



FILLING THE SKILL GAP IN INDIA'S CLEAN ENERGY MARKET: SOLAR ENERGY FOCUS

As India faces rising fuel demand, threats to energy security, and the impacts of climate change, renewable energy offers a critical solution. Innovative clean energy solutions, including large solar parks and rooftop solar panels in dense urban areas, can help solve these daunting challenges, while increasing energy access, creating jobs, and reducing toxic pollution. By the Government of India's own estimates, a \$100 billion investment and a strong policy framework are needed to stimulate immense growth of solar and wind energy markets.

To create the policy support needed to realize these ambitious clean energy goals, the Government of India has introduced a suite of international and domestic initiatives. Most recently, at the United Nations' Conference of Parties in December 2015, Prime Minister Narendra Modi announced India would lead an International Solar Alliance of more than 120 solar rich countries to facilitate widespread deployment of solar power and development of the supporting ecosystem including knowledge exchange on manufacturing and skills.ⁱ Given the population growth rate of the country, India needs to create 10 million new jobs every year.ⁱⁱ The employment

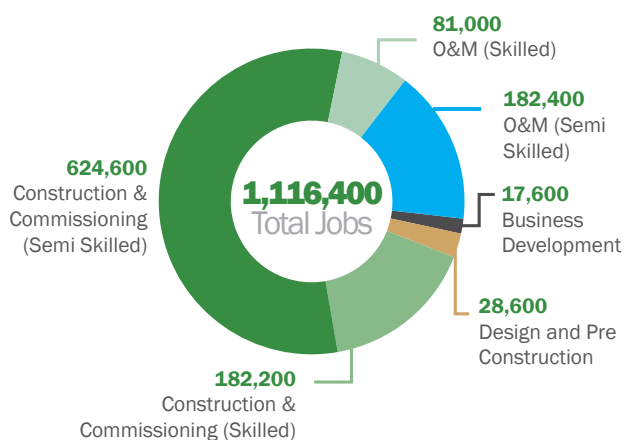
generation potential of a robust domestic renewable energy market is immense. Original analysis by the Council on Energy, Environment and Water (CEEW) and the Natural Resources Defense Council (NRDC) in 2015 shows that solar and wind renewable energy projects have created **nearly 79,000 full time equivalent (FTE) jobs** as of November 2015.ⁱⁱⁱ The analysis also shows that as many as **1 million FTE jobs** could be created if India achieves its target of 100 GW of installed solar energy by 2022. Similarly, approximately **183,500 FTE jobs** would be generated if India were to reach the target of 60 GW of wind energy capacity by 2022.



30 kWp Boond-Mynergy Solar Rooftop Installation at Jesus and Mary College in New Delhi, India

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Number and Type of Jobs Created in India's Solar Sector by 2022



NATURAL RESOURCES DEFENSE COUNCIL



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Prime Minister Narendra Modi and French President François Hollande, along with world leaders, launched an International Solar Alliance (ISA) on the inaugural day of the U.N. Climate Summit in Paris in December 2015. The solar alliance brings together key countries and invites over 120 solar-rich countries between the Tropics of Cancer and Capricorn to address the lack of systematic information about the on-ground requirements, scarce capacity building and training of users of solar technologies, as well as a shortage of affordable financing opportunities. The ISA will serve as a platform to collaborate and address these shared needs to propel clean energy by mobilizing cost-effective technology and financing. India's National Institute of Solar Energy (NISE) will lead the coordination of the solar alliance initiative for the first five years.

The Government of India is also giving priority to job creation, most recently directing ministries to explicitly include the employment generation potential of all new proposals presented to the Cabinet.^{iv} Recognizing the vast number of jobs that a scaled up clean energy market would create, domestic initiatives that support manufacturing, job creation and skill development have been introduced. For example, solar manufacturing capacity is receiving a needed boost under the “Make in India” initiative. An existing gap and ongoing challenge within India's workforce is the lack of employees trained with the skills needed to construct and operate solar plants. This skill gap is increasingly recognized as a barrier to realizing the country's renewable energy targets.

Given the large employment generation potential of solar and wind in India, a significant proportion of the Indian workforce would need to be trained with the necessary skills to support the market. This report serves to expand upon existing clean jobs assessments, to take stock of the current scenario of solar PV and wind skills and training programs in India, and address the question of matching available jobs with availability of skills – both for project installation and manufacturing. Looking ahead, given India is on the path of achieving 160 GW cumulative of solar and wind installed capacity, this report provides insights on the steps that the Government of India and industry could take to facilitate improved training programs, which could create the requisite skilled workforce for these sectors to thrive.

GROWING NEED FOR SKILLED SOLAR WORKERS

A multitude of skilled workers across the solar project value chain are needed to achieve India's targeted 100 GW of solar by 2022. New CEEW and NRDC analysis of the jobs created in the solar PV sector along with the related skills required in every phase of a solar project, estimates that India would need nearly **210,800 skilled plant design and site engineers and approximately 624,600 semi- and low-skilled technicians for construction**, most of whom would be needed to achieve the targeted 40 GW rooftop solar capacity addition. As many as **81,000 highly skilled workers would be needed by 2022 to carry out annual and ongoing**

performance data monitoring of solar projects totaling 100 GW. An additional **182,400 workers would be needed by 2022 to carry out low-skill operation and maintenance functions for the numerous solar rooftop and utility scale projects**. While most survey respondents agreed on the essential role of site engineers and project managers, several respondents also highlighted the key role played by unskilled or semi-skilled personnel, such as installers, security personnel, administrative support staff, construction labor and drivers.

The availability of appropriately skilled manpower has been identified as one of the most prominent challenges in hiring required personnel. Other key challenges include a shortage of platforms to advertise for solar jobs, low salaries and the proximity to training institutes. Solar companies find a lack of proximity to training institutes to be the most difficult challenge to overcome in hiring trained personnel and are currently relying primarily on in-house training to meet their needs. The poor quality of existing training programs was identified by respondents as the biggest challenge facing existing training programs for solar employers in India. High quality, accessible certification programs that reduce the need for on-site internal trainings of new workers is a big opportunity.

To give priority to the provision of training programs, determining factors for the location of training institutes should consider higher irradiation regions, regions with aggressive solar targets or significant commissioned capacity, and favorable policy environments such as net metering. Furthermore, policymakers should consider establishing at least one prominent solar training institute in each of the regions that have high solar potential and aggressive targets. Opportunities for skill transferability also exist between traditional employment sectors and the renewable energy industry. Workers from industries with considerable skill overlap, including electrical and construction, can build upon their skill sets with a renewable energy focus. The solar industry has identified the need for training programs in operations and maintenance of solar plants as the biggest current priority. Given that the key skill needed for O&M is performance data monitoring, which



Kiran Energy Utility Scale Plant in Phalodi, Rajasthan

NRDC and CEEW have previously identified as a necessity to attract more financing to the solar sector. Banks have a lower comfort level with solar investments because of the lack of information publicly available, and need more data and statistics on project development, deployment, and performance. Currently, a lack of skilled personnel corresponds to the lack of a track record of appropriate performance data from solar. Given that financiers base their lending decisions on the availability of such critical data, availability of trained and skilled personnel to record reliable, high quality performance data can encourage financiers to invest on a broader scale in the solar industry.

Make in India

Building off India's National Manufacturing Policy, the Government of India created 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 labor force. The goal is to make India the top destination globally for foreign direct investment. The campaign focuses on 25 industries in India, including the renewable energy sector.

National Skill Training Programs

The Ministry of Skill Development and Entrepreneurship (MSDE) has made an effort to create 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 shows MSDE may be readying itself to provide more concentrated support for the renewable energy labor force. The Ministry of New and Renewable Energy (MNRE) has also been working to integrate renewable energy curricula into numerous formal and non-formal training institutions in India. MNRE has integrated renewable energy coursework into India's numerous Industrial Training Institutes (ITIs), which could help broaden the accessibility of renewable energy 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 programs.

KEY FINDINGS AND RECOMMENDATIONS

CEEW and NRDC developed the following findings and recommendations based on a survey of 40 solar companies in India during 2015, as well as stakeholder consultations and roundtable discussions with industry and government representatives such as the Skill Council for Green Jobs (SCGJ), the National Solar Energy Federation of India (NSEFI) and the National Institute of Solar Energy (NISE). The recommendations aim to strengthen supportive policies and programs to train the staggering number of employees needed to realize India's solar potential.

FINDING: Unavailability of appropriately skilled manpower – especially for construction and commissioning – has been identified as one of the most prominent challenges in hiring required personnel. The Skill Council for Green Jobs has also identified this existing gap for skilled construction and commissioning labor and are developing plans to address the gap.

