Scoping Study and Policy Imperatives on Green Jobs and Eco-Entrepreneurship Opportunities for Women in Select States in India.

RENEWABLE ENERGY

Green jobs and Eco-Entrepreneurship has been integral to the discourse on green growth/economy for over a decade and has assumed greater significance of late. This study - Scoping Study and Policy Imperatives on Green Jobs and Eco-entrepreneurship Opportunities for Women in Select States in India was initiated in early 2020 and draws upon the learnings from the United Nations Development Programme (UNDP)'s project "Creating Employment and Entrepreneurship Opportunities for Women in India" (Disha) project. The intent of the study is to identify areas for and promote greater women's workforce participation in renewable energy, green construction, green transport, water management and carbon sinks (forests and marine fisheries). Given the vastness of its scope and geographies, the study was confined to the UNDP's Inclusive Growth project states of Delhi, Haryana, Maharashtra, Karnataka, Telangana, Uttarakhand and Odisha.

The report, prepared by KPMG, is based on secondary sources and stakeholder interactions, as the study was initiated just prior to the COVID-19 pandemic and lockdown, that greatly limited access to primary research, physical consultations and data collections. Even though virtual stakeholder interactions, online consultations and peer review provided information across thematic areas, it is likely that there may be some gaps due to unavailability of gender disaggregated data or restricted information.

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Scoping Study and Policy Imperatives on Green Jobs and Eco-entrepreneurship Opportunities for Women in Select States in India

RENEWABLE ENERGY

Contents

List of Abbreviations

Ah	Ampere hour
AJAY	Atal Jyoti Yojana
C	Centigrade
CAGR	Compound Annual Growth Rate
CFL	Compact Fluorescent Lamp
CP	Clean Production
EE	Energy Efficient
EEREM	Energy Efficiency & Renewable Energy Management Centre
EESL	Energy Efficiency Services Limited
FDI	Foreign Direct Investment
GW	Gigawatt
HAREDA	Haryana Renewable Energy Development Agency
IIT	Indian Institute of Technology
ILO	International Labour Organization
IREDA	Indian Renewable Energy Development Agency Ltd.
IRENA	International Renewable Energy Agency
KREDL	Karnataka Renewable Energy Development Ltd.
KW	kilowatt
LED	light emitting diode
MEDA:	Maharashtra Energy Development Agency
MNRE	Ministry of New and Renewable Energy
MSDE	Ministry of Skill Development and Entrepreneurship
MUDRA	Micro Units Development and Refinance Agency Ltd.
MSME	Micro, Small and Medium Enterprise
MW	megawatt
NCEF	National Clean Energy Fund
NCO	National Classification of Occupation
NISE	National Institute of Solar Energy
NIWE	National Institute of Wind Energy
NNBOMP	New National Biogas Organic Manure Programme
NOS	National Occupational Standard
NSQF	National Skill Qualification Framework
O&M	Operation and Maintenance
OREDA	Odisha Renewable Energy Development Agency
PM-KUSUM	Pradhan Mantri Kisan Urja Suraksha evem Utthan Mahabhiyan
PV	Photovoltaic
QP	Qualification Pack
R&D	Research and Development
RE	Rnewable energy
RPL	Recognition of Prior Learning
SC	Scheduled Caste
SCGJ	Skill Council for Green Jobs
SETNET	Solar Energy Training Network
SHP	Small Hydro Power
SIDBI	Small Industries Development Bank of India
SNA	State Nodal Agency
ST	Scheduled Tribe
STEM	Science, Technology, Engineering and Mathematics
SWOT	Strength, Weakness, Opportunity and Threat
TSREDCO	Telangana State Renewable Energy Development Corporation Ltd.
UREDA	Uttarakhand Renewable Energy Development Agency

Foreword

Climate change is perhaps the biggest challenge of our times and it is forcing all of us to define the kind of economy that works for everyone. The effects of climate change will undoubtedly alter the structure of employment; new jobs and new job families will emerge, others will evolve or become unsustainable. Economies must find ways to reorganize work and production differently.

According to ILO, at least half of the global workforce, around 1.5 billion people will be affected by the transition to a greener economy. The challenge lying ahead of us is the urgent need to equip the people with the right skills that will help them adapt to this transition. Skills gaps have already started emerging across a number of sectors, such as renewable energy, energy and resource efficiency, renovation of buildings, construction, environmental services and manufacturing.

Moreover, the exclusion of women and their needs in decision-making process for mitigation or adaptation measures can pose challenge to achieving gender equality at work. This will have a deep impact on the larger economies. Given that women make up a little over half of the world's population (WEF 2013), their untapped talent could significantly alter our economic development (UNDP 2013).

Nearly 60 percent of India's population is directly dependent on climate-sensitive sectors such as agriculture, fisheries and forestry for its livelihoods, and 80 percent of economically active women are in the agriculture sector. Hence the climate crisis severely affects the women who are dependent on these climate-sensitive livelihoods and who do not have any alternative livelihoods.

Keeping in mind these multiple challenges and based on our learnings from Disha Project that UNDP implemented in partnership with IKEA Foundation, to create employment and entrepreneurship opportunities for women, a study was commissioned to assess the green jobs and eco-entrepreneurship opportunities for women in India. The study focused on five major sectors identified by the Skill Council for Green Jobs: renewable energy, green transport, green construction, forestry, fisheries and water management. It covered Delhi NCR (National Capital Region), Haryana, Maharashtra, Karnataka and Telangana as well the potential states such as Uttarakhand and Odisha.

Although we faced the challenge of lack of gender-disaggregated data, and the study being conducted during the COVID- 19 pandemic, the sector-specific reports present some promising prospects for a greener skilling and livelihoods ecosystem. The Government of India and some of the state governments are already moving in the right direction. For instance, the International Solar Alliance in the Renewable Energy space has already gained momentum and the cost of the solar panels in India has reduced in the recent years.

While substantial work has been done to build capacities of people and communities on water management, forest or fisheries, to promote climate-resilient practices, women are often left out and mostly under-represented in such initiatives. As we recover from the pandemic, we must ensure that women are given equal opportunities to be part of our green recovery. Only when we tap into their talents and the huge demographic dividend that is often left out, can we achieve our Sustainable Development Goals at the end of this decade.

UNDP has been working closely with the Government of India and other key partners for an inclusive and climate-sensitive response to COVID-19 that paves the path to greener pathways for recovery. India, as an emerging economy, holds immense potential, given its demographic dividend. But it can never recover fully, or reach its full potential, if half of the population – the women- are not part of its green recovery.

Shoko Noda
Resident Representative

Acknowledgement from Lead Facilitator

UNDP India has undertaken a study on the "Scoping Study and Policy Imperatives on Green Jobs and Eco-Entrepreneurship Opportunities for Women in Select States in India". The report takes into cognizance the climate crises and its implications on lives and livelihoods of the people, and provide some pathways in terms of nature-based livelihoods, that can often be turned into opportunities for more decent work. Be it renewable energy, green transport, green construction water management, forest or fisheries, strides are being made by the Governments at national and state levels to build the capacity of the people and promote climate-resilient practices. And it is but appropriate to bring in the women to partake in the development and be part of the dynamic workforce in the country. And this forms the basis of the study.

This report has been made possible with contributions from many individuals and experts, who took out time and helped put this study together. This report was initiated just prior to the onset of pandemic and was drafted virtually through the lockdown period. A number of virtual consultations with thematic and regional experts were held between April and November 2020, and inputs received on each of the chapters drafted.

In this endeavour, we owe our deepest gratitude to Dr. Sunita Sanghi (Additional Secretary and Senior Advisor, Ministry of Skill Development and Entrepreneurship, Government of India), Dr. Praveen Dhamija (Advisor, Sector Skill Council on Green Jobs), Vandana Bhatnagar (Chief Programme Officer, NSDC), Sudipta Bhadra (Senior Programme Officer, ILO), and Anubha Prasad (National Coordinator, PAGE) for their guidance while discussing our findings, assessing the quality of analysis, the reliability of data, and the soundness of the recommendations emerging from the study.

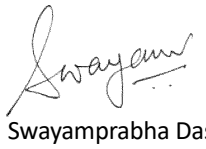
The support provided by our collaborators in the formulation of background papers needs a special mention. We express our utmost appreciation for the hard work put in by the KPMG team lead by Manpreet Singh and Vivek Panda.

We would like to thank and acknowledge the inputs received during the peer review of the draft chapters by Dr. Srinivas Shroff Nagesha Rao (CEO, REC Foundation), Hitesh Vaidya (Director, NIUA), Suneel Padale (Director Programs, CARE India), Vishaish Uppal (Livelihoods Specialist, WWF India), Moho Chaturvedi (Independent Consultant) and Ramya Rajagopalan (Independent Researcher).

Our gratitude to UNDP colleagues for their insightful comments during the peer review process. Our heartfelt appreciation for the overall insight and guidance by Harsh Singh, Amit Kumar, Alka Narang, and the contributions by UNDP India team, especially Sushil Choudhury, Saba Kalam, Dilip Singh, Abha Mishra, Rashmi Bajaj, Manisha Choudhury and colleagues from the Inclusive Growth team.

We are eternally grateful to Ms. Shoko Noda, Resident Representative, UNDP India and Ms. Nadia Rasheed, Deputy Resident Representative, UNDP India for their inspiration, encouragement and guidance throughout the process. None of would have materialised without the faith that they reposed in our endeavours.

We thank all the members for their support and contribution.



Swayamprabha Das
Inclusive Growth

Executive Summary

India, one of the fastest growing emerging economies in the world, has doubled its energy demand since 2000. While the demand growth has largely been served to date by the consumption of fossil fuels, the Government of India has shown a clear commitment towards clean energy transition for the future with a renewable energy (RE) target of 175 gigawatts installed capacity by 2022. India can benefit in a number of ways from this sustainable development in renewables, including access to affordable clean energy, gender equality, 'decent work' and economic growth, and climate change mitigation – the four Sustainable Development Goals of the United Nations (goals 7, 5, 8 and 13, respectively).

Globally, there are an estimated 7.7 million jobs associated with the RE industries, with solar photovoltaics (PV) being the largest renewable employer. Significant development outcomes can be gained from a gender-mainstreamed approach to planning and implementing energy related projects. The benefits can be considered in two main categories: those for women as consumers or users of such energy solutions; and those for women as part of the production of such energy solutions.

According to the Renewable Energy and Jobs - Annual Review 2019 report from the International Renewable Energy Agency (IRENA), the global RE sector employed 11 million people directly and indirectly in 2018 as compared with 10.3 million in 2017. Currently, women represent 32 percent of workers across all renewables workforce (28 percent science, technology, engineering and mathematics (STEM) jobs, 35 percent non-STEM technical jobs and 45 percent administrative jobs) compared with 22 percent in traditional energy industries such as oil and gas, IRENA's report shows. However, according to IRENA's new report – Wind Energy: Gender Perspective 2020 – the average share of women in wind energy stands at 21 percent globally. The solar PV, bioenergy, hydro and wind power industries were the biggest employers. In India, the total estimated direct and indirect number of jobs in the RE sector in 2018-19 was 719,000 (hydropower: 48 percent; solar PV (grid connected): 16 percent; wind energy: 8 percent; liquid biofuels: 5 percent; solar heating/cooling: 3 percent; solid biomass: 8 percent; and biogas: 12 percent).

The scope of this study is limited to wind energy, solar off-grid system (lanterns, home lighting systems, pumps, street lights and standalone commercial and industrial systems), small hydro plants (up to 25 megawatt under the Ministry of New and Renewable Energy (MNRE), Government of India), and biogas plants (family type biogas plants under MNRE's New National Biogas and Organic Manure Programme). The sectoral analysis for this study included policy interventions, growth and job projections, participation of women in this sector, value chain mapping with potential job roles, skill gaps, case studies and eco-entrepreneurship models, discussed in this report.

Projection of the total number of jobs is directly related to sectoral growth, which is based on government policies and interventions and future optimistic set targets for them. Based on the policies and schemes available for the RE sector in India, the total number of jobs has been estimated. Similarly, based on stakeholder interactions and secondary research, participation of women in the RE sector has also been gauged.

	Wind Energy (in no. cumulative)	Solar Off-grid (in no.)	Small Hydro Plant (in no.)	Biogas Plants (in no.)
Jobs in 2019	47,632	85,501	1,836	3,067
Share of Women	10,003	19,665	588	705

As estimated, skill gaps in employment growth totalling 163,244 will exist from 2019 to 2021-22. Hence bridging the skill gaps is an important task which can only be addressed by implementing upskilling and re-skilling training programmes along with academic learning through advanced technology or innovative and interactive interventions.

It is quite evident that women play a significant role in the energy value chain at all levels. Their enhanced inclusion will lead to more effective implementation of initiatives related to clean energy, a greater livelihood creation and expanded emission reduction opportunities.

Women in the RE sector continue to face the challenge of finding permanent employment along with a secure career. In addition to creating opportunities for women in technology installation, repair, dissemination, awareness generation and marketing, there is a growing need within the energy sector to involve women in the formal engineering aspects of technology design and innovation. The dominance of male engineers and technical designers often results in a larger number of technologies failing to address important issues for women users. Based on our stakeholder consultations and secondary research for the selected states/union territories, i.e., Delhi NCR, Haryana, Karnataka, Maharashtra, Odisha, Telangana and Uttarakhand, it has been noted that cultural and social norms are the prime barrier for women to work in the RE sector; around 90 percent of respondents cited these reasons.

Skill development and training play a crucial role in enhancing women's participation in the RE sector. At present, the Skill Council for Green Jobs is one of the nodal agencies for development of National Occupational Standards (NOS) and Qualification Packs (QPs) under the skill development mission for the green business ecosystem in India. However, there is an opportunity available to develop more QPs and NOS with the National Skill Qualification Framework (NSQF) level 1 to 4 which will touch upon the life of people mainly from marginalized communities including women, e.g., solar pump assembler (NSQF-4), quality analyst (NSQF-4), pump raw material procurement specialist/executive (NSQF-4), biogas plant fabricator and installer (NSQF-4) and biogas plant marketing and sales executive (NSQF-4).

In India, various women centric, eco-entrepreneurship models in the RE sector are available which have been highlighted in this report: a. Distribution through proprietary agent networks: selling solar off grid products through diffused networks of generalist or specialist solar distributors; b. Institutional partnerships: enterprises partner with rural banks, microfinance institutions, community saving groups or non-governmental organizations to market their products to partner organizations' customer base or membership network; c. Energy-as-service model solutions: focus on offering an energy service rather than a product, meaning households pay for electricity as they consume it. Under pay-as-you-go models, end users provide periodic repayments counting towards the eventual ownership of the product.

With the outbreak of COVID-19, the RE sector in India is facing immense challenges due to the nation-wide lockdown announced on 25 March 2020 and the resulting break-down of all supply chains. However, to overcome the COVID-19 situation and revive the sector, India plans to attract more foreign investment in the RE sector. The Ministry for New and Renewable Energy that at "a time when many companies are planning to shift their manufacturing base from China, it is [the] opportune time for India to bring policy changes for facilitating and catalysing manufacturing in India.[1] Further, to reduce the impact of COVID-19 on the sector, the Government of India has undertaken various measures such as grant of extension of time to stakeholders of RE projects by MNRE; permission for RE projects to invoke the Force Majeure clause if a project is hampered or delayed due to supply chain disruption; and reduction of repayment charges to enhance funds availability for new projects by the Power Finance Corporation Ltd., Rural Electrification Corporation and Indian Renewable Energy Development Agency.

[1]India seeks to woo renewable energy firms shifting from China, plans manufacturing hubs at ports | Hindustan Times

1

Overview

1.1 SETTING THE CONTEXT

Rapid growth in population and the consequent increase in demand for natural resources such as fossil fuel creates an overwhelming burden on the environment, with detrimental impacts on climate. Industrialization and globalization have caused our carbon emissions to rise continuously. This rise in emissions has been somewhat mitigated in the last two years due to a decline in coal usage but the world is still far from being on track to meet the goals of the Paris agreement on climate change, i.e., limit the rise in average global temperature below the 1.5°centigrade mark. According to the latest report of the United Nation, we need to cut our global emissions by 7.6 percent every year for the next decade to meet the 1 Paris target. Hence, we need to explore new alternatives to reduce our emissions. In this combat, renewable energy (RE) plays a vital role which would not only tackle the emission-related issues but also have a positive impact on employment generation and thus boost the economy for any nation. A nation can benefit in several ways from RE, including through access to affordable clean energy, gender equality, decent work and economic growth and climate change mitigation, which are four of the Sustainable Development Goals of the United Nations (goals 7, 5, 8 and 13, respectively).

The RE sector has a potential to create large employment including conventional and non-conventional green jobs. This job potential would not only cater to men but also promote women's participation. The study conducted by the International Renewable Energy Agency (IRENA) in 2018-19 highlights that women's participation in the RE sector is around 32 percent of the global RE workforce. However, there is significant disparity in the sector regarding gender neutrality, both in highly developed markets and in communities where renewables are only now extending energy access.

This report presents a sectoral analysis of RE in India and outlines policies in place pertinent to green jobs and eco-entrepreneurship opportunities for women in selected states.

BACKGROUND

This scoping study on Green Jobs and Eco-entrepreneurship opportunities for women in select states, draws its strength and learning from the UNDP-IKEA Foundation project 'Creating Employment and Entrepreneurship Opportunities for Women in India (Disha)'. This project focused on enhancing opportunities for marginalized women in jobs and entrepreneurship and enabled development of models and curriculum like the Biz Sakhi and Women Sourcing Managers. Though some of the pilots under Disha did include components of green initiatives, but a full-fledged pilot/programme could not be developed majorly because of lack of disaggregated data/ information. But as the conversations around jobs/ entrepreneurship - climate change nexus gathered momentum, a need was felt to design a study to fill this gap and develop sector specific pathways with a focus on marginalised women.

While the discourse on Green Economy/Green Growth is huge and covers a range of sectors, the study focuses on addressing the following two-fold objectives:

- Gap assessment of existing and potential green jobs and mapping the availability of skilled workforce for the identified job roles in the RE sector; and
- Development of an implementation roadmap and provision of recommendations to enable women to leverage the existing and potential opportunities.

Given the limitation and the acceptance that many areas in the Green Jobs sector is still evolving and maybe in nascent stage, the geographic scope of the study was limited to the states of Delhi NCR, Haryana, Maharashtra, Karnataka, Telangana, Uttarakhand and Odisha.

APPROACH AND METHODOLOGY

In terms of phases, the scope of engagement includes the following: finalization of methodology and assessment framework, secondary research and assessment, primary stakeholder consultation, analysis and report writing. In each phase, various tasks as suggested in the scope will be performed to ensure completion.

