Empowering People

EUROPEAN UNION

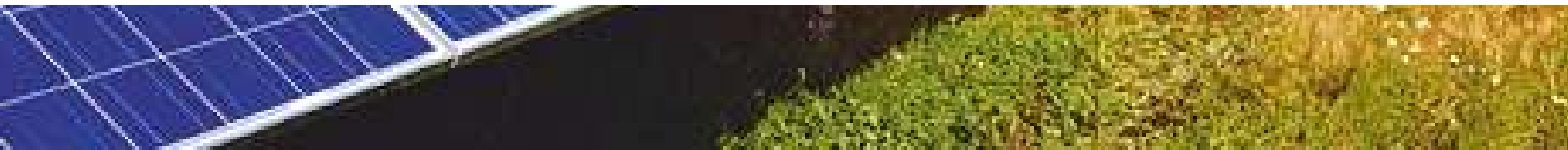
RENEWABLE ENERGY FRAMEWORK & ACCESS

ANALYSIS OF EXISTING SITUATION IN JHARKHAND

IInd Edition, 2020-21

Rural Access to Clean Energy

LIFE EDUCATION AND DEVELOPMENT SUPPORT



LEADS : AN INTRODUCTION

BACKDROP OF LEADS

"Life Education and Development Support" (LEADS) is a voluntary non-profit organization registered under the Indian Trust Act (1882) in 2005. Our aim is to promote social inclusion and democratic governance so that the vulnerable sections of society are empowered to effectively and decisively participate in mainstream development and decision making processes. LEADS have all legal registration (including FCRA) required running the organization. LEADS was established with the purpose to create some developmental model by unfolding human potentials, which is the core element of sustainability and replicate such models with the support of Govt. and other developmental organizations. LEADS work at the field level in partnership with local civil society and people's organizations. The collective experience, learning and insight enable us to work on knowledge building, training and advocacy. All initiatives are executed in a framework of collaboration and partnership to empower people for demanding their entitlements and enable the service providers, including the government, to deliver in a transparent and accountable manner. Since its inception, LEADS has planned to intervene at five levels:

1. Intervention at community level
2. Networking of like minded organizations on issues like, Education, Livelihood, Governance, Budget Tracking, Health and Nutrition, Social Security etc.
3. Issue based lobby and advocacy at community, block, district, state and national level platforms
4. Research and Publication to generate evidences for pro-people policy advocacy
5. Promotional and consultancy support to other developmental actors

IDEOLOGY

LEADS believe in potential of human being irrespective of caste, creed, religion and sex. Every individual has varieties of inner qualities, which can be promoted and utilized in the greater interest of humanity through appropriate life education and development support. Ensuring rights of every individual will provide ample scope for development of all sections of society, which will further help in unfolding human potentials and building confidence of poor and marginalized communities. The organization plans its intervention on the basis of its development understanding and ideology.

CORE GUIDING PRINCIPLE

- Participatory Decision Making is Practiced from Community to organizational Level
- Decentralized structure for enhancing efficiency and effectiveness of the program
- Team work within the organization with specific roles and responsibility
- Promotion of Leadership both at Community and Organizational level to ensure sustainability

VISION

To create an inclusive society where all stakeholders, particularly the vulnerable, participate with full empowerment and gain equal access to and control over services, resources and institutions. The values like mutual respect and cooperation, participation, trust and brotherhood, gender equity, peace and justice will prevail and be practiced in the society. Environment will be free from all sorts of pollution."

MISSION

Our mission is to make real the idea of a society consisting of free and equal citizens who are able to come together to solve the problems that affect them in their particular contexts. The commitment is to work for a paradigm of development and governance that is democratic and polyarchic. We seek to institutionalize the idea that development and governance should not just be left to the state and its formal bodies, such as the legislature and the bureaucracy, but that citizens and their associations should engage separately and jointly with the state.

LEADS believe in people's knowledge, skills and experience. LEADS is committed to give strategic thrust on the issues like: **Empowering Tribal Community, Providing Life Education to Children and Adolescent, Women Empowerment, Livelihood Support to Poor and Marginalized, Natural Resource Promotion, Technical Skill Up Gradation for Employment Generation, Health** etc. to bring appropriate changes and promote dignified life of poor and marginalized people of the society. **Rights based intervention through participatory approach will be core commitment of LEADS.**

OUR REFERRAL PEOPLE

Ultra Poor, Vulnerable groups like Scheduled Tribes, Scheduled Caste, Other Backward Caste, Women and Children, Disable Persons etc.

GEOGRAPHICAL AREA OF OPERATION

LEADS is directly working in more than 1600 villages of Jharkhand, covering the districts of Khunti, West Singhbhum, Latehar, Ramgarh, Hazaribahg, Ranchi, Simdega & Saraikela Kharsawa. In addition to that, Lobby and Advocacy is taken up across the State through network interventions.

RENEWABLE ENERGY FRAMEWORK AND ACCESS

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IInd Edition, 2020-21

Situational Analysis Report Under

RACE

Rural Access to Clean Energy

LEADS

Empowering People

Life Education and Development Support

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Disclaimer

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We thank our donor partner European Union who's support and cooperation helped us in every step in carrying out the exercise. We also express our appreciation to the community mobilisers and staff who are working intensively in the field areas. We express our sincere thanks to the program persons of the partner organization for their timely supervision and action which was extended throughout the study.

A. K. Singh
Director, LEADS

EXECUTIVE SUMMARY

Sustainability of the planet has been the hot topic of this millennium. Multitude of attempts has been made to ensure sustainable development. Sustainable Development Goal – 7 aims to ensure access to affordable, reliable, sustainable and modern energy for all. India too through its National Action Plan for Climate Change, to Millennium Development Goal commitments to SDG commitments, has made attempts to contribute to this global cause.

The commitments have found policy narrative and the targets have gone on to be revised rather quickly. Meanwhile the development in the renewable energy sector too has been fast paced and further contributes to achieving these commitments. Under National Action Plan on Climate Change, India set a target of 20 GW of energy production through renewables by 2020. This was revised to 100GW in 2015 and to 175GW in 2019. Meanwhile India surpassed the original target of 20GW in 2018 itself, 4 years ahead of 2022. The pace of adoption of renewables has been varied, and a reflection of resource curse appears in this sector as well.

The second edition of this document studies the condition of adoption of renewables in the mineral rich state of Jharkhand and draws a comparison with India's policy commitments. Though the targets have been upwardly revised but the ground reality of final commissioning of these power plants, and changing the lives of the people through adoption of renewable energy sources have been limited. Jharkhand has installed only 47 MW of renewable energy capacity against the Indian capacity of 87 GW of non-conventional capacity addition.

LEADS with the support of European Union is assisting in realisation of government's renewable energy projects in the district of Simdega, Gumla, Ranchi and Khunti. With LEADS and its network of likeminded CSOs intervention not just not just programs are being implemented but policy level suggestions too have been made which have been accepted and draft policies relating to mini-grid and cold storage chain is being developed.

The document tries to capture the progress in adoption of national policies as well as the short comings in their implementation. The document also captures the field study of the community in some of the remotest location of Jharkhand, and tries to analyse and suggest ways to draw semblance between the energy needs of the poorest while attaining SDG-7 which promises universal access to affordable, reliable and modern energy services by 2030.

This second edition captures LEADS intervention, which has resulted into training of youth and entrepreneurship among them which would be of utmost urgency for maintenance of the entire infrastructure being installed in villages. LEADS suggestion on training of farmers of solar water pumps; overhead water tanks etc. which would result into sustainable use of water resources. Likewise linkage with private enterprises and financial institutions is also assisting the beneficiaries to adopt reliable and sustainable Clean Energy Solutions.

Fragmented attempts of various CSOs, government departments, and public needs to be synergised which would ultimately lead to realisation of not just INDCs but also ensuring affordable, reliable, sustainable and modern energy for the remotest of population.

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ACRONYMS

AC	Alternating Current
BOLT	Build Own Lease Transfer
BOO	Build Own Operate
BOOT	Build Own Operate and Transfer
CAPEX	Capital Expenditure
CES	Clean Energy Solutions
CFA	Central Financial Assistance
CSP	Concentrating Solar Power
DC	Direct Current
DISCOM	Distribution Companies
DVC	Damodar Valley Corporation
ESCOs	Energy Service Company
FDI	Foreign Direct Investment
FGD	Focus Group Discussion
FY	Financial Year
Go	Government of India
GW	Giga Watt
ICLs	Incandescent Light
IREDA	Indian Renewable Energy Development Agency Limited
ISA	International Solar Alliance
JNNSM	Jawaharlal Nehru National Solar Mission
JREDA	Jharkhand Renewable Energy Development Agency
JSEB	Jharkhand State Electricity Board
JUSNL	Jharkhand UrjaSancharan Nigam Limited
JBVNL	Jharkhand BijliVitaran Nigam Limited
JUUNL	Jharkhand UrjaUtpadan Nigam Limited
JUVNL	Jharkhand Urja Vikas Nigam Limited
kWh	Kilo Watt Hour
MW	Mega Watt
MW	Mega Watt
NA	Not Available
NABARD	National Bank for Agriculture and Rural Development
NBCI	National Biomass Cook stoves Initiatives
NBCP	National Biomass Cook Stoves Program
NHB	National Housing Bank
NSDP	Net State Domestic Product
PDN	Public Distribution Network
PPA	**Power Purchase Agreement**
PV	Photo Voltaic
RE	Renewable Study
REC	Rural Electrification Companies
RESCO	Renewable Energy Service Company
RESPs	Rural Energy Service Providers
RPO	Recruitment Process Outsourcing
RRB	Regional Rural Banks

SAH	Solar Air Heating
SAR	Situational Analysis Report
SDG	Sustainable Development Goals
SECI	Solar Energy corporation of India Limited
SNA	State Nodal Agencies
SPC	Special Project on Cook stove
SWH	Solar Water Heater
UJALA	Unnat Jyoti by Affordable LEDs for All
VAT	Value Added Tax
GCRT	Grid Connected Rooftop Solar Power Plant

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CHAPTER 1

Background and Approach for the Study

Background and Context

Energy is central to nearly every major challenge and opportunity the world faces today – security, climate change, food production, jobs or increasing incomes. Sustainable energy generates opportunity – it transforms lives, economies and the planet. With a population of 1.4 billion and one of the world's fastest-growing major economies, India will be vital for the future of the global energy markets. The Government of India has made impressive progress in recent years in increasing citizens' access to electricity and clean cooking. It has also successfully implemented a range of energy market reforms and carried out a huge amount of renewable electricity deployment, notably in solar energy.

The country's installed electricity capacity increased at a cumulative annual growth rate (CAGR) of 9.3 per cent while generation grew at 6.6 per cent. The renewable energy (RE) sector exhibited even faster growth in the past decade, at a CAGR of 20 per cent. Jharkhand, a state with 76.9% of rural population and growing at a rate of NSDP of 11.16% has seen continuous increase in its energy demands corresponding its growth. The energy demands are largely met through traditional sources like wood, biomass, kerosene, diesel, and to some extent through commercial electricity whose supply is erratic. Traditional sources have greater environmental footprint, polluting, are hazardous to human health, laboring, economically draining and dehumanizing and ultimately are a retrain on rapid and sustainable development. Clean energy solutions to rising energy needs is therefore an imperative. Clean Energy[3] solutions will act as catalyst for socio-economic-sustainable development of rural masses as a whole.

Purpose of the Study

In order to develop a suitable roadmap to achieve the desired target, it is imperative to analyze and evaluate the current RE scenario against its policy & regulatory measures undertaken and technical challenges at the state level and assess its impact. The outcome of the assessment will enable the decision makers to suitably respond to mitigation actions in order to abate the further challenges/roadblocks envisaged. Study of Jharkhand and its neighboring and other states policies has been done for finding ways to enrich from the learning; Field reality is analyzed for drafting better recommendations for the state.

[2]At current prices for period 2012-18. http://statisticstimes.com/economy/gdp-growth-of-indian-states.php

SAR will come out as an advocacy document which will then be used at different level of action advocacy for assessing the existing space for rights of children of indigenous community.

Description of Study Area

Online Study of the documents of Jharkhand and other states was done in order to understand the implementation state and gaps in various schemes and programs on clean energy.

Specific study of Jharkhand in relation to overall Renewable Energy policies adopted by state was done in view of finding the status, awareness and perspective among the communities regarding the policies and entitlement.

Field research was done primarily in the rural areas of four tribal dominant districts of Jharkhand*(Ranchi, Khunti, Simdega, Gumla*) in view of assessment of convenience, availability, utilization & sustained usage of the RE sources.

Approach and Methodology

- Stating the problem statement and identifying the objective of the study
- Review policies, regulatory and technical documentations and the existing market mechanisms that drive that Renewable market
- Online Study of the documents of Jharkhand and other states
- Study of Jharkhand in relation to Renewable Energy
- Field research in view of utilization and convenience
- Review the state's RE potential and conduct a situational analysis of the state's driven initiatives in response to National RE plan
- Stating the Outcome of Analysis by identifying the deficits
- Suggest the Way Forward post garnering the feedbacks from the current situation of the state

Structure of the Report

- The upcoming chapters discuss about background information in context of Jharkhand including geographical, physiological and socio-economic features. Also it focuses on electricity supply, issues relating to electricity demand and low level of per capita electricity consumption in Jharkhand & relevance of CES and emerging issues of Jharkhand.
- Chapter 3 discusses about renewable energy policy implementation and gaps in Jharkhand.
- Chapter 4 discusses about the results and reflections from the baseline study conducted in the sample villages of 4 districts in Jharkhand.
- Chapter 5 deals with national policies on CES and a snapshot of status and adaptable models from other neighboring states of Jharkhand. The Chapter also talks about the renewable energy potential of Jharkhand.
- The final chapter gives recommendations for some systematic suggestions for Renewable energy for clean energy access in Jharkhand

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NCSEA defines clean energy as derived from renewable, zero-emission sources ("renewable"), as well as energy saved through energy efficiency measures.

CHAPTER 2

The Development Context in Jharkhand

Geographical and Physiological Features

Jharkhand is surrounded by Bihar to the north, Uttar Pradesh to the northwest, Chhattisgarh to the west, Odisha to the south, and West Bengal to the east. The state covers a geographical area of 79.70 lakh hectare. Jharkhand is located in eastern India with its capital at Ranchi. The state is divided into 5 divisions, 24 districts, 38 subdivisions and 260 blocks for administrative purposes.

Figure 1. Geographical Location of Jharkhand

It is the 15th largest state by area, and the 14th largest by population. The state is known for its waterfalls, hills and holy places.

Jharkhand is a word developed from the original tribal language meaning “the land of the jungles." Jharkhand is considered as one of the potentially richest states in the world because of its awesome mineral reserves. Jharkhand with a total area of 79716 sq km has a population of 3.29 crore (2011 census). The population consists of 28% tribal, 12% Scheduled Castes and 60% others.

Socio-Economic Features

Jharkhand witnesses high incidence of poverty and inequality .The state suffers from what is sometimes termed a resource curse, it accounts for more than 40% of the mineral resources of India, but 39.1% of its population is below the poverty line and 19.6% of children under five years of age are malnourished. Jharkhand is a source of coal but production of electricity is not good. People refer to it as rich land of poor people.

The other Industries are cottage industry and IT industry. Jharkhand approximately has 14% irrigated land and 86% unirrigated land. Farmers lack strategic irrigation facility. The farmers largely depend on monsoon and any deviation in monsoon directly affects the agricultural output. Given this scenario, farmers need proper irrigation system.

The state is primarily rural, with only 24% of the population living in cities. Jharkhand is among the leading states in economic growth. In 2017-18, the GSDP growth rate of state was at 10.22%.

Electricity Supply in Jharkhand

Jharkhand is being served by multiple distribution licensees - JBVNL, DVC, Tata Steel, JUSCO and SAIL Bokaro. Two licensees, DVC and JUSCO, have overlapping geographical boundaries with the state distribution utility.

Jharkhand had a total installed power generation capacity of 1762.06 MW, comprising 554.05 MW under state utilities, 753.27 MW under private sector and 454.74 MW under central utilities.

Backed by large coal reserves in the state, of the total installed power generation capacity in the state, 1,543.74 MW of capacity was contributed by coal-based thermal power plants.

Additionally, the state has total 191 MW of installed hydropower generation capacity and 24.42 MW from renewable sources. Per capita electricity consumption in the state was recorded to be 552 kWh, as compared to the country's average of 1,010 kWh, during 2015-16.

Figure2.2 Thermal Power Plants List in JharkhandAs of November 2017, 2,349 villages had been electrified in the state which is 93% of the target. The remaining 176 villages are expected to be electrified under various state and central government schemes. Also, 54,89,706 households have been electrified in the state.