RECOMMENDATION: Robust skill training programs focused on clean energy projects should be expanded across the country. Policymakers should consider establishing at least one prominent solar training institute in each region projected to be a hub for major solar activity (e.g., Gujarat, Rajasthan, Karnataka).

FINDING: Long distances from training institutes (measured by the variable “proximity to training institute”) was identified as a barrier to finding skilled personnel both in the survey and in the roundtables held with solar companies. Geographical gaps in the locations of training institutes makes local skill training challenging.

RECOMMENDATION: The locations of training institutes should be mapped to identify the geographical gaps, and new and expanding training programs should prioritize geographical diversity. Additionally, mobile training courses in which the trainers move from location to location should be considered to bridge this gap.

FINDING: Some of the skills most challenging to find are not the most technical skills, rather they are basic construction and commissioning skills.

RECOMMENDATION: In order for new or expanded training programs to be most responsive to industry needs, they should target the skills most difficult to find and hire for, even if those skills are not the most difficult or technical skills to acquire (which is a common focus for technical training programs).

FINDING: Most respondents fill the existing gap of hiring skilled personnel by providing in-house training programs. For example, developers, EPC companies and manufacturers impart special in-house training for PV plant design engineering and PV construction management.

RECOMMENDATION: Explore how the IT or building construction sector approaches this common issue. If there is a need for training standardization, explore whether the National Occupational Standards (NOSs) and Qualification Packs (QPs) could be expanded for new clean energy training programs.

FINDING: The biggest challenges facing existing solar training programs in India are that the quality of current programs is poor and thus not match industry needs, according to respondents.

RECOMMENDATION: There is a clear need for improved training and certification programs which are accessible to workers of varying backgrounds and skillsets across states. For example, renewable energy training clusters could be located near ongoing solar energy projects. MNRE's newly formed Skill Council for Green Jobs should consider these gaps when formulating future training programs to scale solar and wind energy projects.

FINDING: India's solar industry currently lacks adequately skilled personnel, and may benefit from employing workers from conventional labor markets with relevant skill sets.

RECOMMENDATION: Solar and wind stakeholders should seek employees in existing traditional fields to provide overlapping skills. Training institutes could offer targeted courses or corporate training programs to fill in gaps to enable this skill transfer. With the large number of skilled employers needed in the clean energy field, this approach could help fill the gap and transform the market quickly.

FINDING: Intergovernmental coordination through the International Solar Alliance (ISA) framework would be helpful and could be leveraged to address domestic challenges such as the skill gap in India's solar workforce.

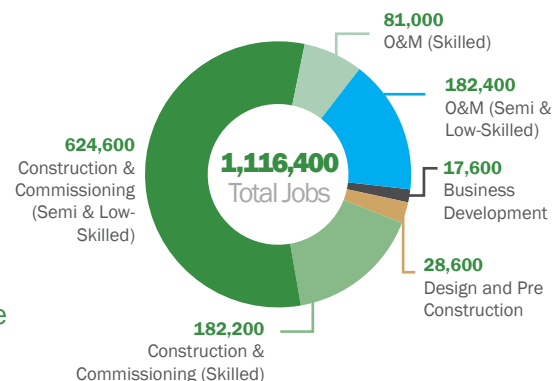
RECOMMENDATION: India's National Institute of Solar Energy (NISE), through the ISA, could help set up training programs using international best practices. Utilising this international common platform and technology like the Knowledge e-Portal could help achieve consistency in training programs for the solar workforce.

SECTION 2

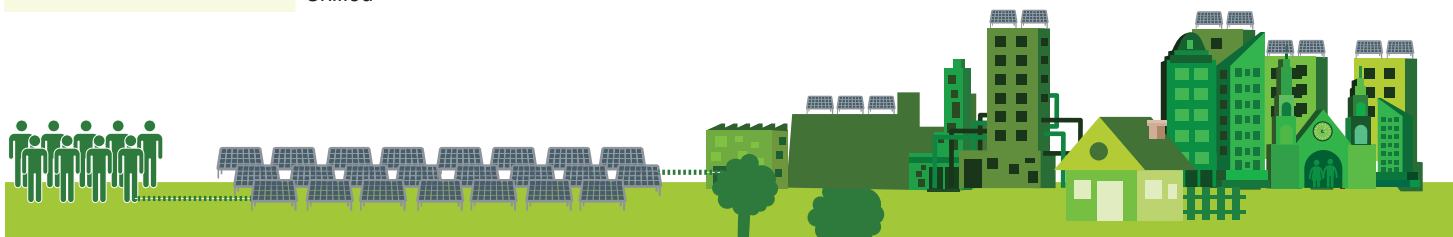
SCALE OF SKILLED WORKERS NEEDED TO ACHIEVE SOLAR TARGETS

Analyzing the jobs created in the solar PV sector along with the related skills required in every phase of a solar project to reach the targeted 100 GW of solar by 2022 suggests that India would need nearly 210,800 skilled plant design and site engineers and approximately 624,600 semi- and low-skilled technicians for construction, most of whom would be needed to achieve the targeted 40 GW rooftop solar capacity addition. As many as 81,000 highly skilled workers would be needed annually by 2022 to carry out annual and ongoing performance data monitoring of solar projects totaling 100 GW. An additional 182,400 workers would be needed annually by 2022 to carry out low-skill operation and maintenance functions for the multitude of solar rooftop and utility scale projects.

Number and Type of Jobs Created in India's Solar Sector by 2022



Function	Educational Skill and Qualification Level	Key skills	Number of Trained Personnel to Achieve 40 GW of Rooftop Solar (Projected by 2022)	Number of Trained Personnel to Achieve 60 GW of Utility Scale Solar (including solar parks) (Projected by 2022)	Training and/or Degrees Required
Manufacturing*	Highly Skilled	Research and product development	-	-	Photovoltaics engineering
Business Development	Highly Skilled	Tracking the market, Drafting bids, Land selection, Project Finance	15,200	2,400	Masters degree or diploma in business administration
Design & Pre Construction	Highly Skilled	Plant design engineering	18,400	10,200	Engineering degree in civil, mechanical or electrical engineering
Construction & Commissioning	Highly Skilled	Site engineering	154,000	28,200	Engineering degree in civil, mechanical or electrical engineering
	Semi and Low Skilled	Electricals training and PV installing	338,400	286,200	-
Operation & Maintenance	Highly Skilled	Performance data monitoring	48,000	33,000	Engineering in electrical systems
	Semi and Low Skilled	-	92,400	90,000	-



* Manufacturing jobs were not quantified in the original analysis on which the job creation estimates (above) are based.* We note that there is a high potential for employment generation in the manufacturing sector as well, which may be assessed in a future clean energy survey.

Survey Methodology

CEEW and NRDC developed a survey questionnaire to assess the key skills required in the various phases of solar and wind projects, from manufacturing to operations and maintenance. The questionnaire aimed to capture the nature of skills required, the amount of training required per skill type and matching the skills required with the available trainings. The survey was developed through a consultative process with several industry stakeholders, and was designed to capture qualitative responses about the nature and availability of skills as well as the sources and shortfalls of the current training sources.

The survey was administered by Dexter Consultancy – a market research firm - through telephonic interviews. The analysis is based on the responses to the survey questionnaires completed by 40 solar companies, as well as stakeholder consultations and roundtable discussions with industry and government representatives such as the Skills Council for Green Jobs (SCGJ), the National Solar Energy Federation of India (NSEFI) and the National Institute of Solar Energy (NISE). NRDC and CEEW also conducted stakeholder consultations through meetings and group roundtable discussions with key industry representatives in 2015.

In this report, CEEW and NRDC analyze the top skills required for project developers, engineering, procurement and construction (EPC) companies and solar manufacturers operating in India. The analysis also identified skills that are most difficult to find in potential employees, suggesting the urgent need for correcting the demand/supply mismatch in the skilled clean jobs market, especially as the market for solar and wind energy continues to grow rapidly.

As can be seen in the figure below, the survey responses that form the foundation of the analysis in this report, are a well balanced mix of solar PV manufacturers, EPC companies and grid connected project developers for large-scale and rooftop solar projects. The respondents varied from small organizations, with 44% of the respondents being from organizations with less than 100 employees, to very large organizations such that 6% of the respondents were from organizations with employee strength greater than 500.