Figure 1: Scope of engagement

Scope of the Study

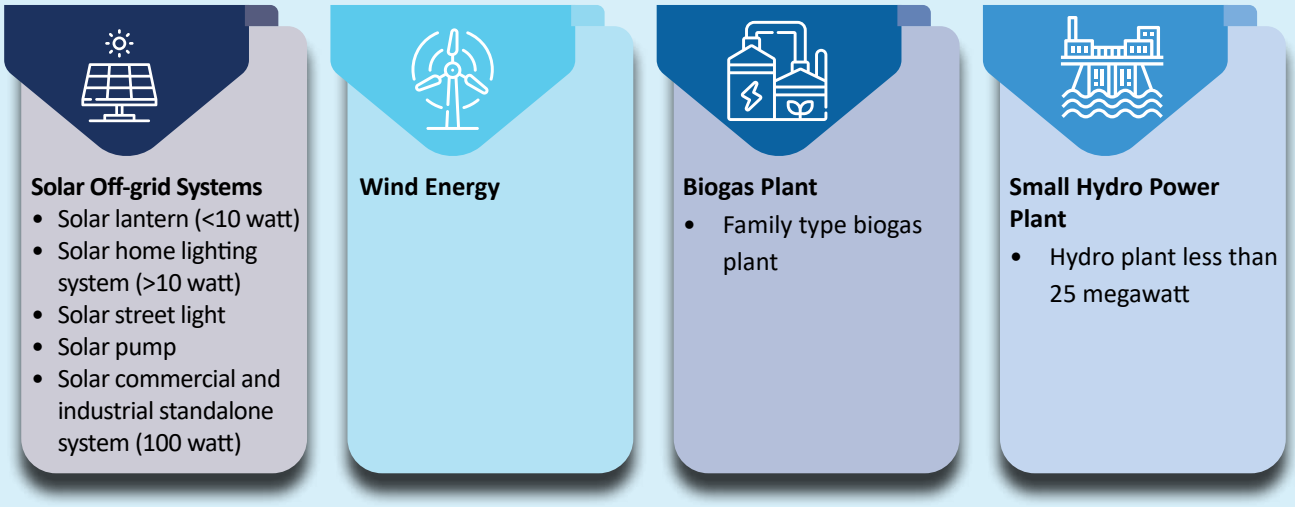
For this study, the RE sector's scope is limited to: solar off-grid, wind energy, biogas plants and small hydro power plants.

- Solar off-grid systems can be used to provide smaller communities with electricity, or those who prefer to be self-sufficient and not rely on public utilities for their power. Solar off-grid systems which have been considered under this study are solar lanterns, solar home lighting systems, solar pumps, solar street lights and standalone commercial and industrial systems;
- Wind energy is the most mature and developed RE. It generates electricity through wind, by using the kinetic energy produced by the effect of air currents;
- Biogas plants rely on anaerobic digestion, a fermentation process in which waste is digested by microbes to produce methane gas which can

be used for cooking and lighting purpose. In this study, only family type biogas plants under the New National Biogas and Organic Manure Programme (NNBOMP) been considered; and

- Small hydro plants generate electricity from running water which can be used by the local community or sent to the grid. Hydro projects up to 25 megawatt (MW) capacity are categorized as small hydro power (SHP) projects in India.

Figure 2: Scope of the study

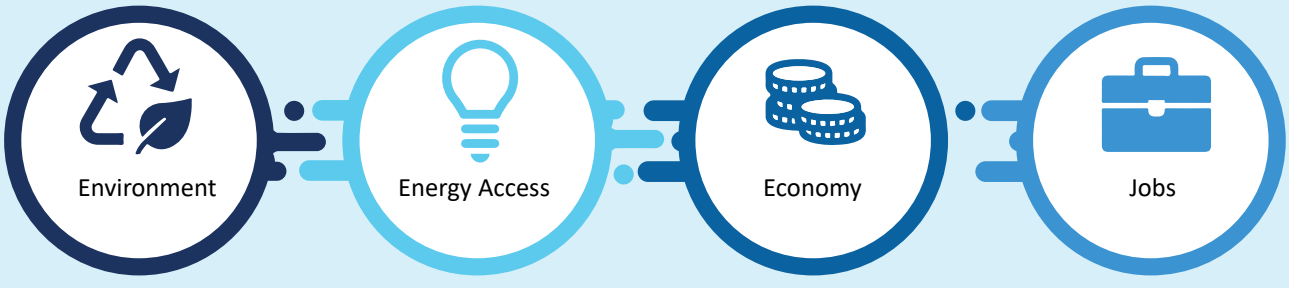


1.2 INTRODUCTION

RE plays a vital role in meeting the country's energy demand without degrading the environment. In India, the scope of RE is enormous as the current energy mix for RE is around 23.39 percent in the total installed generation capacity, i.e., 368.98 gigawatt (GW) up to February 2020 (as per the Ministry of New and Renewable Energy (MNRE). The sector also has a huge potential for generating employment/livelihoods, especially for women and the rural population. In India, more than 0.7 million people are employed in this sector (Renewable Energy & Jobs, Annual Review 2019, IRENA) including (hydropower: 48 percent; solar photovoltaic (PV, grid connected): 16 percent; wind: 8 percent; liquid biofuels: 5 percent; solar heating/ cooling: 3 percent; solid biomass: 8 percent; and biogas: 12 percent).

In India, a large percentage of the population is very young and thus employability could be an issue; the estimated youth unemployment rate in India in 2019 was at 10.51 percent (according to International Labour Organization (ILO) data). For the past decade, India's

Figure 3: Positive impact of renewable energy



youth unemployment rate has been hovering around the 10 percent mark, while the average unemployment rate in was around 7.34 percent from 2018 until 2020. Hence RE can contribute significantly to lower the unemployment rate in India.

Of 640,932 villages in India, i.e. 597,608 inhabited and 43,324, but also by utilizing the locally generated power to boost rural economies. Application of off-grid/ decentralized energy systems is causing an impact and boosting the local economy, aiding economic and social growth. The emergence of adaptable productive-use technologies such as solar lantern, solar home lighting systems, solar pumps and other applications have created new jobs, entrepreneurial opportunities and avenues for skills development in rural areas.

DEFINING GREEN JOBS

ILO defines green jobs as those that, "are decent jobs that contribute to preserve or restore the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency."

According to ILO, decent work involves "opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men."

The United Nations Environment Programme defines green jobs as "work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution."

For the purpose of this study:
'Green' implies:

- Limiting or preventing negative environmental impacts, such as pollution, of ecosystem components such as air, water and soil;
- Being climate friendly via minimization of resource wastage;
- Maximizing resource efficiency; and
- Focusing on resource conservation.

'Green jobs' include social considerations such as improvement of working conditions, promotion of health and well-being, better livelihood generation, community development, etc. Green jobs can be existing or may require, reskilling, upskilling or developing new skills.

DEFINING THE SECTOR

As per ILO, RE is a major contributor to the transition to a low carbon economy. It also addresses wider issues of sustainability, such as reducing pollution, improving energy security and enabling access to energy.

Components of Renewable Energy

- Large, inexhaustible source of energy;
- Clean source of energy
- Use of materials that are non-toxic, and sustainably produced/available
- Enhancing quality of environment; and
- Various sources of energy: solar energy, wind energy, micro hydro systems, bio-energy. geothermal energy, nuclear energy.

1.3. IMPLICATIONS OF THE COVID 19 PANDEMIC ON THE SECTOR

Currently the world is dealing with the COVID-19 pandemic which is impacting all commercial and economic activity including the RE sector. The RE sector in India faced the brunt of COVID-19 because of the nation-wide lock down announced on 25 March 2020. The complete RE supply chain was adversely affected due

to restrictions on movement under India's corona virus lockdown; it is now slowly recovering after the lockdown has been eased in most areas of the country.

According to the Confederation of Indian Industry, the RE sector will likely experience a steep hike in RE system and component prices due to insufficient production and constraints on the supply chain and logistics from China. As estimated, around 3 GW of RE installations will be impacted negatively by COVID-19.

As the Government of India invoked the Epidemic Disease Act 1897 followed by a complete lockdown in India, employment across the sector hit rock bottom, especially the unskilled and semi-skilled workers. Workers involved in construction and installation of RE systems lost their jobs temporarily for couple of months. However, the rate of new job creations in this sector as well as various skill development initiatives will be severely affected by the pandemic.

India's RE sector aims to increase its RE capacity to more than 175 GW by 2022, including 100 GW from solar energy, 60 GW from wind, 10 GW from bioenergy and 5 GW from SHP. India is progressing at a moderate growth rate due to policy confusion and land acquisition issues. With the coronavirus now posing a new threat to India's plans, it is expected that disruptions due to COVID-19 would leave an impact for the next two to three quarters.

However, to recover from the COVID-19 situation, India is trying to attract more foreign investment in the RE sector. Most RE companies are trying to shift their manufacturing base from China to India for ease of business. MNRE, in its statements, has emphasized that, "It is an opportune time for India to bring policy changes to facilitate and catalyze manufacturing in India,"[2] Hence, MNRE has instructed the state governments and port authorities to identify land parcels of 50-500 acres to set up RE manufacturing parks. Odisha has already expressed an interest in this initiative.

To reduce the impact of COVID-19 on the RE sector, the Government of India has initiated various reforms:

i. MNRE has granted extension of time for initiation and completion of the RE projects, to stakeholders for RE projects equivalent to the period of lockdown and an additional 30 days for normalization after end of such a lockdown;

ii. Allowed RE projects to invoke the force majeure clause if a project is hampered or delayed due to supply chain disruption; and

iii. Power Finance Corporation Ltd, Rural Electrification Corporation and IREDA have reduced their repayment charges to 2 percent to enhance funds availability for new projects. Moreover, IREDA has brought out a scheme for project-specific funding to promote RE manufacturing in India.

2 https://pib.gov.in/PressReleasePage.aspx?PRID=1615611

2.

Sectoral Analysis

SECTOR-SPECIFIC VALUE CHAIN AND POTENTIAL JOB ROLES

The value chain and job roles related to the RE sector including solar off-grid, wind energy, biogas (family type) plants and SHP were outlined in discussions with industrial stakeholders and technical experts dealing with or related to RE system integration, manufacturing, distribution and maintenance. Secondary research has also been carried out to identify activities and job roles available in this sector. The job roles listed (Tables 2 to 5) are a result of comprehensive discussions and reflect the type of occupations that will be required to realize the full potential of the RE sector. Figures10 to 13 and Tables 2 to 5 reflect the key occupational activities and job roles available in this sector.

1.5 MW Sangrah SHP in Kargil District under Ladakh Renewable Energy Initiative, *MNRE Annual Report*

Figure 10: Wind energy value chain

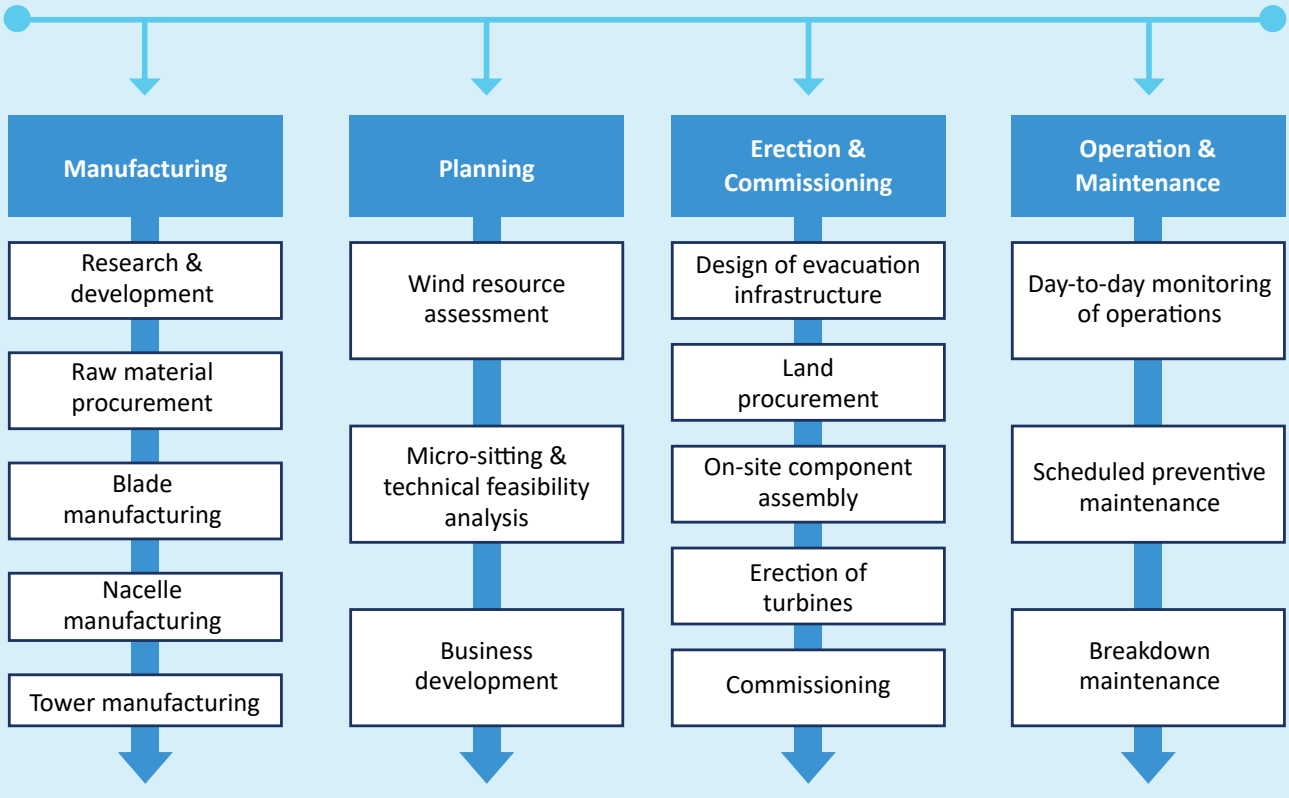


Table 2: Wind energy potential job roles

Manufacturing	Planning, Erection & Commissioning	Operation & Maintenance
• Maintenance Technician – WTG Blade, • Production Operator – WTG Blade Manufacturing • Wind Nacelle/Blade/Tower Manufacturing – Painter • Wind Nacelle/Blade/Tower Manufacturing – Packer • Maintenance Technician – WTG Nacelle • Wind Nacelle/Blade/Tower Manufacturing – Technician – Electrical Maintenance • Maintenance Technician – WTG Tower Manufacturing • Wind Nacelle/Blade/Tower Manufacturing – Mechanical Maintenance • Wind Nacelle/Blade/Tower Manufacturing – Production Supervisor • Wind Nacelle/Blade/Tower Manufacturing – Mechanical Engineer • Wind Nacelle/Blade/Tower Manufacturing – Electrical Engineer • Wind Manufacturing Quality Assurance Engineer • Production Operator- WTG Nacelle/Tower Manufacturing • Wind Nacelle/Blade/Tower Manufacturing – Maintenance In – Charge • Wind Manufacturing Quality Manager • Wind Nacelle/Blade/Tower Manufacturing – Production Manager • Wind Nacelle/Blade/Tower Manufacturing – Fiber Technologist • Wind Nacelle/Blade/Tower Manufacturing – Resin Technologist • Wind Nacelle/Blade/Tower Manufacturing – Ceramic Technologist • Wind Nacelle/Blade/Tower Manufacturing R&D Manager	• Construction Technician (Electrical) – WPP • Construction Technician (Civil) – WPP • CMS Engineer – WPP • Construction Technician (Mech.) – WPP • Crane Operator • Procurement Executive- Wind, • Site Surveyor- WPP • Assistant Planning Engineer – WPP • Construction Engineer (Electrical) – WPP • Construction Engineer (Civil) – WPP • Construction Engineer (Mech) – WPP • Assistant Site Surveyor – WPP • Wind Resource Assessment Manager • Wind Land Acquisition Officer • Procurement Manager – Wind • Planning Engineer (Civil/ Structural)- WPP • Planning Engineer (Electrical) – Wind Power Plant • Site Manager/ Subcontractor/ Entrepreneur – Wind Power Plant • HSE Engineer • Project Head – Wind Power Plant • Project Design Manager – WPP • Project Manager – WPP • System Planning Engineer – WPP • HSE Manager	• O&M Electrical and Instrumentation Technician – WPP • O&M Mechanical Technician – WPP • O&M Engineer (Mechanical) – WPP • O&M Engineer (Electrical) – WPP • O&M Manager – WPP

