narayanapatna in Koraput and 14 villages across the blocks of Dharmgargh, Junagargh, Jayapatna, Kesinga, Sadar, Thuamul Rampur in Kalahandi. The field study involved focus group discussions with two representative hamlets in each village and 417 respondents who participated in the study. Household surveys were further conducted in 60 households in Kalahandi and 40 households in Koraput. The questionnaire used for the focus group discussions and household surveys are attached in the Appendix B.

During the field study it was revealed that all the responding groups with the exception of one group were connected to the grid. Though both electrified and unelectrified villages were selected based on the 2011 census, several villages received connection in the year 2013-14.

Figure 3.27 and 3.28 show the number of hours of power cut across seasons. In these figures, it is revealed that households suffer, on an average, 6-8 hours of power cuts in villages of Kalahandi and Koraput. In the survey households also stated that due to their interior locations if there is power failure due to problem in the grid infrastructure, repair often takes months and they remain without electricity.

Figure 3.27: Load Shedding Situation in Koraput

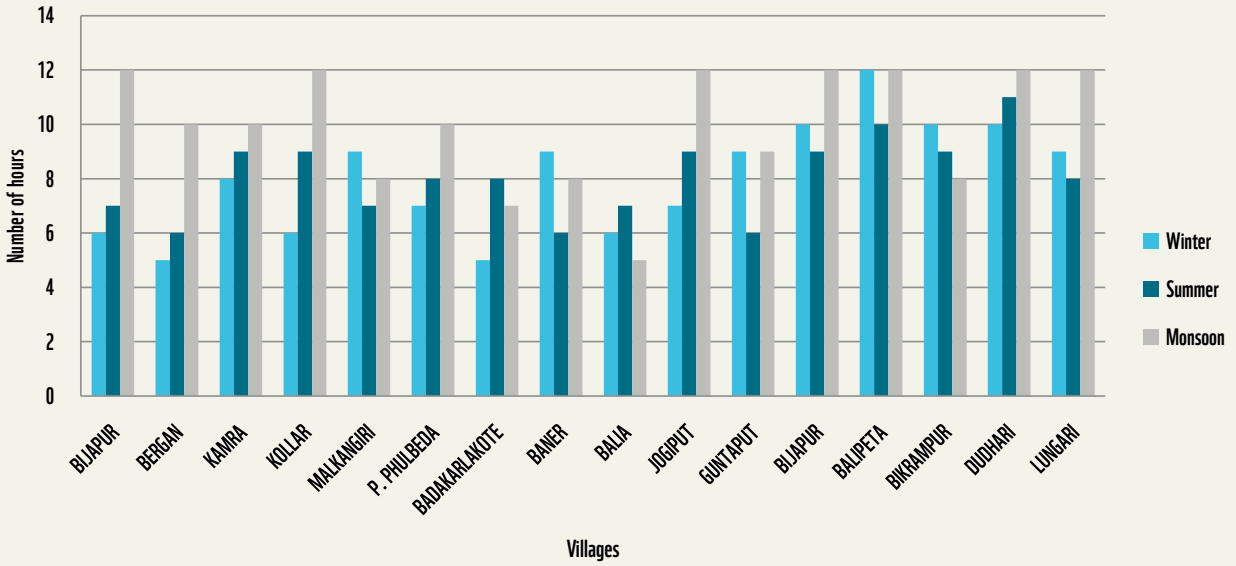
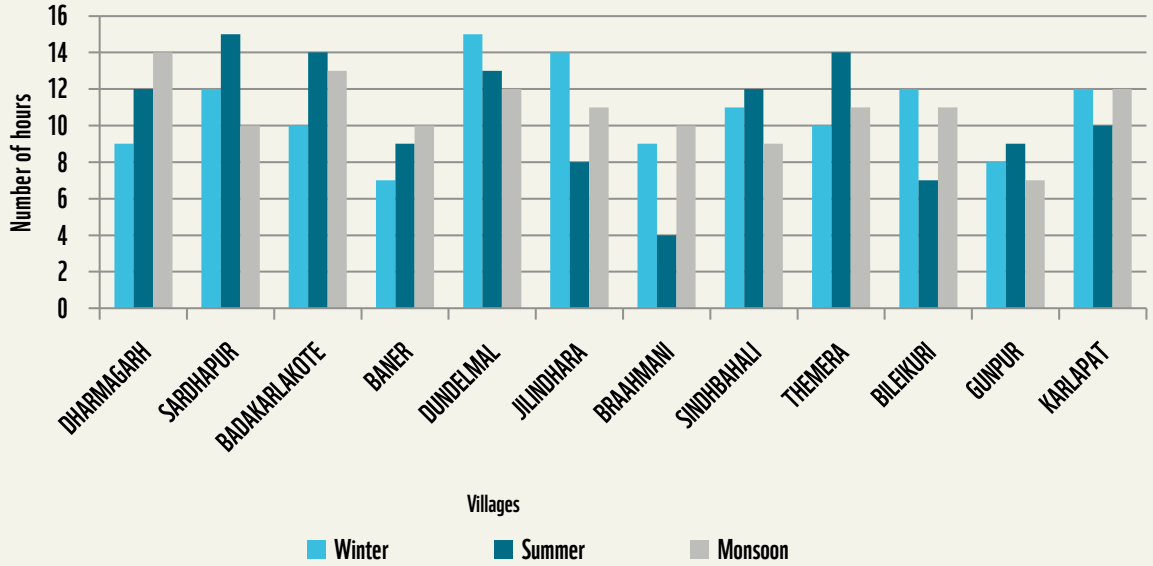


Figure 3.28 captures the load shedding situation in Kalahandi where households face six to ten hours of power failure.

Figure 3.28: Load Shedding Situation in Kalahandi



Though households have meters for calculating their grid usage, meter readings are not taken regularly. Instead the consumption is calculated over a long period and an aggregated bill is presented to the villagers amounting from Rs. 500 to Rs. 1000. Most households use electricity only for lighting, mobile charging and television.

Households incapable of paying these bills default, leading to their connections being cut. Households in the region do not have access to three phase power limiting the appliances and machinery they can use. Figure 3.29 outlines the usage of conventional sources of fuel and the expenses associated with their usage.

Figure 3.29: Fuel Sources and Usage in Koraput and Kalahandi

PETROL
Used for: Travel
Use per month: 4 liters
Expense per month: Rs. 355

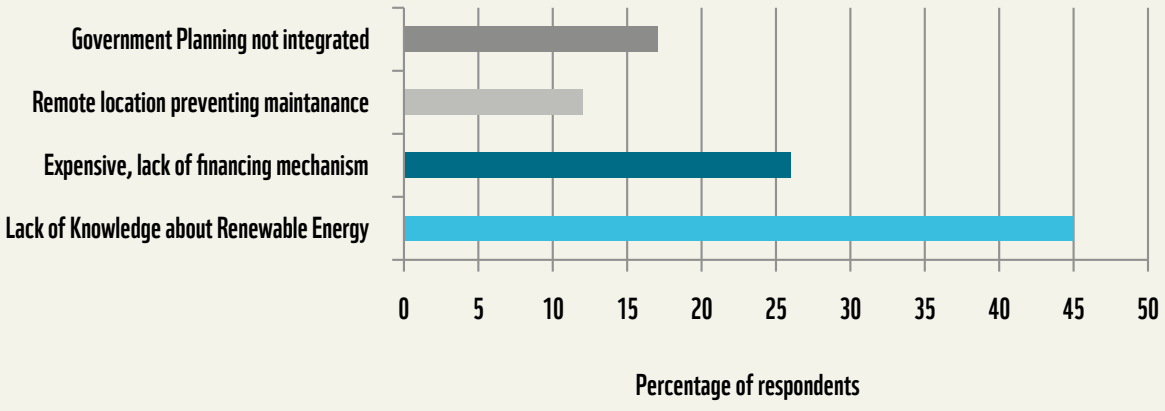
KEROSENE
Used for: Lighting, Cooking
Use per month: 3 ltrs (PDS) + 1 ltrs (open market)
Expense per month: Rs. 51 (PDS) + Rs. 50 (Open Market)

FIREWOOD
Used for: Cooking
Use per month: 100 kg
Expense per month: Rs. 400

RENEWABLE ENERGY

Several households in Kalahandi and Koraput have been given solar products from the OREDA for basic lighting and mobile charging. But this has not enabled the development of a strong ecosystem for renewable energy deployment. Figure 3.30 lists the reasons the respondents mentioned as challenges in adopting renewable energy.

Figure 3.30: Renewable Energy Access: Challenges in Koraput and Kalahandi



FUEL FOR COOKING

During the field surveys it was revealed that most households depend heavily on firewood for cooking and only 19 of the 417 respondents had LPG connection for cooking. In the context of the high level of fire wood consumption, ICS have been tested and provided in the region by government and NGOs, but are faced by challenges related to awareness and end-user finance for the margin money payments. Village-level entrepreneur networks have been successful in delivering ICS solutions and the same can be explored in Koraput and Kalahandi (Bairiganjan and Sanyal 2013).

FINANCIAL ECOSYSTEM

Table 3.5: Finance Overview of Koraput and Kalahandi

Region	Bank Branch-es (nos.)	Post Offices (nos.)	Basic Savings Bank Deposit Accounts (nos.)	Bank Deposit (Rs. in cr.) (2014-15)	Bank Advances (Rs. in cr.) (2014-15)	Advance to Agriculture (Rs. in cr.) (2014-15)
Kalahandi	128	307	61,681	2,044.04	1,310.94	2,74.98
Koraput	104	188	86,461	3,120.02	1,428.92	2,42.68

Source (SLBC 2015a)

There is slow development in banking in the region through Customer Service Points and Business Correspondents. The recovery rate of agriculture loan in the region according to bankers interviewed stood around 50 per cent.

- **MSME**
  Under the priority sector lending Rs. 63.94 crores in Kalahandi and Rs. 95.96 crores in Koraput were extended to micro and small entrepreneurs during the financial year 2014-15 (SLBC 2015a).

- **Microfinance**
  Under the National Rural Livelihood Mission, earlier initiatives for Self Help Group (SHG) formation and the state counterpart of the programme, 10,015 women SHG in Kalahandi (10,488 in Koraput) were formed with a total membership of 1.10 lakh members (1.08 lakh in Koraput). Some of the activities taken up by the SHGs are vegetable farming, horticulture, animal husbandry, poultry farming, food processing etc.