The Section 2 phase-specific job creation numbers, quantifying the scale of skilled workers needed to achieve the 100 GW solar target, were arrived at based analysis by CEEW and NRDC in August 2014 and February 2015, as compared against MNRE annual targets to reach 60 GW of utility-scale solar and 40 GW of rooftop solar by

2022. The methodology for that analysis is available starting on p. 9 of CEEW NRDC report “Solar Power Jobs: Exploring the Employment Potential in India’s Grid-Connected Solar Market, August 2014, available at: <http://www.nrdc.org/international/india/files/renewable-energy-solar-jobs-report.pdf>.

The “project implementation” process consists of development, design, construction, and commissioning. Jobs created as part of project implementation are one time jobs and last as long as the project is being set up i.e. before the project is online and generating power. This phase is followed by the post-commissioning operation and maintenance of the project, which lasts the duration of its life cycle. Solar project developers and EPC firms are responsible for these activities.

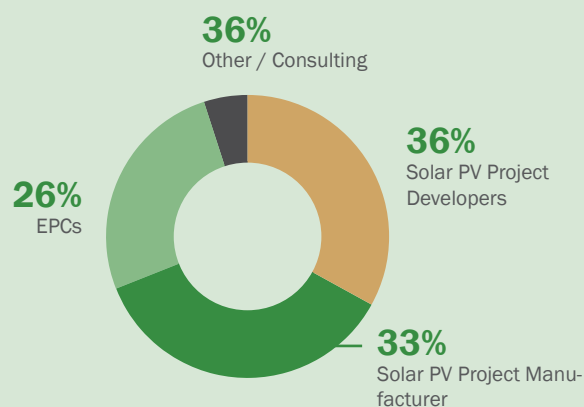
For the purpose of this report, the project execution process has been categorized into four stages: business development, design and pre-construction, construction and commissioning, and operations and maintenance (O&M). Business development includes all actions taken to develop a specific project prior to submission of a possible bid (if the project is selected through a government policy scheme), as well as ongoing efforts to promote business. Direct employment generated includes jobs in sales, marketing, legal, financial, and government/regulatory affairs. Design and pre-construction entails design of the project once a bid has been won. Direct employment created includes jobs for designers, planners, architects, engineers (non-installers), resource analysts and legal personnel. Construction and commissioning consists of the actual installation of the project and setting up a connection to the national power grid. Direct jobs are created for construction workers, electricians, technicians, engineers, meteorologists, and technicians working for equipment vendors (such as inverter suppliers). Both skilled and unskilled workers are required during this phase of execution. Operations and maintenance creates direct jobs for technicians, electricians, maintenance and security staff, and operations managers. Both skilled and unskilled workers are required to carry out O&M in the plant.

KEY TERM DEFINITIONS

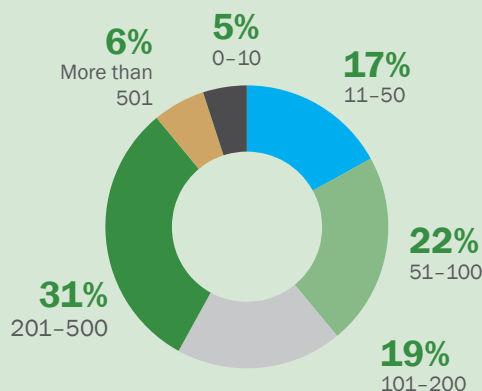
Skill Levels

- High skilled: engineering or advanced degree required
- Semi-skilled: technical qualifications or vocational skills required
- Low-skilled: no formal education required

SURVEY RESPONDENTS: SOLAR



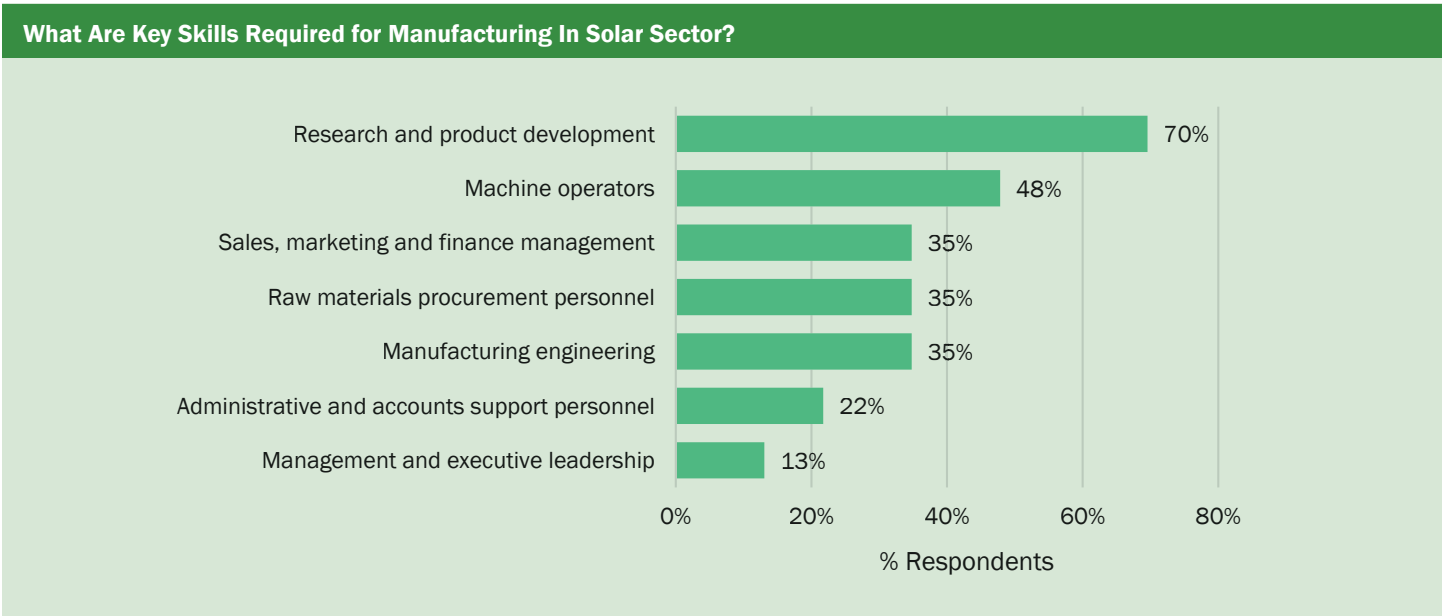
EMPLOYEE STRENGTH IN SURVEYED ORGANIZATIONS



SECTION 3

IDENTIFYING THE SKILL GAP CHALLENGES FACING THE SOLAR INDUSTRY

CEEW and NRDC calculated and collated the following data based on the solar industry’s survey responses. Solar companies identified the key skills required for each phase of solar power deployment, including manufacturing. In order to understand the skills needed for each phase of a solar project, we asked survey respondents to rate the skills that they considered essential. For manufacturing, 70 percent of the respondents have listed research and product development as a priority skillset. This would correspond to training for photovoltaics engineering or similarly advanced programs. 48 percent respondents have listed operating machinery as the second highest priority skill required for solar manufacturing which requires a technical diploma.

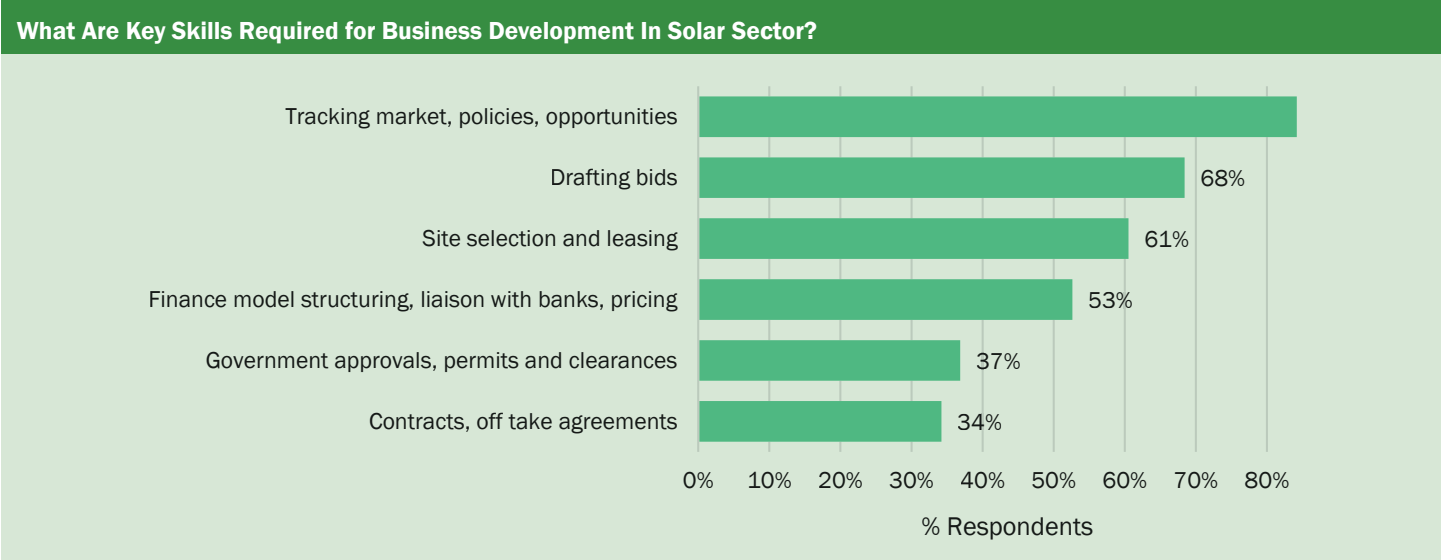


30 kWp Boond-Mynergy Solar Rooftop Installation at Jesus and Mary College in New Delhi, India