Figure 11: Solar off-grid value chain

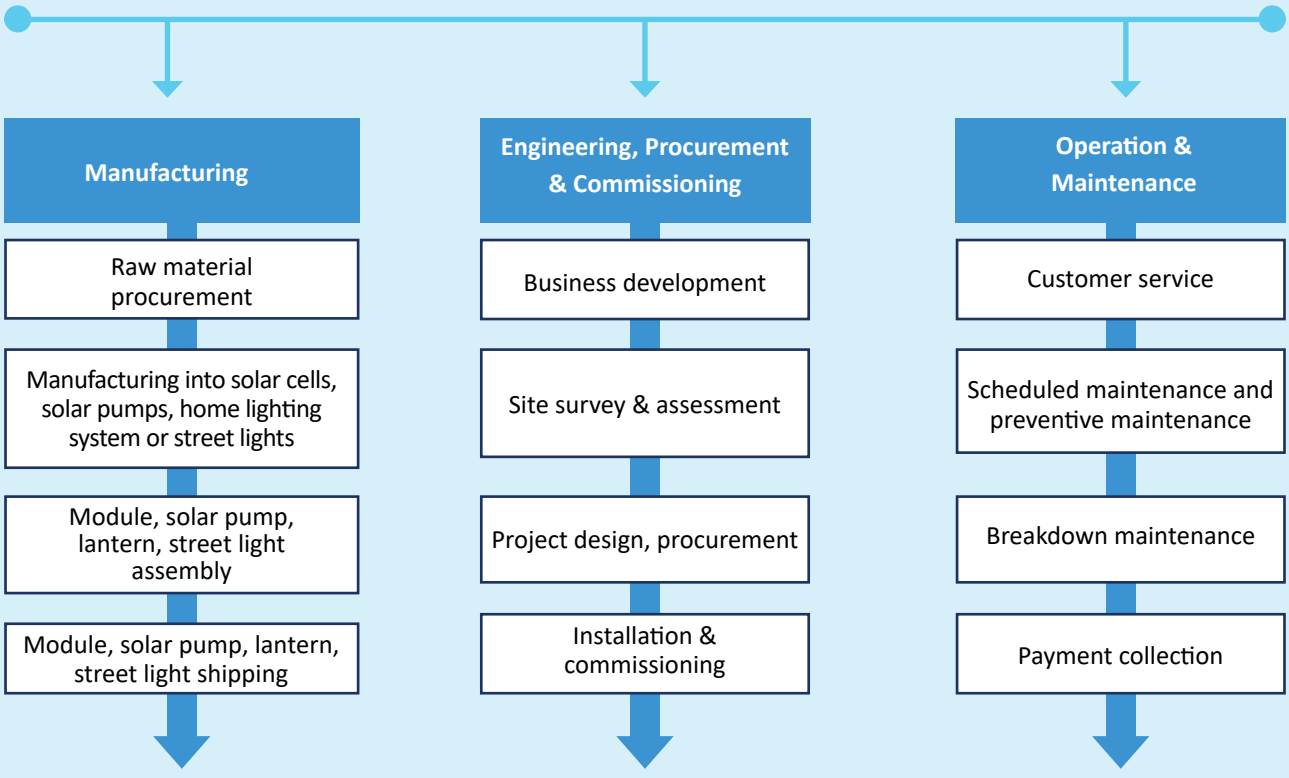


Table 3: Solar off-grid potential job roles

Manufacturing	Engineering, Procurement & Commissioning	Operation & Maintenance
• Solar Streetlight Pole Fabricator, • Head Solar PV – Pump • Head Solar Street Lighting • Head Solar Lantern and Solar Home Lighting • Solar Off-grid Production Manager (Solar Lantern & Solar Home Lighting) • Solar Off-grid Production Supervisor (Solar Lantern & Solar Home Lighting)	• Solar Off-grid Entrepreneur • Solar Off-grid Installation & Repair technician (Streetlight) • Solar Off-grid Installation & Repair Technician (Solar Lantern and Solar Home Lighting) • Solar Street Light Installer • Solar PV Pump Installation & Maintenance Manager/Solar Pump Entrepreneur • Site Supervisor • Civil-Sub Contractor • Solar Off-grid Street Lighting Installation & Maintenance Engineer • Mechanical/Civil Supervisor • Mason	• Solar PV Engineer (Option: Solar Water Pumping Engineer) • Solar PV Project Helper • Solar Pump Technician • Customer Care Executive • Solar Off-grid Machine/ CNC Operator • Solar Off-grid Manufacturing Technician (Solar Lantern and Solar Home Lighting) • Solar Off-grid Sales Manager • Solar Off-grid Sales Executive

Figure 12: Biogas plant value chain

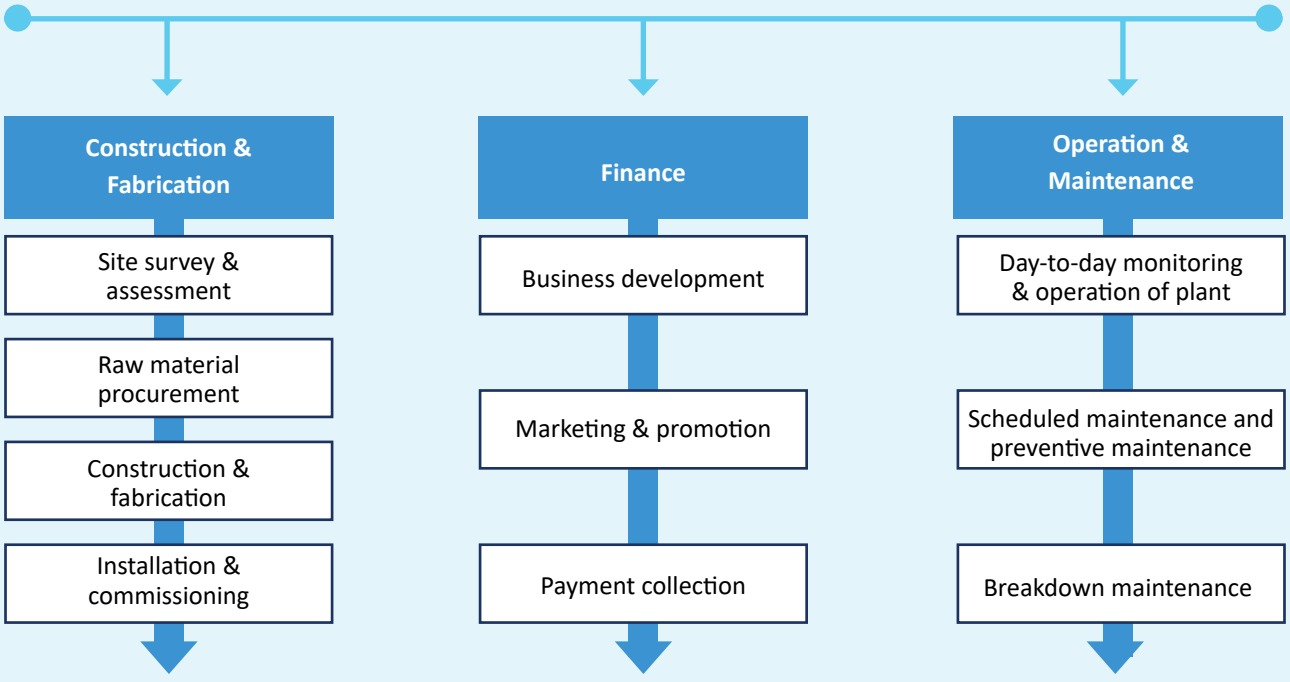


Table 4: Biogas plant potential job roles

Construction & Fabrication	Operation & Maintenance	Finance
• Construction Manager • Biogas Plant Fabricator / Mason • Biogas Plant Store In-charge	• Maintenance Manager • Lab Technician • Animal Waste Manure Aggregator (option: Biogas Plant Operator/ Compost Plant Operator) • Agri-residue Aggregator	• Marketing & Sales Executives • Office Manager • Office Assistant • Payment Collector

Figure 13: SHP value chain

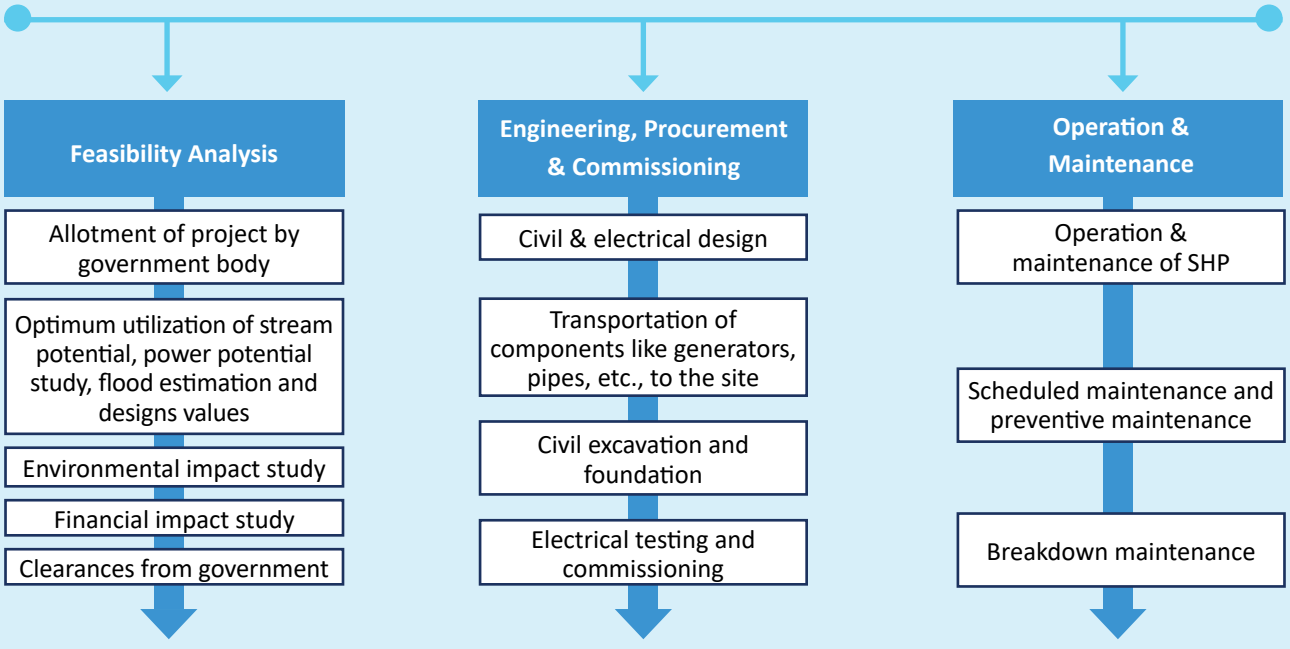


Table 5: SHP potential job roles

Feasibility Analysis	Engineering, Procurement & Commissioning	Operation & Maintenance
• SHP Site Surveyor • SHP Assistant Site Surveyor • Hydrology & Geology Expert • Small Hydro Liaison Officer/ PRO/ Patwari • SHP Designing Head	• Small Hydro Procurement Executive • Small Hydro Project Electrical Foreman – Transmission • Small Hydro Project Weir Site Foreman • SHP Water Conductor Foreman • SHP Electrical Supervisor – Transmission • SHP Project Electrical Supervisor – Substation • SHP Electrical Foreman • SHP Mechanical Technician • SHP OEM Foreman • Small Hydro Crane Operator • SHP Design Engineer (Electrical and Commercial & Industrial) • SHP Design Engineer (Civil/ Structural) • CAD/Draughtsman • Small Hydro Procurement Manager • SHP Manager/Subcontractor/ Entrepreneur • SHP Electrical and Commercial & Industrial Engineer • SHP Commercial & Industrial Technician • SHP Mechanical Engineer • SHP Engineer (Civil) • SHP OEM Supervisor • SHP Weir Site Supervisor • Small Hydro Blasts Man • SHP HSE Manager • SHP HSE Engineer	• SHP Helper – EPC and O&M • Small Hydro O&M Mechanical Technician • Turbine Generator Operator • Fitter • Small Hydro O&M Instrumentation Technician • Security Guard • Small Hydro O&M Engineer Mechanical / Small Hydro Control System Engineer • Small Hydro O&M Civil Technician • Small Hydro O&M Electrical Engineer • Small Hydro O&M Civil Engineer • Small Hydro O&M Site In charge

SECTORAL ANALYSIS AND WOMEN'S PARTICIPATION

Wind Energy

According to MNRE's Annual Report 2017-18 and physical progress report (as on 31 December 2019), year-wise wind power installed in India totals 32,848.46 MW, 35,625.97 MW and 37,505.18 MW, respectively. To meet the national target of 60,000 MW by 2022, India needs to install 22,494.82 MW. Assuming that the remaining target of 22,494.82 MW will be evenly achieved, i.e., 11,247.41 MW per year in 2020 and 2021 (though the targets have not been declared by MNRE), two job growth scenarios have been outlined (Figures 14 A and B).

Scenario 1: According to IRENA's 2020 report, women's participation in wind energy was around 21 percent in 2019. Based on this estimation, the annual jobs growth rate increased with a CAGR of 16.25 percent from 2017-2021. This scenario considers the same CAGR for calculating women's share in the total job roles in a participation year.

Scenario 2: This scenario considers an annual job growth rate increase with a CAGR of 6.8 percent from 2017 to 2019 and a CAGR of 26.4 percent from 2019 to 2021 (to meet the target of 60,000 MW) to estimate women's share in the total jobs with both CAGRs in the respective years.

For estimating the number of jobs in the wind energy sector, a job factor of 1.27 has been considered.[3]

Solar Off-grid

As per Solar Foundation's report the total participation of women in the solar sector was 18.7 percent in 2013, and 28 percent in 2016.[4] As per Powering Jobs Census 2019, the share of women in decentralized RE is about 23 percent. Considering these factors, i.e., participation of women in 2013, 2016 and 2019 was 18.7 percent, 28 percent and 23 percent, respectively, we assume that women's share in the solar sector increased at an annual growth rate of 3.1 percent per year from 2013 to 2016 and decreased at the annual rate of 1.67 percent from 2016 to 2019.

Figure 14 A: Wind energy scenario 1

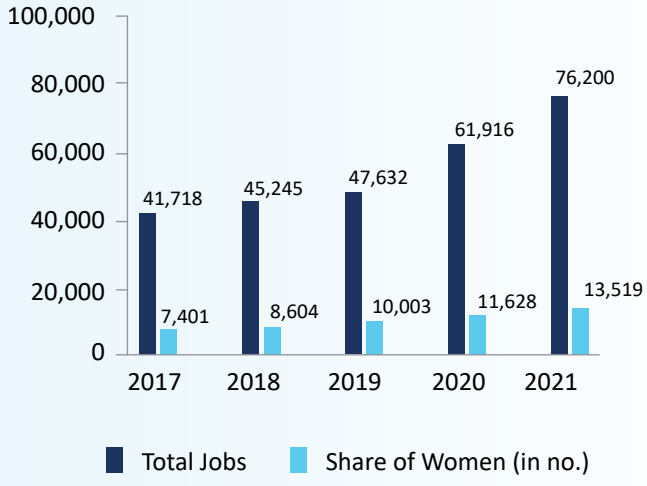


Figure 14 B: Wind energy scenario 2

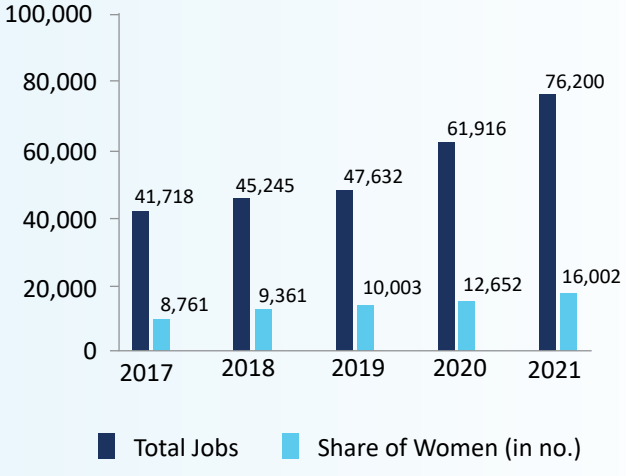


Figure 15: Women's participation in solar off-grid

3 https://www.nrdc.org/sites/default/files/greening-india-workforce.pdf
4 https://www.thesolarfoundation.org/wp-content/uploads/2017/09/TSF-DiversityReport2017_FINAL-1.pdf

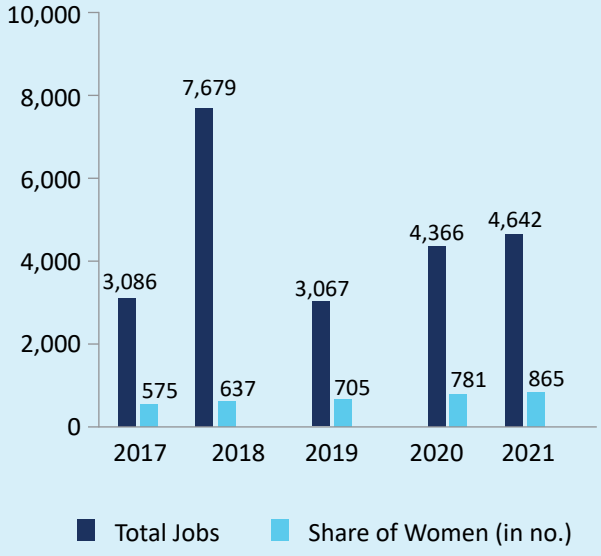
Hence the overall impact on women's share is a 0.7 percent increment, calculated by considering the annual growth factor of 0.7 percent for the years 2020 and 2021.

Biogas Plant

It has been observed that 42.7 percent of biogas plants were installed in 2015 against the allocated target of MNRE. Similarly, 30.87 percent and 50.0 percent of biogas plants were installed in 2017 and 2018, respectively, according to MNRE's Annual Report. The total number of biogas plants installed in 2019 (as on 29 February 2020) was around 20,000 against the target of 76,000. Hence, by taking the average installation rate as 37.47 percent and CAGR as 6.3 percent for the growth of the biogas plant sector,[5] the number of biogas plants to be installed in 2020 and 2021 has been estimated. As per the MNRE HRD report 2010, job factors have also been considered for estimation of the jobs from 2017 to 2021, i.e., 7.5 plants can be installed per person per year and 50 plants can be handled by a person.[6]

The total number of jobs increased with a CAGR of 10.4 percent from 2017-2021 (Figure 16) and, according to the Powering Jobs Census 2019, the share of women in distributed RE is about 23 percent. The share of women in the number of total jobs has been estimated

Figure 16: Job growth in the biogas plant sector



A 3 cubic metre biogas plant in Amlighat village in Assam, *MNRE Annual Report*

5 https://www.transparencymarketresearch.com/biogas-plant-market.html
6 https://mnre.gov.in/img/documents/uploads/d79ed3cc9f8b45ae95db647f91b633a6.pdf

from 2017 to 2021 on the basis of this information.

SHP

According to MNRE's physical progress report, a total of 4,683 MW of SHP has already been installed in India (as on 29 February 2020). In 2017 and 2018, SHP plants with capacities of 84 MW and 175 MW, respectively, were installed. To achieve the goal of 5,000 MW, India needs to install 317 MW in the next two years. By assuming a target the installation of 158.5 MW of SHP capacity per year for the next two year, job projections in the SHP sector from 2017 to 2021 have been made. It has been estimated that jobs would increase with a CAGR of 17.23 percent from 2017 to 2021.

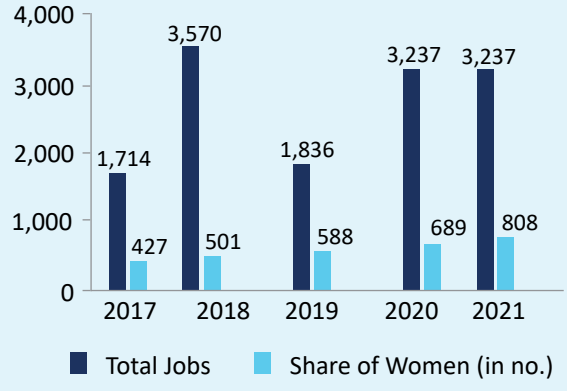
SCGJ has reported that a SHP plant with a capacity of 0-10 MW will generate 52 jobs in engineering, procurement and commissioning and around 50 jobs in operation and maintenance (O&M). Women's share in jobs has been estimated as shown in Figure 17 by assuming that the average of 0-10 MW (5 MW) will generate around 102 jobs and on the basis of information in IRENA's 2019 report that the total share of women in the RE sector is around 32 percent.