CAPACITY BUILDING ECOSYSTEM

- **Education**

Table 3.6: Education Overview of Koraput and Kalahandi

Region	Primary Schools (nos.)	Enrolment (nos.)	Upper Primary & Above Schools (nos.)	Enrolment (nos.)	Junior College	Graduate College
Kalahandi	1,649	1,00,063	1,125	1,80,627	46	22
Koraput	1,691	92,573	1,045	1,48,423	28	14

Source: NUEPA 2014

Koraput

Only 13.60 per cent of the schools have electricity and 12.10 per cent of the schools have computers (NUEPA 2014).

- **ITI:** There is one government Industrial Training Institutes (ITIs) and 11 Industrial Training Centres in Koraput. Intake in the government ITI is 320 students per year (data collected from field research).
- **RSETI:** Under the Rural Self Employment Training Institute initiative that is operational since 2008, there is one RSETI in Koraput. During 2014 about 177 students were trained. Since inception of the programme 9 trained entrepreneurs were supported through bank loan to set up their own ventures (SLBC 2015a).

Kalahandi

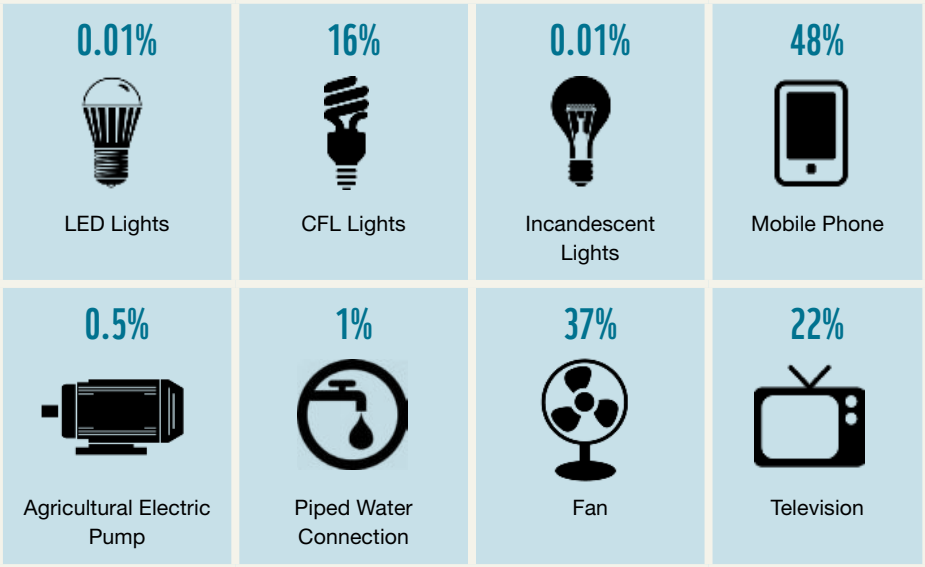
Only 14.90 per cent of the schools have electricity and 5 per cent of the schools have computers (NUEPA 2014).

- **ITI:** There is one government Industrial Training Institutes (ITIs) and six Industrial Training Centre. Intake in the government ITI is 556 (data collected from field research).
- **RSETI:** Under the Rural Self Employment Training Institute initiative that is operational since 2008, there is one RSETI in Kalahandi. During the year 2014 an estimated 493 students in Kalahandi were trained. Since inception of the programme 119 trained entrepreneurs in Kalahandi were supported through bank loan to set up their own ventures (SLBC 2015a).

TECHNOLOGY ECOSYSTEM

There are very few retailers of renewable energy systems in the districts of Kalahandi and Koraput. Though government programmes in solar, biomass and biogas is present, these have not led to private purchase of renewable energy systems among villagers. Villager interaction with technology is limited. Figure 3.31 gives the percentage of respondents (of the 417 surveyed) who own specific appliances.

Figure 3.31: Ownership of Assets in Koraput and Kalahandi (Percentage of Respondents)



About 84 per cent of the households in Koraput district use biomass as cooking fuel with firewood (81.4 per cent) being the most common fuel, followed by crop residue (2.80 per cent) and cow dung cake (0.60 per cent). Access to LPG is high among the urban households (57.90 per cent), but very low among the rural populace (2.80 per cent) (Census of India 2011c). There are 12 LPG distributors in Koraput catering to a consumer base of 62,610 households and institutions (SLBC 2015).

In Kalahandi close to 94 per cent of the households use biomass for cooking with firewood (90.10 per cent) being the most common fuel used followed by cow dung cake (2.80 per cent) and crop residue (1.60 per cent). Urban households have greater access to LPG (38.10 per cent), but a large number of households still depend on firewood (52.80 per cent). Less than 2 per cent of the rural households have access to LPG (Census of India 2011a). There are 11 LPG distributors in Kalahandi supplying to 37,095 households and institutions (SLBC 2015).

Despite the high level of LPG penetration in the urban regions, rural areas are yet to benefit from this clean fuel source. Some of the possible reasons are the high connection cost, absence of strong LPG distribution network, high monthly expense, lack of awareness and easy availability of firewood (Jain et al. 2015).

INFRASTRUCTURE ECOSYSTEM

Communication and Transportation

The physical infrastructure in the region is poor with limited connectivity within villages and unmaintained roads. Though the block headquarters is connected with transportation and road, the absence of reliable bus connectivity in the villages is a gripping issue.

Health, Water and Sanitation

The water both in Kalahandi and Koraput is contaminated with nitrate (above 45mg/ltr), and iron (1mg/ltr) according to the Central Ground Water Board. Most villagers depend on ponds or hand pumps for water (CGWB 2012). Despite the growth in sanitation facilities there is the need for behavioural changes in the adoption of the same.

Table 3.7: Number of Healthcare Facilities in Koraput and Kalahandi

Region	Medical Institution	
	Government	Private
Kalahadi	82	136
Koraput	81	45

Source: Directorate of Economics and Statistics 2015

POLICY AND REGULATION ECOSYSTEM

Under the off-grid solar programme the state has several schemes under the aegis of the Odisha Renewable Energy Development Agency (OREDA), being implemented in collaboration with several government departments. Some of the popular programmes in Kalahandi and Koraput are:

1. **Rural Electrification:** Solar home, street and institutional lighting under the Remote Village Electrification Programme.
2. **In Kalahandi and Koraput private entities,** in collaboration with the government, are in the process of developing wind projects. A 10 MW biomass project is being proposed in the district of Kalahandi.
3. **The RSETI in the state** has recently created partnerships to conduct "solar technician" training courses. The courses are currently restricted to six institutions, but can be adopted across all RSETIs in the state.
4. **Under the Sansad Adarsh Gram Yojana**, the blocks of Thaumul Rampur in Kalahandi and Similiguda in Koraput have been selected for integrated village development.
5. **Under the National Biogas and Manure Management Programme (NBMMP n.d.),** over 66 biogas plants in Kalahandi and 380 in Koraput have been set up (data collected from field interviews from OREDA).

6. There is a strong presence of Integrated Tribal Development Agency. The Odisha Tribal Empowerment and Livelihoods Programme undertake several developmental programmes with regard to SHG creation and development, facilitating access to renewable energy, employment, setting up of Ekalavya Model Residential Schools, development of infrastructure such as roads, bridges, minor irrigation projects, hostel buildings, educational complexes, drinking water facilities etc. They have a strong partnership with NGO's such as Gram Vikas, Antyodaya, Lutherean World, Pradahan, Kartabya, Landesa etc., for implementation.
7. The government imposes VAT on solar and other renewable energy products and solutions, which leads to a higher cost burden for end-users and sends conflicting signals in the presence of subsidy for RE solutions.

4. LEARNINGS AND RECOMMENDATIONS

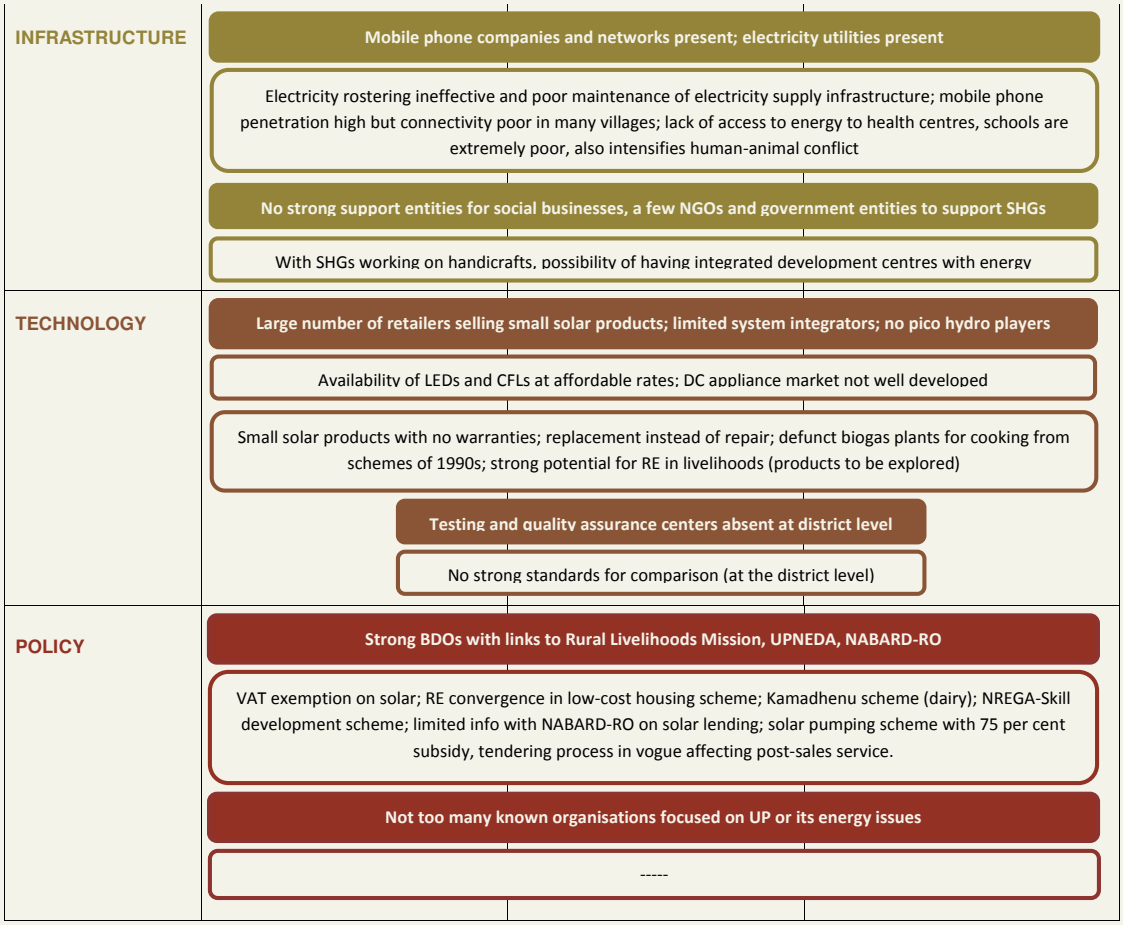
This chapter seeks to apply the framework to each of the focus regions to better understand the scenario in each region and then provides recommendations for moving forward in each of the regions.