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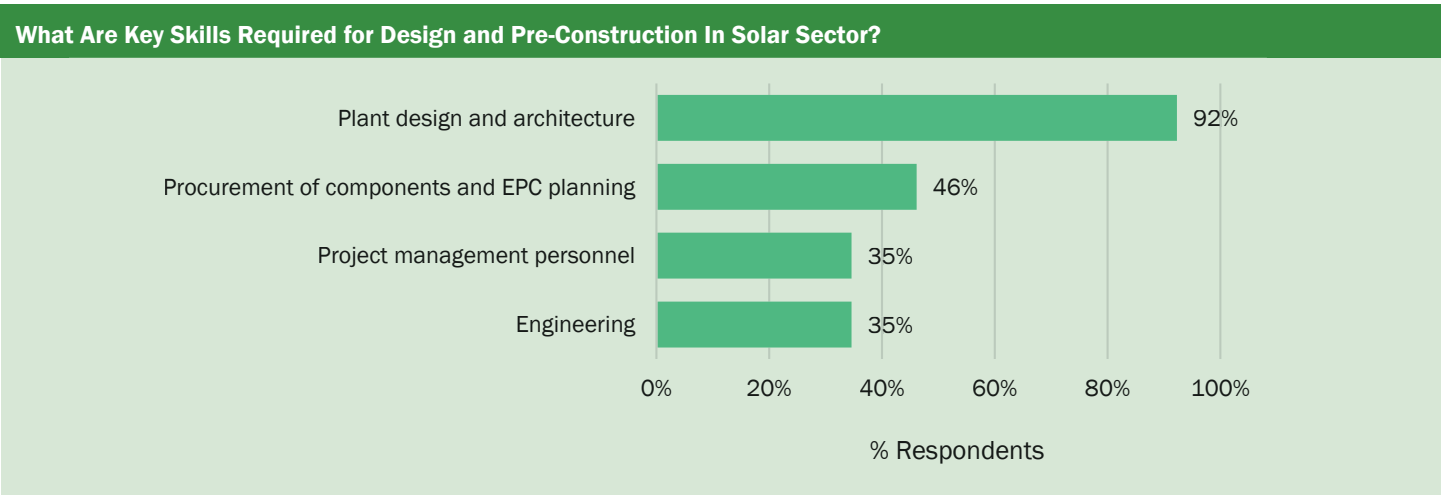
In the business development phase, 84 percent of the respondents listed tracking of market opportunities as a priority skill. 68 percent of respondents recognized the ability

to draft bids as a priority skill. Site selection and leasing was listed as the third highest priority skill for business development.



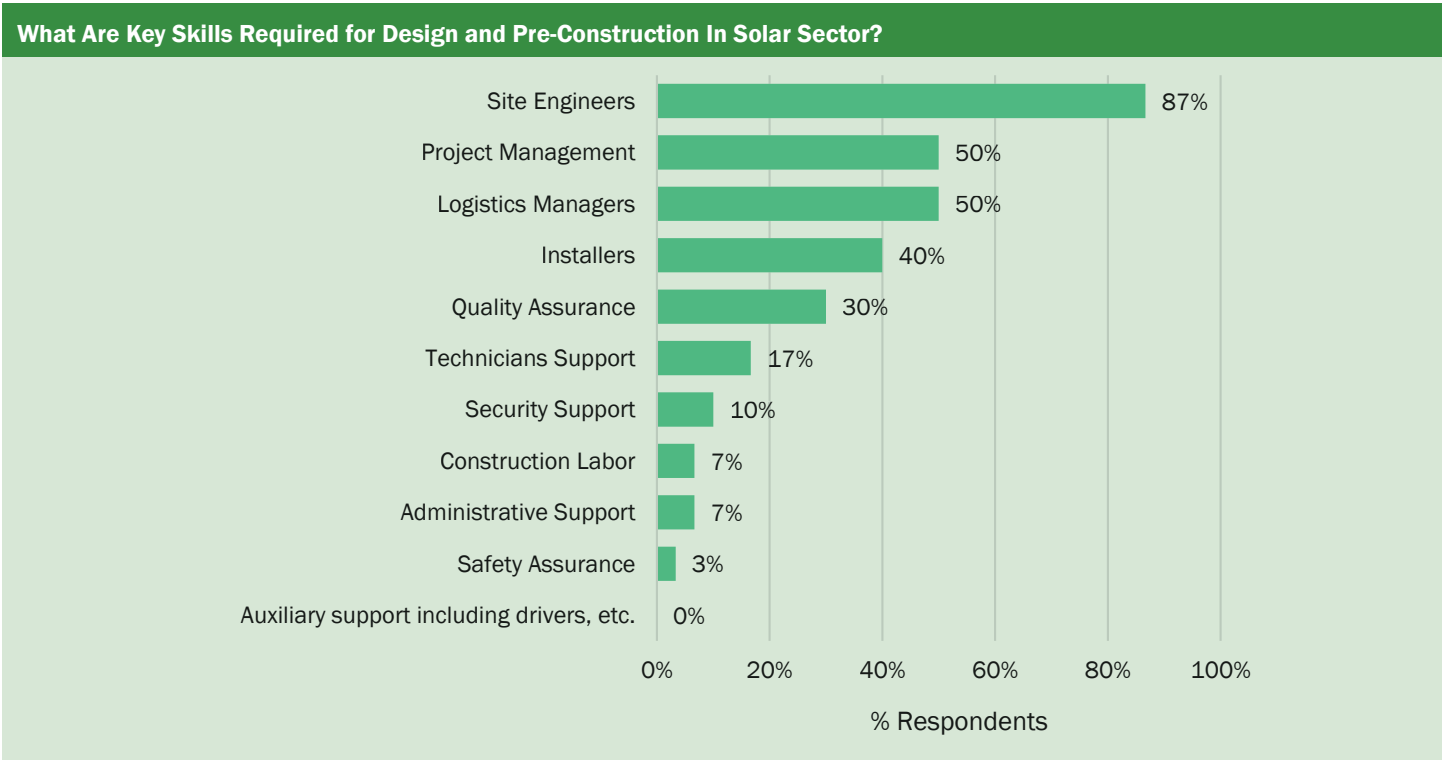
Similarly, respondents listed plant design and architecture, EPC planning and project management as the key skills needed for the design and pre-construction phase. 92 percent

of the respondents listed plant design as a top priority skill for this phase.



For the construction and commissioning phase, 87 percent of respondents listed site engineering as a top priority skill, followed by project management and logistics management as the top skills needed for this phase. While most respondents agreed on the essential role of site engineers and

project managers, several respondents also highlighted the key role played by unskilled or semi-skilled personnel, such as installers, security personnel, administrative support staff, construction labor and drivers.



In the operations and maintenance phase of a solar project, respondents unanimously selected the monitoring of performance data as the top priority skill. Additionally, respondents also identified the need for technical equipment maintenance and management for grid integration and transmission.

Despite the survey being administered to each respondent individually, there was a fair degree of consensus between respondents on the key skills required in each phase. Following table summarizes the top three priority skills for each phase, as identified by the respondents.