EXISTING JOB ROLES FOR WOMEN

There is a patriarchal mindset that believes that women are not technology enthusiasts and incapable of contributing to socio-economic, nation building activities. It is evident that women play a significant role in the energy value chain at all levels which will lead to more effective implementation of initiatives related to clean energy, a greater livelihood creation and expanded emission reduction opportunities. However, while more attention is being paid to the crucial role of women in the energy sector, there is still a lack of recognition of women in the energy domain. Gender disparities exist in the RE sector across the globe. Currently, women represent 32 percent of workers across the entire renewables workforce (28 percent science, technology, engineering and mathematics (STEM) jobs, 35 percent non-STEM technical jobs and 45 percent administrative jobs) compared with 22 percent in traditional energy industries such as oil and gas, analysis conducted by IRENA in 2019 has shown. However, according to IRENA's new report, Wind Energy: Gender Perspective 2020, the average share of women in the wind energy sector stands at 21 percent globally.

In India, women's share in the decentralized RE sector

Figure 17: Share of women's employment in the SHP sector



is around 23 percent which is quite low as compared to their male counterparts. Through discussions with sector experts and other stakeholders and comprehensive secondary research, it is noted that women's job roles in various sub-sectors of renewables are very limited due to social stigma, cultural barriers, lack of awareness and training, and limited financial assistance.

SECTOR-SPECIFIC CHALLENGES FOR WOMEN

Under-representation of women in the RE sector is primarily due to cultural and social norms that act as barriers to their participation and joining the workforce. IRENA's 2019 report lists common barriers which limit women's progress in this sector. Cultural and social stigma often restricts women from going outside the house to work, specially in rural areas. Most of their time is dedicated to their household and childcare responsibilities. Other major social hindrance is the mindset of elders or family members who believe work is supposed to be done by men only; women should themselves to household chores and not bring shame to the family name by going out to work. Women lack awareness and mentorship opportunities which stops them from stepping out and results in low participation of women in the workforce. Inequity in ownership of assets is another barrier against women especially in rural areas. Ownership of assets is strongly associated with the levels of income and confidence of women in rural area. Lack of ownership of assets

makes women more vulnerable and dependent on their partners and destroys their confidence to go out and work. Other reasons which triggered the issue of under-representation of women in this sector are lack of gender sensitive policies and schemes in the RE sector, last-mile connectivity, and safety and security of women, mainly in semi-urban and rural areas.

Most of the above observations were reflected and reiterated in the stakeholder consultations and secondary research for the states for this study. It is noted that cultural and social norms are the prime barrier for women to work in the RE sector in India; around 90 percent of respondents cited these reasons. Around 50 percent of respondents stated that 'lack of gender sensitive policies', 'lack of gender sensitive training opportunities', 'lack of mentorship opportunities' and 'lack of skills' create hindrances for women to work in this sector. Only 30 percent of respondents believes that 'inequity in ownership of assets' was a barrier.

Women in the RE sector continue to face the challenge of finding permanent employment along with a secure women users.

career. In addition to creating opportunities for women in technology installation, repair, dissemination, awareness generation and marketing, there is a growing need within the energy sector to involve women in the formal engineering aspects of technology design and innovation. The dominance of male engineers and technical designers often results in a larger number of technologies failing to address important issues for

Figure 18: Barriers to women's participation in the RE sector

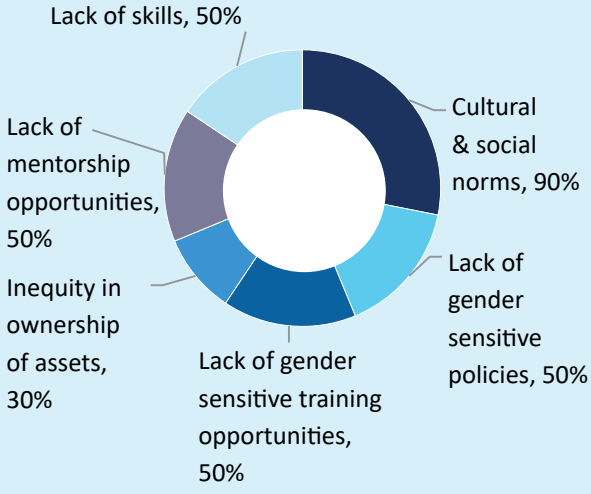
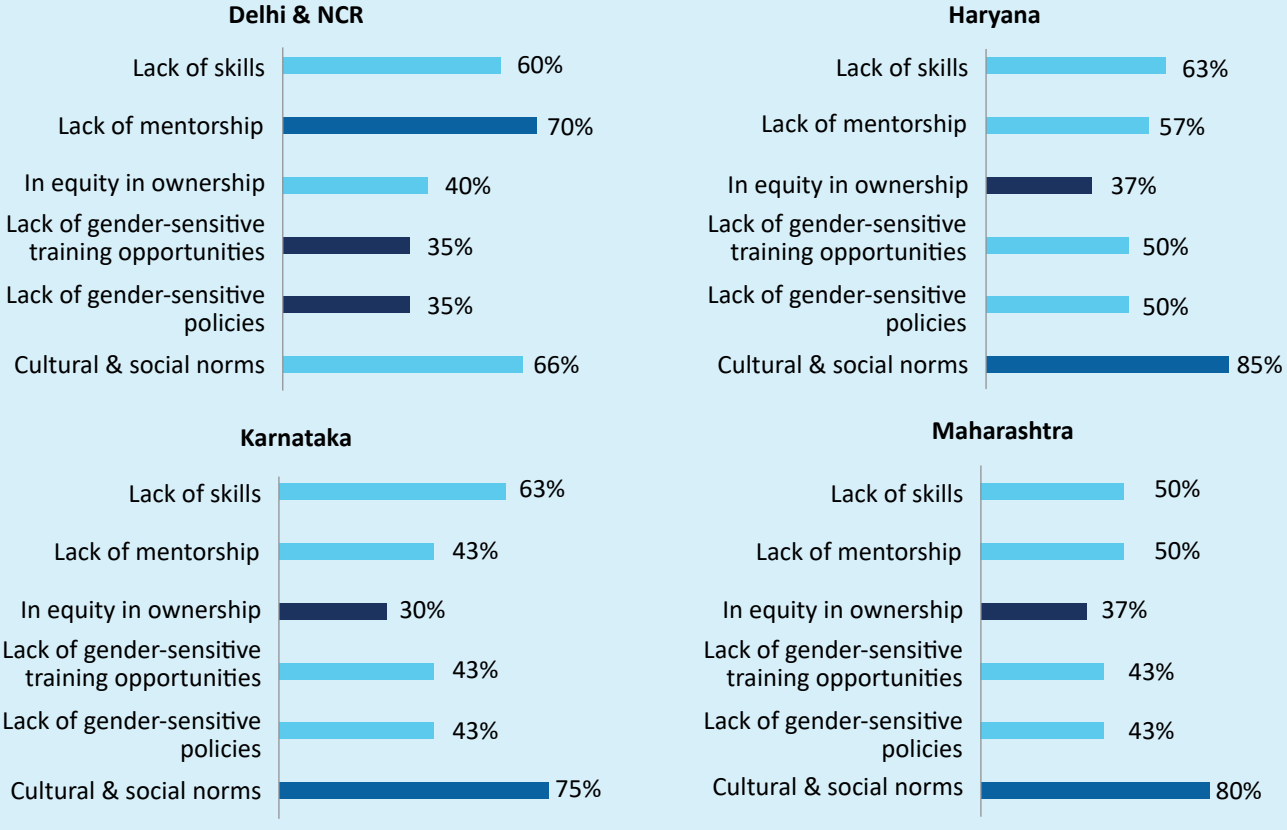
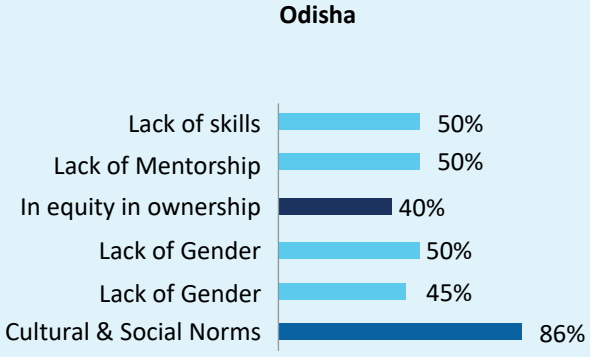
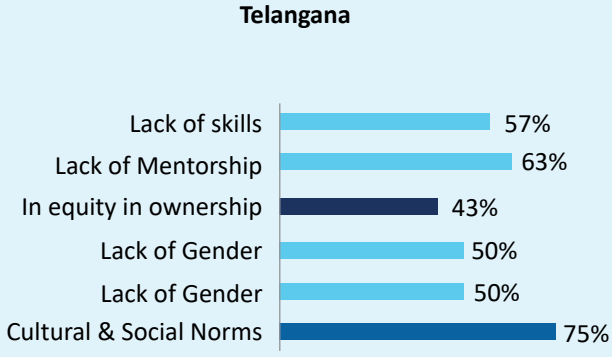
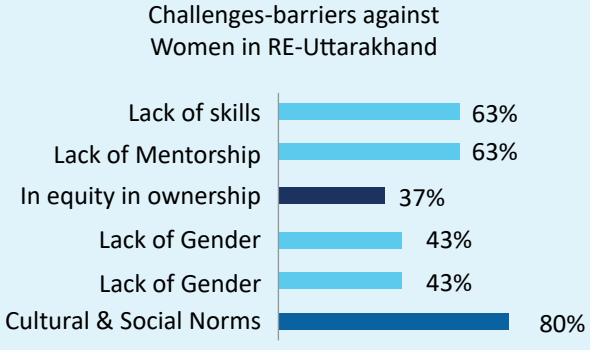


Figure 18: Barriers to women's participation in the RE sector, state wise







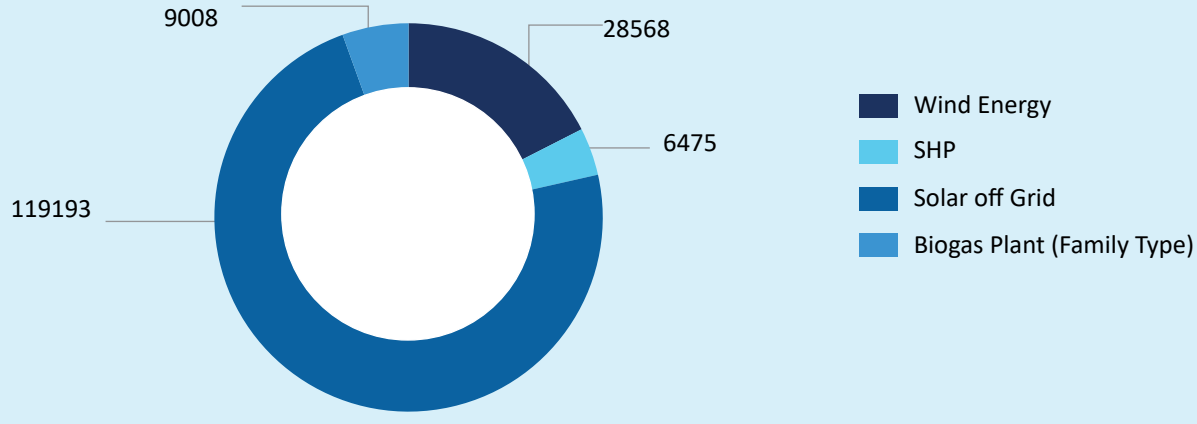


STATE-SPECIFIC BARRIERS FOR WOMEN SKILL GAPS AND OPPORTUNITIES

It has estimated that around 30,955 jobs will be available in the wind energy sector by 2021 (from 2019) including 2,387 jobs in 2019 because of various government schemes and to achieve the target of 60,000 MW by 2021-22. Similarly, from 2019 to 2021, 8,311 jobs will be created in the SHP sector including 1,836 jobs in 2019; 204,694 jobs will be created in solar off-grid including 85,501 jobs in 2019; and around 12,075 jobs in the biogas plant sector including 3,067 jobs in 2019. Hence it is projected that around 163,244 jobs will be created in 2020-21and 2021-22 in the RE sector, i.e., wind energy, solar off-grid, biogas plant and SHP.

In India various skill development measures have already been undertaken but the government should concentrate more on the decentralized RE sector as it has the maximum potential for generating jobs. Training and skill development should be imparted to the existing workforce also under RPL for their betterment

Figure 19: Skill gap sub-sector wise



Solar water pump
Source: MNRE Annual Report

and quality of work.

QUALIFICATION PACKS UNDER SKILL INDIA MISSION

Currently, there are five and two related qualification packs (QPs) available for the biogas plant and SHP sectors, respectively. Eight are available for the wind energy sector and five for the solar off-grid sector under the Skill India Mission. The details of QPs available against each job roles are given in

Table 6: Wind energy sector QPs

Manufacturing	Planning, Erection & Commissioning	Operation & Maintenance
Available QPs with SSCs • No QP Available	**Available QPs With SSCs** • Assistant Planning Engineer – Wind power Plant (NSQF-4) • Construction Technician (mechanical) – Wind power Plant (NSQF-4) • Construction Technician (Civil) – Wind power Plant (NSQF-4) • Construction Technician (Eletrical) – Wind power Plant (NSQF-4) • site Surveyor-Wind Power Plan (NSQF-4) • CMS Engineer - Wind Power Plan (NSQF-4)	**Available QPs with SSCs** • O&M Mechanical Technician – Wind Power Plant (NSQF-4) • O&M Electrical & Instrumentation Technician – Wind Power Plant (NSQF-4)
Job roles for which QP not exist • Maintenance Technician WTG Blade (NSQF-4) • Production Operator WTG Blade Manufacturing (NSQF-4) • Wind Nacelle/Blade/Tower Manufacturing Painter (NSQF-4) • Wind Nacelle/Blade/Tower Manufacturing Packer (NSQF-4) • Maintenance Technician WTG Nacelle (NSQF-4) • Wind Nacelle/Blade/Tower Manufacturing Mechanical Maintenance (NSQF-4) • Wind Nacelle/Blade/Tower Manufacturing - Production Supervisor • Wind Nacelle/Blade/Tower Manufacturing Mechanical Maintenance (NSQF-4) • Wind Nacelle/Blade/Tower Manufacturing • Wind Nacelle/Blade/Tower Manufacturing R & D Manager (NSQF-6)	**Job Roles for which QP not exist** • Construction Technician (Electrical)- WPP (NSQF-4) • Construction Technician (Civil)- WPP (NSQF-4) • CMS Engineer – WPP (NSQF-5) • Construction Technician (Mechanical)- WPP (NSQF-4) • Crane Operator (NSQF-4) • Site Surveyor – WPP (NSQF-4) • Procurement Executive-Wind (NSQF-4) • Assistant Planning Engineer (NSQF-4) • Construction Engineer (Electrical)WPP (NSQF-5) • Construction Engineer (Civil)WPP (NSQF-5) • Construction Engineer (Mechanical)WPP (NSQF-5) • Assistant Site Surveyor-WPP (NSQF-5) • Wind Resource Assessment Manager (NSQF-7) • Wind Land Acquisition Officer (NSQF-7) • Procurement Manager – Wind (NSQF-7)	**Job roles for which QP not exist** • O&M Engineer (mechanical) – WPP (NSQF-5) • O&M Engineer (Electrical)– WPP (NSQF-5) • O&M Manager – WPP (NSQF-7)

Manufacturing	Planning, Erection & Commissioning	Operation & Maintenance
• Production Supervisor (NSQF-5) • Wind Nacelle/Blade/Tower Manufacturing Mechanical Engineer (NSQF-5) • Wind Nacelle/Blade/Tower Manufacturing Electrical Engineer (NSQF-5) • Wind Nacelle/Blade/Tower Manufacturing Electrical Engineer (NSQF-5) • Wind Manufacturing Quality Assurance Engineering (NSQF-5) • Production Operator: WTG Nacelle/Tower Manufacturing (NSQF-4) • Wind Nacelle/Blade/Tower Manufacturing Mechanical Maintenance IN Charge (NSQF-6) • Wind Manufacturing Quality Manager (NSQF-7) • Wind Nacelle/Blade/Tower Manufacturing Production Manager (NSQF-7) • Wind Nacelle/Blade/Tower Manufacturing Fiber Technologist (NSQF-6) • Wind Nacelle/Blade/Tower Manufacturing Resin Technologist (NSQF-6) • Wind Nacelle/Blade/Tower Manufacturing Ceramic Technologist (NSQF-6) • Wind Nacelle/Blade/Tower Manufacturing Ceramic Technologist (NSQF-6)	• Planning Engineer (Civil Structural)-WPP (NSQF-6) • Planning Engineer (electrical) – WPP (NSQF-5) • site Manager / Subcontractor/ Entrepreneur – WPP (NSQF-6) • HSE Engineer (NSQF-5) • Project Head – WPP (NSQF-8) • Project Design Manager – WPP (NSQF-7) • Project Manager – WPP (NSQF-7) • system Planning Engineer – WPP (NSQF-8) • HSE Manager (NSQF-6)	

Table 7: Solar off-grid sector QPs

Manufacturing	Engineering, Procurement & Commissioning	Operation & Maintenance
Available QPs with SSCs • No QP Available	**Available QPs With SSCs** • Solar Grid Entrepreneur (NSQF-5) • Solar Lighting Technician (Options: Home Lighting System/ Street Lights) (NSQF-4)	**Available QPs with SSCs** • Solar PV Engineer (Option: Solar Water Pumping Engineer) (NSQF - 5) • Solar PV Project Helper (NSQF-2) • Solar Pump Technician (NSQF – 4)*
Job roles for which QP not exist • Solar Street light pole fabricator (NSQF-4) • Head solar PV-Pump (NSQF-8) • Head Solar Street Lighting (NSQF-8) • Head Solar Lantern and Solar Home Lighting (NSQF-8) • Solar off Grid Production Manager (Solar Lantern & Solar Home Lighting) (NSQF-7) • Solar off Grid Production Supervisor (Solar Lantern & Solar Home Lighting) (NSQF - 5)	**Job Roles for which QP not exist** • Solar Street Light Installer (NSQF-4) • Solar PV Pump Installation & Maintenance Manger/ Solar Pump Entrepreneur (NSQF-7) • Site Supervisor (NSQF-6) • Civil-Sub Contractor (NSQF-6) • Solar Off Grid Street Lighting Installation & Maintenance Engineer (NSQF-5) • Mechanical/ Civil/Supervisor (NSQF-5) • Mason (NSQF-4)	**Job roles for which QP not exist** • Customer care executive (NSQF-4) • Solar Off Grid Machine/CNC Operator (NSQF-4) • Solar off Grid Manufacturing Technician (Solar lantern and Solar home Lighting) (NSQF-4) • Solar Off Grid Sales Manager (NSQF-7) • Solar Off Grid Sales Executive (NSQF-7)