Project Promoter	Location	Capacity
Corporate Power Ltd	Bana, Latehar District	540 MW
Bokaro Power Supply Co	Bokaro	720 MW
HDIL Energy	Chakulia, East Singhbhum District	1320 MW
Essar Power (Jharkhand) Ltd	Chandwa, Latehar District	2000 MW
Corporate Ispat Alloys	Chitrapur, Latehar District	500 MW
CESC	Dumka	1000 MW
Tata Power Co	Jojobera, Jamshedpur District	120 MW
Adhunik Thermal Energy	Kandra, Saraikela District	270 MW
Divine Vidyut	Kaushalgarh, Saraikela District	20 MW
Usha Martin	Ketat, Palamu District	1200 MW
Jayaswals Neco	Moitra, Hazaribagh District	135 MW
Electrosteel Thermal Power	Soparam, Latehar District	1200 MW
Usha Martin	Tatisilwai, Ranchi District	20 MW
Jharkhand Integrated Power	Tilaiya, Hazaribagh District	4000 MW
Inland Power	Tonagatu,Gola, Ramgarh District	126 MW

Figure 2.2 Thermal Power Plants List in Jharkhand

Issues Related to Electricity Demand

Despite its mineral wealth, Jharkhand is one of 'Indias poorest states. The 40 million Indians living in Jharkhand have few economic opportunities besides agriculture and mining. One important reason for the state's economic stagnation is the lack of reliable electricity supply. Without adequate power, industrial growth is very difficult. The state's power sector woes do not stem from a lack of fuel. Jharkhand is home to large coal fields and supplies fuel to coal-fired power plants across the country. Instead, the problem lies with lack of adequate governance. Some of them can be listed as under

i. The state's electricity tariffs are among the lowest in India. Because of the low tariffs, distribution companies cannot cover their costs.

ii. Jharkhand's distribution companies have failed to curb power theft and improve billing and collection efficiency.

iii. Distribution companies fail to send electricity bills to households on time, let alone actually collect the money.

iv. Jharkhand has had a history of low tariffs, high technical and commercial losses, and high external dependency due to a lack of in-state generation. Almost seventy percent of JBVNL's power purchase costs come from Central generators, or entities like the Damodar Valley Corporation (DVC).

v. The crisis in the state's electricity bureaucracy is just as worrying. Despite the many promises made to the Central government associated with UDAY, accusations of meter tampering, graft, and preferential treatment in the granting of industrial power connections are rife among the state's power bureaucracy. Not long ago, an open and shut case of industrial power theft was dismissed in the Ranchi High Court because JBVNL engineers failed to collect sufficient evidence. Under Prime Minister Modi's *Saubhagya* scheme and installed a meter to every household, but nobody bothered to actually connect and activate the meters.

Low Level of Per Capita Electricity Consumption

Per capita electricity consumption in the state was recorded to be 552 kWh, as compared to the country's average of 1,010 kWh, during 2015-16. As of November 2017, 2,349 villages had been electrified in the state which is 93% of the target.

Relevance of Clean Energy Solutions

Similar to the other Indian states, in Jharkhand too maximum power generation is based on the conventional energy sources such as coal and mineral oil-based power plants. They are highly polluting. Though nuclear energy is a good alternative solution to reduce fossil fuel consumption, it is equally hazardous to human life. Hence, the energy world should think of judicious utilization of renewable energy resources, such as solar, wind, ocean energy, biomass, and geothermal energy. The Research and Development activities carried out in the past three decades have shown good progress in finding feasible solution to the problem of finding new renewable energy resources.

The GoI has set a target of installing 175 GW of grid connected renewable power capacity from various renewable energy sources by the year 2022. This includes 100 GW from solar, 60 GW from wind, 10 GW from bio-power and 5 GW from small hydro power.

According to various studies carried out, an estimated Renewable Energy potential of 1097 GW has been estimated in the country which includes 749 GW from solar, 302 GW from wind, 25 GW from bio energy and 21 GW from small hydro power. Clean energy is not just environmentally sustainable and healthier solution but also enterprising.

RE potential in Jharkhand

Wind Power	Small Hydro Power	Biomass Power	Bagase Cogeneration	Waste To Energy	Solar	Estimated reserve	Total	% distribution
(MW)	(MW)	(MW)	(MW)	(MW)	(MW)		(MW)	(MW)
-	227.96	**107**	-	**10**	18180	18525	18508	1.85

Fig 2.3 Renewable Energy Potential in Jharkhand

Emerging issues of Jharkhand

Economic growth of any region depends only on the long term availability of energy from sources that are affordable, accessible and sustainable.

Trust is the basis of all achievements and hence vision and mission plan has to be revised and should be insisted with 4E's concept such as "*Education, Engineering, Enforcement and Evaluation*". By allotting sufficient funds to promote the RE projects in time for our future demand to cater our energy needs. Many Indian states have witnessed the uneven development in renewable energy sectors; especially, for example, Tamil Nadu has developed more than 70% of its rich wind potential when compared with other states. Jharkhand, being a state in energy transition can sufficiently utilize solar and other cleaner source of energy for greater sustainability and prosperity.

[4]Source 2018 Issue: CENTRAL STATISTICS OFFICE MINISTRY OF STATISTICS AND PROGRAMME IMPLEMENTATION GOI

Chapter 3

POLICIES RELATED TO CLEAN AND RENEWABLE ENERGY

Need for a clean source of energy has become eminent in the era witnessing Global Warming. Global efforts since *Rio de Janeiro's Earth Summit, 1992* has stressed on the need to turn to greener sources of fuel to reduce carbon emission. In 2000, UN came up with *Millennium Development Goals* which changed into *Sustainable development Goals* in 2015 which tried to balance the developmental needs as well as sustainability of the planet earth. It transpired into 17 SDG and setting up global frameworks within which countries set up their own framework to achieve the common target for a better future of the planet earth. Some of the attempts undertaken globally can be listed as under -

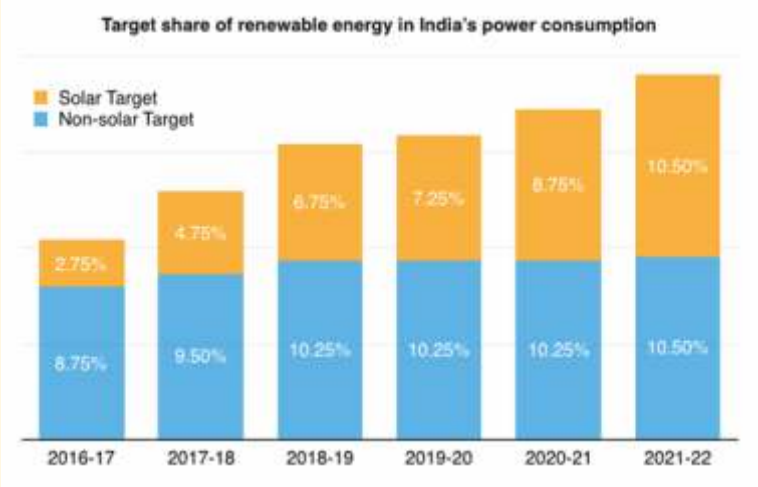
INTERNATIONAL POLICIES

SDG 7- Ensure access to Affordable, reliable, sustainable and Modern Energy to All

There is no development without fuelling the engine of growth. Energy is critical and people with no sustainable access to energy are deprived of the opportunity to become part of national and global progress. And yet, one billion people around the world live without access to energy. More than 781 million people in 2016, or 39% of the world's population, do not have access to clean fuels and technologies for cooking.

Why is this important?

The Secretary-General of the United Nations, Ban Ki-moon, has said, "Energy is the golden thread that connects economic growth, social equity, and environmental sustainability. With access to energy, people can study, go to university, get a job, start a business – and reach their full potential." Energy is central to nearly every major challenge and opportunity the world faces today – security, climate change, food production, jobs or increasing incomes. Sustainable energy generates opportunity – it transforms lives, economies and the planet. There are tangible health benefits to having access to electricity, and a demonstrable improvement in wellbeing. Energy access therefore constitutes a core component of the sustainable development agenda for energy. The production of useable energy can also be a source for climate change – accounting for around 60% of total global greenhouse gas emissions.



How can we address this?

Goal 7 of the SDGs aims to correct this enormous imbalance by ensuring everyone has access to affordable, reliable, and modern energy services by the year 2030. To expand energy access, it is crucial to enhance energy efficiency and to invest in renewable energy. Asia has been the driver of

progress in this area, expanding access at the twice the rate of demographic growth. 72% of the increase in energy consumption from modern renewable sources between 2010 and 2012 came from developing regions, including parts of Asia. Energy from renewable resources – wind, water, solar, biomass and geothermal energy – is inexhaustible and clean. Although the solution to energy's climate crisis lies off-grid, renewable energy currently constitutes only 15% of the global energy mix. It is time for a new global partnership on sustainable energy for all, guided by Sustainable Development Goal 7 on universally accessible, efficient, clean, and reliable energy sources and services.

Targets for Goal 7

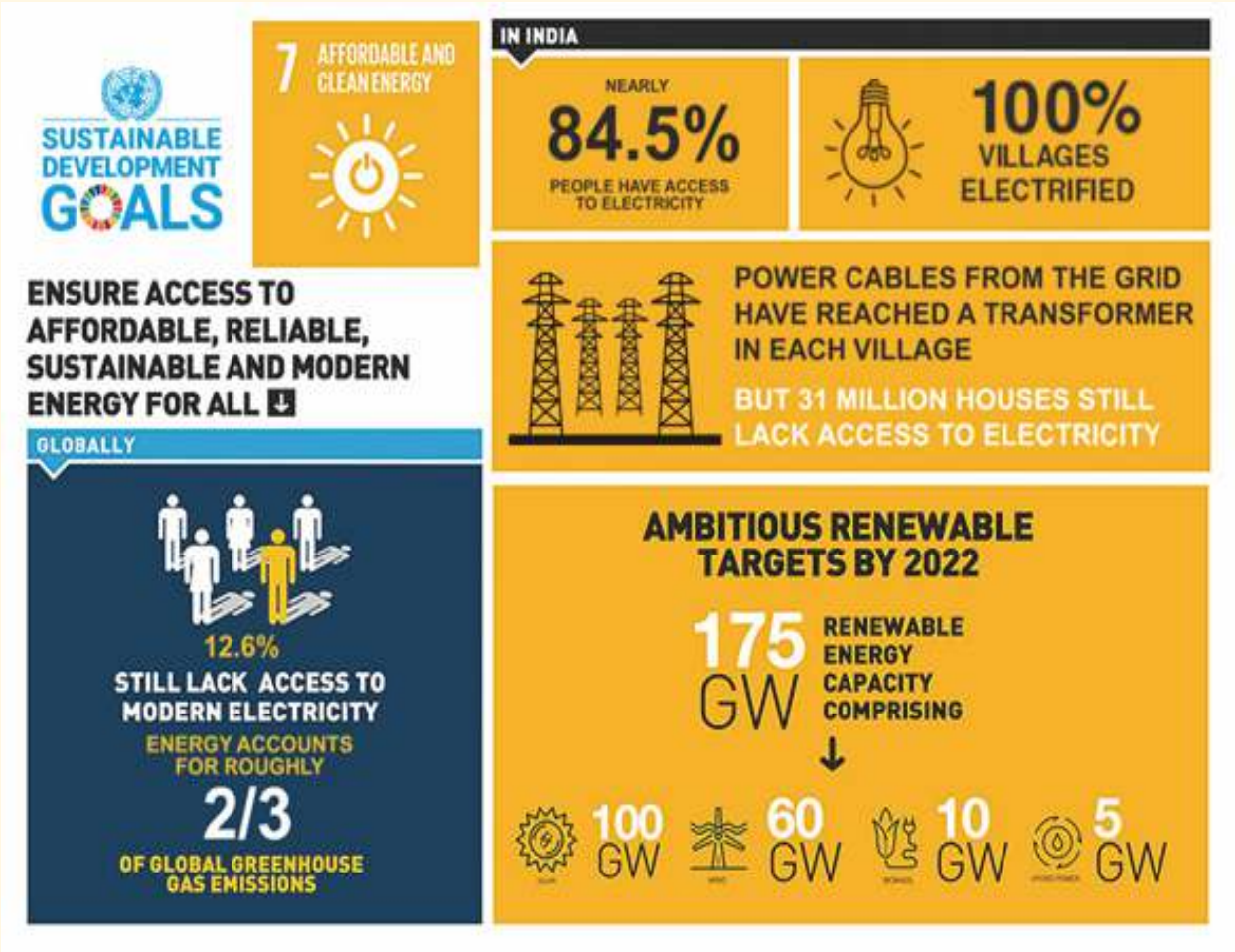


Figure 3.1 SDG and India

India and Goal 7

India is projected to be a significant contributor to the rise in global energy demand, around one-quarter of the total. However, as of 2016, more than 207 million people in India do not have access to electricity. The government's National Solar Mission is playing an important role in the work towards renewable energy, and interventions in rural electrification and new ultra-mega power projects are moving India towards achieving universal energy access.

- By 2030, ensure universal access to affordable, reliable and modern energy services.
- By 2030, increase substantially the share of renewable energy in the global energy mix.

[5] The area of Earth located in between the Tropic of Cancer and Tropic of Capricorn is called the tropical (torrid) zone

- By 2030, double the global rate of improvement in energy efficiency.
- By 2030, enhance international co-operation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.
- By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing states and land-locked developing countries, in accordance with their respective programs of support.

International Solar Alliance

The International Solar Alliance (ISA) is an alliance of 121 countries initiated by India, most of them being sunshine countries, which lie either completely or partly between the Tropic of Cancer and the Tropic of Capricorn. The primary objective of the alliance is to work for efficient exploitation of solar energy to reduce dependence on fossil fuels. This initiative was first proposed by Indian Prime Minister Narendra Modi in a speech in November 2015 at Wembley Stadium, in which he referred to sunshine countries as *Suryaputra* ("Sons of the Sun"). The alliance is a treaty-based inter-governmental organization. Countries that do not fall within the Tropics can join the alliance and enjoy all benefits as other members, with the exception of voting rights. After the United Nations, it will be the largest grouping of states world-wide.

The initiative was launched by Prime Minister Narendra Modi at the India Africa Summit, and a meeting of member countries ahead of the 2015 United Nations Climate Change Conference in Paris in November 2015. The framework agreement of the International Solar Alliance opened for signatures in Marrakech, Morocco in November 2016, and 200 countries have joined.

The area of Earth located in between the Tropic of Cancer and Tropic of Capricorn is called the tropical (torrid) zone. The points on the Tropic of Cancer are the northernmost points up to which the Sun can pass directly overhead. Similarly, the southernmost points are on the Tropic of Capricorn which follows the same criteria. Location at the north of the Tropic of Cancer shows the Sun appearing at the south of the zenith. The sunniest countries of the world are on the African continent, ranging from Somalia- Horn of Africa-, east to Niger, west and north to Egypt.

For India, possible additional benefits from the alliance can be a strengthening of ties with the major African countries and increasing goodwill for India among them.

Guiding Principles

1. Members take coordinated actions through Programs and activities launched on a voluntary basis, aimed at better harmonizing and aggregating demand for, inter alia, solar finance, solar technologies, innovation, research and development, and capacity building.
2. In this endeavor, Members cooperate closely and strive for establishing mutually beneficial relationships with relevant organizations, public and private stakeholders, and with non-member countries.
3. Each Member shares and updates, for those solar applications for which it seeks the benefits of collective action under the ISA, and based on a common analytical mapping of solar applications, relevant information regarding: its needs and objectives; domestic measures and initiatives taken or intended to be taken in order to achieve these objectives;

obstacles along the value chain and dissemination process. The Secretariat maintains a database of these assessments in order to highlight the potential for cooperation.

4. Each Member designates a National Focal Point for the ISA. National Focal Points constitute a permanent network of correspondents of the ISA in Member countries. They inter alia interact with one another and also with relevant stakeholders to identify areas of common interest, design Program proposals and make recommendations to the Secretariat regarding the implementation of the objectives of the ISA.

Programs and Other Activities

1. A Program of the ISA consists of a set of actions, projects and activities to be taken in a coordinated manner by Members, with the assistance of the Secretariat, in furtherance of the objective and guiding principles described in article I and II. Programs are designed in a way to ensure maximum scale effect and participation of the largest possible number of Members. They include simple, measurable, mobilizing targets.
2. Program proposals are designed through open consultations among all National Focal Points, with the assistance of the Secretariat, and based on information shared by Members. A Program can be proposed by any two Members or group of Members, or by the Secretariat. The Secretariat ensures coherence among all ISA Programs.
3. Program proposals are circulated by the Secretariat to the Assembly by digital circulation, through the network of National Focal Points. A Program proposal is deemed open to adhesion by Members willing to join if it is supported by at least two Members and if objections are not raised by more than two countries.
4. A Program proposal is formally endorsed by Members willing to join, through a joint declaration. All decisions regarding the implementation of the Program are taken by Members participating in the Program. They are carried out, with the guidance and assistance of the Secretariat, by country Representatives designated by each Member.
5. The annual work plan gives an overview of the Program, and other activities of the ISA. It is presented by the Secretariat to the Assembly, which ensures that all Program and activities of the annual work plan are within the overall objective of the ISA.

NATIONAL POLICIES – CLEAN ENERGY

The Government of India is playing an active role in promoting the adoption of RE by encouraging private sector investment and mandating the use of renewable resources. It is offering various incentives, such as GBIs and tax holidays, to encourage the development and use of RE sources. GoI has also created a liberal environment for foreign investment in RE projects. In addition to allowing 100% foreign direct investment (FDI), the government is encouraging foreign investors to set up RE-based power generation projects on a build-own-operate (BOO) basis in the country.

RE equipment prices have fallen dramatically due to technological innovation, increasing manufacturing scale and experience curve gains making RE cost competitive with fossil fuels. This is particularly true of solar and wind technology, where solar module prices have declined by almost 80% since 2008. Wind turbine prices have declined by nearly 30% during the same period [6]. Falling equipment prices have led to large-scale deployment of the technologies in India and globally.