Ecosystem for Energy Access Solutions in Uttar Pradesh

Given below is the schematic capturing of the current ecosystem for deploying energy access solutions in Uttar Pradesh, based on takeaways from the field research undertaken in two districts, viz., Pilibhit and Lakhimpur Kheri.

Table 4.1: Representation of the Energy Access Ecosystem in Uttar Pradesh

	Households	Livelihoods	Community
FINANCE	Branches of Nationalised banks and RRBs present; Limited number of MFIs		
		SHGs created by the State Rural Livelihood Mission	
	Difficulties in accessing loans, <50 per cent HH have savings accounts, institutional savings low, Fear of NPAs restricts lending	•Lending restricted to agriculture; •Few loans for self-employment (even through RSETI); and •Fear of NPAs restricts lending	
	RE Convergence possibilities with KCC and micro credit plans of SHGs; Pay-as-you-go and rental models		
		Interest from Bilateral agencies and the Government to support the State	
		Few sources of international grant accessed in this region	
		Limited platforms to access investment and R&D capital	
CAPACITY BUILDING	Forest/wildlife conservation NGOs exist with some work on community development, other CSOs limited		
	High levels of awareness about the need, usage of RE, particularly solar; behavioural change difficult with cooking energy		
		Existence of only five ITIs and one RSETI in Pilibhit; four ITIs and one RSETI in Kheri	
	Low levels of maintenance: replacement instead of repair; limited number of ITIs providing course for becoming electrician		
		No post-training support in the region	
			No financier capacity building
		Operational training undertaken by enterprises	


INFRASTRUCTURE
Mobile phone companies and networks present; electricity utilities present
Electricity rostering ineffective and poor maintenance of electricity supply infrastructure; mobile phone penetration high but connectivity poor in many villages; lack of access to energy to health centres, schools are extremely poor, also intensifies human-animal conflict
No strong support entities for social businesses, a few NGOs and government entities to support SHGs
With SHGs working on handicrafts, possibility of having integrated development centres with energy
TECHNOLOGY
Large number of retailers selling small solar products; limited system integrators; no pico hydro players
Availability of LEDs and CFLs at affordable rates; DC appliance market not well developed
Small solar products with no warranties; replacement instead of repair; defunct biogas plants for cooking from schemes of 1990s; strong potential for RE in livelihoods (products to be explored)
Testing and quality assurance centers absent at district level
No strong standards for comparison (at the district level)
POLICY
Strong BDOs with links to Rural Livelihoods Mission, UPNEDA, NABARD-RO
VAT exemption on solar; RE convergence in low-cost housing scheme; Kamadhenu scheme (dairy); NREGA-Skill development scheme; limited info with NABARD-RO on solar lending; solar pumping scheme with 75 per cent subsidy, tendering process in vogue affecting post-sales service.
Not too many known organisations focused on UP or its energy issues
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Ecosystem for Energy Access Solutions in Odisha

Given below is the schematic capturing the current ecosystem for deploying energy access solutions in Odisha, based on field research undertaken in two districts, viz., Koraput and Kalahandi.

Table 4.2: Representation of the Energy Access Ecosystem in Odisha

	Households	Livelihoods	Community
FINANCE	**Branches of Nationalized banks and RRBs present; Limited number of MFIs, Post office savings limited**		
		SHGs created by Livelihood Mission	
	Only 20 per cent HH have bank accounts; limited institutional savings; tedium in accessing loans; bank accounts opened mainly for government schemes;	No specialised MSME Branch; existence of MFI lending for livelihood; lending is mainly for agriculture; financing for MSME limited by slow entrepreneurial growth	
	RE convergence possibilities with SHG lending and housing finance; community-based financing for RE in interior regions useful		
		Interest from bilateral and government financiers to support the State	
		International grant available for NGOs for livelihood development	
		Limited platforms for enterprises to access Investment and R&D capital	
CAPACITY BUILDING	**Tribal development government agencies with strong NGO partnership**		
	Low awareness about RE and its scope; cooking dependent on firewood		
		Existence of only one ITI and one RSETI each in Kalahandi and Koraput; poor infrastructure	
	Low levels of maintenance and servicing; presence of limited vocational training; course curriculum unsuited to local employment opportunities; RE technician training in RSETI exist in other districts and can be replicated		
		One solar incubation centre; placement opportunities for other vocations limited	
		Limited presence of RE entrepreneurs, suppliers, retailers	
	Capacity building of NGOs needed to further develop financing mechanisms, work with banks, create village service entrepreneurs and improve awareness on RE		

INFRASTRUCTURE	**Mobile phone companies present but network weak; utility companies with poor infrastructure, maintenance and billing structures** Several villages and households yet to be electrified; poor availability of power when electrified (months without supply); poor road and transportation connecting villages especially due to flooding during monsoon **Strong presence of NGOs and other civil bodies** Need for greater interventions for livelihood development and health; monitoring of NGOs important
TECHNOLOGY	**Few retailers selling small solar products, limited system integrators; few pico-hydro players/NGOs** Limited availability of LEDs and CFLs; DC appliance market not well developed; free solar home systems provided through government schemes in early 2000 lie defunct with no servicing RE technology needed for better medical, educational facilities and basic amenities. Strong potential for RE in livelihoods (products to be explored); High potential for Pico hydro **Testing and quality assurance centers absent at district level** Standards largely absent and no awareness around this
POLICY	**Absence of sufficient government administrative officers at block level (unfilled vacancies)** VAT exists on RE; RE convergence being explored in Koraput by the Collector; convergence in energy provisioning efforts of different government agencies and NGOs. **Many NGOs attempting work in Orissa - linkage with Government only in few cases** Integrated energy planning absent

Recommendations for Addressing Gaps in the Ecosystems of the Focus Regions

Based on the ecosystem framework and an understanding of the circumstances in these regions, a set of possible recommendations have been made. Some are region specific, while others are more generic and relevant for both the focus regions.

FINANCE

- **Access to Credit and Reducing Bank Risk**
  In the focus districts of each of these regions, only 15-20 per cent of the households have bank accounts with the formal banking system and bank branches are clustered in the block headquarters region. In areas of Uttar Pradesh where awareness levels are higher, increasing access to credit for end user households to purchase larger energy systems would prevent issues around purchase of smaller products that lack quality standards. To address this, along with the perception of NPAs associated with solar, funding sources such as National Clean Energy Fund (NCEF), National Solar Mission and other bilateral sources could be used as bank guarantees to incentivise lending while simultaneously addressing the risk of the banker.

- **Innovative Financing and Collection**
  Development of alternate channels of banking is critical in these regions. Concepts such as Banking Correspondents, Customer Service Points, Mobile-based banking and Pigmy collections would need to be explored in financing for RE solutions.

  Using pay-as-you-go technologies to either finance in the absence of bank financing or to use the hardware's "system cut-off" facility as a risk mitigation method, with the power to cut-off supply being in the hands of bankers, can do a great deal to address the issue around collections and perception of defaults. This could address a critical concern for many bankers.

  However, in the interior parts of Odisha, where people have seasonal incomes and low purchasing power and have subsidised RE systems, there is a need for alternative models for replacement of batteries and other expensive RE components. Here households may not be willing to/not have the resources to pay for such operational expenses. This could be covered through crowd funding platforms, separate bank scheme, revolving fund, government scheme etc.

- **Specialised MSME Branch**
  Presently most lending is restricted to agriculture and allied sectors. Bankers have not engaged enough in lending to MSMEs, therefore limiting the access to finance for small entrepreneurs for RE solutions or to run RE based businesses. Under government schemes for MSME's such as the Micro Units Development and Refinance Agency (MUDRA), Credit Guarantee Trust Scheme for MSE (CGTMSE), Prime Minister's Employment Guarantee Programme (PMEGP), there is greater scope to facilitate lending with flexible terms for RE entrepreneurs whose ticket sizes may not be very high. A strong drive would be essential to help bankers and entrepreneurs understand the value in financing through this mechanism.

CAPACITY DEVELOPMENT

- **Technical Awareness Workshops for Households**
  Basic aspects around adoption of decentralised clean energy solutions to meet current needs are essential in parts of Odisha. Even in areas of UP where there is awareness about renewable energy, there is a need for awareness on the following:
  - Differences in decentralised RE solutions and the performance and value addition of each across portable systems, home systems, micro grids
  - Importance of servicing and maintenance and the cost-benefit analysis of using a quality system with longer warranty.
  - Ability to distinguish between quality of the products, warranty, quality of components etc.
  - There are very few shops currently selling energy efficient consumer durables including LEDs and CFLs. Awareness of these products could encourage greater demand thereby increasing supply and providing more options.

- **Technical Training**
  There is an urgent need to develop local capacity development programmes to create technicians who can service and maintain RE solutions, especially related to solar and pico-hydro projects. Many households have lost confidence in RE products due to lack of servicing of 'free products' distributed through government or NGO programmes.

  There is a great opportunity to build the capacity of existing ITIs and RSETIs in the region (and NGOs that do capacity building) to introduce short, 1-3 month, energy courses that cover technical as well as operational aspects related to provision of energy access solutions. Graduates of such courses can ensure maintenance, while having the potential to become micro entrepreneurs. Another model would be to build the capacity of existing diesel rental entrepreneurs (after understanding their model) to manage and rent renewable energy products for low-income households.