Table 8: SHP sector QPs

Feasibility Analysis	Engineering, Procurement & Commissioning	Operation & Maintenance
Available QPs with SSCs • No QP Available	**Available QPs with SSCs** • No QP Available	**Available QPs with SSCs** • Security Guards-unarmed (NSQF-4)* • Fitter (NSQF3)**
Job roles with QP not exist • SHP Site Surveyor (NSQF-6) • SHP Assistant Site Surveyor (NSQF-4) • Hydrology & Geology Expert (NQF-7) • Small hydro Liaison Officer/ PRO/ Patwari (NSQF-5) • SHP Designing Head (NSQF-8)	**Job roles with QP not exist** • Small Hydro Procurement Executive (NSQF-5) • SHP Electrical Foreman- Transmission (NSQF-3) • SHP Weir Site Foreman (NSQF-3) • SHP Water Conductor Foreman (NSQF-3) • SHP Electrical Supervisor – Transmission (NSQF-3) • SHP Project Electrical Supervisor – Substation (NSQF-4) • SHP Electrical Foreman (NSQF-3) • SHP Mechanical Technician (NSQF-4) • SHP OEM Foreman (NSQF-3) • Small Hydro Crane Operator (NSQF-4) • SHP Design Engineer (Electrical and C&I) (NSQF-5) • SHP Design Engineer (Civil & Structural) (NSQF-5) • CAD/ Draughtsman (NSQF-4) • Small Hydro Procurement Manager (NSQF-7) • SHP Manger/ Subcontractor/Entrepreneur (NSQF-7) • SHP Electrical and C&I Engineer (NSQF-4) • SHP C & I Technician (NSQF-4) • SHP Mechanical Engineer (NSQF-5) • SHP Engineer (Civil) (NSQF-5) • SHP OEM Supervisor (NSQF-4) • SHP Weir Site Supervisor (NSQF-4) • Small Hydro Blasts Man (NSQf-4) • SHP HSE Manager (NSQF-6) • SHP HSE Engineer (NSQF-5)	**Job roles for which QP not exist** • SHP Helper – EPC and O&M (NSQF-3) • Small Hydro O&M Mechanical Technician (NSQF-4) • Turbine Generator Operator (NSQF-4) • Fitter (NSQF-4) • Small Hydro O&M Instrumentation Technician (NSQF-4) • Security Guard (NSQF-3) • Small Hydro O&M Engineer Mechanical / Small Hydro control system Engineer (NSQF-5) • Small Hydro O&M Civil Technician (NSQF-4) • Small Hydro O&M Electrical Engineer (NSQF-5) • Small Hydro O&M Civil Engineer (NSQF-5) • Small Hydro O&M Site in Charge (NSQF-6)

*QP available with Management & Entrepreneurship and Professional Skills Council
**QP available with Capital Good Skill Council

Table 9: Biogas plant sector QPs

Construction & Fabrication	Operation & Maintenance	Finance
Available QP with SSCs • No QP Available	**Available QPs with SSCs** • Animal Waste Manure Aggregator (option: Biogas Plant Operator/ Compost Plant Operator) (NSQF-4) • Agri-residue Aggregator (NSQF-4)	**Available QP with SSCs** • Office Assistance (NSQF-3)* • Payment Collector (NSQF-4)** • Account Executive (NSQF -4)***
Available QP with SSCs • Construction Manager (NSQF-6) • Biogas Plant Fabricator & Installer (NSQF-4) • Biogas Plant Store in Charge (NSQF-5)	**Available QP with SSCs** • Maintenance manger (NSQF-6) • Lab Technician (NSQF-4)	**Available QP with SSCs** • Biogas Plant Marketing & Sales Executive (NSQF-4)

*QP available with Management & Entrepreneurship and Professional Skill Council;
**QP available with IT-ITes sector skill council (extra NOS can be included as optional for filed visit;
***QP available with BFSI Sector Skill Council of India;

Tables 6 to 9.
It is evident that opportunities are available for the development of more QPs to minimize the existing skill gaps in this sector. Based on secondary research and national classification of occupation (NCO) 2015, each job role in each sub-sector has been assigned with a national skills qualifications framework (NSQF)-level based on the knowledge, skill and aptitude required for a job role. NSQF was developed by the National Skill Development Agency. It is based on an outcome-based approach and each level in the NSQF is defined and described in terms of competency levels that need to be achieved. The job roles corresponding to each of these competency levels would be ascertained with the involvement of the industry through Sector Skill Councils.

QPs should be developed for job roles with NSQF level 1 to 4 under the Skill India Mission as large volumes of skill gaps exist in the RE sector for these job roles. Development and implementation of QPs with NSQF level 1 to 4 may cater to the marginalized sections of society, including women, to improve employment opportunities for them.

Solar and wind energy stakeholders should seek employees in existing traditional fields to provide overlapping skills. Training institutes could offer targeted courses or corporate training programmes to fill in gaps to enable this skill transfer. Recognition of prior learning plays a vital role for development of skill of existing manpower.

OVERVIEW OF PRESENT SKILL DEVELOPMENT AGENCIES

Various initiatives have been undertaken by the Government of India to develop the skills of the required and existing workforce in the field of RE. There are various centres which continuously work towards skill development.

i. **National Institute of Solar Energy and SETNET**
The National Institute of Solar Energy (NISE), an autonomous institution under MNRE, is the apex national R&D institution in the field of solar energy. It oversees solar training initiatives in India and offers a variety of solar training courses throughout the year including the Suryamitra course. NISE certification courses are offered in each of the 35 SETNET partnering institutions. Many organizations outside of SETNET also offer training courses but may not provide training that is consistent with NISE standards.

ii. **National Institute of Wind Energy (NIWE)**
The National Institute of Wind Energy (NIWE) is part of MNRE which is primarily responsible for overseeing the wind energy sector including R&D, assessment, training, etc., in India. NIWE has pioneered the promotion of wind energy as a primary energy source in India.

It has conducted 31 national training courses on self-financed and trained over 1,300 professionals from all part of the country.

iii. **SCGJ**
SCGJ is an autonomous body of the Ministry of Skill Development and Entrepreneurship and was founded in May 2015 in collaboration with the Confederation of Indian Industry and the National Skill Development Corporation. SCGJ acts as a bridge between the Government of India, state governments and industry for developing strategies and implementing programmes for skill development correlated to industry needs but also aligned to best International practices. SCGJ has developed various national occupational standards and QPs for solar, wind and bioenergy sub-sectors. From 2017 to 2025, SCGJ plans to train 1,320 trainers and certify around 1,000,320 learners. It currently has 23 QPs in solar energy, eight in Wind Energy and 4 QPs in Bio-energy sub-sectors.

iv. **Industrial Training Institutes**
These institutes present a viable opportunity to increase access to solar training programmes in India. MNRE has integrated RE coursework into India's numerous Industrial Training Institutes, which could help broaden the accessibility of RE education.

DEVELOP BUSINESS AND ECO-ENTREPRENEURSHIP MODELS

As the RE sector is gaining unrivalled traction and become increasingly integrated into the country's energy mix, there is a growing need for entrepreneurs

who shall understand the RE ecosystem and maintain the balance of innovation mindset and project implementation to navigate this change. Entrepreneurship business models also help in creation of jobs across the value chain of different sub-sectors.

There are various eco-entrepreneurship model case studies available in the RE sector specially for decentralized RE systems in which women from marginalized sections of society and remote locations play important roles for their own livelihood generation and community development. Successful eco-entrepreneurship models which may be promoted across the country include:

- **Distribution through proprietary agent networks:** The solar company sells its products through diffused networks of generalist or specialist solar distributors. Some companies are also vertically integrated and have developed proprietary distribution networks or are using franchise models throughout the supply chain;
- **Institutional partnerships:** The enterprises partner with rural banks, microfinance institutions, community saving groups or non-governmental organizations to market their products to partner organizations' customer bases or membership networks. Finance is often provided by the partner organization; and
- **Energy-as-service models solutions:** Under these related approaches, solar providers focus on offering an energy service (like a micro-utility) rather than a product, meaning households pay for electricity as they consume it. In leasing models, end-users do not own the products but are guaranteed a replacement product if it fails. Under pay-as-you-go models, end users provide periodic repayments counting towards the eventual ownership of the product (and thereby matching energy consumption and payment for energy over time). These models are mainly used to finance larger lantern systems or solar home systems.

Eco-entrepreneurship models in the RE sector

Solar Mamas: This is a concept in which women from various part of world received training on making solar panels, lights and PV circuits during a special six-month course conducted by Barefoot College in Tilonia village in Rajasthan. The trained women are fondly known as Solar Mamas. Any woman over 35 years of age and from a remote, inaccessible area without electricity can enrol for the solar engineering course, provided she has backing from her village. The respective governments arrange their passports, visas and transport to Barefoot College. The Indian Ministry of External Affairs provides a fellowship that covers the cost of stay in Tilonia. Training programmes such as this not only help in generation of livelihoods for women in the rural areas but also help in meeting our Sustainable Development Goals.

Biogas Project, Supported by Gram Vikas: Gram Vikas is a not-for-profit organization,, extensively working in the field of rural livelihood and sustainable development in Odisha. Gram Vikas has supported biogas projects which saw villagers using cattle dung to produce gas for cooking and lighting. Many plants built during the 1990s fell out of use because of lack of knowledge relating to maintenance of biogas plants, time-consuming upkeep and inadequate number of cattle to produce sufficient dung for the plants. Gram Vikas therefore set up a maintenance fund into which every household makes a small contribution to cover the cost of future maintenance and repairs. One person in the village is nominated to operate and manage the system. Gram Vikas' insistence on 100 percent community participation not only increases the chances that the project will last beyond the intervention period but also generate livelihood in the community.

Lighting a Billion Lives: is an entrepreneurial model of energy services delivery to support economically poor rural communities. It is a decentralized solar lighting initiative implemented by TERI in 16 states in India in a total of 640 rural communities where grid electricity is a challenge and people rely on fuel food or kerosene for lighting and cooking. This initiative is based on a pay for service model. Under this model, a solar lantern charging station is been set up in villages and lanterns are rented to householdson a daily basis. A typical charging station consists of 50 lanterns, five solar panels and five junction boxes. Lanterns are either CFL or LED types which provide four to five and six to seven hours of light, respectively. These stations are operated and managed by people from the local community.

Bombay Bijlee: is a Mumbai-based start-up which deals in off-grid electricity since 2018. It has developed a Bijlee Boqx which allows rural households to have access to off-grid electricity. Bijlee Boqx is an Internet of Things -based smart solar energy harvester, storage and delivery device. It consists of a 75-watt solar panel, a television set and set-top box, and three LED bulbs. The television set is made in-house, from refurbished e-waste of old desktop monitors. Bombay Bijlee's solution integrates payments, after sales service and data-driven scaling of power back up. Households can buy home appliance on a "pay as you go" model using their platform. The self-diagnostic hardware can detect any fault in the entire system (source, battery, loads, e.g., TV, fan, etc.) and sends an automatic SMS to the field local technician to provide proactive and prompt service. Usage pattern and batteryare also monitored which can be used to scale the power back-up without over-sizing the system thus saving rural customers' money.

SELCO -- Remote Village with Solar Power: Kattehole village is a small and remote village in district Chitradurga, Karnataka, located on hilly terrain. Due to its remoteness, families residing in the area face extreme challenges in terms of energy access. The irony is that the village is located along the foothills which have large wind turbines towering above them but the villagers do not experience the benefit of the output. To provide energy access, SELCO Solar Light Pvt. Ltd., is a for-profit social enterprise based in Bengaluru, approached the villagers and demonstrated solar technologies to them. Though they were interested in adopting the solar technologies low incomes and lack of financing options deterred them

SELCO approached its partner bank in the area, Pragathi Gramin Bank, which agreed to finance the systems provided a 15 percent down payment was to be made as per the bank's regulations. SELCO used its Renewable Energy & Energy Efficiency Partnership supports to finance the down payment and also to leverage the remaining 85 percent of the loan to the beneficiaries. This amount then could be repaid on a monthly basis leading to affordable monthly instalments for the villagers.

Around 15 families had used this financing option and enjoy solar light in their homes. As power distribution, a potent barrier to remote rural electrification, this project had reiterated the importance of site-specific solutions rather than mass-based ones.

Solar Sister (Africa): Solar Sister is a social enterprise that combines the life changing power of clean energy access and women's enterprise. it is building a network of women entrepreneurs who sell and deliver clean energy to their communities in rural Africa. Solar Sister trains and supports women to deliver clean energy directly to homes in rural communities. It provides essential services and training that enable women entrepreneurs to build sustainable businesses in their own communities. Each Solar Sister entrepreneur buys her lights and cook stoves from Solar Sister, then sells and delivers them, woman-to-woman to her family, friends and neighbours.

Solar Sister serves as the backbone of women's enterprise, decreasing the risks and costs women face in starting independent businesses in the clean energy sector. Management staff train and recruit business development associates , who are locally hired field staff and Solar Sister's direct link to entrepreneurs. In turn, each they recruit, train and support a group of one to 25 self-employed women entrepreneurs. Since establishing operations in 2010, Solar Sister has empowered more than 4,000 entrepreneurs in Uganda, Nigeria and Tanzania who have in turn provided solar and clean cooking solutions to over 1.5 million beneficiaries.

The Wonder Women (Indonesia)- Wonder Women a unique initiative of Kopernik, non-profit organisation of Indonesia where women have been empowered to get the last mile electricity through off-grid energy solution. Under this initiative, around 500 wonder women have been recruited and who have reached around 250,000 people across the country by selling clean energy technologies (e.g. solar lighting system) at market stalls and small shops, or at community events. This initiative provides training on product use and maintenance, sales and marketing, book-keeping and financial management, and public speaking.to the women entrepreneur

Under this initiative, a survey has been carried out after 12 months of implementation and found that around 21% of women entrepreneurs become more empowered within their families and taking on a greater role in household decision making.

3.

Policy and Regulatory Frameworks

GREEN JOBS IN INDIA: POLICIES AT NATIONAL AND STATE LEVEL

In order to promote RE and its applications, the Government of India and state governments have outlined and implemented various RE-related policies and schemes at the national and state/union territory level, respectively. MNRE is the nodal ministry that drives RE strategies in India.

A list of relevant RE-related policies or schemes implemented across the country is provided in Table 1.

Table 1: RE policies/schemes implemented across India

Solar Off-grid	
Pradhan Mantri Kisan Urja Suraksha evem Utthan Mahabhiyan (PM-KUSUM)	PM- KUSUM, introduced in 2019, aims to develop decentralized solar energy and other RE generation plants of capacity up to 2 MW which could be connected directly to existing 33/11 or 66/11 or 110/11 kilovolt sub-stations of a distribution company, thus reducing transmission system requirements and transmission and distribution losses. Such plants near sub-stations may be developed, preferably by farmers, giving them an opportunity to increase their income by utilizing barren and uncultivable land for solar or other RE- based power plants. Cultivable land may also be used if the solar plants are set up on stilts and crops can be grown underneath; RE power can be sold to distribution companies. Under this scheme, agriculture diesel pumps will be replaced with solar water pumps and solarized grid-connected agriculture pumps. It has mainly three components: • Component-A: Setting up of 10,000 MW of decentralized ground/stilt-mounted grid-connected solar or other RE-based power plants; • Component-B: Installation of 1.75 million stand-alone solar agriculture pumps; and • Component-C: Solarization of 1 million grid-connected agriculture pumps.
Atal Jyoti Yojana (AJAY) Phase II	MNRE launched AJAY to illuminate dark regions through the establishment of solar street lights. It is a sub scheme under MNRE's off-grid and decentralized solar application scheme. Phase I was implemented during September 2016-March 2018 and Phase II is being implemented during 2018-19 and 2019-20. Under Phase II, a total of 3,04,500 12-watt light emitting diode (LED) solar street-lights (200,000 in 2018-19 and 104,500 in 2019-20) will be installed in conjunction with the Members of Parliament Local Area Development Scheme. The scheme is being implemented by Energy Efficiency Services Limited (EESL) in the country.
70 Lakhs Solar Study Lamp Scheme	The scheme, targeting 7 million solar study lamps for students, was launched by MNRE in five states: Assam, Bihar, Jharkhand, Odisha and Uttar Pradesh. Indian Institute of Technology (IIT) Bombay is responsible for coordinating with all stakeholders for streamlined implementation while EESL is the chief procurement agency. At the grassroots, the scheme is implemented in collaboration with the State Rural Livelihoods Mission as the zonal execution agency and cluster level federations as the block execution agencies. Women's self-help groups are involved in all operations of the scheme, including assembly, distribution, and repair and maintenance. The women are also being trained and encouraged to open their own solar shops. It is envisaged that 7 million students from 22,000 villages in 325 blocks spread across intervention states will be covered. The scheme is expected to generate an employment of 5.6 million man-days for the duration of 18-20 months, with the establishment of 2,333 repair and maintenance centres and 700 solar entrepreneurs in rural areas. Around 1.6 million lamps have already been distributed under the scheme.

Wind Energy	
India's commitment to 175 GW RE by 2022	A target of 175 GW of RE capacity by 2022 has been set by the Government of India. Of 175 GW, 60 GW will come from wind energy. As 31 December 2019, India had achieved 37.5 GW (cumulative) from wind energy. Hence 22.5 GW is yet to be achieved.
National Wind-solar Hybrid Policy	This policy was drafted by MNRE in June 2016. It was found that wind and solar resources complement each other and, thus, their hybridization would be helpful in achieving better grid stability. Since already established wind and solar farms had enough space for hybrid plants, a policy on hybrid plants was essential to encourage a hybrid system comprising small wind turbines and aero generators or small wind turbine and solar panels.. The primary objective of the policy is to provide a framework for the development of grid-connected hybrid projects. The aim is to develop 10 GW capacity of wind-solar hybrid projects by 2022. Two states (Gujarat and Andhra Pradesh) have also launched the hybrid policy.
Wind Bidding Scheme	The scheme, launched by MNRE in June 2016, is aimed at fulfilling a target of wind projects of 1 GW capacity connected with a central transmission utility. The main highlights are: digitalization through e-bidding options, transmission of wind generated electricity to least windy states, and helping the windy states in achieving their renewable purchase obligation targets from non-solar resources.
Integrated Energy Policy (2006)	In 2006, the Planning Commission of India implemented an energy policy which integrated all sources of energy with the aim of achieving sustainable development. Emission problems from fossil fuels were highlighted and RE promotion through strong policies was proposed. To promote wind power, a policy on utilizing private land for setting up wind farms was also recommended.
Biomass (including Biogas Plant) Off-grid	
New National Biogas and Organic Manure Programme	NNBOMP aims to provide clean cooking fuel and to meet lighting, thermal and small power needs of farmers, dairy farmers and users including individual households and to improve organic manure systems based on bio-slurry from biogas plants in rural and semi-urban areas by setting up of biogas plants. This programme helps rural households by reducing the drudgery of women, improving livelihood, etc. The target for 2018-19 was 100,000 biogas plants.
Small Hydro Power	
IREDA NCEF Refinance Scheme	The Indian Renewable Energy Development Agency Ltd. (IREDA) has published a revised refinance scheme supported by the National Clean Energy Fund (NCEF) to revive operations of existing biomass power and SHP projects affected due to unforeseen circumstances.
India's Commitment to 175 GW RE by 2022	As per MNRE, the estimated potential for power generation in the country from small, micro and mini hydro plants is about 20,000 MW. As on 31 December 2019, only 4,671 MW power had been generated through these plants. Around 15,000 MW is yet to be explored which will boost the country's economy along with employment in this sector.
Other National Initiatives	
Make in India Policy	The Government of India launched the Make in India initiative in 2014 to fortify India’s domestic manufacturing industry by attracting investments, enhancing manufacturing infrastructure and improving skill capacity in the Indian labour force. The goal is to make India the top destination globally for foreign direct investment. The policy focuses on 25 industries in India, including the RE sector.