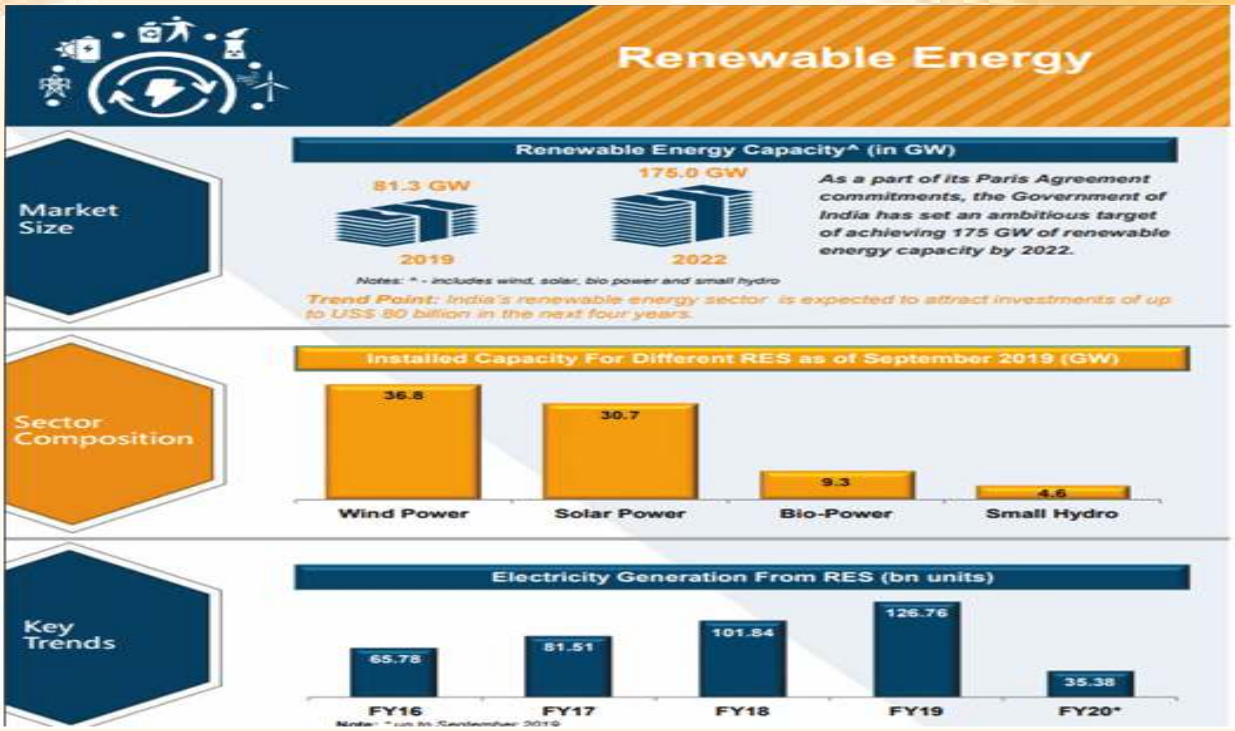


Figure 3.2 Renewable energy market size, sector composition and key trends

National Energy Policy

The National Energy Policy (NEP) aims to chart the way forward to meet the Government bold ambitions for India's energy sector developments. This includes providing access to electricity to all the Census villages by 2018, and for universal electrification to be achieved, with 24x7 electricity by 2022. India's NDCs target reduction of emissions intensity of 33%-35% by 2030 over 2005, through increasing renewable energy capacity to 175 GW by 2022, and increase the share of non-fossil fuel based capacity in the electricity mix to above 40% by 2030. Recognizing that the responsibility for energy policy is spread across different Ministries that hold the primary responsibility of setting their own sectoral agenda, an overarching policy framework is required to achieve the goal of energy security and facilitate coordination between these sources. This is also expected to mainstream emerging energy technologies, and provide consumer energy choices. The NEP builds on the achievements of the earlier overarching policy framework -the Integrated Energy Policy (IEP), and sets the new agenda consistent with the redefined role of emerging developments in the energy world.

There are four key objectives to India's broad arching energy policy under the IEP:

1. Access at affordable prices;
2. Improved security and Independence;
3. Greater Sustainability; and
4. Economic Growth.

To achieve these four objectives, seven areas of intervention were identified, which are:

I. Energy Consumption by businesses, households, transportation and agriculture

II. Energy Efficiency/de-carbonization measures on the demand side

III. Production and distribution of coal

IV. Electricity generation, transmission and distribution

V. Augmenting supply of oil and gas, both by domestic E&P, and through acquisition of overseas acreages

VI. Refining and distribution of oil and gas.

VII. Installation, generation and distribution of renewable energy

National Wind-Solar Hybrid Policy

Solar and wind power being variable in nature pose certain challenges on grid security and stability. Studies revealed that in India solar and wind resources are complementary to each other and hybridization of these two technologies would help in minimizing the variability apart from optimally utilizing the infrastructure including land and transmission system.

Superimposition of wind and solar resource maps shows that there are large areas where both wind and solar have high to moderate potential.

The existing wind farms have scope of adding solar PV capacity and similarly there may be wind potential in the vicinity of existing solar PV plant.

Suitable policy interventions are therefore, required not only for new wind-solar hybrid plants but also for encouraging hybridization of existing wind and solar plants.

To smoothen the wind solar hybrid power further, appropriate capacity of battery storage may also be added to the project.

Implementation Strategy

The implementation of wind solar hybrid system will depend on different configurations and use of technology.

i. Wind-Solar Hybrid- AC integration

ii. Wind-Solar Hybrid- DC integration

New Wind-Solar Hybrid Plants:

New wind-solar hybrid projects shall be encouraged with following provisions:-

i. The hybrid power generated from the wind-solar hybrid project may be used for

   a. captive purpose;

   b. sale to third party through open access;

   c. sale to the distribution company (ies) either at tariff determined by the respective SERC or at tariff discovered through transparent bidding process; and

   d. sale to the distribution company (ies) at APPC under REC mechanism and avail RECs.

ii. The power procured from the hybrid project may be used for fulfillment of solar RPO and non-solar RPO in the proportion of rated capacity of solar and wind power in the hybrid plant respectively.

iii. For procurement of hybrid power through transparent bidding process different parameters may be used. Parameters that may be considered for bidding could be capacity delivered at grid interface point, effective CUF and unit price of electricity.

Hybridization of existing wind/solar PV plants:

Existing wind or solar power projects, willing to install solar PV plant or WTGs respectively to avail benefit of hybrid project, may be allowed to do so with following Conditions:

i. No additional connectivity/transmission capacity charges shall be levied by the respective transmission entity for hybridization at existing wind/solar PV plants if already granted transmission connectivity/ access is being used. Transmission charges may be applicable for the additional transmission capacity/ access granted as per prevailing regulation.

ii. In case capacity margins are available at the receiving transmission sub-station of respective transmission entity, at which the existing winds/solar projects are connected, additional transmission capacity/access may be allowed subject to its technical feasibility.

iii. The additional solar/wind power generated from the hybrid project may be used for

(a) captive purpose;

(b) sale to third party through open access;

(c) sale to the distribution company (ies) either at tariff determined by the respective SERC or at tariff discovered through transparent bidding process; and

(d) sale to the distribution company (ies) at APPC under REC mechanism and avail RECs.

iv. Government entities may invite bids for hybridization of existing wind and solar plants with tariff being the main criteria for selection.

v. The additional solar/wind power procured from hybrid project shall be used for fulfillment of solar/non-solar RPO as the case may be.

Battery Storage:

Battery storage may be added to the hybrid project

a. To reduce the variability of output power from wind solar hybrid plant;

b. Providing higher energy output for a given capacity (bid/ sanctioned capacity) at delivery point, by installing additional capacity of wind and solar power in a wind solar hybrid plant;

c. Ensuring availability of firm power for a particular period. Bidding factors for wind solar hybrid plants with battery storage may include minimum firm power output throughout the day or for defined hours during the day, extent of variability allowed in output power, unit price of electricity, etc.

National Policy for Renewable Energy based Micro and Mini Grids

To promote the deployment of micro and mini grids powered by RE sources such as solar, biomass, pico hydro, wind etc. in un-served and underserved parts of the country by encouraging the development of State-level policies and regulations, that enable participation of ESCOs.

The underlying principles of the policy

- Mainstream RE mini grids for enhancing access to affordable energy services and improving local economy
- Streamline project development procedures for ESCOs
- Provide operational frameworks to operate along with the Distribution Company (DISCOM) grid
- Optimize access to central financial assistance and other incentives
- Foster innovation in mini grid models to cater to rural needs

Micro and Mini Grids

A *'Mini Grid'* is defined as a system having a RE based electricity generator (with capacity of 10KW and above), and supplying electricity to a target set of consumers (residents for household usage, commercial, productive, industrial and institutional setups etc.) through a Public Distribution Network (PDN).

A *'Micro Grid'* system is similar to a mini grid but having a RE based generation capacity of below 10KW. Micro and mini grids2 generally operate in isolation to the electricity networks of the DISCOM grid (standalone), but can also interconnect with the grid to exchange power. If connected to grid they are termed as grid connected mini/ micro grid.

Types of Tariff and Revenues

The Electricity Act, 2003 (Eighth provision of Section 14) exempts ESCOs from the mandatory licensing requirement for distribution of electricity in notified rural

The Ministry is issuing a policy offering likely implementation solutions and approaches for overcoming common issues and challenges that hamper the growth of mini grid sector.

The existing policy and legislative framework (Section 8.6 of Rural Electrification Policy, 2006) also stipulates that if Central and or State Financial Assistance (subsidies, incentives etc.) are availed, the benefits need to be passed to the consumers.

Costs, Revenues and Pricing Mechanisms:

The cost structure of a mini grid project will have the following elements as in any other business – Fixed Costs and Variable Costs.

Policy, Regulatory and Implementation level Interventions

The Ministry will implement the mini grid program through multiple partners:

- State Nodal (Renewable Energy Developmental) Agencies (SNA)
- Public Sector Organizations (Ex: SECI)
- Rural Energy Service Providers (RESPs),
- Financial Institutions (NABARD/IREDA/ RRB/Commercial banks)
- Panchayats Project Site Identification and Development

National Tariff Policy

The Government had launched the *Jawaharlal Nehru National Solar Mission*, with the aim to focus on setting up an enabling environment for solar technology penetration in the country both at a centralized and decentralized level.

The first phase (up to March 2013) having achieved the required target and momentum, Solar Thermal component of JNNSM in balance period (up to March 2022) will now, inter alia, would require focus on promoting off-grid systems including hybrid systems to meet / supplement heating and cooling energy requirements and power.

Challenges

The key challenge is to provide an enabling framework and support for entrepreneurs to develop markets. This scheme program will address off grid and decentralized solar thermal application area/systems.

Name of the scheme

The scheme will be known as 'Capital subsidy scheme for installation of solar thermal systems'

Solar thermal applications/systems areas to be covered in this scheme

The heat produced from solar energy can be used for various applications in different sectors like process heating, drying, distillation/desalination, water heating, space heating and refrigeration and power/electricity generation.

Following systems may be considered for grant of capital subsidy in this scheme

(i) Solar water heating: A solar water heater (SWH) is a combination of an array of collectors, an energy transfer system and a thermal storage system.

(ii) Solar air heating Solar Air Heating (SAH) systems use air as the working fluid for absorbing and transferring solar energy. These systems are used for the production of hot air for drying/space-heating applications.

(iii) Solar steam generation/ pressurized hot water/air systems

(iv) Solar thermal refrigeration/cooling Solar cooling can be considered for two related processes: to provide refrigeration for food and medicine preservation, as well as to provide comfort cooling.

(v) Solar Thermal Power Pack (including hybrid with Solar PV) Concentrating Solar Power (CSP) technologies

(vi) Solar stills

Objectives:

- To promote off-grid applications of solar Thermal systems(solar water/air heating system, solar cooker, solar concentrating system, solar thermal power pack are covered for meeting the targets set in the Jawaharlal Nehru National Solar Mission .
- To create awareness and demonstrate effective and innovative use of solar thermal systems for individual/ community/ institutional/ industrial applications
- To encourage innovation in addressing market needs and promoting sustainable business models.
- To provide support to channel partners and potential beneficiaries, within the framework of boundary conditions and in a flexible demand driven mode.
- To create a paradigm shift needed for commoditization of off-grid decentralized solar thermal applications
- To support consultancy services, seminars, symposia, capacity building, awareness campaigns, human resource development, etc.

Mode of Implementation

The program would be implemented through multiple agencies - State Nodal Agencies/Depts. implementing the renewable energy program, Solar Energy Corporation of India, Channel Partners and other Govt. organizations i.e., PSUs/Institutions/State Departments/Local Governments/Municipal Corporations/NHB/NABARD/IREDA etc.

National Policy on Biofuels

In order to promote biofuels in the country, a National Policy on Biofuels was made by Ministry of New and Renewable Energy during the year 2009. Globally, biofuels have caught the attention in last decade and it is imperative to keep up with the pace of developments in the field of biofuels. Biofuels in India are of strategic importance as it augers well with the ongoing initiatives of the Government such as Make in India, Swachh Bharat Abhiyan, Skill Development and offers great opportunity to integrate with the ambitious targets of doubling of Farmers Income, Import Reduction, Employment Generation, Waste to Wealth Creation. Biofuels program in India has been largely impacted due to the sustained and quantum non-availability of domestic feedstock for biofuel production which needs to be addressed.

Salient Features:

i. The Policy categorizes biofuels as "Basic Biofuels" viz. First Generation (1G) bioethanol & biodiesel and "Advanced Biofuels" - Second Generation (2G) ethanol, Municipal Solid Waste (MSW) to drop-in fuels, Third Generation (3G) biofuels, bio-CNG etc. to enable extension of appropriate financial and fiscal incentives under each category.

ii. The Policy expands the scope of raw material for ethanol production by allowing use of Sugarcane Juice, Sugar containing materials like Sugar Beet, Sweet Sorghum, Starch containing materials like Corn, Cassava, Damaged food grains like wheat, broken rice, Rotten Potatoes, unfit for human consumption for ethanol production.

iii. Farmers are at a risk of not getting appropriate price for their produce during the surplus production phase. Taking this into account, the Policy allows use of surplus food grains for production of ethanol for blending with petrol with the approval of National Biofuel Coordination Committee.

iv. With a thrust on Advanced Biofuels, the Policy indicates a viability gap funding scheme for 2G ethanol Bio refineries of Rs.5000 crore in 6 years in addition to additional tax incentives, higher purchase price as compared to 1G biofuels.

v. The Policy encourages setting up of supply chain mechanisms for biodiesel production from non-edible oilseeds, Used Cooking Oil, short gestation crops.

vi. Roles and responsibilities of all the concerned Ministries/Departments with respect to biofuels have been captured in the Policy document to synergize efforts.

Expected Benefits:

- **Reduce Import Dependency**: One crore lit of E10 saves Rs.28 crore of forex at current rates. The ethanol supply year 2017-18 is likely to see a supply of around 150 crore liters of ethanol which will result in savings of over Rs.4000 crore of forex.
- **Cleaner Environment**: One crore lit of E-10 saves around 20,000 ton of CO_2 emissions. For the ethanol supply year 2017-18, there will be lesser emissions of CO_2 to the tune of 30 lakh ton. By reducing crop burning & conversion of agricultural residues/wastes to biofuels there will be further reduction in Green House Gas emissions.
- **Health benefits**: Prolonged reuse of Cooking Oil for preparing food, particularly in deep-frying is a potential health hazard and can lead to many diseases. Used Cooking Oil is a potential feedstock for biodiesel and its use for making biodiesel will prevent diversion of used cooking oil in the food industry.

- **MSW Management**: It is estimated that, annually 62 MMT of Municipal Solid Waste gets generated in India. There are technologies available which can convert waste/plastic, MSW to drop in fuels. One ton of such waste has the potential to provide around 20% of drop in fuels.
- **Infrastructural Investment in Rural Areas**: It is estimated that, one 100klpd bio refinery will require around Rs.800 crore capital investment. At present Oil Marketing Companies are in the process of setting up twelve 2G bio refineries with an investment of around Rs.10,000 crore. Further addition of 2G bio refineries across the Country will spur infrastructural investment in the rural areas.
- **Employment Generation**: One 100klpd 2G bio refinery can contribute 1200 jobs in Plant Operations, Village Level Entrepreneurs and Supply Chain Management.
- **Additional Income to Farmers**: By adopting 2G technologies, agricultural residues/waste which otherwise are burnt by the farmers can be converted to ethanol and can fetch a price for these waste if a market is developed for the same. Also, farmers are at a risk of not getting appropriate price for their produce during the surplus production phase. Thus conversion of surplus grains and agricultural biomass can help in price stabilization.

Central Financial Assistance and Fiscal Incentives

CFA for Biomass Power Project and Bagasse Cogeneration Projects by Private/Joint/Coop./Public Sector Sugar Mills

Project Type	Capital Subsidy
Biomass Power projects	Rs.20 lakh X (C MW)^0.646
Bagasse Co-generation by Private sugar mills	Rs.15 lakh X (C MW)^0.646
Bagasse Co-generation projects by cooperative/ public sector sugar mills 40 bar & above 60 bar & above 80 bar & above	Rs.40 lakh* Rs.50 lakh* Rs.60 lakh* Per MW of surplus power@ (maximum support Rs. 8.0 crore per project)

CFA for Bagasse Cogeneration Project in cooperative/ public sector sugar mills implemented by IPPs/State Government Undertakings or State Government Joint Venture Company / Special Purpose Vehicle (UrjaAnkur Trust) through BOOT/BOLT model

PROJECT TYPE	CAPITAL SUBSIDY
Single coop. mill through BOOT/BOLT Model Minimum Configuration 60 bar & above 80 bar & above	Rs.40 L/MW of surplus power *Rs.50 L/MW of surplus power*(maximum support Rs.8.0 crore/ sugar mill)

CFA for Bagasse Cogeneration Project in existing cooperative sector sugar mills employing boiler modifications

PROJECT TYPE	CAPITAL SUBSIDY
Existing Cooperative Sugar Mill Minimum Configuration 40 bar & above 60 bar & above 80 bar & above	Rs.20 L/MW of surplus power * Rs.25 L/MW of surplus power* Rs.30 L/MW of surplus power* (** Power generated in a sugar mill (-) power used for captive purpose i.e. Net power fed to the grid during season by a sugar mill. CFA will be provided to the sugar mills who have not received CFA earlier from MNRE under any of its scheme.*)

National Biomass Cook Stoves Program (NBCP)

In the context of concerns over health, climate change and energy security, the Ministry of New and Renewable Energy through a Special Project on Cook stove(SPC) during 2009-10 initiated the process of consultations under its Core Group on cook stoves to ascertain the status of various types of biomass improved cook stoves being developed and promoted by various organizations, NGOs, entrepreneurs and industries in the country, and to identify ways and means for the development and expansion of the deployment of improved biomass cook stoves. The consultations indicated that biomass cook stoves do have the potential to directly address health and welfare concerns of the weakest and most vulnerable sections of society. The cleaner combustion in these devices will also greatly reduce greenhouse pollutants.