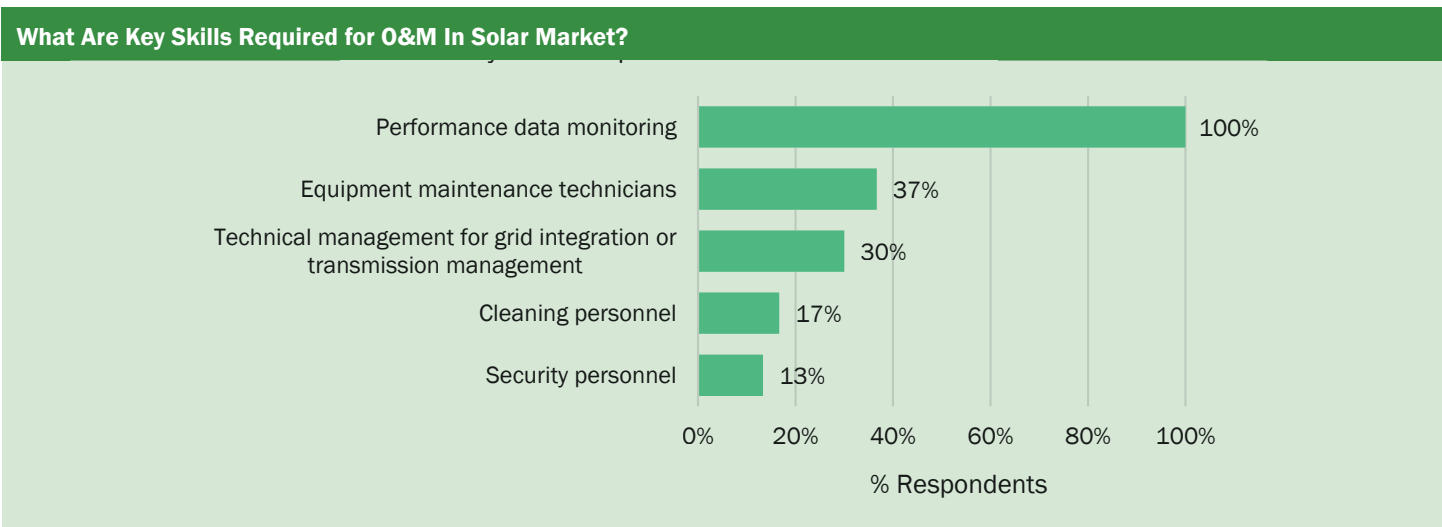


Table: Snapshot of top 3 priority skills needed for each phase

MANUFACTURING

- research and product development (patents)
- machine operating
- sales and marketing

BUSINESS DEVELOPMENT

- market and opportunity tracking
- bid drafting and pricing
- site selection and leasing

DESIGN AND PRE CONSTRUCTION

- plant design engineering and architecture
- procurement and EPC planning
- project management

CONSTRUCTION AND COMMISSIONING

- site engineering (civil, electrical and mechanical)
- project management
- logistics management

OPERATIONS AND MAINTENANCE

- performance data monitoring
- equipment management
- technical management for grid integration

FINDING

Some of the skills most challenging to find are not the most technical skills, rather they are basic construction and commissioning skills.



RECOMMENDATION

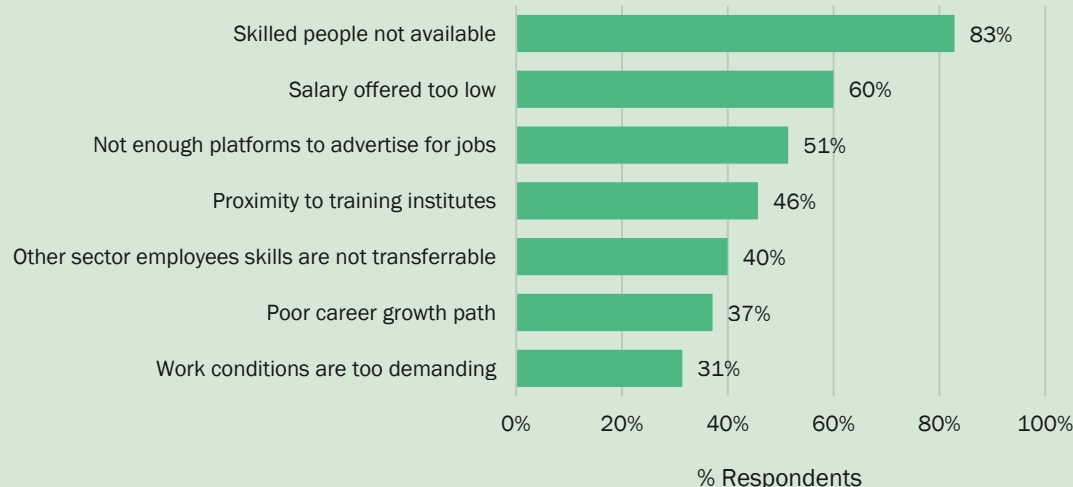
In order for new or expanded training programs to be most responsive to industry needs, they should target the skills most difficult to find and hire for, even if those skills are not the most difficult or technical skills to acquire (which is a common focus for technical training programs).



There is, however, a disconnect between the priority skills needed and the ease with which such skilled personnel can be found. Respondents identified several impediments to employing skilled personnel. 83 percent of respondents identified the unavailability of skilled labor as the biggest challenge in hiring skilled personnel. 60 percent of the respondents listed low salaries as another challenge to employing skilled personnel. In other words, talent acquisition requires a higher salary than is commonly offered.

Respondents rated the difficulty they experienced in meeting the challenges in finding skilled personnel. The analysis later reveals that companies provide special in-house training to prepare its workforce with the necessary skill sets to succeed, which helps companies overcome the lack of available skilled workers. However, proximity to training institutes is the challenge that the respondents find most difficult to

Challenges in Finding Skilled Personnel



FINDING

Unavailability of appropriately skilled manpower – especially for construction and commissioning – has been identified as one of the most prominent challenges in hiring required personnel. The Skill Council for Green Jobs has also identified this existing gap for skilled construction and commissioning labor and are developing plans to address the gap.



RECOMMENDATION

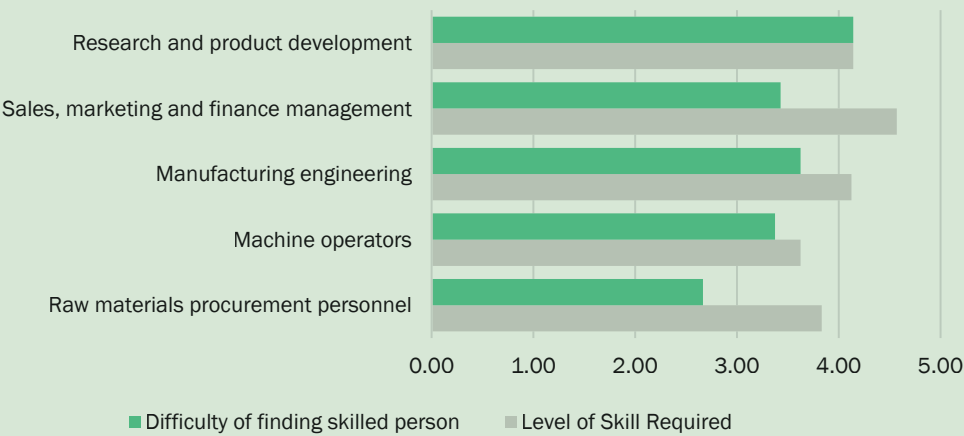
Robust skill training programs focused on clean energy projects should be expanded across the country. Policymakers should consider establishing at least one prominent solar training institute in each region projected to be a hub for major solar activity (e.g., Gujarat, Rajasthan, Karnataka).

overcome. Intuitively, this makes sense since establishing training institutes requires time, large capital and human resource investment.

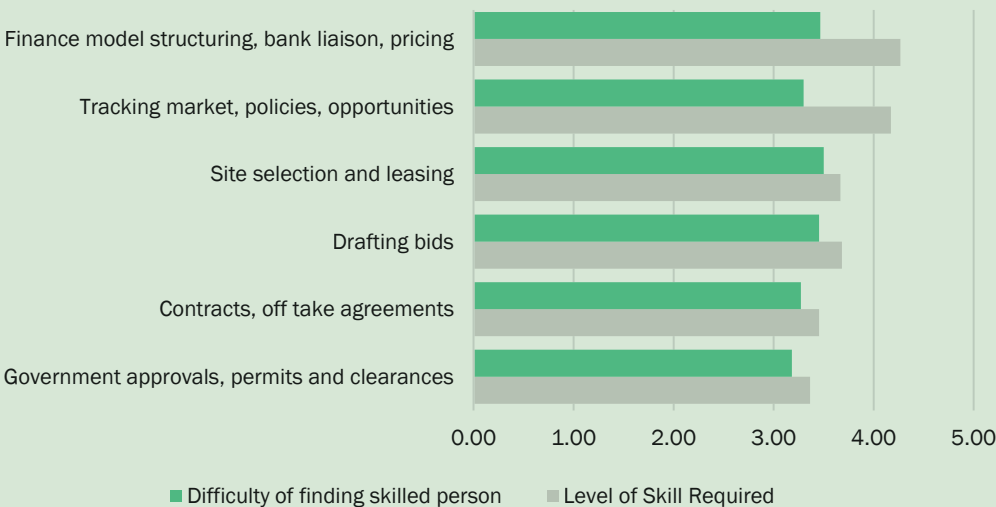
For each phase of solar power deployment, the skill difficulty may vary from the hiring difficulty. For instance, in the business development phase, while structuring the finance model is the most difficult skill, hiring skilled personnel for site selection and leasing is more challenging than hiring personnel for finance and accounting. In the business development phase, developers find it difficult to hire employees skilled in drafting bids. For the design and pre construction phase, hiring for plant design and architecture is the most challenging, while project management personnel are the most highly skilled employees for this phase and relatively more available. During construction of the solar project, EPC companies find it hardest to hire personnel for quality assurance as well as installation of the solar modules. For O&M, grid integration and transmission management personnel are the hardest to hire as well as the most skilled.