National Skill Training Programme	The Ministry of Skill Development and Entrepreneurship (MSDE) has created qualification standards within India's workforce which could prove effective in improving the quality of India's domestic production markets. The recent creation of the Skill Council for Green Jobs (SCGJ) shows MSDE may be readying itself to provide more concentrated support for the RE labour force. MNRE has also been working to integrate the RE curricula into numerous formal and non-formal training institutions in India. The RE coursework has been integrated into India's numerous industrial training institutes, which could help broaden the accessibility of RE education. MNRE partnered with the United States to create the Solar Energy Training Network (SETNET) of India to establish greater consistency and collaboration among India's solar energy training programmes.
Pradhan Mantri MUDRA Yojana	The scheme provides loans of up to INR 1 million to the non-corporate, non-farm small/micro enterprises. Micro Units Development and Refinance Agency Ltd. (MUDRA) is a non-banking financial company that supports development of the micro enterprise sector in India. MUDRA loans are extended for a variety of purposes which provide income generation and employment creation, including equipment finance for micro units as well as transport vehicle loans.
Sustainable Finance Scheme by Small Industries Development Bank of India (SIDBI)	The objective of this start-up scheme is to assist the entire value chain of energy efficienct (EE)/cleaner production (CP) and sustainable development projects which lead to significant improvements in EE/CP/sustainable development in the micro, small and medium enterprises (MSMEs) and which are presently not covered under existing sustainable financing lines of credits. Under this scheme, suitable assistance using term loan or working capital is granted to the energy service company that implements EE/CP/RE project. To be eligible for this grant, the energy service company must be an MSME or otherwise the unit to which it renders its services has to be an MSME.
Other National Initiatives	
Standup India by SIDBI	This scheme facilitates bank loans between INR 1 million and INR 10 million to at least one borrower belonging to the scheduled caste (SC) or scheduled tribe (ST) community and at least one woman borrower per bank branch, to set up a greenfield enterprise.
SIDBI Make in India Soft Loan Fund for MSMEs	The aim of this scheme is to provide soft loans, in the nature of quasi-equity, and term loans on relatively soft terms to MSMEs to meet the required debt-equity ratio for the establishment of new MSMEs and also to enable the growth for existing ones. Fiscal incentive includes: 10 percent of the project cost, subject to a maximum of INR 2 million as the loan amount for the general category; 15 percent of the project cost subject to a maximum of INR 3 million for enterprises promoted by SC/ST/persons with disabilities and women; persons belonging to these categories must own a controlling stake (i.e., 51 percent or higher).

STATE NODAL AGENCIES

MNRE has established state nodal agencies (SNAs) in different states and union territories of India to promote and monitor the application of RE and its systems. The primary objective of a SNA is to develop, coordinate, finance and promote research projects in the new and renewable energy field. SNAs are also responsible for implementing the central and state level policies across the respective states. The following SNAs exist:

- Delhi: Energy Efficiency and Renewable Energy Management Centre (EEREM);
- Haryana Renewable Energy Development Agency (HAREDA);
- Karnataka Renewable Energy Development Ltd. (KREDL);
- Maharashtra Energy Development Agency (MEDA);
- Odisha Renewable Energy Development Agency (OREDA);
- Telangana State Renewable Energy Development Corporation Ltd. (TSREDCO); and
- Uttarakhand Renewable Energy Development Agency (UREDA).

GREEN JOBS AND EXISTING INTERVENTIONS IN THE SELECTED STATES

Haryana

i. **SHP:** In Haryana, the potential for SHP is very limited. According to MNRE's Annual Report 2018-19, only 33 plants of a total capacity of 107 MW can be installed across the state. However, till date, only nine plants with a total capacity of 73.5 MW have been installed. In 2018-19, no new plants were installed; no new jobs in SHP were generated in 2018-19.

ii. **Solar off-grid systems:** HAREDA is promoting various solar off-grid systems in the state with the support of MNRE, including LED home lighting, solar lanterns, LED solar torches and solar PV power plants (1 kilowatt (KW)).

   a. LED home lighting: The system consists of a 12 watt solar PV module, 12 volt 20 ampere hour (Ah) and illuminance minimum 15 lux when measured from a height of about 2.5 metre and illuminated over an area of at least 2.5 metre diameter with 2 luminar (3 watt each) working for 4 four hours per day. The product costs INR 4,500 on which the state provides a subsidy of INR 2,500 and the user pays INR 2,000.

   b. Solar lantern: A solar PV lantern is a lighting system consisting of a 7 watt compact fluorescent lamp (CFL), 12 volt 7 Ah battery and electronics, all placed in a suitable housing made of metal or plastic or fibre glass, and a PV module of 10 watt. The product costs INR 2,350 ; the state provides a subsidy of INR 1,000 and the user's share is INR 1,350.

   c. LED solar torch (Kishan Jyoti): The system consists of a 2.5 watt solar panel, 6 volt 4 Ah battery and a LED lamp with a mobile charging facility. The product costs INR 1,100, state subsidy is INR 650 and the user's share is INR 550.

   d. Solar PV power plant (1 KW): The system consists of a mono/multi crystalline silicon solar cells PV module of 75 watt peak or more power conditioning unit, 24 volt, 300 Ah or 48 volt 150 Ah low maintenance valve regulated lead–acid battery /lead acid tubular plate. The product costs INR 210,000 (with a five-year warranty), the subsidy is INR 63,000 per KW (INR 81 per watt or 30 percent of the project cost whichever is less) and the user share is INR 147,000.

   e. Solar pumps: As per the PM-KUSUM scheme, a target of 15,000 standalone solar powered agriculture pumps should be achieved. This would generate around 450 jobs in the state.

iii. **Biogas plant:** Haryana has a total potential of 300,000 family type biogas plants according to MNRE. However, in 2018-19, a total of 272 biogas plants were installed which would have generated around 42 direct jobs. In 2018-19, the state had a target of 1,700 biogas plants which may have generated around 261 jobs if the state achieved its target for the year.

Karnataka

i. **Wind energy:** Karnataka has huge potential for wind energy. As estimated, around 78 GW of power can be generated from wind energy in the state. In 2018-19, plants with a capacity of around 901.8 MW have been installed and the cumulative target of 4,694.9 MW reached. This would have generated around 1,145 jobs in this sector.

ii. **SHP:** Karnataka has a very large potential for SHP with a capacity to install around 3,726 MW. However, in 2018-19, only one project of around 26 MW was installed. This would have generated around 530 direct jobs in the state.

iii. **Solar off-grid:** As per Karnataka Solar Policy 2014-21, the state has placed emphasis on solar powered irrigation pumps which would supplement the conventional power requirement of farmers. Under the PM-KUSUM scheme, 6,000 solar powered agriculture pumps need to be installed in 2019-20, which will generate around 180 direct jobs. The implementation of this scheme is the responsibility of KREDL.

iv. **Biogas:** The state has a potential of around 6,80,000 family type biogas plants, of which around 4,97,479 have already been installed. In 2018-19, a target of 8,900 biogas plants was set and around 9,844 biogas plants have been constructed, which surpassed the target for 2018-19. This measure has generated around 1,509 direct jobs across the state.

Maharashtra

i. **Wind energy:** The total potential for wind energy in Maharashtra is around 56.7 GW (at different heights, i.e., 50, 80 and 100 metre above ground). In 2018-19, only 16.5 MW of wind energy was installed. India is yet to install around 22 GW up to 2022 in order to achieve its 60 GW target, in which Maharashtra plays an important role.

ii. **SHP:** In 2018-19, a total of three new SHP projects were undertaken in the state with a total capacity of 26.4 MW. However, the state has the potential of around 786.46 MW of SHP. In 2018-19, 539 direct jobs have been generated.

iii. **Solar off-grid:** MEDA is responsible for handling the PM-KUSUM scheme in Maharashtra for the installation of solar powered agriculture pumps. In 2019-20, a target of 30,000 solar pumps has been set which would have generated around 897 direct jobs in this sector.

iv. **Biogas:** Maharashtra has the potential of 8,97,000 family type biogas plants which has already been achieved. The total cumulative target till 31 March 2018 is around 9,09,511 biogas plants. In 2018-19, 13,339 biogas plants were installed which would have generated around 2,045 direct jobs.

Odisha

i. **SHP:** The state has a potential of 286 MW of SHP of which only around 65 MW has been installed till 2018-19. In 2018-19, no new SHP plant has been installed, hence it is estimated that no new direct jobs were generated.

ii. **Solar off-grid:** OREDA is responsible for having installed around 2,500 solar powered agricultural pumps in 2019-20 under PM-KUSUM in the state. It is expected that it would have generate around 75 direct jobs.

iii. **Biogas:** Odisha has a huge potential, i.e., 60,500 family type biogas plants especially in the rural areas. In 2018-19, a 4,500 biogas plant target was set of which only 269 plants were installed due to poor outreach of the responsible agency; this generated around 41 direct jobs. If the state had achieved its target, an estimated 690 jobs would have been generated.

Telangana

i. **Wind energy:** The wind energy potential in the state is moderate, i.e., 4,244 MW at 100 metre above ground level. In 2018-19, only 27.3 MW of wind energy was installed which would have generated around 40 new jobs.

ii. **SHP:** The state has a very limited potential for SHP, i.e., 102.25 MW, according to MNRE, of which around 90.87 MW has already been achieved. In 2018-19, no new project was undertaken by the state nodal agency.

iii. **Solar off-grid:** The state promotes rooftop solar power plants of 1 kWp to 10 kWp for domestic independent houses where central financial assistance is 40 percent for 1-3 kWp and 20 percent thereafter. In 2018-19, a total of 1,211 new connections were installed for solar rooftops with a total capacity of 36.30 MW.[2] This would have generated around 3,659 jobs including formal and informal jobs.

iv. **Biogas:** The overall potential for biogas has not been estimated yet by MNRE in the state. However,

up to 31 March 2019, 19,644 biogas plants (family type) had been installed. The state has a target of installation of 2,500 biogas plants in 2018-19, but no new biogas plant were installed due to lack of outreach of the nodal agency and awareness among people.

Uttarakhand

i. **SHP:** Uttarakhand has a moderate potential for SHP of around 1,664 MW, of which 214.32 MW has already been achieved. In 2018-19, no new SHP was installed or commissioned due lack of central and state level policies.

ii. **Solar off-grid:** UREDA is the nodal body for the implementation of various schemes/policies relating to RE in the state. Under the solar off-grid programme, UREDA is promoting solar lanterns, solar street lights, home lights and solar charkhas.

iii. **Biogas:** In 2018-19, a total of 1,357 biogas plants were constructed against the target of 2,200 biogas plants. This would have generated around 208 jobs in 2018-19 in this sector as estimated. This state has a huge potential for biogas plants (family type) and has installed around 362,915 biogas plants.

Delhi NCR

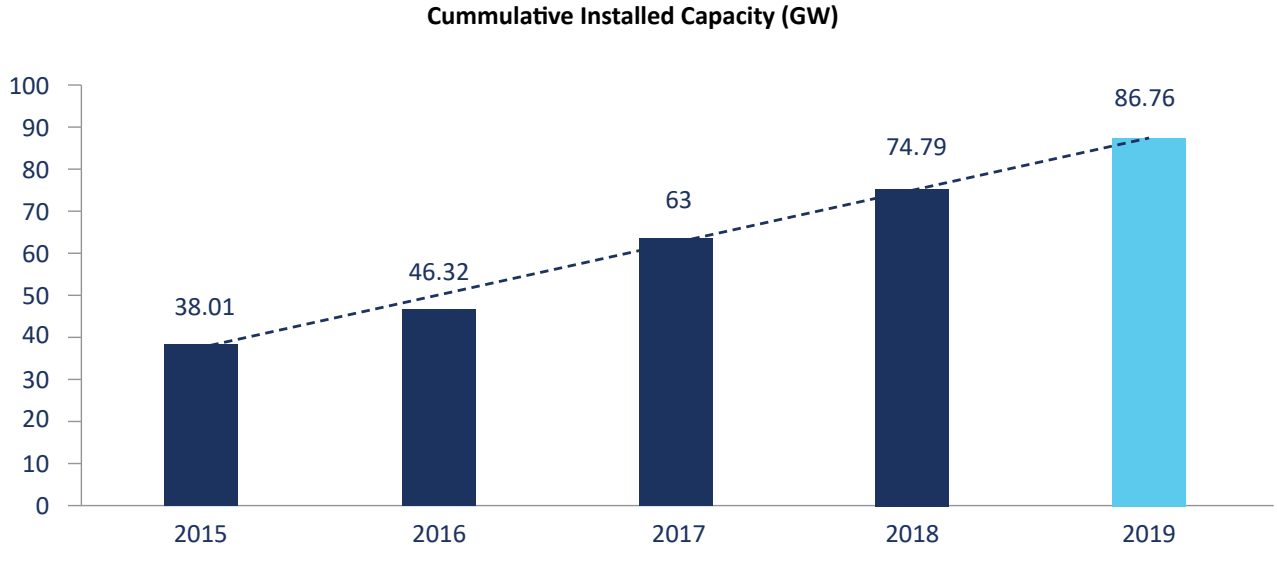
i. **Biogas:** Delhi NCR has the potential of 12,900 family type biogas plants, of which 578 have already been installed. In 2018-19, Delhi NCR targeted the installation of 600 biogas plants; however, none had been installed till 31 March 2019.

The Municipal Corporation of Karimnagar, Telangana, has made it mandatory for commercial establishments, houses, apartment complexes and community halls to install solar panels on rooftops, if their built-up area is more than 2,700 square feet to reduce the carbon footprint and dependence on conventional power. This rule is applicable for older construction also. The corporation offers a 30 percent subsidy on the installation process, which is handled by TSREDCO. It is currently encouraging greater citizen participation by adopting a net-metering facility along with the Northern Power Distribution Company Limited, which will buy surplus power at INR 3.50 per unit from property owners.

GROWTH DRIVERS FOR EMPLOYMENT OPPORTUNITIES IN SELECTED STATES

At present the RE sector in India is continuously growing with a compound annual growth rate (CAGR) of 22.9 percent from 2015 to 2019 (calculated as on 29 February 2020)[3] which is a healthy growth rate but insufficient to meet India's ambitious target of 175 GW by 2022. This could be the key growth driver for the RE sector in India as the sector needs more aggressive and tangible schemes or policies from the Government of India as well as state governments.

Figure 4: Growth of installed capacity of renewable energy in India: CAGR 22.9%



Source: Ministry of New & Renewable Energy

For 2019: RE installed capacity considered as on 29 February 2020

Figure 5: Growth drivers of the RE sector in India

RE potential

- India is one of the top five clean-energy producers globally and is well on course to surpass its original target of 20 GW.
- India has a huge potential for RE, in fact, it is now eyeing 225 GW from renewables.

Government Policies

- Ambitious target of the Indian government to achieve 175 GW of RE by 2022 including national Solar Mission
- Wind-Solar Hybrid Policy
- PM KUSUM
- JAY Phase II
- NNBOMP

Skill Development

- To meet the rising demand of trained manpower, Skill India Mission has been launched in 2015.
- Recognition of prior learning (RPL) scheme under the Skill India Mission aims to impart skills training for existing workers to align competencies of the unregulated workforce.
  RPL focuses on enhancing the career/employability opportunities of an individual and provides alternative routes to higher education.

Foreign direct investment

- The RE sector in India has seen more than US$42 billion of investment since 2014 and around US$7 billion of foreign direct investment (FDI) between April 2000 and June 2018.
  Many multilateral and bilateral agencies have put in significant FDI into the RE sector – solar and wind power generation firms, electric vehicles and storage projects, etc.

A 5 horsepower solar pump installed in Sambhar, Jaipur district, Rajasthan.
Source: MNRE Annual Report.

Key drivers of growth of the RE sector in India mentioned in Figure 5 will trigger the momentum of employability in the sector and an increase in the installed capacity of RE will increase employment opportunities in India.

There is a huge potential for entrepreneurship opportunities in the RE sector especially in the decentralized RE system in rural areas. To promote entrepreneurship opportunities, the Government of India has launched various schemes.

Pradhan Mantri MUDRA Yojana is an initiative aimed at provision of micro-finance, low-interest rate loans to entrepreneurs from disadvantaged socio-economic backgrounds. An initial capital of INR 20 billion was allocated for this scheme in 2018.

Loans amounting to INR 3,110 billion in total were issued between 1 April 2018 and 31 March 2019 in India.[7]

Another scheme, Stand-Up India, was launched in April 2016 by the Ministry of Finance to facilitate bank loans between INR 1 million and INR 10 million to at least one borrower from the SC or ST community and at least one woman borrower per bank branch for setting up greenfield enterprises. This enterprise may be in the manufacturing, services or trading sector. In case of non-individual enterprises at least 51 percent of the shareholding and controlling stake should be held by either an SC/ST or woman entrepreneur.

Gadag Wind Farm, Harthi, Karnataka

The Gadag wind farm was commissioned in 2006 and is one of the largest wind farms in Karnataka. Wind World Ltd. (formerly Enercon) operates around 235 wind turbines, which supply directly to the state power sub-station located approximately 20 kilometre away from the Gadag office in Harthi.

The site employed around 70 skilled employees on a permanent basis along with 85 semi-skilled and unskilled contracted workforce on site as cleaners, drivers, office boys and security staff. The unskilled workers were local employees, whereas among the skilled workers 20 people were from nearby villages and towns and the remaining 50 from across the state of Karnataka. This project also helped in improving the local service provisionof water, electricity, infrastructure, schools, etc., through its corporate social responsibility initiatives.