National Biomass Cook stoves Initiatives (NBCI)

As a result of the above consultations, a National Biomass Cook stoves Initiative (NBCI) was launched by MNRE on 2nd December 2009 at New Delhi with the primary aim to enhance the use of improved biomass cook stoves.

Unnat Chulha Abhiyan Program

As follow up to the National Biomass Cook-stove Initiative (NBCI), the Ministry initiated a new proposal for promoting the development and deployment of Unnat Chulhas (Biomass Cook stoves) in the country during the 12th Plan Period for a budgetary cost of Rs. 294/- crores appraised and recommended by the Expenditure Finance Committee.

Accordingly the Administrative Approval with detailed Guidelines for the Unnat Chulha Abhiyan were formulated and issued on 27th June 2014.

Objectives

To develop and deploy improved biomass cook-stoves for providing cleaner cooking Energy solutions in rural, semi-urban and urban areas using biomass as fuel for cooking.

i. To mitigate drudgery of women and children using traditional chulha for cooking.
ii. To mitigate climate change by reducing the black carbon and other emissions resulting from burning biomass for cooking.

A target of 2.75 million improved cook stoves/ chulha swaswaswas disseminated/installed in the remaining period of the 12th Plan Period .

UJALA Yojana

Key Features of UJALA

- Unnat Jyoti by Affordable LEDs for All (UJALA) scheme was launched on May 1, 2015 to promote efficient use of energy at residential level and enhance consumer awareness on using efficient equipment to reduce electricity bills and help preserve the environment.
- The scheme promotes the use of LED bulbs as a substitute to incandescent bulbs, tube lights and CFL bulbs.
- LED bulbs under UJALA are distributed at subsidized rates through special counters only set up at designated places in different cities across the country.

The Need for UJALA Yojana

As per a study conducted by the Ministry of Environment and Forest in 2011, lighting consumption constituted about 30 percent of overall residential energy consumption. The main lighting options in Indian households comprised of Incandescent Light (ICLs) bulbs, Tube-lights (Fluorescent lamps) and CFLs.

The consumers availing bulbs under UJALA can save nearly INR 336 every year on their electricity bills per LED bulb. 3 UJALA – 'A Way to Light' Under the scheme, the Government's target is to replace all 77 crore inefficient bulbs in the country with LED bulbs by 2019, which would result in an annual reduction of 20,000 MW load and Green House Gas reduction of 80 million tons every year.

The 3 states yet to adopt the scheme are Arunachal Pradesh, Tripura and Manipur. The details of UJALA LED bulbs are stated below.

For 2016-17, the Government of India is confident of distributing an additional 20 crore LED bulbs. Sustained efforts under UJALA, coupled with industry support, will help the government achieve its objective of replacing 77 crore inefficient bulbs by March 2019.

Pradhan Mantri Ujjwala Yojana (PMUY)

The Pradhan Mantri Ujjwala Yojana (PMUY) is a government scheme launched in. The scheme envisages the distribution of 50 million LPG connections to women below the poverty line. It was launched with a budget allocation of Rs. 80 billion. A total of 22 million LPG connections were distributed during the first year of its launch.

Context

As per the estimates of the World Health Organisation (WHO), about 5 lakh deaths in India occurred due to unclean cooking fuel. These deaths were caused mostly due to non-communicable diseases including heart disease, stroke, chronic obstructive pulmonary disease and lung cancer. Providing LPG connections to families below the poverty line will ensure universal coverage of cooking gas in the country. The scheme can be a tool for women empowerment in that LPG connections and clean cooking fuel can reduce cooking time and effort, and in most of India, cooking is a responsibility shouldered solely by women. The scheme also provides employment to the rural youth in the supply chain of cooking gas.

Objectives

The Pradhan Mantri Ujjwala Yojana was launched for providing clean fuel to women below the poverty line. The use of unclean cooking fuel is harmful to human health. The aims of the Pradhan Mantri Ujjwala Yojana are:

- To empower women and protect their health.
- To minimise health issues arising from the use of unclean fossil fuel and other fuel while cooking.
- To control indoor pollution from the use of fossil fuel which causes respiratory issues.
- To prevent degradation of the purity of the environment that is compromised by widespread usage of unclean cooking fuel.

Eligibility Criteria

Any applicant who fulfils the below-mentioned criteria is eligible to apply for the Pradhan Mantri Ujjwala Yojana:

- The applicant must be a woman aged above 18 years. She must also be a citizen of India.
- She should belong to a family below the poverty line and no one else from the household should own an LPG connection.
- The overall monthly income of the family should not exceed a certain limit that is prescribed by the UT/State Governments.
- The applicant's name should be in the list of SECC-2011 and should also match with the information provided in the BPL database of the oil marketing companies.
- The applicant should not be registered under any other similar scheme provided by the government.

Apart from the above, the applicant should also submit a set of documents indicating her BPL status, identity, etc.

Major benefits:

- 5 crore LPG connections to families below the poverty line.
- Financial support of Rs 1600 is provided by the scheme for each LPG connection for BPL households. The administrative cost of this support will be borne by the Government. This subsidy is meant for the security fee for the cylinder, pressure regulator, booklet, safety hose, and other fitting charges.
- Under the scheme, oil marketing companies also provide interest-free loans for refilling and purchasing stoves.
- The Pradhan Mantri Ujjwala Yojana covers all the BPL families that come under all forms of distributorship, and distributes various sizes of cylinders (14.2 kg, 5 kg, etc.) as per the field situation.
- The benefits of this scheme are also available for the people of all Hilly States including the NE States (who are treated as 'Priority States').
- The scheme will effectively address several difficulties faced by the people in the States of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Assam, Nagaland, Manipur, Mizoram, Arunachal Pradesh, Meghalaya and Tripura in accessing LPG for cooking purposes.

The Pradhan Mantri Ujjwana Yojana is implemented by the **Ministry of Petroleum and Natural Gas.** This scheme has become successful in establishing around 95.1 lakh LPG connections across 11 states in India.

STATE POLICIES

Jharkhand Solar Policy 2015

Policy, which was revised in the year 2017, aims to push Jharkhand's total solar power production capacity to 2,650 MW by the year 2020, including large scale and rooftop solar plants.

Jharkhand Solar Energy Policy Updates 2017

A 50 percent subsidy to residential consumers and a 10 percent subsidy to commercial (industrial) consumers installing rooftop solar will be provided by the Jharkhand State government, the policy was implemented in July 2017.

Objective

- To encourage participation of private sector to set up solar power based projects in the state & increase solar power generation to 2650MW by the year 2020in a phased manner.
- To build favorable atmosphere for setting up solar power projects.
- Ensure energy security of the state by stable and non-pollution means.
- To promote local manufacturing facilities which will generate employment in the state

Applicability

Solar Parks

The State shall promote development of solar park on non-productive Government land or any other land falling within the area of solar park. State Government will identify land for the development of Solar Parks. The State Electricity Regulatory Commission shall develop suitable framework to ensure successful development of Solar Parks in the State.

The State Government, under this Policy, will help facilitate in building up the necessary infrastructure like power evacuation infrastructure, water requirements and internal road etc. Solar Park will consist of various zones viz. Solar Power Projects, Manufacturing Zones, R&D and training centers. The state will extend all facilities and fiscal incentives provided by central Govt. / National Solar Mission to the Manufacturers and Power Project Developers in Solar Park.

Solar Power Plants on Canals

The State is promoting development of Solar Power Plants on the Canal Top and on the banks of canal, after undertaking its technical feasibility. In addition, the Nodal Agency shall coordinate with the Ministry of New and Renewable Energy for implementation of its scheme announced from time to time.

Rooftop Solar Power Plants

Jharkhand government is encouraging implementation of the minimum target specified for rooftop solar photovoltaic power plants, connected with electricity system.

Solar Thermal Power Plants

Eligibility Criteria

All registered companies/ firms/societies, government entities, consumers of Discoms and individual will be eligible for setting up of solar power projects within the state for sale of electricity / captive use, in accordance with the electricity Act 2003 as amended from time to time.

Security

For projects for sale of power to Discoms of Jharkhand, security deposit will be governed by provisions in the bid document and PPA.

For plants under REC mechanism, captive use, third party sale/sale to other state through Open Access, the developer shall have to deposit security amount of Rs. 30.00 lakh/MW in the form of bank guarantee within one month from the date of issue of in-principle clearance/approval of the project by JREDA, failing which the approval of the project shall automatically stand cancelled.

Security amount deposited shall not be convertible or transferable and shall be refunded within 30 days after receipt of written request from the developer after Commissioning of the project.

In case the developer fails to commission the power plant within the time schedule, the security deposit shall be forfeited.

Incentives

i. SPP to be treated as industry. Intra-state Open Access for tenure of the project or 25 years whichever is earlier. Equipment exempted from VAT, Electricity duty, Cross Subsidy Surcharge. Exempted for Distribution Losses for projects injecting at 33 kV or below.

ii. Remote Village Electrification program: progress by Jharkhand Renewable Energy Development Agency JREDA program for off-grid RE devices including cooking energy solutions.

Project on Hybrid System (Solar & Wind) in Lapung, Ranchi

JREDA on the vase of converting more and more energy from renewable sources is now focusing on hybrid system for generation of electricity

IIT Madras has got approval from MNRE of solar energy corporation of India department to work and research for the term of 2 years and submitted the report and found the possibility of electricity generation and potential with the help of JREDA.

Solar Power Plant in Sikidiri, Ranchi

JREDA is going to set up 2MW of electricity generation on Canal Top Plant at Sikidiri, about 39 KMs from the state capital. It would be providing electricity to near about 1000 households.

Solar Energy Efficient Buildings in Jharkhand

The new Jharkhand Assembly premise is the first in the country which will be entirely paperless. For energy efficiency, 300 KVA two solar power systems have been installed through which power will be supplied to new building. Sources said that the new Assembly building will meet 40 per cent of its power requirement through renewable energy. Following table enlist the buildings and their energy capacities at different locations in Jharkhand.

[8]https://www.tandfonline.com/doi/abs/10.1080/15567036.2018.1454548
https://swachhsurvekshan2019.org/Rankings/Morethan1Lakh

Sr. No.	District	Phase -1		Phase -2		Phase -3		Phase -4		Total Capacity (kWp)	Total No of Building
		Capacity (kWp)	No. of Building	Capacity (kWp)	No. of Building	Capacity (kWp)	No. of Building	Capacity (kWp)	No. of Building		
1	Bokaro	180	5	216	13	280	9	275	17	951	44
2	Chatra	35	3	354	22	60	1	200	20	649	46
3	Deoghar	60	1	174	11	30	1	155	11	419	24
4	Dhanbad	280	2	124	8	110	2	355	31	869	43
5	Dumka East	155	8	140	14	350	20	185	14	830	56
6	Singhbhum	355	4	132	13	170	3	370	28	1027	48
7	Garhwa	270	6	312	22	6	1	330	30	918	59
8	Girdih	30	3	78	5	360	14	525	32	993	54
9	Godda	70	2	2	1	438	17	220	22	730	42
10	Gumla	90	4	22	3	265	12	0	0	377	19
11	Hazaribagh	195	3	182	11	75	2	50	2	502	18
12	Jamtara	105	5	196	9	20	1	120	12	441	27
13	Khunti	215	4	10	1	156	11	75	6	456	22
14	Koderma	80	1	106	4	205	11	125	8	516	24
15	Latehar	95	4	178	12	254	17	50	2	577	35
16	Lohardaga	10	1	90	5	75	2	80	8	255	16
17	Pakur	90	3	146	11	225	8	100	7	561	29
18	Palamu	140	5	8	4	417	16	320	29	885	54
19	Ramgarh	190	3	202	8	0	0	110	8	502	19
20	Ranchi	1395	15	342	22	527	8	600	39	2864	84
21	Sahibganj Saraikela	200	6	10	1	185	9	265	18	660	34
22	Kharsawan	20	2	34	3	360	11	155	14	569	30
23	Simdega West	185	4	0	0	266	15	25	1	476	20
24	Singhbhum	120	4	336	24	97	10	260	9	813	47
	Total	4565	98	3394	227	4931	201	4950	368	17840	894

Table 3.1 : District wise Installed SPV Plant in Govt. Building till October, 2019

Sr. No.	Category	No of Building Installed	Installed Capacity (kWp)	Sanction Capacity (kWp) Total	Total No of Building Sanction
1	Residential	48	252.24	385	73
2	Social Sector	29	1136	1987	45
3	Industrial Consumer	2	60	130	5
	Total	79	1448.24	2502	123

Table 3.2: Installed solar rooftop capacity

Solar PV Powered Cold Storage System

Solar PV Powered Cold Storage System is a cold storage facility for storage of fresh horticultural produce, powered by solar photovoltaic with battery backup. The puff insulated walk-in type cold storage chamber, constructed and fitted with a vapour compression refrigeration system and a humidifier. Temperature and relative humidity controllers are fitted in the cold storage chamber to maintain desired room temperature (5–25°C) and relative humidity (65–95 per cent) for storage of horticultural produce. For operation of the cold storage unit, solar photovoltaic (PV) power plant and minimum battery backup are required. The battery backup is provided to store solar power generated during the day and supply power during night and cloudy weather. The lead acid solar batteries are used for storage of power off-sun shine operation. Energy output from the solar panel plant is sufficient to operate the cold storage unit. The power conditioning unit/inverter of the solar power plant converts the DC power produced from the solar panel into three phase AC electricity for operating the cold storage unit and other utilities. Such facility has been set up in Gumla and Koderma districts of Jharkhand and is managed by JREDA.

State	Gujarat	Maharashtra	Jharkhand	Jharkhand
Location	Dahegam	Yavat	Gumla	Koderma
Capacity Utilization	40% utilization (average)	Almost 100% utilisation matching with the crop cycle	Not determined	50-60% utilization with the given crop cycle
Reduction Wastage	Substantial reduction in crop wastage has been achieved	The members of the FPC have been able to achieve negligible wastage of their produce	Farmers have been able to avoid wastage by using solar cold rooms on rental basis	Working towards reducing wastage; especially tomato
Increased Access	Facilitated access to market larger markets such as Delhi	Facilitated access to markets where premium on flowers is high, such as Ahmedabad	The fruit vendor in Pasanga has created backward linkages in wholesale market and forward linkage in the retail market at the village level.	The FPC has not been able to access larger markets as of now
Price realization	Realised almost 200% higher prices as compared to prices offered in local market	Revenue per stick of flower has increased almost by 75%-100%	Not determined as facility is being rented out	Realized almost 100% better prices by timing the market
Financial Viability	Financially viable and the farmer also has expansion plans	Financially viable; nearby farmers are also willing to invest in the technology	Not viable at present	Revenue stream is not defined yet
Payback Period	4-6 years, depending on the subsidy component	About 1 year	More than 10 years in case grant is not available	Not computed

Figure 3.1: Solar PV Powered Cold Storage System

Solar Street Lights

The Ministry of New and Renewable Energy (MNRE) launched the Atal Jyoti Yojana (AJAY) to illuminate dark regions through establishment of solar street lights. It is a sub scheme under off –grid and decentralized solar application scheme of Ministry of New and Renewable Energy (MNRE), Govt. of India.

The Phase I was implemented during September 2016- March 2018. The Phase II is being implemented during 2018-19 and 2019-20. Energy Efficiency Services Limited (EESL) has been entrusted to implement the scheme.

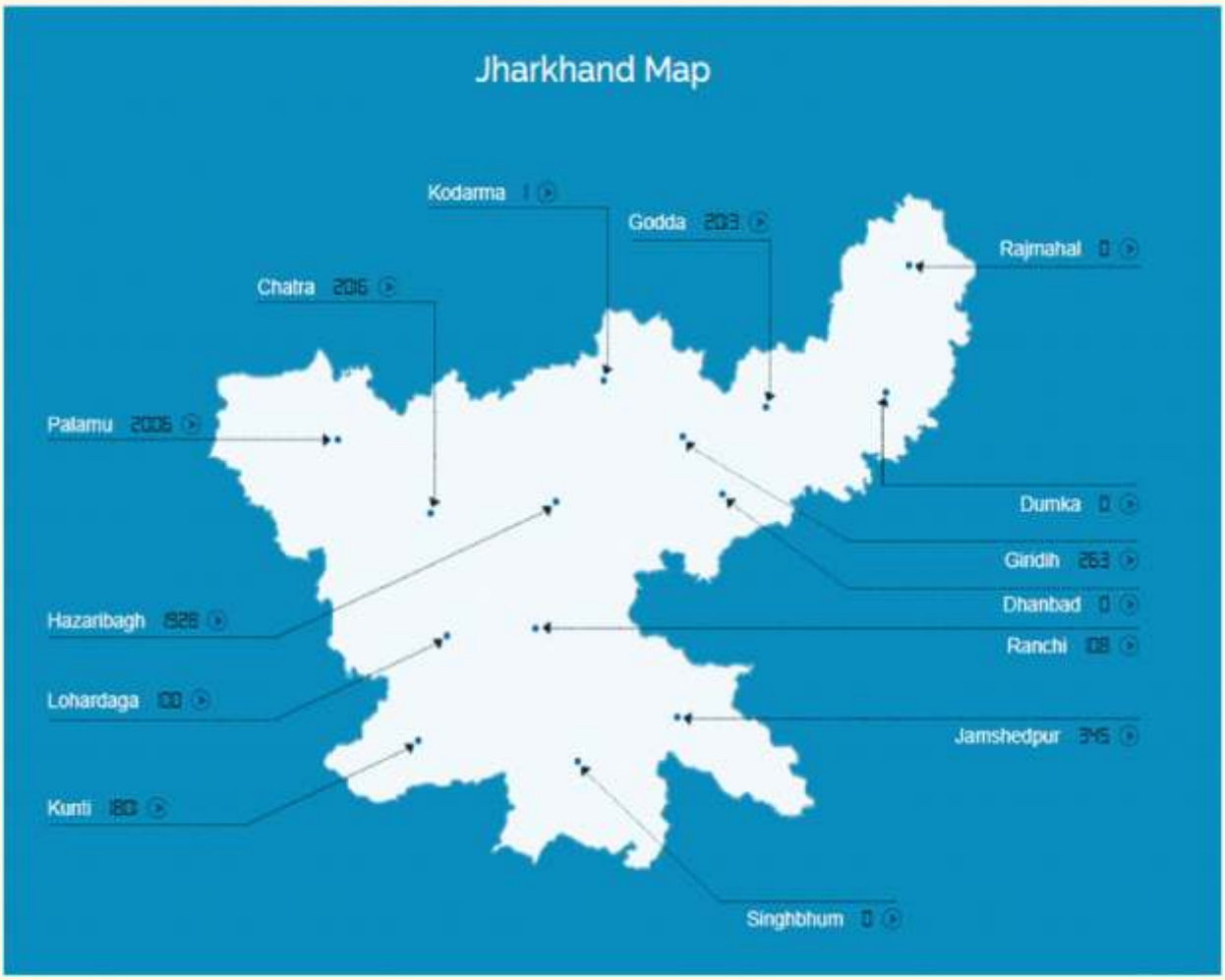


Figure 3.3 Spread of Solar Street Lights in Jharkhand

Wind Power in Jharkhand

In India the Wind farms can be installed at MNES identified potential sites, where it has a mean annual wind power density of 200 W/m2 or more at 50m above ground level.