- **Entrepreneur Development Schemes**
  Schemes for development of MSMEs, such as PMEGP, SHG, CGTMSE, SJSRY (Swarna Jayanti Shahari Rozgar Yojana), MUDRA etc., are present in the region and bankers are broadly aware of the same. Lending under these, however, has not been high enough. Independently, a strong Incubation effort and post training support in terms of business planning or placement should be provided to the entrepreneurs and trainees, and this would go a long way in sustaining interest. While institutions existing locally can become hubs for such support, there is an essential need for further development in this area.

- **Convergence with Government Capacity Building Initiatives**
  Schemes like the Pradhan Mantri Kaushal Vikas Yojana of the Ministry of Skill Development and the Project for "Livelihood in Full Employment (LIFE)" a component of the MGNREGA (implemented through the Deen Dayal Upadhyaya Grameen Kaushalya Yojana) have been launched in 2015, and have a strong scope for the capacity development of decentralised renewable energy micro entrepreneurs. These should be leveraged to develop RE entrepreneurs in the region. Convergence of the above schemes with the Green Jobs Sector Skill Council affiliates would add value.

- **Capacity of Financial Institutions, NGOs and SHGs**
  Capacity development of SHGs to operate and manage RE systems can encourage access to energy in the region. This is important in the context of poor community cohesion that otherwise prevents collaborative action in the region.

  The banking sector and other non-banking financial institutions need to be sensitised to provide credit towards innovative products and technologies. Awareness of schemes to lend for renewable energy either for households or entrepreneurs, such as the Differential Rate of Interest scheme, MUDRA, CGTMSE, JNNSM (Jawaharlal Nehru National Solar Mission), lending for RE based SHGs and JLGs (Joint Liability Groups), combining RE with local schemes such as Lohiya Awaas Yojana, Kamadhenu and so on.

  - Awareness on types of livelihood technologies powered by RE that can be financed through banks.
  - Development of mechanisms to enhance recovery and convert non-performing assets to performing loans in order to encourage greater lending towards RE products and services. This could focus on community participatory approach for improved collection mechanism.

  Several NGOs working in the region can help in the provision of renewable energy solutions for off-grid regions. Capacity building with community development organisations and NGOs is essential for them to develop the right kind of incentives to ensure longer term usage and sustainability of solutions provided. For example, in a community based micro-hydro system in Kalahandi, Odisha, a television was provided as a community asset. It was noted that the system was maintained well to ensure the continued functioning of the television and whatever cost was incurred was immediately pooled in by the community.

TECHNOLOGY

- **Renewable Energy Products for Livelihood**
  RE can be explored for several livelihood activities such as agriculture processing, small power looms, diary processing, cold storage, mini oil press units, small rice mills, small cashew processing units etc. NGOs and government can work together to pilot these initiatives. These solutions can be managed by micro entrepreneurs for greater efficiency and sustainability. Value addition through RE technologies for non-timber forest products will also enhance livelihoods in the regions with forest cover. Where products do not exist, organisations like Clean Energy Access Network (CLEAN) can be involved in working with manufacturers, R&D institutions and academia to determine the demand and possibilities.

- **Standardisation**
  Many of the RE products, especially solar solutions available in the markets in Pilibhit and Lakhimpur Kheri do not conform to quality standards or provide warranties. Hence standards suitable to local conditions with regard to usage, weather conditions and so on need to be developed. Basic testing centres can be developed in the existing institutions such as the ITI etc., and CSOs, Energy entrepreneurs or government institutions can participate in monitoring the standards.

- **Clean Cooking Strategy**
  There is a need to relook at the clean cooking programmes and create an independent one for areas in UP where dependence on forests and conservation efforts overlap. Encouraging newer technologies and private players across a host of clean cooking solutions – solar, biogas, efficient chulhas – need to be explored before determining the strategy. The initiative can also evaluate the accessibility of LPG to ensure better delivery of services.

- **RE for Socio-Economic Infrastructure and Institutions**
  There is limited grid power supply in several medical centres in the districts of Kalahandi and Koraput in Odisha. These institutions heavily depend on diesel run generation sets or battery based back-up systems. The several health sub-centres and anganwadis also do not have this facility. In Odisha in particular, health is an important aspect of energy usage where additional work is required on understanding medical equipment and energy appliances.

INFRASTRUCTURE

- **Integrated Energy Centres and Digital Centres**
  There is a growing demand for energy-based assets such as charged batteries for lights and mobile phones, especially for shops, mobile vendors etc. Community energy services such as photocopying, water purification, television, basic medical facilities, internet and communication can also be added in with a rental fee for users. These can run either on solar or pico-hydro systems depending on the area. These can also help address some financing challenges in communities where access to institutional financing is extremely unlikely.

  Given the remoteness and inaccessibility of these communities', digital education centres powered by decentralised renewable energy can be created to cater to development of livelihood, education and health-linked initiatives. Given the reliance on agriculture and other allied sector in the region, there is also scope for the development of Kisan (farmer) Centres which can provide digital inputs on soil testing, crop suitability, crop development, renewable energy based weather station etc.

- **Mobile Technology**
  Given the high penetration of mobile phones, this technology can be leveraged for developing pay-as-you-go models for renewable energy products, for providing information to develop capacity/awareness, for managing demand and supply for entrepreneurs, managing support services, etc.

- **Power Utilities**
  There is a need to engage with local power utilities to support in improving efficiency, in particular to ensure that electricity rostering is effective and operates as per schedule. This is critical to better planning of last mile delivery of DRE solutions.

- **Convergence in Infrastructure Planning**
  To reduce conflict between forest and community, RE technologies for lighting and fencing can be explored that run on commercial basis to ensure sustainability, in forest fringe areas.

  Convergent planning for better utilisation of gram panchayat funds to address community challenges such as water purification, sewage treatment, better health facilities, disaster management (flooding) etc., that can be addressed through energy. This can be particularly useful in Uttar Pradesh where the government allocations provide support for gram panchayat initiatives.

POLICY AND REGULATION

- **Beyond Subsidy**
  To encourage adoption of renewable energy, incentives that are provided should be sustainable and targeted at ecosystem development beyond mere subsidies. For example, encourage bank finance, encourage MSME establishment, innovative financing through revolving funds, collateral back-up, interest subsidy, margin money relaxation, customised instalments etc.

  In programmes where subsidies are introduced, there is a need for greater coordination between the central government department, NABARD and the relevant state government departments to avoid "competing subsidy practices". For example, the targets for solar water pump subsidy through NABARD financing are not being met in many states owing to additional subsidies being provided by state governments, independent of the banking channel.

- **Tendering**
  The process of government tendering of any technology intensive product encourages the participation of companies from across the country. Often companies from other states are selected to provide the products based on the lowest bidding price. However, the installation and servicing needs post purchase are often neglected. Replacement of product or components that is assured by companies results in excessive delays for the consumers. This calls for changes in the tendering process where focus should be moved towards mandatory servicing, guaranteed by the presence of the enterprise in the region. This would also encourage local entrepreneurs.

- **Utilisation of NCEF and NABARD Innovation Funds**
  The National Clean Energy Fund and the NABARD innovation funds are targeted at the development of renewable energy in the country. These funds could be leveraged to benefit the regions. The NABARD Rural Innovation Fund is targeted at the development of innovative technologies and processes also relating to renewable energy, water and waste management, agriculture etc.

- **Convergence of Schemes**
  There are different government schemes that can converge to leverage the benefits provided under each of them and accelerate the deployment of RE in energy deprived regions. For example, convergence of Indira Awas Yojana with JNNSM (a version of which has been explored through Lohiya Awaas Yojana in U.P.), KCC

with JNNSM, Swachh Bharat Abhiyan with schemes for piped water connection and solar lighting, NRLM, MUDRA and CGTMSE with DRE entrepreneur promotion etc.

Through the Sansad Adarsh Gram Yojana, a village in Pilibhit, U.P., has been adopted by a Member of Parliament. It is important to outline and advocate for the role of RE solutions in aspects linked to model village planning so they can be replicated in other regions as well.

- **Targets and Monitoring for Bank Financing**
  Currently, bank financing for RE does not have mandates at the district level that can be monitored. With RBI promoting RE under the priority sector lending, creating bank mandates might increase the likelihood of financing for RE and monitoring over time could help in determining strategies for improving the scenario.

  There are often delays in the communication of information between nodal banking institutions such as the NABARD, SLBC (State Level Bankers Commitee) and the individual bank head offices and branches. Addressing this communication gap could go a long way in preventing bankers' reluctance to provide credit.

- **Taxation**
  Despite the growing emphasis on renewable energy in the country, many states including Odisha continue to impose Value Added Tax (VAT) on renewable energy products. Uttar Pradesh is one of the few states that has been successful in removing VAT on solar products and spare parts. There is a need to influence policymakers with regard to Goods and Services Tax (GST) to ensure that all RE solutions are exempted from taxation especially to benefit the rural poor.

  To encourage the presence of suppliers and system integrators in smaller districts of the states, incentives need to be created, for example, tax holidays for locating in rural and interior blocks etc.