Hence RE projects such as this not only help in generating clean energy but also provide socio-economic benefits to society.

Biogas Plant Manufacturer, Kolar, Karnataka

SKG Sanghaa biogas plant manufacturer and a non-profit organization, in Kolar district of Karnataka, fabricates and installs hybrid vermicompost biodigesters/ biogas plants in rural Karnataka and in other states of India to provide clean cooking gas generated through biogas and to enable rural households to earn additional income by making saleable fertilizer from biogas residue and other unmanaged agricultural and domestic organic wastes.

SKG Sangha has built and supplied over 80,000 biogas plants in rural areas of India. The cost of a typical 2 cubic metre biogas plant comes to about INR 18,000 and overhead costs are about INR 2,000. Constructing the vermiculture system adds about another INR 12,000 to the total cost.

Biogas plant installation reduces the drudgery of women and children in collecting woods for cooking and saves time while mitigating indoor air pollution. It also creates opportunities for the rural population to generate income and reduces the usage of chemical fertilizers and their impact.

7 https://renewablewatch.in/2019/07/30/tapping-solar-2/

CURRENT PROJECTIONS FOR GREEN JOBS IN SELECTED STATES

About 86.76 GW of RE had been installed in India till 29 February 2020[8] including solar (39.65 percent), wind (43.4 percent), small hydro (5.39 percent), bio energy (11.36 percent) and others (0.2 percent). Some states have a huge potential for a particular source of RE, e.g., Karnataka and Maharashtra, which are leading in wind energy potential or Maharashtra and Odisha which show large potential for solar off-grid systems. Based on the target allocated for solar off-grid, wind energy, SHP and biogas plants in Delhi NCR, Haryana, Karnataka, Maharashtra, Odisha, Telangana and Uttarakhand by MNRE, employment potential in the year 2017 and 2021 has been estimated.

Solar Off-grid: There is a huge potential for solar off-grid systems in Maharashtra and Odisha. In 2017, around 7,835 and 4,158 jobs were created in Maharashtra and Odisha, respectively. These jobs opportunities are likely to increase by 47 percent in Maharashtra and 92 percent in Odisha by 2021. Similarly, it has been observed that there were few job opportunities created in the Haryana and Uttarakhand in 2017 as only limited off-grid systems were installed in these states. It is estimated that around 3,700 jobs will be created in these states (combined) by 2021 if the target allocated by the governments for solar off-grid system is achieved.

Wind Energy: Since they possess long coastlines, Karnataka, Maharashtra and Telangana have a huge potential for wind energy generation. As on 29 February 2020, the total installed capacity of wind energy in India was around 37.67 GW of which 9.9 GW, i.e., 26 percent of the total wind power plants, have been installed in these states. It is estimated that around 11,013 jobs (4,817 jobs in Karnataka, 6,068 jobs in Maharashtra and 128 jobs in Telangana) were created in 2017 and around 20,066 jobs will be created in 2021 in these states (combined). There is no wind energy potential, and therefore no job opportunities mapped by MNRE in Delhi NCR, Haryana, Odisha and Uttarakhand.

Assembly and distribution of solar study lamps under the 70 lakh lamp scheme of MNRE

8 https://mnre.gov.in

Figure 6: Job opportunities in solar off-grid

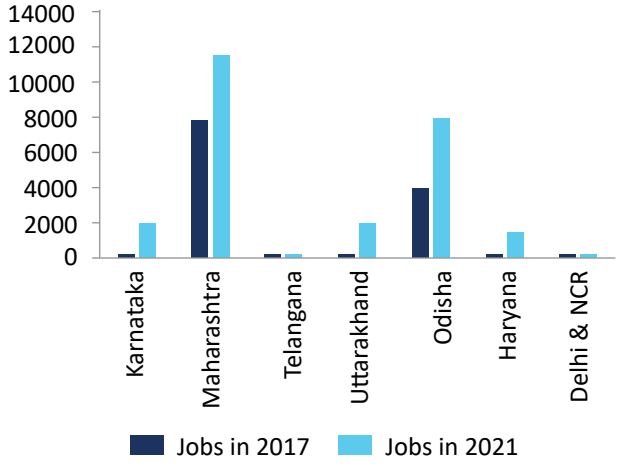
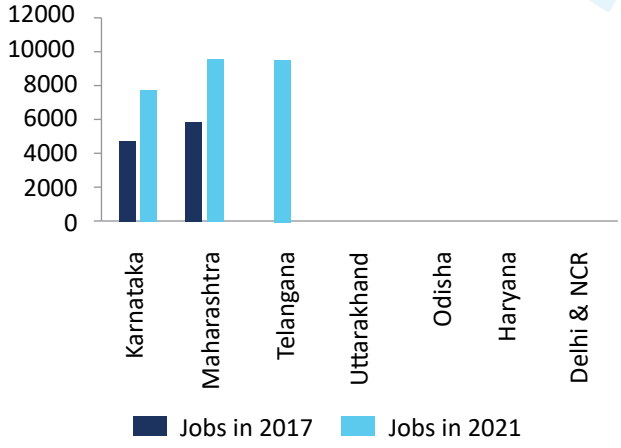


Figure 7: Job opportunities in wind energy



Biogas Plants: There is a huge potential for biogas plants in Karnataka and Maharashtra. A large number of biogas plants have been installed in these states which generated around 305 jobs in Karnataka and 523 jobs in Maharashtra in 2017. It is estimated that around 4,993 jobs in Karnataka and 6,690 jobs in Maharashtra will be generated, if the targets allocated by the governments in these states are achieved by 2021. Similarly, around 1,568 jobs will be generated in Haryana, Odisha and Uttarakhand by 2021. There is no potential of biogas plants in Delhi NCR and Telangana according to MNRE.

SHP: At present, a total SHP capacity of 4,683 MW has been installed in India of which only 2,103 MW is installed in Haryana, Karnataka, Maharashtra, Odisha, Telangana and Uttarakhand. Karnataka, Uttarakhand and Maharashtra have a huge potential to generate around 46,000 jobs in SHP by 2021. Odisha and Telangana have already achieved their allocated target; hence it is estimated that no new jobs will be generated in these states by 2021. No jobs will be created in Delhi NCR as it has not SHP potential according to MNRE.

Figure 8: Job opportunities in biogas

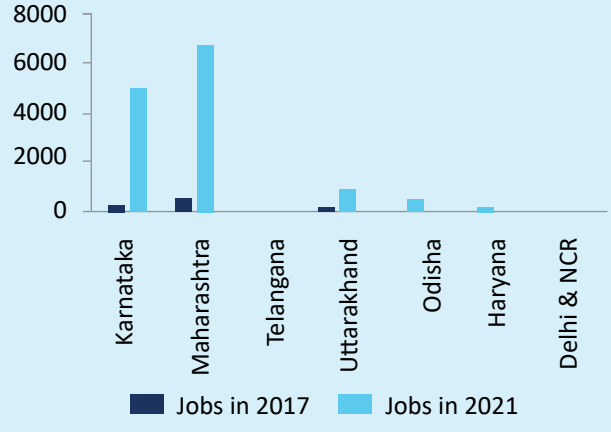
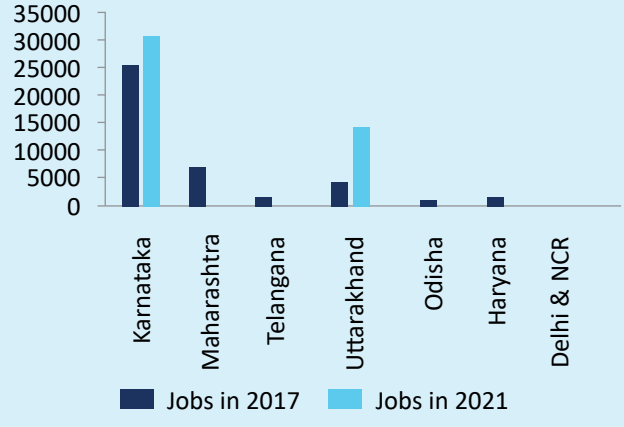
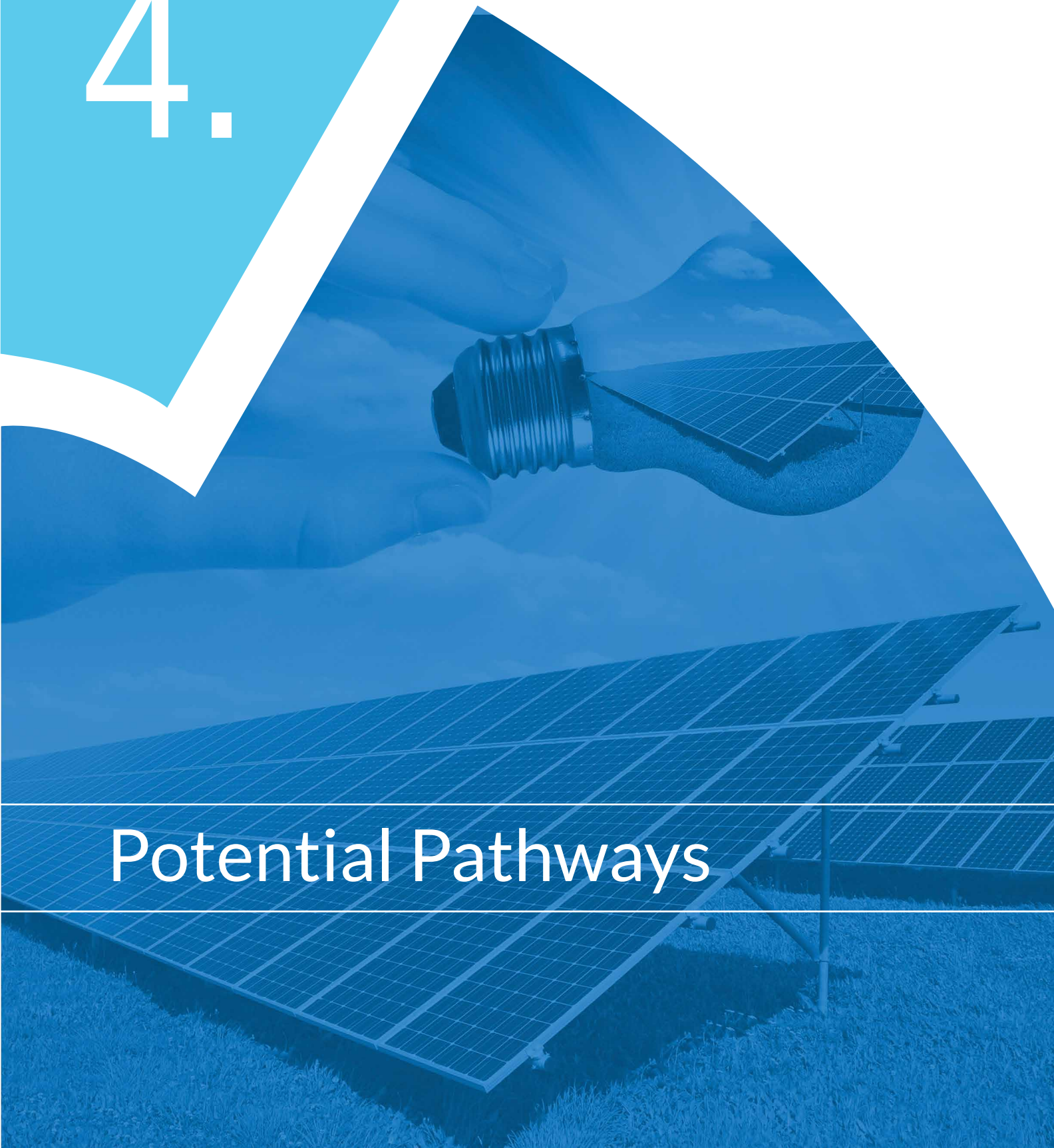


Figure 9: Job opportunities in SHP



5 https://mnre.gov.in/the-ministry/physical-progress

4.



Potential Pathways

As observed, the current share of women in the decentralized RE sector is around 23 percent and, in the wind sector, it is around 21 percent which is very low as compared to their male counterparts. This gender disparity should be reduced by the government and its nodal agencies by implementing stringent measures. As estimated, around 163,244 more person days will be needed in the RE sector by 2021-22; women can play a crucial and stabilising role here.

Based on consultations and study of the sector, various social, cultural and economic barriers for women in the RE sector in selected states of India, have been identified. Issues that need to be addressed are:

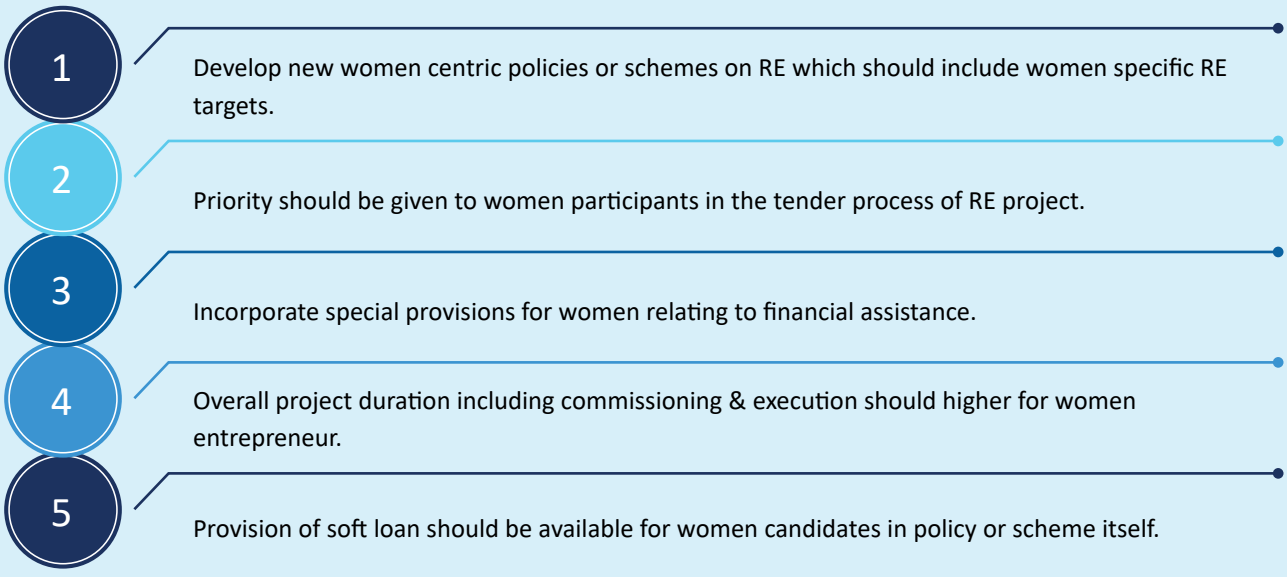
a. **Reducing the social stigma for women:** Social issues can only be tackled by spreading more awareness especially in the rural areas. Interactions should be conducted for Gram Sabha and Panchayat to keep them apprise them of job opportunities for women and related benefits.

Figure 20: Awareness training session structure

1. Identify a target village or group of villages where training on RE & gender sensitization needs to be conducted.
2. Develop content for the training in the vernacular language.
3. Identify a resource person or group from the local area for resource mobilization.
4. Conduct the session on RE & gender sensitization with relevant examples & case studies
5. Conduct impact assessment post awareness session to determine efficacy of the programme

b. **Gender sensitive policies and schemes:** There is a dearth of women-centric policies and schemes at central and state levels. To improve women's participation in the RE sector, the governments need to make specific interventions and special provisions to ensure the sound implementation of these policies at national or state levels through implementing agencies.

Figure 21: Changes required on existing policies/schemes



c. **Skill development and training:** Skill development and training play a crucial role for enhancing women's share in the RE sector. At present SCGJ is one of the nodal agencies for the development of NOS and QPs under the Skill Development Mission for the green business ecosystem in India. However, there is an opportunity available to develop more QPs and NOS with NSQF levels 1 to 4 which will touch upon the life of people mainly from marginalized community including women. At present, some QPs are available for the sub-sectors of the RE sector. Need assessment should be carried out by sector skill councils and nodal agencies to determine the demand of existing job roles and their related QPs and NOS (Table 10).

Table 10: QPs and NOS to be developed based on demand assessment

Wind Energy	Solar Off Grid	Small Hydro Power	Biogas Plant
• Construction technician-Electrical-Wind Power Plant (NSQF-4) • Construction technician-Mechanical-Wind Power Plant (NSQF-4) • Assistant Planning Engineer-Wind Power Plant (NSQF-4) • Maintenance Technician-WTG Blade/ Nacelle/WTG Tower Manufacturing (NSQF-4)	• Solar Street Light Pole fabricator (NSQF-4) • Solar Street Light Installer (NSQF-4) • Solar Off Grid Machine/CNC Operator (NSQF-4) • Solar Off Grid Manufacturing Technician -Solar lantern and Solar Home Lighting (NSQF-4) • Customer care executive (NSQF-4)	• Mechanical Technicians (NSQF-4) • Civil Technician (NSQF-4) • Electrical Technicians (NSQF-4) • Foreman (NSQF-3) • Turbine Generator Operator (NSQF-4) • Instrumentation Technician (NSQF-4) • C&I Technician (NSQF-4)	• Biogas Plant Fabricator & installer (NSQF-4) • Material Handler (NSQF-4) • Store in-charge (NSQF-4) • Biogas Plant Marketing & sales Executives (NSQF-4)

d. **Last-mile connectivity and security of women** are also very sensitive issues in rural areas. The government should ensure that all the training centres located in remote or rural area are well connected via road at least and should have enough security measures for women to feel safe. In case of no transport is available, the government or training centre should collaborate with the Gram Panchayat or local authority to identify and arrange dedicated modes of transport with a fixed fare, route and timing.

e. **Empowering women eco-entrepreneurs:** Women from rural areas or economically backward households need to be empowered by implementing various eco-entrepreneurship models. Concepts such as Solar Mamas in which women are provided with training on assembling of solar products (such as lanterns, home lighting systems) and their sales and maintenance should be promoted so that women can create livelihoods for themselves.

Entrepreneurship models currently available include:

- Distribution through proprietary agent networks (Solar Mamas, Solar Sister, refer to case studies); and
- Energy-as-service models solutions, i.e., pay-as-you-go models (refer to case studies: Bombay Bijlee, Lighting a Billion Lives).