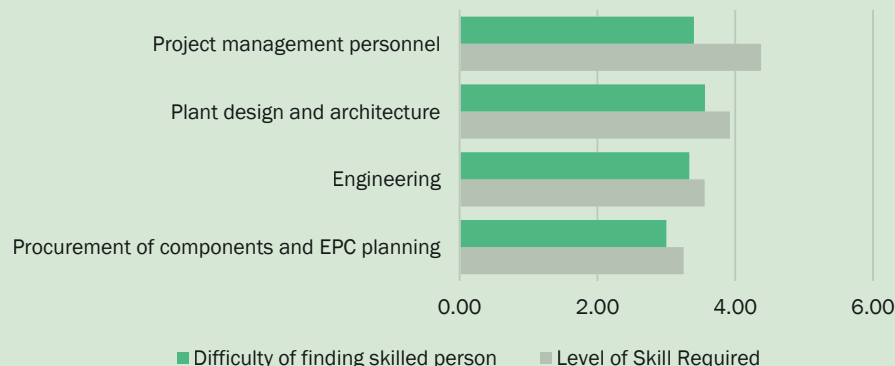
Skill and Hiring Difficulty: Manufacturing



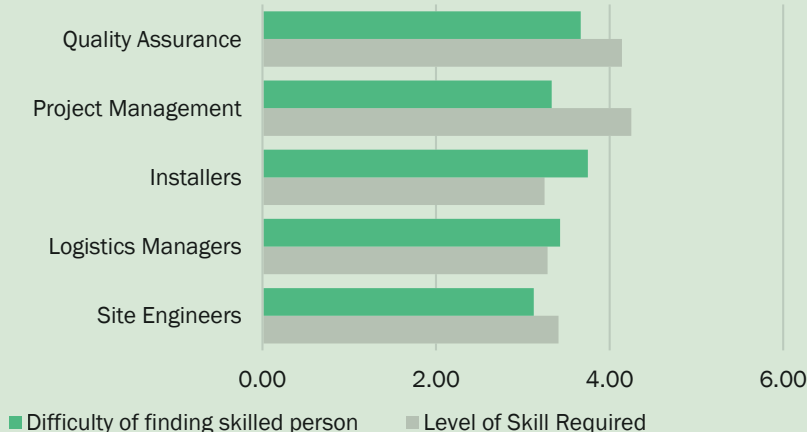
Skill and Hiring Difficulty: Business Development



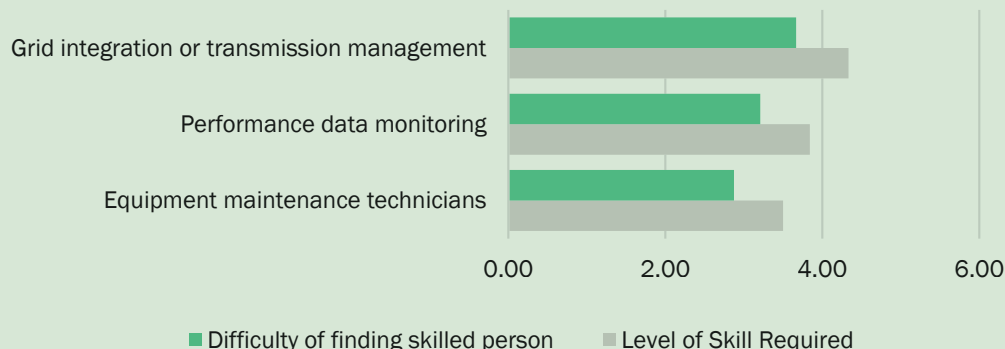
Skill and Hiring Difficulty: Design and Pre-Construction



Skill and Hiring Difficulty: Construction and Pre-Commissioning



Skill and Hiring Difficulty: Operations and Maintenance



FINDING

Most respondents fill the existing gap of hiring skilled personnel by providing in-house training programs. For example, developers, EPC companies and manufacturers impart special in-house training for PV plant design engineering and PV construction management.



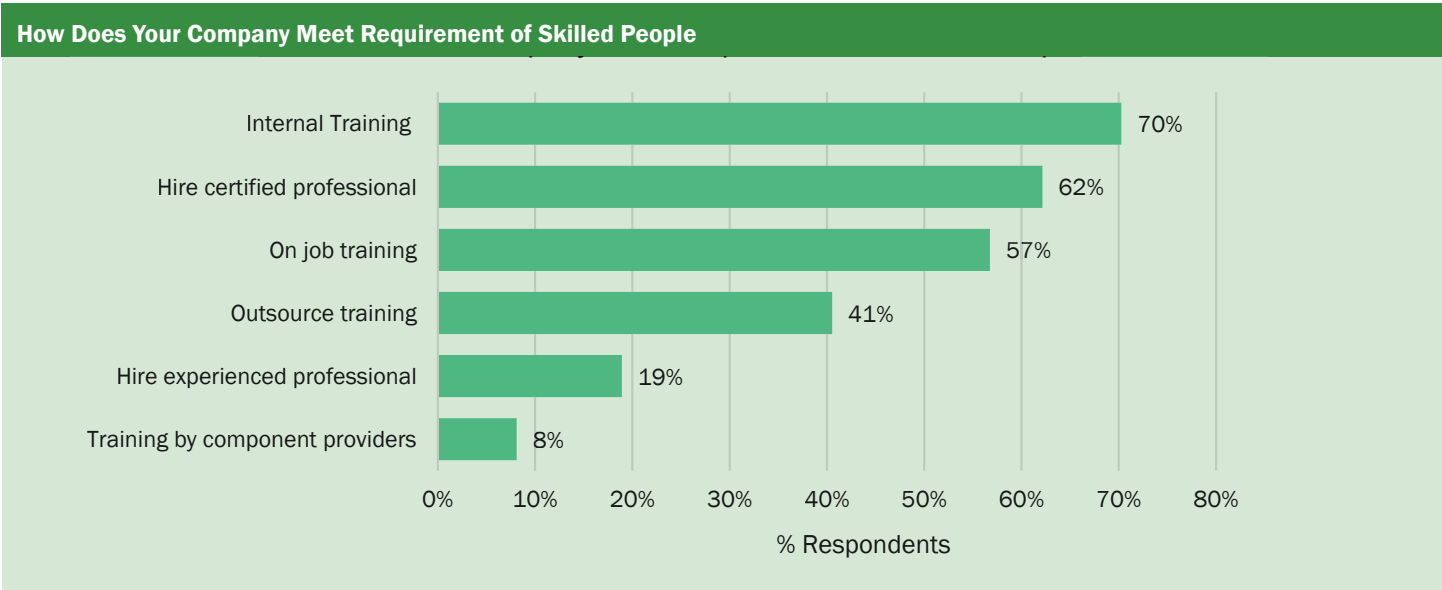
RECOMMENDATION

Explore how the IT or building construction sector approaches this common issue. If there is a need for training standardization, explore whether the National Occupational Standards (NOSs) and Qualification Packs (QPs) could be expanded for new clean energy training programs.