A study by National Institute of Technology, Patna was conducted to study feasibility of Wind turbines at selected locations in Jharkhand. This study evaluated the availability of wind energy for electricity production at different locations, i.e., Ranchi, Jamshedpur, Devghar, Lohardaga, and Chaibasa, in Jharkhand, India. Due to the rapidly rising demand for power in Jharkhand, there is a

requirement of an alternative renewable source of energy to lower the dependence on its limited fossil fuel resources. The studied locations were found to be unsuitable for wind to electricity generation on a large scale at 10 m height above the ground. However, small-scale wind turbines can be used to extract energy from low-speed wind, preferably at a height above 10 m from the ground.

Waste to Energy

There is no clear idea on how much we generate as the data on generation of solid waste is not based on measurement, but is estimated. The thumb rule is: – Small cities generate approximately 0.3 kg/capita/day and the big cities 0.5-0.6 kg/capita/day. But what is clear is that per capita waste generation is growing across country. Waste generation is linked to wealth. As we grow wealthier, we generate more waste. The richest cities and states in India generate the most waste. Ranchi is estimated to generate more than 600 MT of garbage/waste every day. The generation rate of everybody is about 350 –400 gm per person/day.

RANK[7]	CITY NAME	SCORE
#15	Jamshedpur	3805.72
#46	Ranchi	3319.31
#56	Dhanbad	3190.09
#64	Hazaribag	3112.56
#66	Chas	3095.89
#95	Mango	2897.5
#111	Deoghar	2797.5
#130	Ramgarh Nagar Parishad	2682.16
#152	Giridih	2587.12
#167	Adityapur	2495.66

Table 3.3: Placement of Jharkhand cities on Swachh Survekhshan

The table represents position of Jharkhand cities in Swachh Survekshan which are mostly lowly ranked. Solid waste management in the villages is even worse with no organized collection, processing or disposal. With shrinking places and growing penetration of industrial products into the villages, management of waste in villages has become an eminent need.

Estimation of Green House Benefit

One tones of methane is equivalent to 21 tons of carbon dioxide. The estimated quantity of methane is in Cu. Meter. ; 53060092 X 0.5= 26530046 m3 of methane = 26530046 m3 of methane X 0.672; (LFG is assumed to be 50% methane) = 17,828,191 Kg of methane. CO2 Equivalent = 21 X 17828191= 374392011 Kg = 368364 Tons.

Urban Component

The urgency to take a call on the WTE plant comes with Ranchi Municipal Corporation (RMC) resulted into termination of the contract of the Mumbai-based Essel Infra Projects, which had been assigned to handle door-to-door garbage collection and set up the WTE plant across 12 acres

at Jhiri, around 15km from Ranchi, at a cost of over Rs 200 crore. The project was initiated on October 4, 2016, and was expected to be completed in November 2018. But so far, no construction has started and solid waste continues to be dumped at the Jhiri site. The Indian character of wastes is completely different from that of western countries. In India we have nearly 60 per cent organic waste which has higher moisture content. Also, there is lack of dry and wet waste segregation at source unlike western countries which makes WTE financially unviable. It won't be proper to blindly adopt western solutions to waste management in India.

Rural Component

GOBAR (Galvanizing Organic Bio-Agro Resources) DHAN, to kick-start the use of biogas and organic waste for energy generation purposes in the state. Household and agricultural waste would be used extensively by the state to produce biogas. Using waste for biogas production will also ensure that villages and cities in the state remain clean. The Centre provides subsidies of up to 100 per cent for biogas plants manufactured by gram panchayats.

National Biogas and Manure Management Program (NBMMP), is a Central Sector Scheme, which provides for setting up of Family Type Biogas Plants mainly for rural and semi-urban/households. A family type biogas plant generates biogas from organic substances such as cattle –dung, and other bio-degradable materials such as biomass from farms, gardens, kitchens and night soil wastes etc. The process of biogas generation is called anaerobic digestion (AD) and salient benefits of biogas technology are given below-

i. It provides clean gaseous fuel for cooking and lighting.
ii. Digested slurry from biogas plants is used as enriched bio-manure to supplement the use of chemical fertilizers.
iii. It improves sanitation in villages and semi -urban areas by linking sanitary toilets with biogas plants.
iv. Biogas Plants help in reducing the causes of climate change.

Potential of Geothermal Energy

Jharkhand has the good reservoir of geothermal energy in its earth's interior, whose surface manifestations are the steaming grounds and hot springs. The hot springs in Peninsular Shield of Jharkhand are located along a zone running more or less parallel to Damodar Valley Coalfield, i.e. along faulted boundaries.

In Jharkhand the thermal springs are found in Tatta- Jarom of Palamu district and Surajkund, Duari, Bagodar of Hazaribag district. The Tatta spring occurs within the Gondwana rocks and Jarom occurs within Proterozoic rocks. The temperature of the thermal discharge at Jarom is 50 degree c. (centigrade) to 57 degree c. while at Tatta it varies from 61 degree c. to65 degree c. in different spouts. All the thermal springs in Hazaribagh district are grouped in Damodar valley graben geothermal province.

Study conducted by NIT Durgapur found negative environment impact of geothermal power plant is almost negligible and greenhouse gas emission is almost zero. Moreover maintenance cost is low and the land requirement is less in compare to conventional solar power plant or wind power plant of capacity of 500 kW. Geothermal Power Plants can remains on line 97% and it can supply the base load power. Since India has more than 300 hot springs, the country may think about this renewable energy sources. Presently geothermal power plants are in operation in 24 countries

throughout the globe, however unfortunately there is no such a plant in India till the date. The estimated temperature of the geothermal reservoir of the Bakreswar–Tantloi is around 82-39 °C. This proves that the test site has potential for the exploration of geothermal energy which can be further utilized to generate electricity. It is noteworthy that there is already a thermal power plant (1050 MW) at Muthabaria within 8km from the proposed site of the geothermal power plant. The problems related to CO_2 emissions from the existing thermal power plant and the coal ash that is being accumulated in the ash ponds (creating environmental hazard) can be mitigated to certain extent by harnessing the geothermal resources in this area. This is high time for India to think about development of geothermal power plant as a potential renewable energy resource.

Development Projects under JREDA

Sl No	Type of System	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20	Cumulative Capacity / Installation
1	GCRT Project (MWp)	4.565	3.552	7.831	3.409	19.357
	GCRT Project (No of Building)	100	236	242	399	977
2	Solar Pump (No. of Unit)	225	707	126	960	2018
3	Solar Street Light Pump (No. of Unit)	500	3200	5000	433	9133
4	Solar Highmast, Pump (No. of Unit)	-	-	49	19	68
5	Rural electrification of village through solar mini/microgrid & solar stand alone Pump (No. of Unit)	-	212	30	0	242
6	H/H Electrification under SAUBHAGYA Scheme Pump (No. of Unit)	-	-	4954	4198	9152

Table 3.4: Development in projects running under JREDA

Chapter 4

Interface with Different Stakeholders: A Practical Reflection

SAR includes the study and recommendations from the baseline survey which was conducted in the month of August 2019. The purpose of a baseline study is to provide an information base against which to monitor and assess an activity's progress and effectiveness during implementation and after the activity is completed. The current study specially focuses on advocating the current issues towards accessing the CES and stimulates policy and program level initiatives for improving the reach of CES in rural tribal areas. The findings of the study will be used for evidence-based advocacy from the grassroots with tribal people to enhance their know-how and capacity on usage of CES up to the state l in creating enabling environment for promotion of CES would engender positive political commitment for promotion of CES at all levels. Showcasing and demonstrating proven rights based models at the grassroots will have rippling effect across the decision making agencies in the target area.

Process of interface

Selection of the Study Area

The baseline was done in the 4 intensive blocks from 4 districts of RACE intervention area in Jharkhand. In the selected blocks 70 % of the total populations are Tribes. Those include Munda, Oraon, and Primitive tribes. Total 63 villages and 2392 House Holds were shortlisted and selected for the study. The details of district, block and Organization is as follows-

Sl.No	District	Blocks	Partner undertaking data collection
1	Ranchi	Namkom	World Vision
2	Khunti	Murhu	LEADS
3	Gumla	Bishunpur	Vikas Bharti
4	Simdega	Kolebira	LEADS

Table 4.1 Baseline study Location and Organization

The Samples

Table 4.2 Distribution of baseline study The project is planned to cover more than 350 villages from 4 blocks during the 5 year tenure. But for baseline stage, it was planned to cover 20% of the total villages in a particular block for direct interview. This comes as 63 villages in total for all the four intensive blocks. For FGD, five villages each were taken for every block.

Sl.No	District	Blocks	Village	FGD(SMC)	FGD GS & SHG
1	Ranchi	Namkom	9	5	5
2	Khunti	Murhu	28	5	5
3	Gumla	Bishunpur	15	5	5
4	Simdega	Kolebira	11	5	5
No of Villages			63	20	20

Table 4.2 Distribution of baseline study

Sampling Technique and Selection & Sample size

The study planned to adopt Random and Cluster probability sampling techniques. The general rule for selection was taken as 20 percent of the total.

Sample size determination is the act of choosing the number of observations or replicates to include in a statistical sample, the probability that the sample accurately reflects the attitude of the population. Although it is a subset, it is representative of the population and suitable for research in terms of cost, convenience, and time. The sample size for house hold survey is as follows:

Name of block	Total no of Panchayat & Villages	No of Sample villages (20% of total)	Total Household	**Sample HH (20%)**
Namkom	Panchayat 23 Village 110	9 Villages	2332	607
Murhu	Panchayat 16 Villages141	28 Villages	3008	615
Bishunpur	Panchayat 8 Villages 68	15 Villages	2797	610
Kolebira	Panchyat 11 Village 53	11 Villages	2693	560
Total	372	63	10830	2392

Table 4.3 Panchayat and Village distribution

Instruments for Data Collection

- Direct observation : it reflected that solar pump are beneficial, its advantage are less known to individuals, even if they adopt,the main problem is in its maintenance
- Checklist
- Questionnaire for Household Survey
- Questionnaire for Focus Discussion
- Demographic features
- Unstructured Interviews with other stakeholders

Data Collection

The exercise was initiated in the month of July 2019 with the mapping of the target area. Household listing and complete census was done during preparatory phase.

The actual data collection started in August. The programme managers made field visits to the study area and provided hand holding supports to the field investigators and community mobilizes. During the visit the research coordinators ensured that the questionnaire was filled by the field investigators while visiting the Households. Investigators also used observation method and inspection methods for data collection. The data was collected through the questionnaire and was filled on the spot using pencils and pens. The data collection was also done through focused group discussions with SMC, SHG& Gram Sabha& Household and village survey as per the structured format.

Processing of Data

Data collection of the Households survey & FGDs was completed by the 22nd of August 2019. The completed formats were sent by the program persons to LEADS where the Research Coordinator compiled the formats from each block and prepared for the data entry. A master sheet for the data entry of HH survey and FGD was separately prepared for all the blocks in Microsoft Excel Sheet. Data entry was done by all the partners and Data management (including translation) was done by LEADS.

Data Entry started on 23rd of August 2019 and it took 10 days to complete the data entry process. Simultaneously, the all field staffs and program persons communicated in case the data sheets were unfilled and unattended areas were tried to fill. Through this information were collected and data entry process was completed.

Method of Data analysis

Data analysis was carried out in Microsoft Excel on the basis of the master sheet prepared for the data entry. The analysis sheet/data entry sheet resembles the survey instrument (questionnaire). After the data entry and compilation, data analysis was carried out in block wise. Separate sheet was used for the analysis of direct interview & FGDs wise. The analyzed data were interpreted in the table formats and Graphs.

Findings and Data Analysis

Demographics

The area under study consisted of mostly nulcear families with three-quater being nuclear in almost all districts. The data showed this percentage being 87.9% for Ranchi, 73.3% for Simdega, 73.6% for Khunti and 68% in Gumla district. These numbers are concurrent with the level of development in these districts. Families are mostly patriarchal and women headed families are very few.

Population in these areas is mostly tribal with nearly three quater representation. Area under study in Simdega had 65% population as tribals, whereas Khunti had 76.1% tribal people, Ranchi had 78.9% tribals and Gumla had 94.1% tribals. Scheduled castes and other backward classes too formed significant numbers in these districts.

Economically as well, the area appears to be relatively backward, with 58% population in Gumla registered as BPL, numbers being 62.7% in Simdega while Ranchi and Khunti had 75.9% and 85% registered as BPL, respectively. Thus,the area showed socio-economic backwardness recognised by the government data as well.

The sex ratios are quite even in the districts being almost equal. The population is mostly young, with under 18 years being 40.9% in Khunti, 40.77% in Simdega, 36.86% in Ranchi and 39.61% in Gumla district. Thus, high demographic devidend is clearly visible in the study area.

Educational Attainment

On the educational attainment the districts appear quite backward, with illiteracy being significantly high for both male and females. The numbers being 18.1% males and 27% females in Khunti, whereas in Simdega this number is 21.4% and 32.5%, Ranchi had 27.2% illiterate males and 42% females as illiterate whille Gumla had 34.9% males and 43.4% illiterate females. Thus, even in illiteracy females have greater numbers. Just 2.2% males and 1.6% females in Khunti have graduation or post graduation degree, whereas these numbers are 4.24% and 3.11% for Simdega,

5.2% and 4.6% for Ranchi and 2.9% and 3.4% in Gumla district. Thus, the data signify the backwardness in educational attainment of these districts.

Occupation

The population is agriculture depedent with 58.9% in Khunti, 52.8% in Simdega, 36.4% and 64.6% in Gumla engaged in aricultural activity for their livelihood. Other source of income being labour with numbers being 36.9% in Khunti, 43.9% in Simdega, 51.1% in Ranchi and 31.6% in Gumla. Service sector and business employs miniscule population.

Electricity Availability

The area under study showed extreme backwardness in the availability of electricity in these districts. Nearly 90% of the study area received less than 12 hours electricity per day. These figures in percentile are 96.4% for Khunti, 96.62% for Simdega, 91.7% for Ranchi, and 85.4% in Gumla. Thus, though electricity penetration has increased in Jharkhand availability throughout the day has been a long dream. Corresponding to unavailability of electricity, lantern, charging lamp, inverters etc are employed to provide power. 73.61% in Khunti use lantern/dhibri to light up, where as 86.58% Simdega use it, in Ranchi 80.62% population employ dhibri/lantern to light after dark where as 85.37% in Gumla use it for work after sunset and before sunrise.

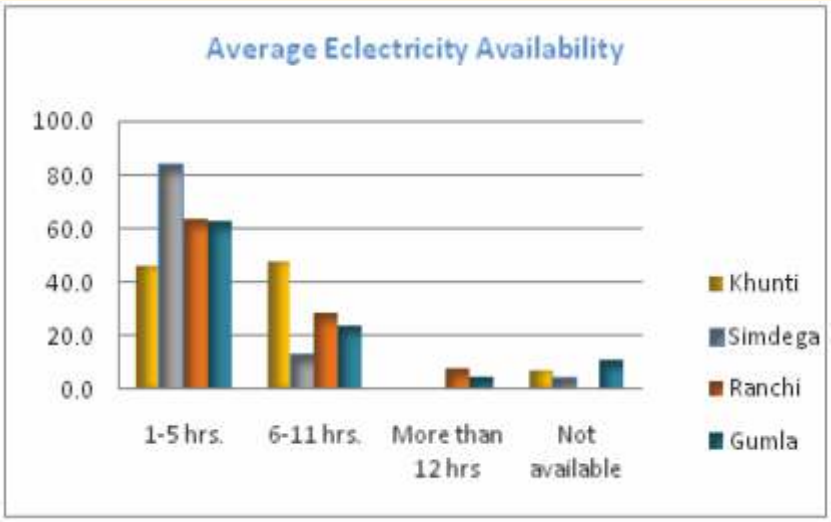


Figure 4.1 Average Hours of Electricity Availability

Fuel Sources Employed for Lighting

Most of the population employs wood for cooking food. In Khunti 61.63% of population use wood for cooking whereas this no is 55.39% in Simdega, 72.86% in Ranchi and 88.34% in Gumla district. Percentage of population employing gas for cooking is 37.76%, 44.51%, 25.67%, 11.65% for these districts respectively. Thus, there exists extensive scope for employing clean cooking solutions in these areas.