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Roadmap for Intervention in Pilibhit and Lakhimpur Kheri, Uttar Pradesh

Table 4.3: Roadmap for Intervention in Pilibhit and Lakhimpur Kheri, Uttar Pradesh

Factor	Uttar Pradesh	Actor
Finance	• Pay-as-you-go technology: Pay-as-you-go models can be piloted in Pilibhit and Lakhimpur Kheri for DRE as a risk mitigation mechanism for banks. To address the issue of recovery, banks can be given control over the system and in case of default in payment; the banker will be able to disconnect the system. • Micro credit planning: SHG development with women as its focus has been taken up robustly in the region. Renewable energy can be one of the projects that are adopted. Micro Credit Plans of the SHGs can be modified to adopt the same. • Gram Panchayat funds: The gram panchayat has been allocated funding for RE at the village level. Currently their interventions are restricted to solar powered street lighting. New products can be explored based on the needs of the community.	Technology providers and Energy enterprises NGOs, SRLM/NRLM District administration, gram panchayats
Capacity Building	• Conversion of diesel entrepreneurs: There are several diesel energy entrepreneurs, i.e., people who supply power using diesel generator sets to households on a monthly payment model. These entrepreneurs can be supported and incubated to become renewable energy entrepreneurs supplying DRE through products such as metered micro grids, SHS, portable system rentals and so on. • End-user sensitisation programme: Since the market in many regions is flooded with low quality products, especially for solar solutions, additional awareness would be required for end user households and institutions. There is a low level of awareness of the 'cost-benefit' of servicing, warranty and guarantee available for various sizes/specifications of renewable energy solutions. • Some of the largest barriers to adoption of ICS are linked to awareness and behavioural change. Existing efforts can be extended to these regions. • Rural self employment institutions: The RSETI in Lakhimpur Kheri, an award winning institution in training and creating entrepreneurs, could potentially be a strong partner for training and dissemination of entrepreneurs/operators who could take on DRE as a livelihood in itself as well as adopt DRE solutions for existing livelihoods.	Energy enterprises, NGOs (community mobilisation) Energy enterprises, NGOs (community mobilisation), Manufacturers of solar products Self employment training institutions/programmes
Technology	• Water purification: Water purification solutions are critical in Pilibhit and Lakhimpur Kheri. High levels of water contamination from indiscriminate usage of fertilizers have affected the quality of drinking water. Water testing and development of suitable solar-based water purification technologies can be piloted. • ICS, biogas and LPG act as potential alternatives to firewood based cooking. In particular, supply chain development and financing for LPG could alleviate the situation.	Technology innovation and Design centres, NGOs working on livelihoods
Infrastructure	• Power Utilities: Engagement with local power utilities on the importance of effective electricity rostering is essential to facilitate scheduled load shedding. Improved scheduling can help in identifying energy gaps and could lead to better planning of DRE solutions that can complement the availability of grid electricity. • Forest fringe areas: To address aspects of human-animal conflict in forest fringe areas of these two districts, DRE technologies can be explored, particularly for flood lighting, fencing and cooking. Existing forest department schemes could be leveraged for the same.	NGOs, Policy and Planning institutions, Power Utilities Energy Enterprises, Forest Departments, NGOs

Factor	Uttar Pradesh	Actor
Policy and Regulation	• Solar water pump subsidies: The targets for solar water pump subsidy routed through NABARD are not being met in many states owing to parallel schemes with additional subsidies being provided by state governments. Advocacy with State Agriculture Department, UPNEDA and NABARD to integrate funding from various channels can facilitate better achievement of project goals. • Uttar Pradesh is one of the few states that have been successful in removing VAT on solar products and spare parts. Advocacy for continuation of tax exemption in the Goods and Services Tax (GST) regime for all RE products. • Capitalising on the Lohiya Awaas Yojana: The Lohiya Awaas Yojana has taken the first step to integrate solar energy solutions as part of housing intervention.	Policy and planning institutions, state nodal agencies. National and state government agencies coordinating energy, finance and taxation; policy and planning institutions.

Roadmap for Intervention in Koraput and Kalahandi, Odisha

Table 4.4: Roadmap for Intervention in Koraput and Kalahandi, Odisha

Factor	Odisha	Actor
Finance	• MSME branch: There is a need for creation of specialised MSME bank branches where each branch has trained bankers who can better understand and cater to the needs of MSMEs, while capitalising on relevant schemes. These can support energy entrepreneurship as well as uptake of DRE solutions by small enterprises. • Replacement costs: The community's ability to pay and the need to raise additional resources for replacement and maintenance have been challenges to the long-term sustainability of existing DRE systems in this region. To address this, particularly in the interior regions of Kalahandi, alternative funding models could be explored through crowd funding platforms, CSR funds, soft funding sources.	Banks, policy and planning institutions CSR, philanthropic capital, NGOs
Capacity Building	• NGO training: NGOs can be sensitised about the potential of DRE for households and livelihoods. While some NGOs do work on awareness around DRE for lighting, there is still limited awareness of its potential for small livelihood applications, such as solar powered sewing machine, printers, mobile charging, refrigerators for hospitals and retail outlets etc. • Financial inclusion and Bank sensitisation programmes: In the interior regions of Kalahandi and Koraput people are hesitant to approach banks and there is limited awareness among bankers on the financial viability of DRE solutions. Undertaking awareness programmes through SHGs on the value add and services of banking could be a first step towards developing a stronger engagement with financial institutions. In parallel, there is a need to work directly with bankers to increase their understanding of DRE solutions and their economic viability to enhance their willingness to lend. • Creation of service entrepreneurs: Availability of service is often an area of concern for bankers and end users considering decentralised energy systems. This can be an important step to work with local training institutions to increase confidence among bankers and financiers.	NGOs, energy enterprises NGOs, SHGs, training institutions and business incubators Energy enterprises, training institutions
Technology	• Cold storage units and poultry incubators: Among the livelihoods in Kalahandi and Koraput, horticulture and poultry farming are upcoming sectors that would benefit from DRE interventions. For example, cold storage units for horticultural produce and poultry incubators. There is also an increasing demand for solar powered pumping solutions that are portable and can benefit multiple farmers in a single crop cycle.	Technology innovation and design centres, energy enterprises, NGOs
Infrastructure	• Integrated Energy Planning: The timelines and plans associated with grid extension and Government RE programmes need to be more transparent and systematic. Integrated planning could facilitate DRE extension efforts of energy enterprises. • Integrated energy centres and livelihood centres In parts of Odisha where power failures remain unresolved for a long period due to lack of servicing, temporary decentralised energy powered centres could address immediate energy needs of households and local livelihoods. These could also serve as community centres for activities of livelihoods, education, healthcare and so on.	State nodal agencies and Energy departments, Policy and Planning institutions NGOs, Energy enterprises

Factor	Odisha	Actor
Policy and Regulation	• VAT/GST exemption Advocacy can be undertaken in Odisha for removal of Value Added Tax (VAT) on all renewable energy products and spare parts. This should also be continued into the GST regime. • Convergence with Tribal development projects: There are a number of agencies and programmes focussed on improvement of tribal communities and their livelihoods. Creating mandates around clean lighting and cooking solutions as a part of these programmes would enhance the impact of current programmes.	Policy and planning institutions, national and state agencies coordinating energy, finance and taxation

Roadmap for Overall Intervention

Table 4.5: Roadmap for Overall Intervention

Factor	Overall	Actor
Finance	• Fund utilisation for collateral and interest subsidies: Hesitation of banks can be addressed by providing collateral and guarantees for DRE loans. Available funding sources such as NCEF and bilateral programs can be channelled to provide collateral back-up for bank lending towards DRE systems. Similar funding sources can also be used for reducing the burden of high interest rates (especially through MFIs) for end users. This can function similar to the Differential Rate of Interest scheme of RBI with eligibility criteria such as household income.	Philanthropic funds, CSR, bilateral funding, government sources
	• Banker toolkits: To support bankers in understanding the application of specific schemes for energy solutions, determining the financial viability of the solution, payback periods etc., a bankers' toolkit can be created for dissemination through entities like NABARD and RBI.	Business incubators, policy and planning institutions, NABARD, banks
Capacity Building	• Technical training and entrepreneur development: There are a number of existing courses in ITIs and RSETIs such as electrician trade, plumbing, motor winding, masonry etc., that could be enhanced with the addition of short modules to cover RE applications. The government has also initiated programmes to improve skills including National Rural Livelihood Mission, Pradhan Mantri Kaushal Vikas Yojana, Project for 'Livelihood in Full Employment' (LIFE) and so on. Integrating energy servicing and energy entrepreneurship possibilities into the set of courses offered/ skills provided could go a long way in building strong maintenance networks in rural areas. Energy entrepreneurs could then approach banks for financing.	Training institutions, content providers, NGOs, CSR and bilateral funds, banks
	• Awareness among bankers, NGOs, SHGs: Encouraging lending towards DRE and developing innovative mechanisms for recovery of loans are important aspects of capacity building for banks and the NGOs, SHGs they interact with. These awareness programmes need to provide practical knowledge on the technical functioning of systems as well as their financial viability and risk mitigation strategies for bankers.	Training institutions, NGOs, energy enterprises
	• End users awareness on product longevity: There is a need for greater transparency and awareness to end users on the true quality, longevity and warranty of products/ services that are being offered to them. This will go a long way in increasing user-confidence in better quality products.	NGOs, energy enterprises, manufacturers

Factor	Overall	Actor
Technology	• Testing centres: The development of basic testing centres in existing institutions such as the ITIs, polytechnic, engineering colleges to test the quality of the RE products sold in the local markets could be a good way of monitoring product quality and aid in end user awareness. The government can use the infrastructure and staff for their testing, which can be monitored by government nodal agencies responsible for testing. Government institutions can be encouraged to adopt standards based on enterprise and end-user experience and ensure monitoring of such standards through the basic testing centres.	ITIs, local academic institutions, manufacturers, government bodies
	• Clean cooking strategy: There is some consensus that improvements in affordability and distribution around LPG could be a longer-term solution to clean cooking for households. In the interim, the high dependence on firewood needs to be addressed through rigorous field testing of various ICS product designs. The feedback of communities must be taken into account while developing region specific clean cooking strategies that combine the use of ICS, biogas and improved LPG connections.	Energy enterprises, government bodies, NGOs, technology innovation and design centres
	• Technology innovation for livelihoods: Existing technologies and appliances that have been tested on the field can be deployed with suitable financing for value addition in a variety of small livelihoods. For example, energy efficient motors, powered by DRE, for powering looms and small motive loads, refrigeration, solar powered water pumps and so on.	Energy enterprises, NGOs, technology innovation and design centres
Infrastructure	• Integrated energy centres: Given the remoteness and inaccessibility of a number of these communities' and the unreliability of power in these regions, temporary decentralised energy powered centres could address immediate energy needs of households and local livelihoods. These could also serve as community centres for activities of livelihoods, education, healthcare and so on.	Technology innovation and design centres, CSR and bilateral funds, government entities and funds, energy enterprises, NGOs
	• DRE for community needs: Energy infrastructure for community needs that warrant greater reliability such as street lighting, Institutional lighting, water purification and pumping, school lighting and digital aids, basic health appliances and so on can be powered by decentralised renewable energy programs.	
Policy and Regulation	• Targets and monitoring for bank lending: Setting targets for lending towards Decentralised Renewable Energy which can be monitored by NABARD and State Level Bankers' Committee can facilitate an institutionalisation of energy in the portfolio of bank lending.	Policy and planning institutions, government agencies, banks, NABARD, State Level Bankers' Committee, RBI
	• Changes in the tendering process: There is a need for the government's tender based programmes to shift focus from lowest bids to mandatory and strong servicing requirements including guaranteed presence in the region and collection/ repayment mechanisms. This is critical for long-term sustainability of government funded energy solutions deployed in the field.	
	• DRE and grid planning: It is essential to undertake a bottom-up approach to energy planning and lay out areas or loads that would be better served through DRE solutions, thus providing a complement to the current capacity of the grid. This must serve as a framework for government planning on future grid extension, making sure there is no duplication of efforts and facilities exist for integration of DRE solutions with the grid in the long term.	
	• Convergence of programmes: Convergence of RE with other government schemes especially linked to livelihoods (National Rural Livelihood Mission, Pradhan Mantri Kaushal Vikas Yojana), Housing (Indira Awaas Yojana), Education (Digital India), Agriculture and so on will go a long way in institutionalising renewable energy as a part of planning for other developmental interventions.	