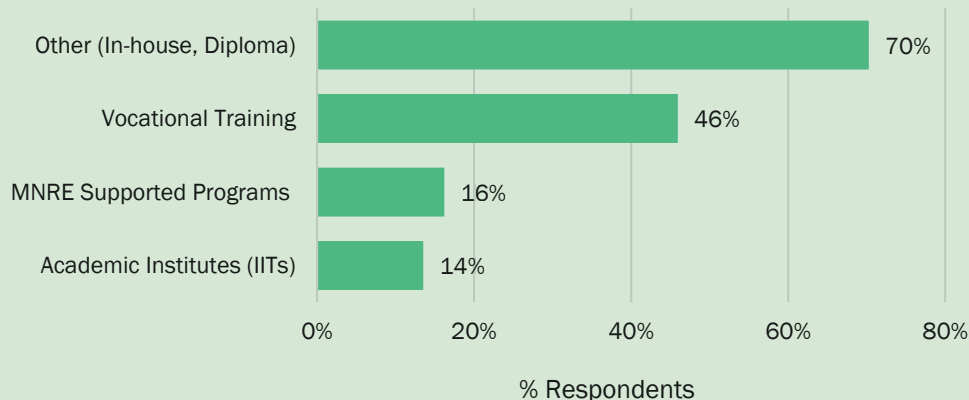
SECTION 4

STATUS OF TRAINING PROGRAMS IN INDIA

As many as 70 percent of the respondents said that they provide special on-site internal training to meet their need for employees with certain skills. For example, project developers and manufacturers rely on internal training as the primary source for meeting their requirements of skilled personnel. The poor quality of existing training programs was identified by respondents as the biggest challenge facing existing training programs for solar employers in India. High quality, accessible certification programs that reduce the need for on-site internal trainings of new workers is a big opportunity.



Institutes For Training Sources



Survey respondents were asked to list the skills for which they feel the need to conduct special training programs in house.^{vi}

In their responses, project developers revealed that while it was necessary to impart basic technical training to new employees, special training is also provided specifically for the following key skills:

- plant design engineering
- construction management/installation management and procurement
- project management and techno-financials
- performance engineering
- negotiation

Knowledge of critical software such as AutoCAD was listed as an essential requirement for potential employees of solar PV project development firms.

Similarly, EPC companies find it necessary to impart basic technical training. Additionally, special trainings are provided for PV plant construction engineering and installation with

special technical training on PV modules and calculating the energy generation ratio.

Manufacturers provide special trainings for machine operation at the plant and procurement, in addition to plant design.

FINDING

The biggest challenges facing existing solar training programs in India are that the quality of current programs is poor and thus not match industry needs, according to respondents.

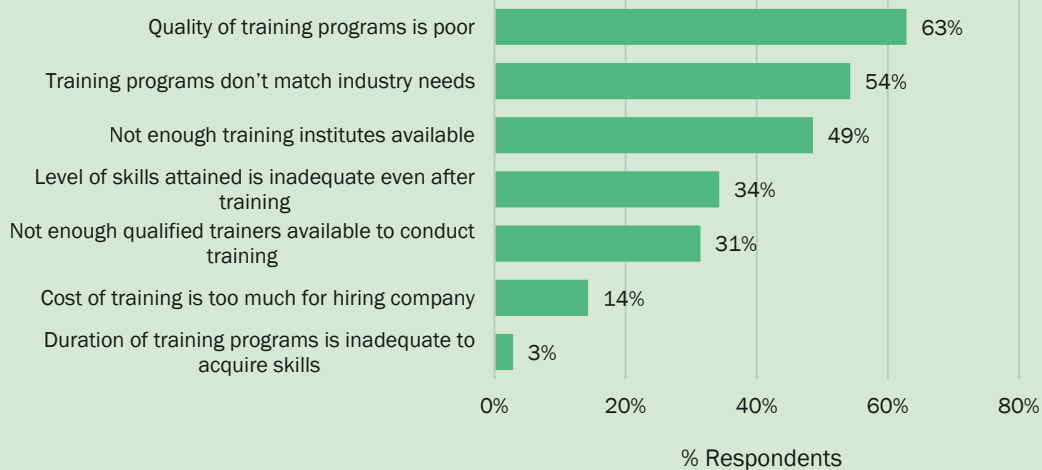


RECOMMENDATION

There is a clear need for improved training and certification programs which are accessible to workers of varying backgrounds and skillsets across states. For example, renewable energy training clusters could be located near ongoing solar energy projects. MNRE's newly formed Skill Council for Green Jobs should consider these gaps when formulating future training programs to scale solar and wind energy projects.



Challenges with Respect to Training Programs



A total of 63 percent respondents named the poor quality of available training programs as the biggest challenge to a skilled workforce. 54 percent described a mismatch between the available programs and the solar industry's needs. 74 percent of respondents said that they would want to see certification programs for skills needed in operation and maintenance.

INDIA'S SKILLED LABOR FORCE

India's skilled workforce has struggled to keep up with other global economic powers. According to Rajiv Pratap Rudy, Minister of State for Skill Development and Entrepreneurship, India's skilled workforce comprises only 2-4 percent of the labor supply, while other countries such as China, Germany and South Korea maintain far more robust skilled labor forces (47%, 74% and 96%, respectively).^{vii} Inadequacies in India's skilled workforce, among other reasons, could inhibit India's solar ambitions. A report by the International Renewable Energy Agency (IRENA) found that India's solar manufacturing industry has had trouble competing with solar products from other countries for several reasons, including skills. The report also found that India has been performing far below its module and cell production potential—at 28% and 20% of its total capacity, respectively.^{viii}

To rectify this deficiency and stimulate economic growth, the Government of India has enacted a flurry of skill development initiatives, many of which directly pertain to India's renewable energy job market. The success of these initiatives will be critical in helping the Indian workforce to effectively satisfy the demands of India's renewable energy missions.

OPPORTUNITIES FOR SKILL TRANSFERABILITY

Opportunities for skill transferability exist between traditional employment sectors and the renewable energy

industry. Workers from industries with considerable skill overlap, including electrical and construction, can build upon their skill sets with renewable energy principles. According to research conducted by the US-based Interstate Renewable Energy Council (IREC), solar industry leaders believe that the best approach to meeting the labor demands of solar industry growth is to work with employees from traditional occupational fields with skill overlap, such as electricians, rather than training "solar specialists." This approach can offer workers greater job security in the event that the solar market declines.^{ix} IREC notes that countries can take advantage of skill transferal opportunities by integrating renewable energy principles into existing apprenticeship programs.

The construction industry offers another opportunity for skill overlap with the renewable energy sector. Some viable fields with significant skill overlap include electrical, roofing, air conditioning, and welding.^x Renewable energy agencies are working with experts to publish resources on best practices for renewable energy skill development. These resources could offer valuable insight to renewable energy training programs.

FINDING

India's solar industry currently lacks adequately skilled personnel, and may benefit from employing workers from conventional labor markets with relevant skill sets.

RECOMMENDATION

Solar and wind stakeholders should seek employees in existing traditional fields to provide overlapping skills. Training institutes could offer targeted courses or corporate training programs to fill in gaps to enable this skill transfer. With the large number of skilled employers needed in the clean energy field, this approach could help fill the gap and transform the market quickly.



NSM Utility Scale Solar Project in Jaisalmer, Rajasthan

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SECTION 5

STATUS OF TRAINING PROGRAMS IN INDIA

In India, over 20 distinct ministries and departments work on more than 70 skill development initiatives across various occupational fields. Until recently, these organizations have operated independently and have taken disparate approaches to skill development, resulting in inconsistent training outcomes and placing the Indian skilled workforce at a global disadvantage.^{xi}

I. NATIONAL AGENCIES AND SKILLS

In India, over 20 distinct ministries and departments work on more than 70 skill development initiatives across various occupational fields. Until recently, these organizations have operated independently and have taken disparate approaches to skill development, resulting in inconsistent training outcomes and placing the Indian skilled workforce at a global disadvantage.

To help resolve these inconsistencies, the Government of India established the Ministry of Skill Development and Entrepreneurship (MSDE) in 2014 as the country's overarching skill development agency. MSDE facilitates communication and collaboration among skill development organizations in order to enhance the quality, effectiveness, consistency, and efficiency of training efforts.^{xii} Some of MSDE's key collaborators include the National Skills Development Agency (NSDA), the National Skills Development Corporation (NSDC), and the wide range of sector skill councils.

MSDE is taking action to track skill development progress and create qualification standards within India's workforce

throughout 24 occupational fields in India, which could prove effective in improving the quality of India's domestic production markets. Renewable energy does not currently stand as a distinct occupational field, and may not be the subject of these routine skill development reports. However, with the recent creation of the Skill Council for Green Jobs, MSDE may be readying itself to provide more concentrated support for the renewable energy labor force.