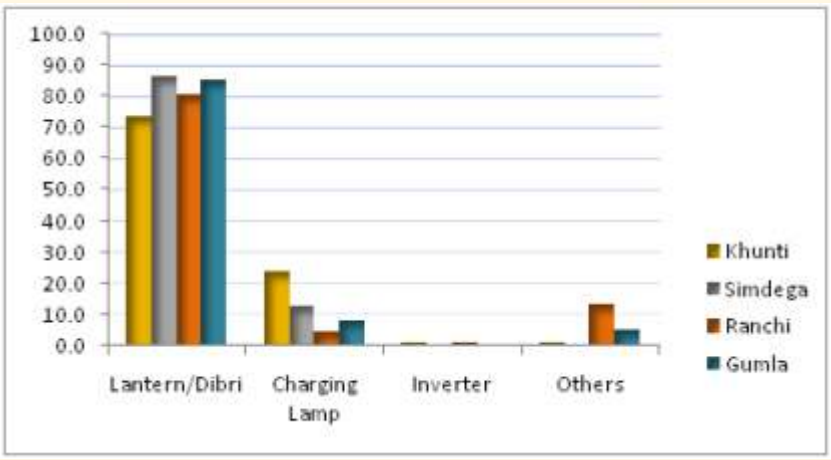


Figure 4.2 Sources Used for Lighting

Fuel Sources for Cooking

The studied districts were found to be using mostly traditional methods of cooking. Wood seems to be the most prevalent form of fuel for cooking. It accounted for 88.3% in Gumla,72.9% at Ranchi, 61.6% in Khunti and 55.4% in Simdega district. Use of LPG has also been quite high in the studied area,; being 44.6% in Simdega, 37.8% in Khunti, 25.7% in Ranchi and 11.7% in Guumla. Other souces suchas Coal, heater, stove, cowdung too are used but are relatively less significant.

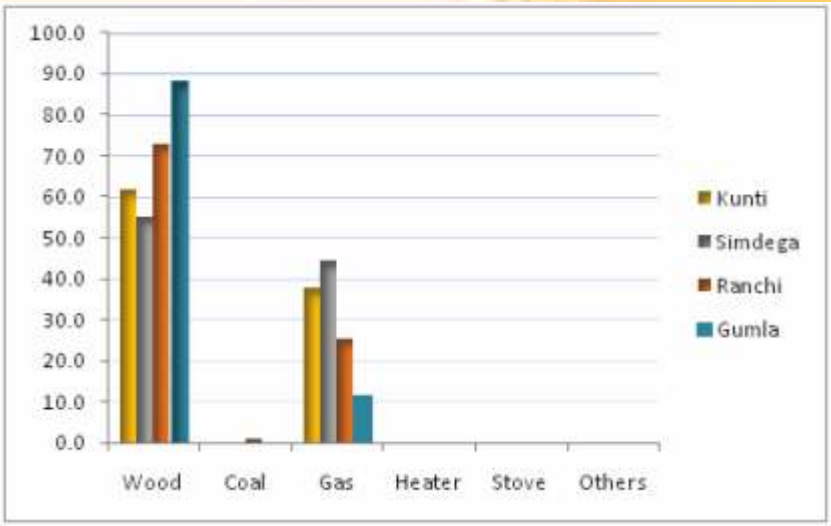


Figure 4.3 Fuels used for Cooking

Water Source for Drinking

Water usage pattern in the districts studies too showed grate variance. People depended on traditional souces for their drinking and other domestic needs. For drinking purposes handpumps and wells sufficed their needs mostly. For Khunti 76.%, Siumdega 90.34%, Ranchi 78.1%, and Gumla 75.4% population depended on just these two sources for their drinking water supply. To some degree solar pumps have penetrated to these districts as well. Khunti with 4.4%, Simdega 3.92%, Ranchi 6.8%, And Gumla 11.4% population are satisfying their drinking water needs from Solar water pumps. Other sources being used for satisfying drinking water needs are river and canals, supply water, chuwa dari,dobha or ponds. But percentage of people using them are minuscule.

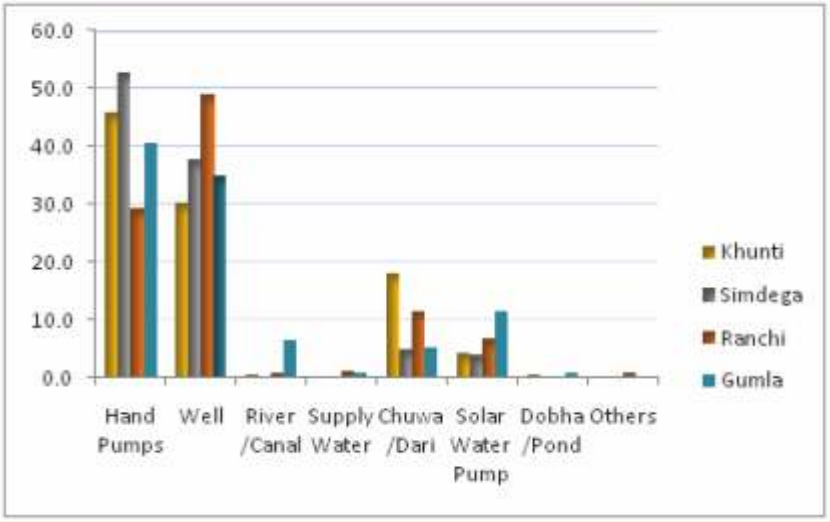


Figure 4.4 Drinking Water Usage Pattern

Water Source for Domestic Usage

For other domestic usage too same sources are being used but the usage percentage showed variance.Wells continued to be the most prevalent source, but Ponds and Chuwa/Dari and river/canals were in greater use. Well usage was 29% in Khunti, 35.3% in Simdega, 38.2% in Ranchi and 30.2% in Gumla. Dobha/pond was in used at 42% in Gumla, 19.17% in Simdega, 19.6% in Ranchi and 5% in Gumla. River/ canals were used by 14.7% people in Khunti, 4.89% in Simdega,

21.3% in Ranchi and 30.5% in Gumla. Handpumps were utilised by 7.6% people of Khunti, 25.2% of Simdega,11.8% of Ranchi, and 22.2% people of Gumla. Thus , water used for drinking and other domestic purposes were found to be from different sources.

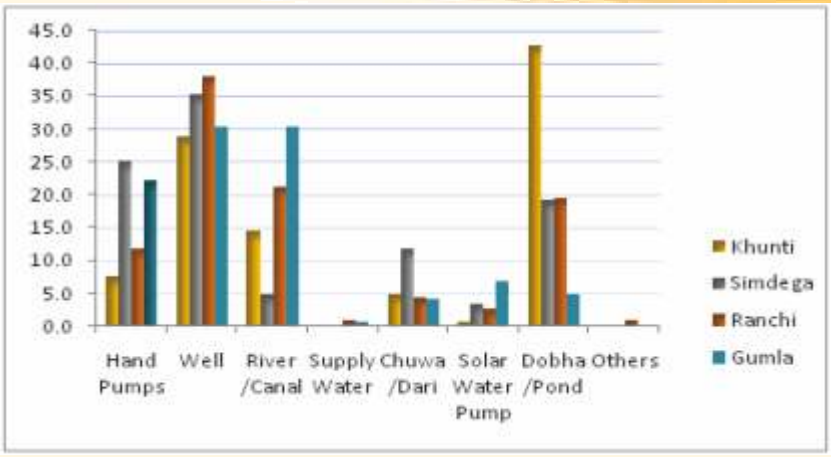


Figure 4.5 Water Usage for Other Domestic Purposes

Water Source for Irrigation

For irrigation purpose the sources used were lift irrigation, tulu pump, summersinle, diesel pump, dang/latta, drip, solar pumps and some other traditional methods. Diel pumps and tullu pumps were the most prominent equipments used for irrigation. Diesel pumps were in use by 44.8% in Khunti, 11.5% in Simdega, 25.8% in Ranchi and 6.9 in Gumla, while tulu pump for these districts had the numbers of 10%,25.9%,55.5% and 22.8% respectively.

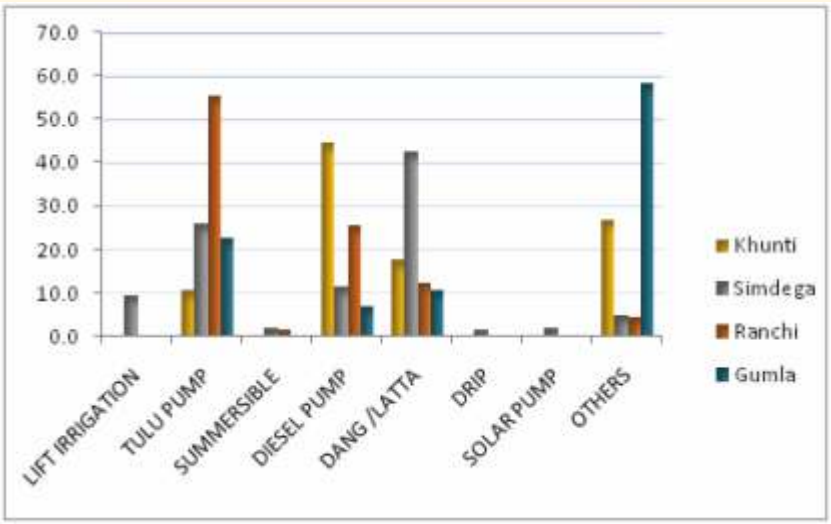


Figure 4.6 Sources of Irrigation

Dang/Latta too was used significantly for irrigation. Solar pumps found semblence in Simdega and Gumla districts with 2.2% and 0.4%.

Usage of Clean Energy Appliances

Usage of clean energy appliances has seen rise in recent times as reflected in the datasets. Appliances like charging lamps, energy efficient bulbs, fans, solar pumps, unnatt chulha , biogas, LPG etc are in use in the study area. Solar charging lamps were in use by 44.4% people in

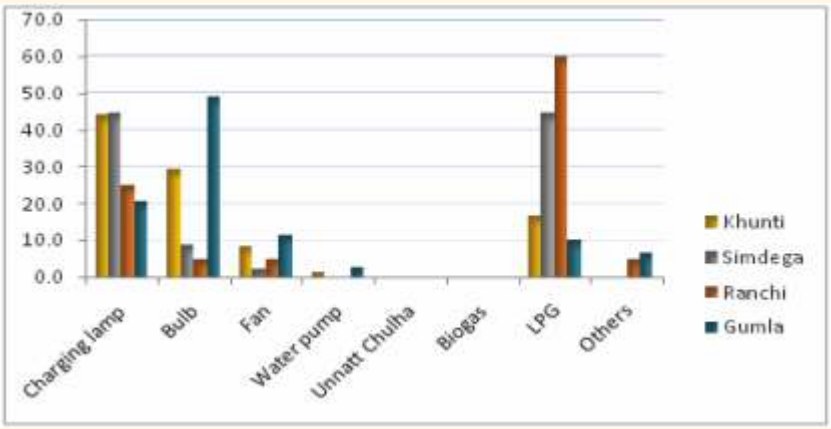


Figure 4.5 Water Usage for Other Domestic Purposes

Khunti, by 44.6% in Simdega, 25% in Ranchi and 20.4% in Gumla. Solar water were in use by 1.3% in Khunti and 2.8% of the studies population in Gumla district.

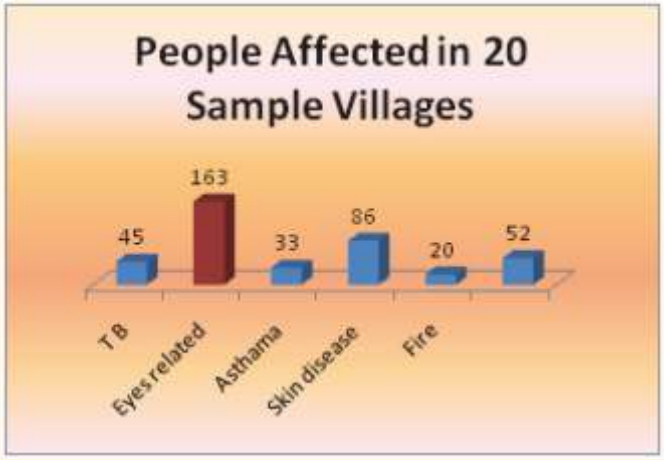
Awareness on CES in Schools and community

- The FGD held with School management committee in 20 sample villages revealed that there is lack of awareness on clean energy
- No awareness activities are carried out on CES as compared to other issues such as hygiene, cleanliness etc
- Very few electrical appliances are in use and the case is even worse for solar equipment which are defunct due to lack of maintenance
- The SMC members are not aware about the schemes and other sources of getting the clean energy equipments allotted
- Solar deep boreing is installed in 12 out of 20 villages
- Limited exposure of community members on CES related knowledge and Skill building exercises

Health effects of air and water

- The FGD held with SHG & Gram Sabha in 20 sample villages Revealed that people are aware and affected by the hazards of using conventional source of energy
- Disease related to Eyes & Lungs are mostly affecting the people

This action revealed that more than 70% of the rural tribal people are still facing abject energy poverty. Aside the biomass, kerosene usage is the only other alternative, which is costly, not easily available and poses several health and environment hazards. And despite connection to the energy grid of a large section of the rural residents, they still suffer power outage as a result of voltage fluctuation issues and frequent breakage of power lines due to heavy storm, especially during rainy season. Being a tribal dominated area, the people are mostly engaged and focused towards sustaining their daily livelihoods. As a consequence, there is poor awareness and utilization of Government programs and schemes related to Clean Energy Solutions (CES) meant for the people to meet their energy demands. Lack of focused initiatives on CES both by NGOs and Government has resulted in poor grassroots mobilization and there are very few rights based forums, platforms and networks that advocate for clean energy as a right of an individual. The tribal welfare schemes are also yet to benefit the people at. The delivery mechanism and systems are not properly responding to ensure clean energy promotion and that there is absence of a strong collective voice for attracting energy programs.



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Chapter 5

Glimpses of Case Studies and Models that can be Adopted

Solar-based village electrification-pilot public–private–people partnership project: Uttar Pradesh

There are 80,000 unelectrified villages in India out of which 18,000 are remote villages. To lift millions of people out of poverty and avoid migration to cities, the development of rural economies is extremely important. Access to energy is a critical component in this regard.

Aim

The aim was to gain further experience with technical, financial, and organizational issues related to the scaling up of village electrification through renewable energy in rural areas.

Solution

This project was an attempt to demonstrate the attractiveness of solar power for those most in need of it. Scatec Solar built two pilot projects in two villages of India. Iinvestments to the renewable energy sector, the Norwegian and Indian governments decided to form a PPPP (private–public–people partnership) and set up another 28 village SPV Solar Photovoltaic) plants as a pilot project.

The project involved installation and operation of CSPPs (community solar power plants) in 28 villages in four states in India: Uttar Pradesh, Madhya Pradesh, Jharkhand and Jammu and Kashmir.

A total of 290 kWp has been installed serving approximately 1300 families, with the size of each CSPP ranging from 4 kWp to 25 kWp.

In addition to lighting the houses, electricity was made available for commercial activities also, in certain cases. The projects in Jharkhand provided electricity to silk reeling centres.

The partnership comprised MNRE (Ministry of New and Renewable Energy, Government of India) and the Norad as funding agencies; the private company Scatec Solar as the project implementer; and IREDA (Indian Renewable Energy Development Agency) as the monitoring agency. The approach adopted for implementation of the project included the following.

- **Worked with local NGOs as a door opener into villages**. The NGOs organized a number of meetings (over several months) for raising awareness among the villagers to participate in the project under the PPPP model and explained to them the objectives and benefits of the project.
- **The NGOs also carried out the needs assessment of the community – 'bottomup approach'** – and thus an estimation of the required load for different villages.
- The project attempted to secure proper operations and maintenance through local ownership. In all **villages, VCECs (Village Clean Energy Committees) have been formed**, with varying number of members in total and varying number of female members
- The VCEC members were in general selected by the villagers.

Problem

The kerosene lamps used earlier caused respiratory and eye problems. Introduction of electricity has had a clear positive health effect on the household.

Benefits:

- Children are able to do their school homework and study in the evenings. This is claimed to have resulted in better marks in school examinations.
- The TV is bringing entertainment, news from the world, and educational programmes to the villagers, which is very positive. Following the commercials, some villagers now want more household appliances such as coolers and refrigerators. They have also become more aware of their own social standing as compared to people/societies seen on TV.
- Available electric light helps women to cook food in the evening, not during day as previously. The evening meals served are thus 'straight from the pot' meaning better quality 'fresher' food.
- Installation of fans makes heat more bearable and helps avoid insect and mosquitoes. The lights make it easier to spot insects inside the house at night.
- Streetlights have made walking outdoor after dark safer. Streetlights have also reduced the number of thefts.
- As electricity has enabled pumping of water, girls do not have walk long distances to collect water. Use of water will also inevitably increase with such systems, and thus hygiene standards in the households will evidently improve.
- In some villages, the value of land has increased, becoming more attractive to immigrants. MNRE and Norad conducted a review of the project in late 2011 to assess the installation of projects as per plans. The review team observed that though the project contributed significantly to social outcomes, the business models were not financially viable and needed further introspection. Learning from this pilot project will be very useful to be considered while developing such projects in future. Some of these are as follows.
- The local governments were not involved in the project in 116 empowering rural India, so the implementation of the CSPPs was not coordinated with other electricity installation in the villages.
- Building the grid infrastructure as well as providing continuous system uptime, also after sundown, is excessively expensive with PV; a hybrid solution would be more cost effective.
- Small systems are not bankable, hence business model innovation coupled with easily accessible support schemes is the prerequisite for success.

World Largest Solar Steam Cooking System at Tirumala, AP

The Solar Steam Cooking System at Tirumala, Andhra Pradesh definitely finds a mention among the most noteworthy initiatives in solar energy as it is the largest of its kind in the world. Tirumala Tirupathi Devasthanam (TTD) in Andhra Pradesh is one of the most popular pilgrimage places in India. People from all over the country and abroad come over to receive the blessings of Lord TirupatiBalaji, the main deity at the temple.

Problem

The temple authorities provide food for huge number of devotees' everyday at the temple. However, they had to contend with the problem of fuel shortage and electricity in this process.