5. CONCLUSION

With increased attention and urgency to meet the energy needs of the large under-served and un-served population, commitments are being created through bodies such as Sustainable Energy For All (SE4All) at the international level, as well as through Ministries of Power and New and Renewable Energy in India. However, given the geographical constraints, supply of power and challenges to extending the grid, there is a case to be made for decentralised renewable energy solutions to occupy a larger position in the 'Power for All' plans in India or 'Sustainable Energy For All' targets in under-developed and developing regions across the world.

Currently, one of the main challenges facing widespread dissemination of such solutions is the lack of a strong foundation of various factors – or an ecosystem – that supports the long-term functioning and sustainability of solutions that are implemented. The ecosystem approach, thus, brings the focus on to the set of factors that need to be developed or strengthened in a holistic manner to disseminate solutions with the final goal of improving energy access.

The ecosystem framework articulated through this project is able to integrate the key stakeholders as well as the resources available to them and deployed by them to arrive at an understanding of the field scenario. Energy solution provision for household, livelihood and community levels are considered. The ecosystem factors in this framework include Finance, Capacity Building, Infrastructure, Technology and Policy. The uniqueness of this framework is its closeness to the field and the utility is the ability to easily identify gaps and opportunities in the energy access ecosystem. While the framework is limited in its ability to provide a quantitative reflection of the scenario and is time and resource intensive to apply, its utility lies in the value-add to the planning and designing stage, closer to implementation, rather than merely determining investor-friendliness or government's commitment to DRE deployment.

The application of the framework to regions within Uttar Pradesh and Odisha revealed the current scenario for the various factors. Access to finance through banks, particularly for small entrepreneurs and end users, seems to be a critical challenge and is worsened by the relatively high default rates in the region. While some basic levels of awareness exist, lack of complete information is leading to misconceptions and risk perceptions among end users and bankers. The lack of field capacity to maintain systems further fuels these perceptions, especially among bankers. While technologies for portable lighting, improved biomass cooking and biogas are in the market and have been deployed on the field, lack of quality control has affected usage over a longer term. There is also a dearth of easily available, energy efficient technologies in the market that can address health and livelihood needs. In terms of infrastructure, poor electricity availability and planning around this is an important factor affecting DRE solution deployment. At the larger level of policy and regulation, taxation on RE systems continues to exist in the state of Odisha while UP has provided an exemption. However, in both states, there have been negative effects of subsidy and tender

programmes, adversely affecting the perception of solar solutions in many areas. In a positive move, some schemes proposed in UP around the integration of DRE systems into housing is an indication of greater convergence possibilities.

A critical step to address the financing issues is to equip banks with better collection and risk guarantee mechanisms to reduce the likelihood of default. In the case of capacity building, there is a need to improve awareness across end users, bankers and NGOs on the types of lighting and cooking products/solutions available in the market and the differences in longevity and quality. This must be supported with the creation of local level technicians (with DRE being a supplementary income) to ensure maintenance of systems installed on the ground. Development of energy efficient equipment, product standards in conjunction with enterprises as well as deployment of DRE powered applications for small livelihoods will be important moves to strengthen energy access. Infrastructure improvements will need to be undertaken in collaboration with power utilities and local gram panchayats for creation of integrated energy centres that are powered through decentralised energy sources and serve community needs.

Finally, at the policy and regulation levels, cognisance of the sector and clearly outlining the role of DRE solutions in complementing the grid, reviewing subsidy, taxation and tender processes that did not have the desired impact on the ground and creating stronger mandates for convergence—integration of energy within financing targets, and development schemes (education, housing etc.) – will go a long way in strengthening the foundation for the deployment of energy access solutions. While the goals are ambitious, it is undeniable that a truly sustainable solution can only be provided when the ecosystem factors are spoken about in the same breath as the actual implementation of solutions.

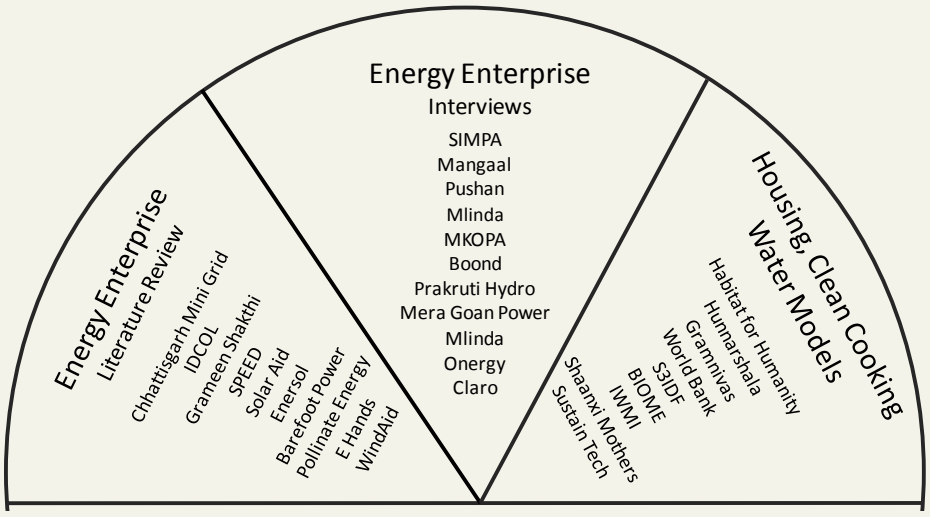
ANNEXURES

Annexure A: Enterprise/Model Review

In the first phase of the study energy enterprises providing decentralised solutions with technologies such as solar, wind, hydro were interviewed and literature review was undertaken of the others. The objective was to understand the fillip that helped the formation and growth of these enterprises and the challenges faced by them in day-to-day operations. Non energy models in housing, clean cooking, water and sanitation were also reviewed in a similar manner.

Some of the enterprises and institutions that were reviewed/interviewed are presented in the below figure.

Figure An 1: Enterprise and Institutions Reviewed



Annexure B: Questionnaires

Focus Group Discussion Questionnaire
Deployment of Renewable Energy - Ecosystem Approach

PART 1: General Information at the Village Level

Name of Block: .....

1.2 Name of the Gram Panchayat: ..... 1.3 Name of the Village: .....

1.4 Population: Total: ..... SC: ..... ST: .....:..... OBC:..... Other (Mention): .....

1.5 Number of Households: Total:..... SC:..... ST:..... OBC:.....Other (Mention):.....

1.6 Is the village connected to the grid: (Y/N)..... 1.7 Which year?: .....

1.8 Renewable Energy Source used in village (Mention if any):.....

1.9 Nearest School Distance: ..... 1.10 Nearest Hospital Distance:..... 11 Nearest Bank/Post Office:.....

PART 2: Information on Group Discussants

2.1 Please fill below details on the focus group

Mention no. of people	Female:	Male:			
Age Group	<15:	15 – 30:	30 – 50:	> 50:	
Caste	SC:	ST:	OBC:	Other:	
Religion	Hindu:	Muslim:	Sikh:	Christians:	
Schooling	1-5th :	6-10th	10 -12th	Diploma/College	No schooling:

PART 3: FGD Livelihood Categorisation

3.1 Please fill below details on the focus group

Employment Category	Mention Details	No. of ppl	Income (Rs. per month)	Expense (Rs. per month)	Number of months employed in a year
Studying Currently					
Agriculture Land owner (crop/single – double crop)					
Agriculture Wage Labour (crop)					
Agriculture Land Lessee(crop)					
Depended on NTFP (mention type)					
Migrant Worker (city and occupation)					
Other Wage Worker (NREGS/Constn. etc.)					
Animal Rearing (mention type)					
Handicraft (mention activity)					
Self Employment (mention activity)					
Un-employed					

PART 4: Asset Ownership

4.1 Please fill below details on asset ownership.

Name of Asset	Number of people in the category		Name of Asset	Number of people in the category	
House	Kutcha	Pucca	Agriculture Land	Acre	No. of ppl
				1or less	
No. of people	Yes	No		1 - 5	
Rented House				6 - 10	
Own House				Above 11	
Toilet			Animal	Hen/Chicken	
Bore Well for home				Goat/Sheep	
Hand pumps				Cow/Buffalo	
Wells			Tractor		
Cycle			Post Office Savings A/C		
Motor Cycle			MPESA		
TV			Insurance		
Fridge			Ration Card	BPL	APL
Mobile					
Pension Card (Govt.)			LPG connection		
IAY Account			NREGS Account		
CGTMSE scheme			Anganwadi		
PMEGP scheme			Mid Day Meal Scheme		
Remote Village Electrifi-cation Scheme			Pradhan Mantri Grameen Vidyukthi Karan Yojna		

PART 5: Household-level expenses

5.1 Please fill below details on household expenses.

Expense Head	Expense (Rs.)	Expense Head	Expense (Rs.)
Food		Mobile recharging	
House Rent		Entertainment	
Education (per year)		Festivals	
Health		TV Charging	
Transportation			

5.2 Energy expenses at the household level per month.

Head (per month)	Purpose of use	Quantity	Expense (Rs.)
Electricity Bill			
Mobile Battery Charging			
Petrol			
Kerosene	PDS		
	Open Market		
Diesel			
Wood			
Agriculture Fuel (Cow Dung/ Crop Residue)			

PART 6: Energy Access

6.1 Please fill below details on energy

Do you have grid connection (Mention no. of ppl)	Yes	No	Why no? :
	Winter	Summer	Monsoon
Mention months J,F,M…			
Hours of power cuts per day			

6.3 Please fill below details on energy consumption of the household.

Appliances Used – Household	Number of people	Average number of appliances	Usage (hrs)	Power Rating (W/V/HP)
	Y	N		
Lights - CFL				
Lights -LED				
Lights -Incandescent				
Fan				
Mobile charging				
Food Mixer				
Fan				

Appliances Used – Household	Number of people	Average number of appliances	Usage (hrs)	Power Rating (W/V/HP)
Television				
Water Pump – Piped Water				
Water Pump Agriculture				
Agriculture Equipment (Mention)				
Livelihood Equipment (Mention)				
Other:				

6.4 Please fill below details on energy consumption in the local institution.

Institution	Electrification Status		Source	Uses
	Y	N		
School				
Health Centre				
Anganwadi				
Community Centre (Panchayat)				

6.8 What are the major challenges you face with regard to energy?

.....