A. NATIONAL OCCUPATIONAL STANDARDS, QUALIFICATION PACKS, NATIONAL SKILLS QUALIFICATION FRAMEWORK

Since its formation just over a year ago, MSDE has enacted numerous policies to establish skill proficiency standards across India. For example, MSDE now mandates the use of National Occupational Standards (NOSs) and Qualification Packs (QPs). NOSs are performance standards for various tasks involved in a given occupation and are created by the skill sector council within that occupational field. NOSs for each job are then compiled to form a comprehensive QP for the employment position.^{xiii} QPs are currently available for more than 1,300 job positions across 28 industries in India, and help employers ensure that their workers are sufficiently qualified to serve their positions.^{xiv}

NSM Utility Scale Solar Project in Jaisalmer, Rajasthan



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However, few of these qualification metrics exist for positions within the renewable energy field, and the sector could benefit from greater inclusion in these frameworks. Seven QPs currently address jobs within the renewable energy sector, including positions for solar pump technicians, solar photovoltaic (PV) system installation engineers, solar PV maintenance technicians, and solar panel installation technicians.^{xv} QPs for other employment positions in the renewable energy industry were not available. MSDE is also working to standardize occupational proficiencies across formal and non-formal educational experiences. The National Skills Qualifications Framework (NSQF) creates a uniform system to evaluate core competencies in the workforce and is included in job QPs.^{xvi} MSDE recently announced that all educational and training programs in India will be required to comply with NSQF by December 2018.^{xvii}

B. THE NATIONAL POLICY FOR SKILL DEVELOPMENT AND ENTREPRENEURSHIP OF 2015: SKILL INDIA AND MAKE IN INDIA CAMPAIGNS

In 2015, MSDE announced a comprehensive policy approach to strengthen India's skilled workforce. The National Policy

for Skill Development and Entrepreneurship (NPSDE) of 2015 seeks to “meet the challenge of skilling at scale with speed, standard (quality) and sustainability.”^{xviii} Two prominent channels by which NPSDE endeavors to improve India's productivity include the SKILL INDIA and Make in India campaigns. These two programs are designed to complement one another: Make in India will create the demand for skilled domestic labor, while SKILL INDIA will develop the talented workforce needed to meet those demands.

SKILL INDIA, enacted in July 2015, aims to engage Indian youth in quality skill development programs and standardize skill certification in order to effectively meet India's national missions.^{xxii} SKILL INDIA incentivizes skill certification by offering INR. 8,000 for youth who complete certification programs. The program is projected to invest INR. 1,500 crores to train 24 lakh (2.4 million) youth.

Building off India's National Manufacturing Policy, Make in India seeks to fortify India's domestic manufacturing industry by attracting investments, enhancing manufacturing infrastructure, and improving skill capacity in the Indian labor force.^{xix} The campaign focuses on 25 industries in India, including the renewable energy sector.

International Solar Alliance

Prime Minister Narendra Modi and French President François Hollande, along with world leaders, launched an International Solar Alliance (ISA) on the inaugural day of the U.N. Climate Summit in Paris in December 2015. The solar alliance brings together key countries and invites over 120 solar-rich countries between the Tropics of Cancer and Capricorn to address the lack of systematic information about the on-ground requirements, scarce capacity building and training of users of solar technologies, as well as a shortage of affordable financing opportunities. The ISA will serve as a platform to collaborate and address these shared needs to propel clean energy by mobilizing cost-effective technology and financing. India's National Institute of Solar Energy (NISE) will lead the coordination of the solar alliance initiative for the first five years.

ISA's five key focus areas are:

- Promote solar technologies and investment in the solar sector to enhance income generation for the poor and global environment;
- Formulate projects and programmes to promote solar applications;
- Develop innovative financial mechanisms to reduce cost of capital;
- Build a common Knowledge e-Portal; and
- Facilitate capacity building for promotion and absorption of solar technologies and R&D among member countries.



FINDING

Intergovernmental coordination through the ISA framework would be helpful and could be leveraged to address domestic challenges such as the skill gap in India's solar workforce.



RECOMMENDATION

NISE, through the ISA, could help set up training programs using international best practices. Utilising this international common platform and technology like the Knowledge e-Portal could help achieve consistency in training programs for the solar workforce.

II. RENEWABLE ENERGY AGENCIES, POLICIES, AND INDUSTRY GROUPS

India's Ministry of New and Renewable Energy (MNRE) is the fundamental supporting institution for renewable energy development. MNRE makes various provisions for human resource development in the renewable energy workforce. Some notable policies include: the certification of educational and training institutions and to offer short-term renewable energy training courses, financial support for individuals seeking advanced degrees in renewable energy fields, and the development of renewable energy curricula for training programs offered in Industrial Training Institutions (ITIs) and other certification programs.^{xx}

A. THE SKILL COUNCIL FOR GREEN JOBS

MNRE recently took a significant step toward advancing renewable energy skill development by creating the Skill Council for Green Jobs (SCGJ). Introduced in May 2015, the SCGJ in collaboration with the Confederation of Indian Industry (CII), MSDE, and NSDC, will assist in drafting skill development plans for the renewable energy industry. By March 2018, SCGJ plans to develop 100 QPs, and certify 67,000 trainees with a presence in 10 states. Further, the SCGJ has designed several interventions and trainings that aim to enhance quality and availability of a skilled workforce.

B. NATIONAL INSTITUTE OF SOLAR ENERGY (NISE) AND SOLAR ENERGY TRAINING NETWORK (SETNET)

Under the PACE agreement, the United States Agency for International Development (USAID) partnered with MNRE and India's National Institute of Solar Energy (NISE) to create the Solar Energy Training Network (SETNET) of India. SETNET seeks to unify India's solar energy trainers to achieve greater communication, collaboration, and consistency among solar training programs. Similar training networks in the US have proven effective in ensuring quality and consistency among training courses, and have been instrumental in collecting and analyzing data on solar skill development. Currently, SETNET has established partnerships with 35 training institutions.^{xxi}

C. INDUSTRIAL TRAINING INSTITUTES (ITIS)

MNRE has been working to integrate renewable energy curricula into numerous formal and non-formal training institutions in India. MNRE has also integrated renewable

energy coursework into India's numerous Industrial Training Institutes (ITIs), which could help broaden the accessibility of renewable energy education. ITIs present a viable opportunity to increase the accessibility of solar training programs in India. Prime Minister Modi recently announced a plan to use India's ITIs to train 50,000 solar workers. A study by McKinsey & Company also recommended that India make use of its ITIs to bolster its renewable energy workforce.

D. SUPPORT FROM LEADING SOLAR CORPORATIONS IN INDIA

Solar corporations in India are also offering training support for the renewable energy workforce. Vikram Solar, one of India's top solar manufacturing companies, recently signed a memorandum of understanding with the Fraunhofer Institute of Solar Energy Systems ISE, Meyer Burger, and Centrotherm. As part of the agreement, these prominent European solar professional institutions will work with Vikram Solar to set up a solar training academy in India. Experts from the Fraunhofer Institute will instruct courses at the solar academy, lending specialized knowledge to program participants.

Azure Power entered into an agreement with the Gujarat Energy Research and Management Institute (GERMI) to create a national certification program for rooftop solar PV installers. GERMI will determine course requirements and oversee student performance, and Azure will promote the program among the local workforce and seek out other institutions, which may be interested in adopting the programme.

III. STATE POLICIES

Leading states in solar energy production, such as Gujarat and Rajasthan, are among the Indian states that have introduced solar energy training components into their local policy frameworks. The Gujarat Solar Power Policy of 2009 addresses renewable energy employment opportunities and skill development for local youth, and also sets basic technical expectations for professionals in the solar industry. With this view, Gujarat established the Gujarat Institute of Solar Energy (GISE) to provide technical training. GISE offers a variety of advanced degree and professional programs for renewable energy, with a focus on enhancing India's youth workforce. Rajasthan enacted the Solar Energy Policy of 2011, which includes provisions for technical training resources and institutions for its residents.



Overview of Current Solar Skill Development Programs

The Government of India is taking various steps to enhance its skilled labor force, and is making specific provisions for the renewable energy sector within these initiatives.

1. National Institute of Solar Energy (NISE) and Solar Energy Training Network (SETNET)

NISE is one of the primary institutions that oversee solar training initiatives in India, and offers a variety of solar training courses throughout the year. 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.

2. Skill Council for Green Jobs (SCGJ)

MNRE created SCGJ in May 2015 in collaboration with the Confederation of Indian Industry (CII), MSDE, and NSDC. SCGJ will assist in drafting skill development plans for the renewable energy industry. By March 2018, SCGJ plans to develop 100 QPs, and certify 67,000 trainees with a presence in 10 states. Further, the SCGJ has designed several interventions and trainings that aim to enhance quality and availability of a skilled workforce.

3. Industrial Training Institutes (ITIs)

ITIs present a viable opportunity to increase the accessibility of solar training programs in India. Prime Minister Modi recently announced a plan to use India's ITIs to train 50,000 solar workers. A study by McKinsey & Company also recommended that India make use of its ITIs to bolster its renewable energy workforce.

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