Solution

Then the authorities resolved this problem with the help of solar power. They set up a huge solar steam cooking system in the temple premises. The solar steam cooking system installed by the Tirumala Tirupathi Devasthanam (TTD) at Tirumala in Andhra Pradesh has the ability to prepare food for 15,000 people / day. This ingenious system uses automatic tracking solar dish concentrators that convert water into high-pressure steam. The steam thus generated is utilized for cooking at TTD. The authorities have linked the system with the existing diesel boiler to ensure that the system's usability and reliability under all climatic conditions. The system designed to produce over 4000 kgs of steam/day at 180 degree centigrade and 10 kg/sq cm is adequate to cook two meals for approximately 15,000 persons. Its installation was accomplished in September 2002 and was launched on 11th October 2002

Benefits

The system can save around 1,18,000litres of diesel per year, valued at Rs2,30,00,000. The total cost of the solar cooking system was about Rs. 110 million and was installed by M/s Gadhia Solar Energy Systems, Valsad under a demonstration scheme of MNES with 50% financial support. The rest of the cost was borne by the TTD trust. The success of this system has led to the installation of 6 such systems in the country. This technology is very useful at places where rice is the staple food and cooking is done on a very large scale. This technology is another instance of exemplary use of solar energy on a large scale.

The first solar kitchen only village in India: A case study from MP

Betul, Madhya Pradesh: Bancha in Betul district is the first village in India to have zero wooden stoves and almost no use for LPG cylinders with all its 75 houses relying on solar-powered stoves to meet their cooking needs.

Supporting Hand

"There are places in India where solar plates are used sporadically for cooking, but with the help of a team from IIT Mumbai, a special solar stove was developed. No trees are cut by the villagers now for lighting their stoves. The Central government's decision to choose Bancha has changed has set an example which can be replicated to make other villages smoke and pollution free".

A NGO official said that the project of installing solar power plates, batteries and stoves in all the 74 houses was started in September 2017 and got completed by December 2018.

Present Situation

Harvind, a villager, who had benefitted from the scheme said that they are now able to cook their food without hassles and it has also brought electricity to their homes."We can now cook our meals within half an hour and that too without the tension of smoke. We also don't have to go anymore to the jungles for picking twigs and branches for the wooden stoves," said Harvind. JamunaBai, a lady from the village termed it as a big development which has changed the lives of children and women across the village.

"Earlier our eyes used to burn while cooking meals, it was due to all the smoke. Our children too had to be sent to jungles instead of schools but the situation has changed now. We all get time for ourselves and the kids can study now," JamunaBai said.

Conclusion

The success story of Bancha is an eye opener which shows the potential of renewable energy. Not only will it help the nation economically but will also prove to work wonders for the environment if implemented across India.

Roof-Top SPV Systems Catch- Up: VidyutSaudha Building in Hyderabad and The Bikalp Shakti Bhavan, Kolkata

A rooftop grid-interactive SPV power system can meet the partial load during peak demand of a building and supply grid-quality power to the utility when power is not required on holidays. Atypical grid-interactive system comprises SPV modules, which supply electrical power to the load through a high-quality inverter.

The inverter converts the direct current (DC) generated by SPV to grid-quality alternating current (AC). When the SPV system produces more power than is needed in the load area, the excess power can be sold to the utility.

During 2001-02 five projects with an aggregate capacity of 275 kWp were commissioned. This brings the total roof-top systems installed up to February 2002 to nine. In addition two rooftop systems are under installation. Among the projects commissioned during the year are those at the VidyutSaudha Building in Hyderabad and at the Bikalp Shakti Bhavan in Kolkata.

The West Bengal Renewable Energy Development Agency (WBREDA) has set up the Kolkata project, which has a capacity of 25 kWp. WBREDA has entered into an Energy Adjustment Agreement with the West Bengal State Electricity Board, under which the WBREDA would pay net energy charges.

Abi-directional import-export energy meter keeps a record of the net energy consumption by the WBREDA and the electricity charges are based on net energy consumption at Bikalp Shakti Bhawan

Co-generation - Bagasse based Cogeneration System

A17 MW co-generation power project set up by M/s Kakatiya Cement Sugar & Industries Ltd in 2002 at Per-uvancha village, KallurMandal, Khammam District, Andhra Pradesh.

The project is the first of its kind for a sugar mill. A high pressure boiler of 87 ata/515 deg C has been installed, which ensures high energy efficiency & better utilization of bagasse resulting in more steam and hence more electricity.

The project envisages generation of power to meet captive sugar plant requirements, cement plant requirements and export of about 10.85 MW of surplus power during season and 14.70 MW during off-season to the State grid.

The project uses bagasse generated from the crushing operations of the sugar mill during season, and stored bagasse, cane trash and coal during off-season.

The project was completed in a record period of 18 months. It achieved a PLF of around 90% in the very first year.

The cost of the co-generation project was Rs. 501.7 million. The technology used was indigenous, except for the turbo-generator, which was improved.

[5] The area of Earth located in between the Tropic of Cancer and Tropic of Capricorn is called the tropical (torrid) zone

Result:

The project has generated direct employment opportunities to about 100 persons and has also contributed to economic development of the area imported

Barefoot College and Solar Mamas[10]

Since the year of its founding, 1972, Barefoot College has trained for six months in India more than 800 women coming from remote communities of 73 different countries. Since 2015 a new center where trainee women train other women has been opened in Zanzibar to prevent women from travelling to much and another center is under construction in Burkina Faso.

Having developed the potential to become agents of change in their respective countries, the 'solar mamas' are trained as in- house solar engineering prom. They have helped turn rural wisdom into a fountainhead for development. It is supported by Ministry of External Affairs.

These barefoot solar engineers rarely have formal education, but the dedication to work for their village is a must in them. So the college narrows its choice of trainees to women who are middle-aged and older, as they are least likely to move out of the village. A young woman, on the other hand, often leaves her village after marriage. So also the men, who are likely to scout for better opportunities outside the village after receiving the training.

From solar energy to health, and from rural water supply to education, the Barefoot College taps the potential of local villagers to find solutions to a range of needs. Having a better understanding of local problems, they are better able to help fellow villagers and are accountable to their community. After a six-month training, the solar mamas are adept at assembling solar lamps, relying on color codes and symbols to guide them. The hands-on practical training equips them with skills that include fabrication of charge controllers and inverters, core winding, printed circuit boards, testing, wiring, installation of solar panels, and repair and maintenance of the lamps.

These barefoot engineers have lighted up villages using solar energy not only in the remote areas of Ladakh, Barmer and Sikkim in India but also in Bhutan, Afghanistan and about 20 countries in Africa. As the movement spreads, its products are diversifying. The parabolic solar cooker is fast becoming popular, and a 'Women Barefoot Solar Cooker Engineers Society' has been registered by the rural women who manufacture them. This environment-friendly, cost-effective, daytime cooker has an in-built spring and clock system that can be accurately set to complete one rotation in a fixed time; this, in turn, rotates the cooker to track the sun's movement and catch the sunlight on the reflectors throughout the day.

Chapter 6

Suggestions and Recommendations

LEADS is working with European Union for pro people clean energy policy support to Government of Jharkhand, since 1st April 2019. These suggestions and recommendations have been, made on the basis of deep involvement with rural areas of Jharkhand and studying all possible documents at state level besides our various interaction with different stakeholders which have been elaborately discussed in the relevant chapters. Relating to this, **SDG-7, aims to "Ensure Access to Affordable, Reliable, Sustainable and Modern Energy for All"** is one of the major concerns to be properly addressed in Jharkhand as state has abundant potential for solar energy**.** These suggestions and recommendation are in the light of the Global Commitments and possible local actions of State and how we can contribute in realisation of SDG-7.

In this context, growing environmental concern about fossil fuel-based electricity generation and increasing price has turned the tide in favour of producing electricity using eco-friendly energy sources worldwide. The sources of electricity production such as coal, oil, and natural gas have contributed to one-third of global greenhouse gas emissions. It is essential to raise the standard of living by providing cleaner and more reliable electricity. India has an increasing energy demand to fulfil the economic development plans that are being implemented.

According to the World Resource Institute (WRI) Report 2017, India is responsible for nearly 6.65% of total global carbon emissions, ranked fourth next to China (26.83%), the USA (14.36%), and the EU (9.66%). Climate change might also change the ecological balance in the world. Intended Nationally Determined Contributions (INDCs) have been submitted to the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. The latter has hoped to achieve the goal of limiting the rise in global temperature to well below 2 °C.

Jharkhand Context

Jharkhand a state carved out of Bihar in 2000, with 32 million populations as per 2011 census, has achieved 100 per cent rural electrification, with electricity reaching all households in the 24 districts. With 75 per cent of the population dependent on agriculture, the thrust on rural electrification has delivered results. **A Central Electricity Authority report says average daily power supply to the agriculture sector is 20 hours a day in Jharkhand. But the ground realities found in rural electrification and quality of electricity is stark.** The power supply has crippled lives of people in rural area of Jharkhand. Our base line survey in its finding found that quality of electricity is poor as electricity supply lasts only 4 to 5 hours in a day (or even less). During rainy season, sometimes it takes 5-6 days to restore the supply disrupted because of thundering. The schemes like Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya) and Pradhan Mantri Ujjwala Yojana (PMUY), Pradhan Mantri Kisan Urja Suraksha Utthan Mahabhiyan(PM-KUSUM) etc. have not found their reach to the beneficiaries. In absence of dedicated staff for clean energy at state level, the initiatives for the same central scheme gets fragmented among various sections of the government. We feel Government of India and government in Jharkhand should work in collaboration to implement time bound program with quality in a time bound manner. The state has showed a continuous fall in its renewable power obligations since 2017 and has been 0 for the year 2017 from the data of JREDA. Similarly schemes for subsidy for roof-top solar, of mini-grid aren't in place reflecting shortcomings of the state policy and commitment. The document hereby

enlists suggestions at various levels both at policy level as well as implementation level to not just contribute to INDC but also provide the population with affordable, accessible and reliable source of clean energy solution to improve their lives.

Community Needs

With 75.95% rural population in Jharkhand as per 2011 census, got its all households electrified by December 31, 2018. But the data of NSSO are quite surprising where it says 90% of the households consume less than 100 units of electricity and between 15-20% households consume less than 30 units of electricity per month. Electricity consumption has become an indicator to measure development, and the data above speaks for itself that a lot needs to be done to ensure accessibility, availability, quality and continuous supply of energy to the rural tribal population which is note the case at present. Electricity from clean energy source can be panacea for great many solutions to rural problems, from environmental sustainability to development to improved lives.

Household Energy

Electricity

- ✓ According to Initiative for Sustainable Energy Policy's (ISEP) report of 2020, nearly 13% of the household are not yet connected to electricity-grid. Thus, electrical connectivity of these households either to the grid or through standalone grids needs to be ensured.
- ✓ Reliability and quality of electricity has been an issue for the rural households. In general power outages are quite high and in adverse weather conditions the villages remain without power for days.
- ✓ With severe power fluctuations chances of electrical devices getting short-circuits or over all damage is quite high.
- ✓ Households which are too remote can be provided with mini-grid connectivity through solar power.
- ✓ *Billing* has been a significant issue in the rural areas of even the cities. Bills are not generated regularly, neither all the households have metered connections, thus they have to pay huge bills of late fine with compounded interest at times when they are in no position to pay the bills. Thus, all households need to be connected to metered power and shall be provided with regular bill payments.
- ✓ *Alternative Usage* - Households provided with large solar equipment like solar water pumps shall have the provision for using the excess power from the solar plates to be used for alternative purposes like household lightings.

Alternate Lighting

- ✓ From the baseline study conducted by LEADS as well as various other studies it was found that inadequate and unreliable electricity supply results into continued use of kerosene for lighting in the rural areas which is distributed through PDS. This supply is insufficient for a family's needs and is fulfilled from the market bought at high price thus adding to the burden of family. Prolonged use has also resulted into reduced study hours and visual impairments among children. Availability of solar powered emergency lights and mechanism of financial feasibility to get them needs to be made available for the rural households.

[11] https://www.tandfonline.com/doi/abs/10.1080/15567036.2018.1454548

- ✓ Community lighting can be ensured from solar powered community infrastructure like solar water pump, panchayat bhavans, schools, street lights etc.

Clean Cooking Fuel

With 75.95% rural population, 29.21% tribal population, and 29.62% forest cover a significant population uses wood, animal waste, coal, plant residue etc. as cooking fuel. This is not just inefficient but is a source of indoor pollution. Thus, both LPG and alternative cleaner cooking fuel shall be the approach to address the issue.

- ✓ LPG connection has reached the availability but not even one-third of the rural population uses them, as they aren't economical for refilling, distance of refilling station, hesitation due to safety, old habits of using firewood, etc. Thus, all these issues need to be addressed through involving CSOs to ensure that Ujjwala Yojna benefits are not limited to providing gas connection and first cylinder itself rather they are in continuous use.
- ✓ Smokeless Chulha; as an alternative to the traditional chulha has found wide acceptance as it reduces the firewood consumption by one-third as well as emits the smoke out of the house thus preventing indoor pollution.
- ✓ Multipurpose use of solar powered community infrastructures like solar water pump for processing rice or flour mill during daytime, solar powered panchayat bhavan for libraries at night for computer, printer etc. for providing alternate sources of livelihoods
- ✓ Jharkhand is rich in its animal capital, which can be used for installing small biogas plants using animal, plant and household wastes.

Livelihood through CES

Clean energy solutions are the foundations of transformation of the lives of rural population, which covers household, irrigation, lighting, cooking, manufacturing, farm produce processing etc. Along with providing CES for various energy needs like, solar water pumps under KUSUM scheme, smokeless chulha or LPG for cooking, solar powered potter's wheel, sewing machines etc. can be made available to rural masses along with easier financial linkages with the banks to improve their living situations and improve their sources of earnings.

- ✓ Food processing units like ragi processing mills, pulse processing plants rice husking plants etc. operated on solar power can be established which would add value to agriculture produce thus enhancing their income and improving their living standard.
- ✓ Solar water irrigation pumps shall be provided with alternate usage like house lighting and even power other smaller machines like fans for iron smith to be multidimensional in usage.
- ✓ Skill of youth and villagers needs to be raised in particular with solar equipment as clean energy is the new green field for opportunity and with increasing amount of equipment at village level maintenance demands too would raise. It also provides an opportunity for entrepreneurship promotion in CES.
- ✓ Solar driers and solar powered cold storage too need to be promoted to add value to agriculture and provide alternate source of livelihood, and use these CES to develop agro based industries in the state as Jharkhand is one of the largest green vegetable suppliers in the eastern part of our country.

Rural Economic Hub Promotion

Similar to Special Economic Zones at national level, for promotion of rural livelihood as well as sustained use of these capital-intensive devices there needs to be promotion of rural economic hubs running on solar power along with grid connectivity wherein power is available for all rural economic purposes supporting activities like agro-based industries, processing and packaging activities, cold storage facilities, etc. They should be developed as models for attraction of more and more rural entrepreneurs to pool in their resources and develop as a common hub. Realisation of potential of economic activities have remained restricted in villages because of the lack of reliable electricity which can be solved by these rural economic hubs. Various activities conducive to the geo-climatic condition of the village or a cluster of villages can be promoted through these hubs and solar energy can be harness and utilised in realising this.

Community Infrastructure Solarisation

Community infrastructure can serve as a beacon of change if they are source of 24*7 lighting sources through solarisation under various schemes of the government at greater scale. Places like panchayat bhavan, schools, PHCs, street lights, can be solarised to ensure the village remains lit irrespective of grid's performance.

Response Needed at Block and District

Systemic Interventions

- ✓ Clean energy projects are distributed among various departments of the government because of which a synergy for clean energy is missing. For example, some of solar water pumps have been installed in Jharkhand under Kusum Scheme of JREDA and some others have been installed by Jharkhand State Livelihood Promotion Society, JSLPS.
- ✓ Often clean energy interventions are looked as just targets to be achieved in any financial year and is looked at extra burden over the nodal officers. Thus, a dedicated pool of staff needs to be put in districts to ensure clean energy initiatives are implemented holistically.
- ✓ Committees constituted at district level for renewable energy are adhoc committees and often constitutes only government bodies. To realize the projects and their timelines for implementation these committees can be made permanent and they can be associated with CSOs to ensure timely implementation.
- ✓ Maintenance of database of all the activities as well as real time monitoring and transparency of it goes a long way in building confidence among the masses as well as ensure smooth and timely implementation of the projects for example, for KUSUM scheme drafts for solar pumps were submitted in 2019-20 itself but no follow up has been done till now and if beneficiary's requests were approved or if they would get pumps is unknown.
- ✓ Dedicated staff at block level for maintenance of this solar equipment is a must to ensure that the attempts of transformation into cleaner energy are not ones-shot event but a process.

Institutional Solarisation

To realise the commitment made via Paris Agreement, low hanging fruits like solarisation of government institutions like secretariats, public hospitals, courts, railway stations, bus stations, post offices, schools and colleges, etc. need to be achieved first. Till date JREDA has achieved roof-top solar of nearly 80 MW but most of these are limited to a few cities. These transformations at

block and district levels would serve as model of attraction and replication by common population.

Policy Suggestions for State

To develop an environment conducive to clean energy a favourable policy guideline needs to be put in place. Jharkhand state's policy for renewables have been lagging behind in several aspects. Jharkhand Renewable Energy Development Authority (JREDA) works as an extension to Ministry of New and Renewable Energy, Government of India. Thus, most of the program and projects are central government projects to which the state government lacks enthusiasm. They are seen more as targets to be achieved rather than as a commitment for betterment of lives of the people. For instance, Renewable Purchasing Obligations (RPO) for the distribution companies are seen as burden over them and thus can be seen from the performance of DISCOMS where it has not been fulfilling its RPO for all the years. Policy formulation on several aspects like state's solar policy, biofuels, mini-grid, roof top solar, waste to energy policy etc. are still in the process of development where as national policies post Paris commitment has been in place for more than 6 years now. Thus, to ensure adoption of clean energy there needs to be provision of dedicated fund as well as clear definition within the budgetary provisions to show the intent.