.....

6.9 What are the uses for which you need more electricity now/future?
(Livelihood, lighting, appliance etc.)

.....

.....

6.10 Please fill below details on renewable energy access (only if applicable)

Alternative Energy Sources (Mention no. of ppl)	Solar		Pico Hydro		Biomass/ Biogas	Other	
	Y	N	Y	N	Y	N	
Individual Home systems							
Centralised system (Solar/diesel mini grid, community biomass plant)							
Purpose (Mention)							
Who installed? (Govt. /Private Name/ NGO Name)							
Amount Paid for connection							
Monthly amount for service/usage							
Is it serviced regularly? (Y/N) If yes, by whom?							

6.11 What are the challenges with regard to renewable energy?

.....

.....

6.12 What are the uses you can use the renewable energy sources for?

.....

.....

6.13 If you were to get reliable source of electricity for 7-8 hours a day how much would you pay for it?

.....

.....

PART 7: Livelihood Development

7.1 How do you think you can improve your livelihood?

Areas	Detail of Exact Item	What are the challenges faced?	How can you enhance your livelihood?
Raw Material			
Training			
Finance			
Development Agency (NGO, SHG/JLG)			
Govt. Regulation – Forest			
Energy Intervention			

7.2 What livelihood opportunities can you take-up now/future?

.....

.....

7.3 Challenges in taking up those activities?

.....

.....

PART 8: Access to Finance

8.1. Give details on access to banking facilities.

Bank Account		Bank Saving			Bank Loan					
Y	N	Y	N	Purpose	Y	N	EMI	Tenure	Int.%	Purpose

8.2 Give details on the following institutions in the vicinity of your village. (2-3 km)

Heads	Do they exist Y/ N	If yes, can you name specific institution	What are the problems you faced in the accessing services?
Bank			
Micro Finance Institution			
Post Bank Savings			
Informal Lenders			
Chit Finance Run by local woman			
NGO			
Cooperative Society			
Self Help Group/ Joint Liability Group			
Government Scheme			

PART: 9: Utilities and Infrastructure Challenge.

9.1 With regard to the below areas please detail the challenges you face.

Area	Is there a challenge? Y/N	What challenge do you face?	How can it be solved?
Education			
Health			
Employment			
Road			
Transport			
Communication			
Water			
Sanitation			

Enterprise Questionnaire
Deployment of Renewable Energy - Ecosystem Approach

PART 1: General Information on Interviewee

1.1 Name of Interviewee: .....

1.2 Designation: .....

1.3 Name of Organisation: .....

1.4 Type of Organisation (Micro, Small, Medium, Large Investment Rs.).....

1.5 Manufacturing or Retail: .....

1.6 Age of Enterprise.....

1.7 Address: .....

1.8 Name of the Village/Town: .....

1.9 Name of Sub-district: .....

PART 2: Enterprise Information

2.1 Please fill below the details on goods/services.

List of Goods/ Services	Average Price of product/service	No. of customers per month	No of months you operate in a year	Avg. revenue	Avg. costs	Profit approx.

PART 3: Cost Information

3.1 Please fill below details on cost incurred by business.

Cost Items	Details on the item	Avg. cost per month	Challenge faced	What support required
Raw Material/ Supplies				
Inventory				
Labour				
Machinery				
Infrastructure – Building				
Technology				
Marketing				
Electricity				
Transportation				

PART 4: Financial Access

4.1 Please fill below details on financial access.

Financial Need	Lender Name	Amount	Interest	Tenure	Challenge	Support Required
Seed Capital						
Asset Purchase						
Working Capital						
R and D Expense						

PART 5: Energy Consumption

5.1 Please fill below details on energy consumption of the business.

Do you have grid connection (Y/N)			
Hours of power cuts per day	Winter:	Summer:	Monsoon:
Do you use alternative energy sources (Y/N)			
Name the source Solar, Hydro etc.			
Name the uses (lighting, charging, other)			
Monthly electricity expenditure (Rs.)			
Appliances Used	Number	Usage (hrs)	Power Rating (W)
*Lights	LED	CFL	Filament
Machinery : List Below			
Other:			

**Tick whatever is applicable under power rating*

5.2 What are the major challenges you face with regard to energy?

.....

.....

5.3 What are the uses for which you need more electricity now/future?

.....

.....

PART 6: Access to Institutions

6.1 Have you ever availed a government scheme? Y/N: .....

Scheme Name	Disbursement Agent (Bank Name/ Govt. Dpt/ NGO etc.)	Type of help received (Money (Rs.)/ Material (Mention))

6.2 What are the challenges you faced in availing the support? (Delay, No information, Poor access etc.)

.....

6.3 Are there other schemes you did not avail but exist? Y/N:

6.3.1 If yes, Name: .....

6.3.2 Why could you not access them? .....

6.4 Give details on the following institutions in your region.

Institutions	Do they exist Yes/ No	If yes, can you name specific institutions in each category	What service do you avail from them?	What are the problems you faced in the interactions?
Bank				
Micro Finance Institution				
Informal Lenders				
Business Support Associations				
DIC – District Industries Centre - Enterprise Incorporation				
Pollution Clearance				
Labour Union				
NGO				
Other: Insurance?				

PART 7: Access to Support and Challenge

List the top four areas of support which is critical for your operation and top challenges that hampers operation

Name Support	Describe support received	Institution	Name Challenge	What support Required?

BDO Questionnaire
Deployment of Renewable Energy - Ecosystem Approach

PART 1: General Information on Interviewee

1.1 Name of Interviewee: .....

1.2 Designation: .....

1.3 Name of Organisation: .....

1.4 Address: .....

1.5 Name of the Village/Town: .....

1.6 Name of Sub-district: .....

PART 2: Community Information

2.1 What are the activities carried out by the BDO in this region?

2.2 How do you implement your work?

PART 3: Community Information

3.1 What are the livelihoods of people in the region?

3.2 What the challenges faced by people in livelihood development?

PART 4: Energy Consumption

4.1 Please fill below details on energy consumption of the business.

What percentage of people in this region have grid connection (Y/N)			
Hours of power cuts per day	Winter:	Summer:	Monsoon:
Do you use alternative energy sources (Y/N)			
Name the source Solar , Hydro etc.			
Name the uses (lighting, charging, other)			
Monthly electricity expenditure (Rs.)			

4.2 What are the major challenges you face with regard to energy?

4.3 What are the uses for which people need more electricity now/future?
.....

PART 5: Government Schemes

What are the government schemes actively promoted in the region?

Scheme Name	Disbursement Agent (Bank Name/ Govt. Dpt/ NGO etc.)	Type of help provided (Money (Rs.)/ Material (Mention))	What are the challenges in implementation?

PART 6: Access to Institutions

6.1 Give details on the following institutions in your region.

Institutions	Do they exist Yes/ No	If yes, can you name specific institutions in each category	What service do people avail from them?	How can these institutions improve their services
School Primary				
School Secondary				
College				
ITI/Polytechnic				
Primary Health Care Center				
Secondary Health Care Center				
Hospital				
Anganwadi				
Bank				
Micro Finance Institution				
Informal Lenders				
Enterprises				
Employment Exchange				
Labour Migration				
NGO				
Livelihood Agencies				
Training Institution				

What are the areas of challenge in this region?

(Education, Heath, Sanitation, Housing, Naxal, Agriculture, Rainfall – absence/flooding, Livelihood, Transportation, Communication, Energy, Migration etc.)

Name Area	Describe the challenge	What support Required?

PART 7: Access to Support and Challenge

List the top four areas of support which is critical for your operation and top challenges that hampers operation

Name Support	Describe support received	Institution	Name Challenge	What support Required?

Financial Institution Questionnaire
Deployment of Renewable Energy - Ecosystem Approach

PART 1: General Information on Interviewee

1.1 Name of Interviewee: .....

1.2 Designation .....

1.3 Name of Organisation: .....

1.4 Type of Organisation (PSU, Private, RRB, NBFC, other): .....

1.5 Name of the Village/Town: .....

1.6 Name of Sub-district: .....

PART 2: Customer - Household Services Information

2.1 Please fill below the details from the perspective of Individual customers

Type of Service	No. of Customers	Average amount size (Rs.)	Details on tenure, interest rate, collateral etc.	Any support Govt./ Bank Scheme ?
Deposit				
Loan – Land				
Loan – Vehicle				
PPF				
Credit Card				
Debit Card				
Internet Banking				
Foreign Exchange				
SHG/JLG				

2.2. What are the services that are most popular among household/individual customers?

2.3 How do you promote products and reach individual customers in remote areas? (Agents, SHG?)

2.3 What are the challenges faced by your institution in providing them? (Awareness, NPA etc.)

2.4 What are the services your institution wants to promote further for individual customers?

2.5 What are the challenges faced by your institution in providing the same?

2.6 How can you promote more savings and increase customer base?

PART 3: Corporate - Business Services Information

3.1 What the different types of corporate customers you provide services to?

Type of Customer	Average size of enterprise (Rs.)	No. of Customers	Products/ Services Provided	Services Demanded
Micro				
Small				
SME Retail				
Medium				
Mid-Corporate				
Large				
Livelihood				

3.2 Please fill below the details from the perspective of corporate customers

Type of Service	No. of Customers	Average amount size (Rs.)	Details on loan use, tenure, interest rate, collateral etc.	Any support Govt./ Bank Scheme ?
Working Capital Loan				
Loan for Asset Purchase				
End-user				
Solar Loans				
Energy Loans				
Other RE Loans				
Livelihood Loans				

3.3 What are the challenges faced by your institution in providing the above services? (Awareness, NPA etc.)

3.4 What are the services your institution wants to promote further for corporate customers?

3.5 What are the challenges faced by your institution in providing the same?

3.6 What are the challenges that you feel corporate face in this region?

3.7 How can banking/financial services help livelihood in this region?

Training Institution Questionnaire
Deployment of Renewable Energy - Ecosystem Approach

PART 1: General Information on Interviewee

1.1 Name of Interviewee: .....

1.2 Designation: .....

1.3 Name of Organisation: .....

1.4 Type of Organisation (ITI, Polytechnic, other): .....

1.5 Is this Govt. run or a partnership (give details)? .....

1.6 Name of the Village/Town: .....

1.7 Name of Sub-district: .....

PART 2: Training Information

2.1 Please fill below the details from the perspective of the training you provide

Course Name	No. of Students	Number of Teachers	Support Infrastructure (Details of Lab, class room Machine etc.)	No. placed	Placement Channel (Industry Interaction, broker)	Industry placed in?