GENDER AND RENEWABLE ENERGY: CONCLUSIONS AND WAY FORWARD

- Women should be considered a special interest group in RE value chain – their involvement will not increase the household incomes, but will also make them economically empowered;
- Women are also the main users of household energy in India. Women and women's organizations (SHGs) can be effectively used to influence or make many household decisions related to energy and promote new technologies and environmentally benign energy sources;
- In addition to direct employment in RE value chain (manufacture, operation, maintenance, marketing, etc), women Self-help groups (WSHGs) can be provided with skill building on enterprises powered by renewable energy
- Based on the Government current policies and plans there would be a huge growth in RE related industries/sectors like the energy storage (batteries) and electric vehicles in the coming years. There would be a huge potential for women in the workforce and as entrepreneurs in these related sectors/industries

Source: MNRE Annual Report

- It is imperative that RE industry (which currently is predominantly male) have adequate and appropriate policies and structures that support women employees for a conducive work environment
- Donor assisted pilot programmes on RE based solutions should specifically focus on the inclusion of women to demonstrate their effectiveness for further scaling up by the private and Government programmes

4.1 SOME SUGGESTED ACTION PLANS FOR CONSIDERATION

As estimated, around 163,244 jobs will be created in solar off-grid, wind energy, biogas plants and SHP sector by 2021-22. Most jobs will be created in the solar off-grid sector, i.e., around 73 percent of total jobs. The remaining 18 percent will be created in the wind energy sector, 4 percent in SHP and 6 percent in biogas plants by 2022. Generation of jobs is directly related to the government's initiatives/schemes and their implementation on the ground by nodal agencies. Participation of women in the RE sector in India is very low, i.e., 23 percent and 21 percent in the decentralized RE and wind energy sectors, respectively. Based on secondary research and interaction with sector experts and other stakeholders, it is observed that women's share in the RE sector in the selected states is very limited and accounts for less than 10 percent of the total jobs available at present. To improve the women's share in the RE sector, eco-entrepreneurship models need to be encouraged. A pay-as-you-go eco-entrepreneurship model based on the Bombay Bijlee initiative has been showcased here. It is suggested that the model may first be piloted in Maharashtra and Odisha and later in remaining states.

ECO-ENTREPRENEURSHIP BUSINESS STRATEGY PLAN

Objective

This social enterprise is supposed to help mainly rural households where access to energy is a challenge. It is aimed at helping realize their dreams by providing customized and energy-efficient energy products on easy payment terms while providing systematic after-sales service.

There are more than 100 million households in rural India that get intermittent power supply and have a national average of monthly income of INR 8,059 as per NABARD's All India Rural Financial Inclusion Survey 2016-17[10] which makes it difficult for them to buy energy-efficient solutions/home appliances such as television sets, etc. Moreover, they are also hesitant to buy these products due to lack of a reliable after-sales service mechanism.

The proposed plan offers a solution based on a pay-as-you-go model and households can use this platform to buy essential energy access devices and appliances and enjoy after-sales services.

Key to Success

- Excellent product and service that will build and maintain customer loyalty;
- A business location that will assure high visibility and flow of customers;
- Self-motivated and self-driven; and
- Commitment to continuous improvement and total quality services.

Start-up Cost and Funding

Based on a conservative estimation, the total start-up cost will be INR 307,183 and the working capital will be INR 425,000.

The interested entrepreneur needs to provide the bulk of start-up financing, i.e., INR 225,000. Out of this, INR 125,000 will be provided by the entrepreneur (free from any interest) and the remaining INR 100,000 will be taken as loan from the bank under the Pradhan Mantri MUDRA Yojana at a 12 percent interest for a period of seven years. The loan could be repaid in equal monthly instalments over a seven-year period.

Approximately INR 200,000 additional funding will be needed to match the working capital for which an investor could be offered a 47.05 percent stake. Funds provided by the investor will be used to buy products, and to cover part of the start-up expenses.

Cash-flow analysis demonstrates the company's ability to repay the loan and meet the interest payment obligations, while maintaining adequate liquidity and generating positive cash flow and sufficient cash reserves for unforeseen future events.

10 https://www.nabard.org/auth/writereaddata/tender/1608180417NABARD-Repo-16_Web_P.pdf

For conservative purposes, the annual interest rate has been estimated at 12 percent. The actual interest rate and borrowing terms will be negotiated with the participating bank.

	Item	FY2021
CAPEX		
1	Long-term assets	30,000
2	Legal	10,000
3	Product cost @ INR 10,000 per product	200,000
	Total	**240,000**
OPEX		
1	Office supplies	36.000
2	Interest/loan repayment @ 12% interest	21,183
3	Salary	0
4	Other	10,000
	Total	**67,183**
	Net total	**307,183**

Product and Services

The enterprise will provide a solar run box (Bijlee Boqx) which is basically a smart solar energy harvesting, storage and delivery device, with self-diagnostic hardware and back-end cloud software system. It can detect any fault in the system and send an automatic alert to the relevant technician (local representative) providing proactive and prompt service. It includes a 75-watt solar panel, set-top box, two LED bulbs and a television set made from refurbished e-waste of old desktop monitors.

The enterprise should provide warranty on all devices for one year except the solar panel as it has a warranty of 20 years. For the initial two years, two sales services will be provided free and afterward on actuals. This condition is subject to market risk and procurement.

The product will not only help rural or semi-urban households to realize their dreams by providing customized and energy-efficient energy products on easy payment terms as well as efficient after-sales service but also help in reducing indoor air pollution due to burning of kerosene. This initiative will also help in achieving the United Nation's Sustainable Development Goals, number 7 (affordable and clean energy) and number 9 (industry, innovation and infrastructure).

Market

At first this entrepreneurship model should be initiated in Maharashtra or Odisha because these states have huge potential for solar decentralized systems. As per census 2011, 310,7049 households in rural areas of Maharashtra still use kerosene as the prime source of lighting and around 171,886 households having no electricity. This initiative may be started in Nashik district (237,837 households use kerosene for lighting and 6,673 have no electricity) or Ahmadnagar district (199,058 households use kerosene and 10,442 have no electricity).

Similarly, in Odisha, 5,113,827 households in rural area depend on kerosene for lighting and 85,903 have no electricity. Mayurbhanj and Ganjam districts are also potential areas where this initiative may be considered. In Mayurbhanj, 431,910 households and in Ganjam 312,092 households depend on the kerosene for lighting and collectively around 12,808 household have no electricity.

Strategy and Planning

The proposed initiative should be undertaken for at least seven years of which four years should be treated as the core period (in which target will be set) and the remaining three years as the cooling period (i.e., with no target). A self-motivated and self-reliant young professional needs to be identified who will be interested in investing in the initiative and taking it forward. The individual should have a residential house or flat with at least one extra room (which may be used as an office). The selected professional shall carry out the demand assessment of the proposed product and outline a list of potential customers across the region.

SWOT ANALYSIS

The SWOT analysis provides an excellent opportunity to examine and evaluate the internal strengths and weaknesses of the proposed enterprise. It also allows us to focus on external opportunities presented by the business environment as well as potential threats.

STRENGTHS

The proposed initiative has a valuable inventory of strengths that would help it to be successful:

- Location;
- Excellent quality of equipment;
- New and unique initiative for decentralized energy access; and
- Clear vision of the market needs.

WEAKNESSES

Strengths are valuable, but it is useful to realize the weaknesses:

- Cost factor associated with state-of-the-art equipment and technology;
- Start-up challenges; and
- Limited operating capacity during peak sales periods.

OPPORTUNITIES

Enterprise strengths and awareness of weaknesses will help it capitalize on emerging opportunities. These opportunities include but are not limited to:

- Fast growing population and demand for energy access;
- No other specialized decentralized energy service providers in the chosen location; and
- Tie-ups with micro-finance institutions.

THREATS

Threats the enterprise should be aware of include:

- Slow recovery process of the economy from the current COVID crisis;
- Changes in the business environment that might reduce sales;
- Higher taxes in the future; and
- Tight credit times, higher interest rate, and higher inflation rate than predicted.

SALES STRATEGY

The proposed initiative will have a duration of seven years and, for the initial four years, targets have been decided, i.e,. for the first year 20 bijlee boqxs has been allotted and for the second, third and fourth years 30, 70 and 100 bijlee boqxs, respectively, need to be installed.

The customer needs to pay an initial commitment fee (down payment) of INR 5,500 to start using the enterprise's services. Balance payments are to be made via a mobile phone in regular instalments of INR 340/ month for a period of four years.

PROMOTION STRATEGY

The enterprise intends to promote the product on social media including Facebook and will flag and paste flex banners at crucial points (at least five) of the region including bus stands or primary health centres. It will mainly depend on word-of-mouth publicity in the rural and semi-urban areas.

Financials

Expenditure

CAPEX and OPEX have been considered here. Under CAPEX, expenditure that will be incurred, i.e., for buying long-term assets (including computer system), cost of legal document preparation and cost of product (@ INR 10,000 per product) has been considered. For the first year, the CAPEX is around INR 240,000 (for 20 products as per target) and similarly for the second year INR 300,000, for the third year INR700,000 and for the fourth year INR1,000,000, respectively.

Under OPEX, costs of office supplies, loan repayment (EMI cost), salary component (which will be effective from the third year) and miscellaneous requirements such as banners, petrol, etc., have been considered. For the first year, OPEX totals around INR 67,183, for the second INR 67,183, for the third INR 155,183, and for the fourth 161,183. For the fifth, sixth and seventh years, the OPEX will be INR11,183 each year. From the second year onwards, products will be procured on credits based on negotiation with the vendor.

The total net expenditure for the first year would be 307,183 and for the second year INR 367,183, and so on. The salary component has been considered under OPEX, from the third year; it is expected someone would be hired locally at a monthly salary of INR 6,500 for the year with a 7.5 percent raise from the next year onwards till the fifth year of business; the salary will then remain at INR 7,500 per month for next two years.

Revenue

Customers will be required to pay an initial amount of INR 5,500 and INR 340 per month over the next four years. Considering that all products are sold, INR 110,000 will be generated as down-payment and INR 81,600 as the first year's instalments for all 20 products.

Hence the total collection in the first year will be INR 191,600; similarly, for the second, third, fourth, fifth, sixth and seventh years it will be INR 369,000, INR 874,600, INR 1,447,600, INR 816,000, INR 693,600 and INR 408,000, respectively.

Hence based on a conservative estimation, the total net revenue after seven years will be INR 1,776,119 (Table 11).

Investor Consideration

For investing INR 200,000 as the company's capital, the new investor would receive a 47.05 percent share. As the investor will hold ownership between 20 and 50 percent in the enterprise, he or she will exercise significant influence over the company's policies. According to our conservative estimates, cumulative dividend that would be paid to the new investor, based on 47.05 percent of ownership, over the next seven years, would be around INR 800,000.

Any investor in a start-up, no matter how well it performs on paper, ultimately needs an exit vehicle. The enterprise would be committed to providing the best alternative to protect the investor's interest while maintaining the potential growth of the company and liquidity and profitability of future operations.

There are several options (exit strategies) that could be discussed while considering alternative methods for the investor to turn illiquid securities into readily tradable securities or cash. These discussions can be taken up during negotiations with investor.

Potential Investor

The potential investors may be identified through secondary research or through one's own network. Alternatively, funds can also be raised by using fund-raising/crowd-funding platforms available in India such as:

- MesoTown
- Wishberry
- Indiegogo
- Fundable
- ImpactGuru
- Kickstarter
- Ketto
- Catapooolt
- FuelADream
- Dream Wallets

Investors can be approached directly with the business plan. Some potential and active angel investors include:

- Sequoin Capital
- Redcliff Capital
- Everest Flavours
- People Group
- Facebook

Other agencies that can be considered for submitting the business plan to are:

- IREDA
- MNRE
- MEDA OREDA
- National Association of Software and Service Companies Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH World Bank

Financial Mode (Indicative)								
	Item	**FY2021**	**FY2022**	**FY2023**	**FY2024**	**FY2025**	**FY2026**	**FY2027**
S. NO	**CAPEX**							
1	Long Term Assets	30000						
2	Legal	10000						
3	Product Cost	200000	300000	700000	1000000			
	Total	**240000**	**300000**	**700000**	**1000000**	**0**	**0**	**0**
S. NO	**OPEX**							
1	Official Supplies	36000	36000	36000	36000	0	0	0
2	Interest/Loan Repayment	21183	21183	21183	21183	21183	21183	21183
3	Salary	0	0	78000	84000	90000	90000	90000
	Other	10000	10000	20000	20000	0	0	0
	Total	**67183**	**67183**	**155183**	**161183**	**111183**	**111183**	**111183**
	Nat total	**307183**	**367183**	**855183**	**1161183**	**111183**	**111183**	**111183**
S. NO	**Revenue**							
1	1st Down Payment	110000	165000	385000	550000	0	0	0
2	1st Installment	6800	17000	40800	74800	68000	57800	34000
3	2nd Installment	6800	17000	40800	74800	68000	57800	34000
4	3rd Installment	6800	17000	40800	74800	68000	57800	34000
5	4th Installment	6800	17000	40800	74800	68000	57800	34000
6	5th Installment	6800	17000	40800	74800	68000	57800	34000
7	6th Installment	6800	17000	40800	74800	68000	57800	34000
8	7th Installment	6800	17000	40800	74800	68000	57800	34000
9	8th Installment	6800	17000	40800	74800	68000	57800	34000
10	9th Installment	6800	17000	40800	74800	68000	57800	34000
11	10th Installment	6800	17000	40800	74800	68000	57800	34000
12	11th Installment	6800	17000	40800	74800	68000	57800	34000
13	12th Installment	6800	17000	40800	74800	68000	57800	34000
	Total	**191600**	**369000**	**874600**	**1447600**	**816000**	**693600**	**408000**
	Net Revenue	**-115583**	**1817**	**19417**	**286417**	**704817**	**582417**	**296817**
	Total Net Revenue after 7 Years	**1776119**						

5.

Annexures

ANNEXURE 1: QUESTIONNAIRE FOR STAKEHOLDER INTERACTION

Questionnaire

Scoping study and policy imperatives on green jobs and eco-entrepreneurship opportunities for women in select states in India.

Section 1 General questions

1. Name of the respondent & organization _____

2. Sector of Operation

Carbon Sinks- Forestry ☐	Fisheries ☐	Green Construction ☐
Green Transportation ☐	Renewable Energy ☐	Water Management ☐
Other ☐		

3. Do you have operations/ offices in any of the following states/UTs?

Delhi NCR ☐	Haryana ☐	Karnataka ☐	Maharashtra ☐
Orissa ☐	Telangana ☐	Uttarakhand ☐	Other ☐

4. The study is being done for skilled, semi-skilled and unskilled categories. What do you think is the tentative proportion of skill requirement at each stage of the value chain for Renewable Energy (Solar, Wind, Small Hydro, Biomass)?

Value Chain/ Skill Type	Manufacturing	Construction and Commissioning	Operation & Maintenance	Others
Skilled				
Semi-skilled				
Unskilled				

Section 2 Women in the Sector/ Organization

1. What according to you is the level of women's participation in Renewable Energy sector as compared to that of men?
   (1) Less ☐ (2) More ☐ (3) Equal ☐

2. What services/benefits available for women in your organization? (Ex. Maternity benefits, flexible working hours, transport, accommodation)

Maternity Benefits ☐	Flexible Working Hours ☐	Transport Facility ☐
Accommodation ☐	Others ☐	None ☐

11 https://pib.gov.in/PressReleasePage.aspx?PRID=1615611

3. What do you think about women's participation in Renewable Energy (Solar, Wind, Small Hydro, Biomass) sector in the following states?

States/UTs	Less than 10%	11-30%	31-60%	More than 60%
Delhi & NCR				
Maharashtra				
Haryana				
Karnataka				
Odisha				
Telangana				
Uttarakhand				

Section 3 Training

1. Do you impart trainings to your current employees/ potential entrants in the workforce?

Yes ☐ No ☐ NA ☐

Section 4 Opportunities

1. What do you think, about the potential job roles where women participation can be increased in the in Renewable Energy (Solar, Wind, Small Hydro, Biomass) sector?

_____

_____

Section 5 Challenges

1. Barriers to women's participation in deploying in Renewable Energy sector state/UT-wise? Please rank these on a scale of 1 to 5, with 1 being the most challenging and 5 being least.

Barrier / States/UTs	Cultural & Social Norms	lack of Gender Sensitive Policies	Lack of Gender Sensitive training Opportunities	In equity in ownership in assets	Lack of Mentorship Opportunities	Lack of skills	Others
Delhi & NCR							
Maharashtra							
Haryana							
Karnataka							
Odisha							
Telangana							
Uttarakhand							

Section 6 Future

1 What are the expected changes in technology/interventions/policies that could affect this sector?

_____

_____

2. What are your recommendations/suggestions for improvement in women's participation in Renewable Energy (Solar, Wind, Small Hydro, Biomass) sector?

_____

_____

3. Please highlight the existing/potential scenario of eco-entrepreneurship among women in Renewable Energy (Solar, Wind, Small Hydro, Biomass) sector.

_____

_____

ANNEXURE 2: STAKEHOLDERS/EXPERTS CONSULTED

Peer Reviewers to the sectoral studies

Sectoral Chapters	Peer Reviewer
Renewable Energy	Dr. Srinivas Shroff Nagesha Rao, *Chief Executive Officer, REC Foundation*
Green Construction	Suneel Padale, *Director Programs, CARE India*
Green Transport	Hitesh Vaidya, *Director, NIUA*
Water Management	Moho Chaturvedi, *Consultant Water Resources and Environment*
Carbon Sinks- Forests	Vishaish Uppal, *WWF India*
Carbon Sinks- Marine Fisheries	Ramya Rajagopalan, *Independent Researcher*

1. **Dr. Parveen Dhamija**
   Advisor, Skill Council for Green Jobs
   Ex. Scientist G, Ministry of New & Renewable Energy, New Delhi

2. **Dr. Preeti Kaur**
   Scientist D, Ministry of New & Renewable Energy, New Delhi

3. **Er. B. K Swain**
   Joint Director, Odisha Renewable Energy Development Agency, Bhubaneswar

4. **Dr. Nikhil P.G**
   External Expert- Renewable Energy, Gurgaon

5. **Abhinav Jain**
   Advisor, Indo German Energy Programme,
   Deutsche Gesellschaft für Internationale
   Zusammenarbeit (GIZ) GmbH, New Delhi

6. **Ganesh Rai**
   Senior Renewable Energy Expert, Artech Solar, Gurgaon

7. **Sourav Dey**
   Programme Manager, Renewable Energy Technology, RECW, New Delhi

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Due to COVID 19 pandemic and the travel restrictions, the report is purely based on secondary sources and information obtained by KPMG from organisations, experts and through stakeholder interactions. This report sets forth information based on the completeness and accuracy of the facts stated and any assumptions. The comments in the report are not intended, nor should they be interpreted to be legal advice or opinion.

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