Distribution Companies (DISCOMs)

Major reforms are, required to ensure that DISCOMs support Renewable Energy (RE). The key reforms required are as follows:

- ✓ *Fixing a minimum percentage of power to be procured by (DISCOMs) – Renewable Purchase Obligations (RPOs).* By 2019-20, 15 per cent of the electricity purchased by DISCOMs in India should be from Renewable Energy (RE). If India has to achieve its target of 175 GW of RE by 2022, then about 16 per cent of the electricity consumed in the country has to be derived from RE by as early as 2019-20. However, compliance with the RPO targets is the big concern in the backdrop of no penalty/disincentive.
- ✓ *Allow competition at the distribution end*. The distribution infrastructure can still be owned by the state monopolies (ideally these should also be moved to private operators or to public-private partnerships), but the sale of electricity to consumers must be opened to competition. This would lead to better collection efficiency, lower Aggregate Technical and Commercial (AT&C) losses, lower political interference and improved operational parameters and financial health of the distribution segment. The state can still subsidize the poor by directly transferring the subsidy to consumers or the companies.
- ✓ *Decentralized renewable energy consumers must pay for using the infrastructure and also to cross-subsidies poor consumers.*

Clearly, without reforms at the distribution end, Jharkhand cannot hope to become a major user of RE.

Along with this, Well-to-do households in Jharkhandget over twice the amount of power subsidies that poor households receive, says a new study by two think-tanks, the International Institute for Sustainable Development(IISD) and the Initiative for Sustainable Energy Policy (ISEP), released in 2020. Thus, a rationalisation of the subsidy process needs to be done in line with the Ujjwala scheme so that only the needy get the benefits of subsidy which would also be beneficial for already stressed DISCOMs.

Kusum Scheme

- ✓ The scheme has continuously missed targets and commitments of 10,000 solar water

pumps have not been achieved even in 2021.Implementation of the scheme shall be time bound so that demands raised at villages can be fulfilled in the ensuing years.

- ✓ Target shall be raised in number to prevent migration and take complete advantage of irrigation in agriculture.
- ✓ Systemic issues like transparency of beneficiary selection, progress of submitted applications, etc. are missing which further slows down the process of implementation.
- ✓ Training to farmers of proper use of this equipment is also missing as well as maintenance of the equipment is not insured.
- ✓ Local youth should be trained through short course to ensure that this equipment get repaired at local level as technical persons to provide regular service.
- ✓ Farmer groups shall be made and their responsibility shall be provided to Agriculture Technology Management Agency, ATMA for providing technical inputs and take complete benefit of the scheme by linking various aspects of agriculture.

Ujjwala Scheme

- ✓ Less than one third of rural population has LPG connection and most of them are not in use. Thus, focus needs to be on the continuous use of the cylinders and not just providing connections.
- ✓ Gas refiling has been cumbersome for people in remote locations. Thus, if greater usage is ensured then it would become economical even for the gas agencies.
- ✓ Training for proper use, maintenance and safety shall be provided to ensure continuous use of LPG.

Solar-roof Top

- ✓ Clear policy guidelines defining subsidies and implementation process shall be defined which is presently missing.
- ✓ Clarity about the finance mechanism shall also be put in place so that the scheme is widely accepted by the people.
- ✓ Delays in payments to the utility provider shall be solved to ensured that they in turn don't delay the implementation of the scheme.
- ✓ The option of solar rooftop consumer to move to lower tariff slab should be discouraged. This compromises the DISCOMs not only from the cross-subsidy angle, but also from the reduction in fixed charges that is required to maintain the distribution infrastructure.

Mini-Grid Policy

The national mini-grid policy was drafted in 2016 but Jharkhand has published two draft mini-grid policy in 2018 and 2021 and has not yet come out with a clear mini-grid policy for Jharkhand. The draft policy mentions State government's commitment to support mini and micro grid operations powered by renewable energy throughout the state. The draft policy has a provision for installation of Mini grid projects of 1 kWp to 500 kWp capacities and various hybrid models using a combination of renewable sources such as solar, biomass and hydro, etc can be deployed through government subsidy or private or community funded projects with 'Build Own Operate and Maintain/Build Own Operate, Maintain and Transfer' (BOOM/BOOMT) basis. JREDA is keen to provide a conducive atmosphere to attract more investment, technological innovations and demonstration and create a level playing field for all concerned parties to enable energy access in

underserved regions of the state. The much-awaited policy though delayed but looks promising but implementation needs to remove the shortcomings already being faced by renewable sector overall. Association of CSOs working on mini-grid and clean energy needs to be associated during implementation to ensure timely delivery.

Solar powered Cold- Storage Policy

Jharkhand's geo-climatic and geo-political position makes it suitable to produce large quantities of vegetables. In absence of cold chains there are often wastage of one- fourth to one-third of the produce. Simultaneously, it also prevents development of agro-based industries. Though some of the storages are run by Tata trust and managed by Agricultural and Processed Food Products Development Authority (APEDA) there remains a lack of guidelines for them from the state. Through LEADS advocacy along with other stake holders in our state level network, JREDA is setting up cold storage on pilot basis in all 24 districts but policy guidelines to own and maintain such cold storages are still missing which government should come out with.

Service

- ✓ Demonstration of CES in service centers like health, Social and economic centers would attract people's gaze who would then in turn be attracted towards adopting these alternative sources.
- ✓ Proximity of service delivery will ensure CES acceptability among masses. For instance, if CES are available through single window systems at block and district levels, it would find greater acceptance among the masses.

Delivery Mechanism

- ✓ Transparency in delivery mechanism so that people are aware about the sources and funds which are responsible for installation of Clean Energy Infrastructure.

Follow Up/Monitoring System

- ✓ Enhance participation and ownership of Panchayat & Community over the infrastructure and installations. This will help towards users control and monitoring
- ✓ It is regular practice that once the scheme is implemented, proper follow up is not done. So, the concern department should take authority for time to time follow up of the implemented schemes
- ✓ To strengthen forums, platforms and Network of CBOs and CSOs with focus on CES

Block/ District Level Grievance Redressal Cell

- ✓ If the problems related to clean energy usage are timely addressed, the community will tend to adopt them whole heartedly. Delay in implementation raises doubts in public minds and further creates trust deficit with the government.

Recycling of Solar Panel

The International Renewable Energy Agency (IRENA) in 2016 estimated there was about 250,000 metric tons of solar panel waste in the world at the end of that year. IRENA projected that this amount could reach 78 million metric tons by 2050.

Solar panels often contain lead, cadmium, and other toxic chemicals that cannot be removed without breaking apart the entire panel. Today recycling costs more than the economic value of the materials recovered, that is why most solar panels end up in landfills.

Possible Methods

- ✓ The first step is a fee on solar panel purchases to make sure that the cost of safely removing, recycling or storing solar panel waste is internalized into the price of solar panels and not externalized onto future taxpayers. An obvious solution would be to impose a new fee on solar panels that would go into a federal disposal and decommissioning fund. The funds would then, in the future, be dispensed to state and local governments to pay for the removal and recycling or long-term storage of solar panel waste. The advantage of this fund over extended producer responsibility is that it would insure that solar panels are safely decommissioned, recycled, or stored over the long-term, even after solar manufacturers go bankrupt.
- ✓ Second, the federal government should encourage citizen enforcement of laws to decommission, store, or recycle solar panels so that they do not end up in landfills. Currently, citizens have the right to file lawsuits against government agencies and corporations to force them to abide by various environmental laws, including ones that protect the public from toxic waste. Solar should be no different. Given the decentralized nature of solar energy production, and lack of technical expertise at the local level, it is especially important that the whole society be involved in protecting itself from exposure to dangerous toxins.
- ✓ Third, the United Nations Environment Program's Global Partnership for Waste Management, as part of its International Environmental Partnership Center, should more strictly monitor e-waste shipments and encourage nations importing used solar panels into secondary markets to impose a fee to cover the cost of recycling or long-term management. Such a recycling and waste management fund could help nations address their other e-waste problems while supporting the development of a new, high-tech industry in recycling solar panels.

Conclusion and Way Forward

- ✓ Lack of focused initiatives on CES both by NGOs and Government has resulted in poor grassroots mobilization and there are very few rights-based forums, platforms and networks that advocate for clean energy as a right of an individual. Thus, to promote clean energy solutions, needs synergized efforts from CSOs and different government departments needs to be promoted.
- ✓ The delivery mechanism and systems are not properly responding to ensure clean energy promotion and that there is absence of a strong collective voice for attracting energy programs. Strong political understanding among masses shall be ensued to ensure transparency and timely implementation.
- ✓ Policy initiatives on clean energy as well as the delivery mechanism needs to be improved and needs to be developed in line with the commitments made as INDC.
- ✓ State Advisory Committee constituting different departments along with CSOs working for clean energy shall exist which shall exchange information to realize policy objectives at the ground.

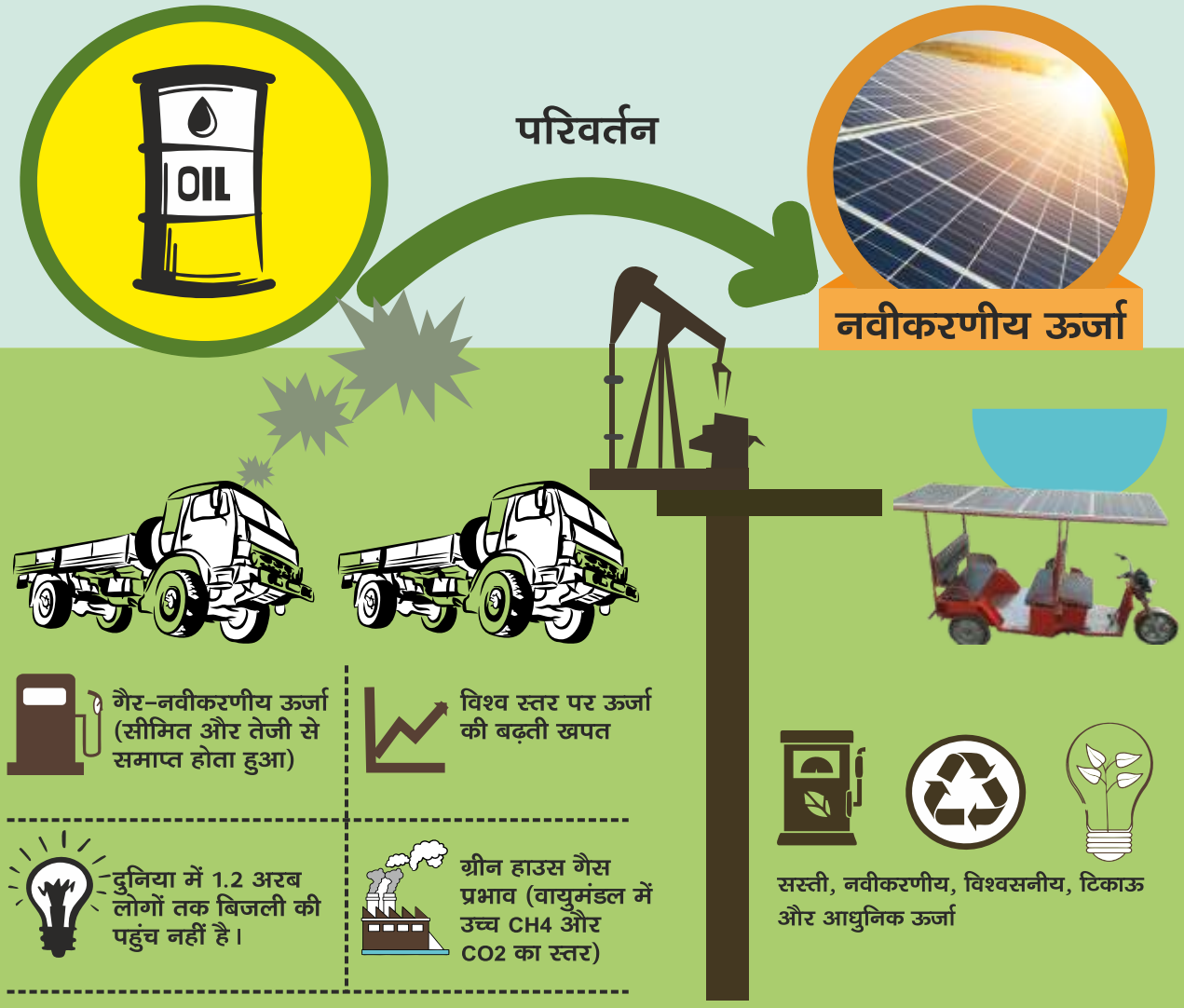
सौर ऊर्जा का उपयोग

SUSTAINABLE DEVELOPMENT GOALS

Goal 7:
Ensure access to affordable, reliable, sustainable and modern energy for all.

सतत् विकास लक्ष्य–7

सभी के लिए सस्ती, विश्वसनीय, टिकाऊ और आधुनिक ऊर्जा तक सार्वभौमिक पहुंच सुनिश्चित करना और तकनीकी शिक्षा का उपयोग कर नवीकरणीय श्रोतों के उपयोग को बढ़ाना है।



कुसुम योजना के तहत सोलर सिंचाई पम्प

रख-रखाव, उपयोग, अन्तर फसल एवं जल संरक्षण

कुसुम योजना क्या है ?

- सौर ऊर्जा का लाभ ग्रामीण किसानों को भी मिले इसके लिए केन्द्र सरकार ने 2018 में कुसुम योजना की शुरूवात की ।
- कुसुम का पूरा नाम 'किसान ऊर्जा सुरक्षा एवं उत्थान महाअभियान योजना' है।
- इस योजना के अत्तर्गत किसानों को मामूली अंशदान से लाभुक को सोलर सिंचाई पम्प मुहैया कराना है।
- इसका मुख्य उद्देश्य है:-
  - ✓ डीजल, किरोसिन के खर्च से किसानों कों छुटकारा दिलाना।
  - ✓ खाली पड़े जमीन में सिचाईं की व्यवस्था कर रोजगार का साधन मुहैया करना,
  - ✓ पर्यावरण प्रदुषण कम करना,
  - ✓ अतिरिक्त प्राप्त बिजली से रोजगार करना,
  - ✓ देश के लिए बिजली उत्पादन की वैकल्पिक व्यवस्था करना।

आवेदन कैसे करें ?

- झारखण्ड में कुसुम योजना का क्रियान्वयन जरेडा के द्वारा किया जाता है।
- योजना का लाभ लेने के लिए किसान के पास खेती योग्य जमीन और सिंचाई का स्रोत होना चाहिए।
- किसान के पास 4, 6, और 8 इंच का डीप बोरिंग अथवा कुआं होना चाहिए जिसमें सालोंभर पानी रहता हों साथ ही जमीन का मालगुजारी रसीद, आधार कार्ड, बैंक पासबुक, पासपोर्ट साईज फोटो एवं वंशावली आदि होना चाहिए।
- इस योजना के तहत् 2, 3 और 5 एचपी पम्प के लिए क्रमशः 5000, 7000 और 10000 रूपये का लाभुक अंशदान जरेडा के नाम डिमाण्ड ड्राफ्ट बनवाकर फॉर्म के साथ जरेडा या प्रखण्ड कार्यालय में जमा करना पड़ता है।

रख-रखाव कैसे करें ?

- सोलर सिंचाईं पम्प के लिए उपयुक्त जगह का चयन करना है।
- सोलर पम्प वहां लगाना चाहिए जहां पेड़, पौधे एवं झाड़ी न हो।
- सोलर पैनल, पानी का श्रोत और जमीन आस-पास हो।
- सामूहिक खेती के लिए 4-5 लाभूक का जमीन आस-पास हो।
- पम्प का उपयोग 10 बजे दिन से 3 बजे दोपहर तक करने से ज्यादा फायदा होगा।
- पैनल में जमे धूल को सप्ताह या पन्द्रह दिन में एक बार साफ करना चाहिए।
- तड़ित चालक, इलेक्ट्रिकल कनेक्शन लूज न रहे।

सिंचाई प्रबंध कैसे करें ?

- सिंचाई के लिए जितना पानी की जरूरत हो उतना ही समय पम्प चलाएं।
- फसल के अनुसार ही सिंचाई करें।
- पानी तक सिंचाई न करें।
- खेत के चारों तरफ ट्रेंच खुदवाएं ताकि वर्षा का पानी खेत में ही समा जाएं।
- खेत के चारों तरफ मेड़ में फलदार या इमारती पेड़ लगाएं ताकि गर्म हवा और धूप से खेत की नमी बची रहे।
- पानी के समुचित उपयोग के लिए मिश्रित खेती या अंतर खेती करें

अंतर फसल प्रबंध कैसे करें ?

- क्यारियों के बीच में कम अवधि वाले पत्तेदार सब्जी लगाएं या ऐसे दो फसल लगाएं जो आपस में किसी का नुकसान न करें। जिससे एक ही सिंचाईं में दोनों फसल हो जाए।
- पूरा खेत को 4 - 5 भाग में प्लाटिंग कर दें और हर प्लांट में अलग समय पर अलग-अलग फसल लगाए ताकि खेत खाली नहीं रहे।
- पानी का समुचित उपयोग के लिए फलदार पौधों के बीच कोई भी सब्जी का खेती कर सकते हैं।
- ड्रीप सिचाईं, स्प्रीकलर सिचाईं, मल्चींग विधि, पोली हाउस खेती, जैविक खेती आदि कई ऐसे तकनीक है जिससे कम पानी का उपयोग कर अच्छी उपज हो सकती है।

योजना की अधिक जानकारी के लिए अपने प्रखण्ड कृषि पदाधिकारी या बीडीओ से सम्पर्क करें।
जरेडा का वेबसाईट www.jreda.com से पता कर सकते हैं।

RACE

Rural Access to Clean Energy

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