2.2. Describe the average student in your institution.
a. Age: b. Sex: c. Prior Education: d. Aspiration:

2.3 What is the drop-out rate?
a. At the application stage – Reason b. After Course joining – Reason

2.4 What are the courses that are most popular?

2.5 How do you encourage students to apply for the course?

2.6 Do you have tie up with partner institutions? Explain your relationship. (NGO, Industry)

2.7 What enterprises (name sector/activity) need trained employees/labour in this region?

2.8 What are the challenges faced by your institution in training students? (Infrastructure, teacher quality/availability etc.)

2.9 What are the challenges faced by your institution in placement?

2.10 What are your views on courses with energy (renewable and non-renewable) as the curriculum focus?

2.11 Is there demand for such courses from students and the industry?

2.12 How can your institution become more relevant for students and the industry? (More courses, more interaction with industry, increased partnership etc.)

Annexure C: Proceedings of the Stakeholder Workshops

Following the field surveys in both the districts stakeholder workshops were conducted to present on the learnings from the field work and discuss the strength and gaps present in the ecosystem. The discussion also revolved around the missing linkages and deliberating on the suitable interventions that can be taken up to strengthen the ecosystem.

I. ODISHA STAKEHOLDER WORKSHOP

The workshop in Odisha was held on the 1 November 2015 in Kalahandi and some of the key suggestions and thoughts from the meeting are presented below.

- **Leveraging Existing Institutions:** Under finance, the focus was placed on leveraging existing institutions of SHGs, Chit Funds for energy. While from the formal banking system, Differential Rate of Interest Scheme could be used in lending for energy among the poor households.
- **Convergence of Government Schemes**: Indra Awas Yojana scheme can be clubbed with energy access. In Koraput this has been spearheaded by district collector as CSR initiative by the banks.
- **Learning from OREDA**: There were serious concerns about the maintenance and servicing of existing solar systems provided by the government.
    - The private ITI player showed interest in considering a servicing course on solar to ensure training of service agents.
    - Thoughts were shared on developing a robust supply chain for spare parts.
    - Enterprise models were discussed for lighting: Centralised charging at an operator's house, Rs. 100 security deposit, Rs. 30 per month on energy for each household – comparable to kerosene spending
- **Livelihoods:**
    - District Industries Centre expressed its interest in supporting energy intervention for MSMEs in this region
    - For example, Rice mill, Oil mill, Wood carving, Pottery, Saw mill etc. Some portable versions being explored
- **Capacity and Willingness to pay of end-user:**
    - There is a capacity to pay but no willingness (used to free/subsidised products, even if it is only likely to come much later)
    - What are the motivations? Can we have flag-points where Mobile charging, TV, small enterprises etc. Gram Vikas's (NGO) pico hydro systems run where the community TV is affected; the TV provided by OTLP.

- **Technology and Maintenance:**

  NGOs actively engaging in renewable energy product provisioning stated that:

  "Even for community driven projects there is a need for external entity to be there or create alternate mechanisms". Because,

  - **Technology:** Local fabricator must be able to deal with small repairs and community should have direct contact with him/her.
  - **Financing:** To cover 15 years of system repair community contribution might be sufficient. This is currently done by creating a corpus fund (Eg: Rs. 1,000 paid per household at the beginning of the project, Rs. 30 after that per month for regular running; Initial amount gets used for 5 year maintenance) But this fund is insufficient for battery replacement costs that are incurred after 5-7 years of the operation of the project. In this context discussion on Revolving fund to revive systems, Crowd funding to repair systems, Bank funding ensued.

II. UTTAR PRADESH STAKEHOLDER WORKSHOP

The workshop in Odisha was held on the 8 September 2015 in Pilibhit and some of the key suggestions and thoughts from the meeting are presented below.

- **Innovative Women Livelihood:** Under the National Rural Livelihood Mission, the BDO of Nighasan expressed an interest in adding decentralised renewable energy to the Micro Credit Plan of the SHGs.
- **Supplier monitoring:** For government tendered projects it was suggested that strong supplier monitoring mechanisms be developed.
- **Village Adoption and implementing Renewable Energy:** Discussions on selecting pilot villages/ gram panchayat and create a model for energy intervention was discussed where:
  - Several stakeholders – including local government institutions, NGOs, SHGs, community, MFI, Banks etc. – are partners
  - Ensures ecosystem aspects are incorporated
  - Chose an area that is on the forest fringe where human animal conflict issues exist
  - Combine livelihood opportunity/agri-energy need into the model
- **Access to Finance:**
  - Discussion ensued on improving access to finance in different ways and exploring mechanisms that would work. For example, collateral support, supporting bankers in identification of customer and recovery of loan and including recovery agents as part of the framework under financing.

Some of the key observations of bankers were:

- Bank financing can be facilitated provided NPAs are minimised, misappropriation of funds is reduced; corruption is controlled, flexibility is provided to develop tailor-made schemes that keep in mind collateral, margin money requirement, repayment models.

- **Agriculture and Renewable Energy:**
  - Marginal and small farmers use diesel generators. Schemes specifically customised for small and marginal farmer must be designed where pumps act as anchor loads
  - Lighting and motorised needs for handicrafts for marginalised and semi-marginalised households can be other important loads.
  - Since no problems of water level, smaller sizes of pumps will also work efficiently.
  - Development of programmes for lighting and fencing for villages in the fringe of the forest was discussed.
  - Focus should be on training women as they are more enterprising. NRLM has started to focus on women and focus is also on personality development.
  - Have to keep in mind community cohesion, caste and community dynamics while designing community programmes.
  - Entrepreneur and operator models have to be promoted to ensure sustainability.

III. NEW DELHI STAKEHOLDER WORKSHOP

A stakeholder workshop was organised in Delhi on the 13 November 2015 to discuss the key learnings from the study. Some of the important suggestions and views of the participants are listed below.

- **Ecosystem Framework:**
  - To make the ecosystem robust it could capture social and cultural issues that affect the factors. For example, migration affects the purchasing power and type of product (portable versus permanent) on which the consumer might want to invest.
  - Reliability of parameters: Can the framework spell out the need for evaluating the reliability of the performance and the efficiency of institutions.
  - Clearly state who can benefit from the tool.
  - Specify the actors who can take up the interventions suggested.
  - Is there a value addition in prioritising the parameters, will it help institutions during implementation?

- **Entrepreneurship:** In the context of the framework being designed from the perspective of entrepreneurs, how can it include aspects of business

sustainability? For example, can the entrepreneur have a location mix where urban consumers subsidise their rural counterparts?

- **Electrification:** In the context of DRE energising villages, how can the definition of electrification be modified, especially for fiscal allocations?
- **Clean Cooking:**
  - LPG has proved to the most reliable clean fuel for cooking, given constraints with regard to price, efficiency, storage etc.
  - LPG adoption is a challenge in India, due to its high cost, easy access to firewood etc.
  - In the context of the high dependence on firewood especially in states of Odisha and Uttar Pradesh, ICS (Improved Cookstoves) are an interim solution to reduce pollution within households and ensure efficient usage of fuel. Field testing of ICS needs to be more rigorous.
  - Community biomass digester has been piloted in Hardoi and Unnao Districts in Uttar Pradesh for fuelling community cooking platforms.
- **Finance:** Under finance there were suggestions made for the inclusion of the below channels for funding.
  - Leveraging Members of Parliament Local Area Development Scheme for DRE interventions
  - Phasing out subsidy for RE and including interventions to strengthen ecosystem.
  - Exploring CSR funding possibilities in the interior regions.

The organisations who attended the workshop are listed below:

- CEEW,
- CLEAN,
- Shakti Foundation,
- New Ventures India/Regain Paradise,
- GIZ,
- The Climate Group,
- Intercooperation Social Development India,
- TERI,
- DST,
- MNRE,
- WWF- India,
- Selco Foundation,
- WWF- International,
- Oxfam and
- USAID Pace-D TA Program.

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WWF-India works across different geographical regions in the country to implement focused conservation strategies on issues like conservation of key wildlife species, protection of habitats, management of rivers, wetlands and their ecosystem, climate change mitigation, enhancing energy access, sustainable livelihood alternatives for local communities, water and carbon footprint reduction in industries, and combating illegal wildlife trade. WWF-India is actively engaged in promoting renewable energy uptake, enabling energy access, demonstrating renewable energy projects in critical landscapes, and overall promoting clean energy solutions.

The Climate Change and Energy Programme of WWF-India is working towards climate resilient future for people, places and species that support pathways for sustainable and equitable economic growth. Low carbon development and renewable energy at scale are the thrust areas of Climate Change and Energy Programme.

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To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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WWF-India Secretariat
172-B Lodi Estate
New Delhi 110003
Tel: 011 4150 4814 Fax: 011 4150 4779

SELCO Foundation
690, 15th Cross,
2nd Phase J P Nagar,
Bangalore 560078
Tel: 080 2649 3145
Fax: 080 26493255