



**POWER** FOR ALL

Schneider  
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The  
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## Powering Jobs Census 2019: Focus on India

In collaboration with:

**CÉEŪ**  
THE COUNCIL

# 1. Report Objectives

This report is part of the first annual job survey for the decentralized renewable energy (DRE) sector in emerging economies. Power for All conducted its inaugural Powering Jobs census in 2018, which captures DRE company employment data for 2017–18, the purpose of which is to establish a baseline that explores the link between Sustainable Development Goal 7, defined as access to affordable, reliable, sustainable, and modern energy for all, and Sustainable Development Goal 8, defined as inclusive and sustainable economic growth, employment, and decent work for all.

The census explores companies working across the range of DRE technologies, including pico-solar appliances, solar home systems (SHS), standalone commercial and industrial (C&I) solar systems, mini-grids, and productive use systems such as solar water pumps. The main report covers three emerging markets, India, Kenya, and Nigeria, each representing different sizes and stages of DRE market development. Key stakeholders across these three countries also participated in focus groups to discuss their experiences and policy recommendations based on the survey data.

This report disaggregates the research findings for India, specifically exploring the Indian DRE employment landscape, skills trends, and future projections across the different DRE technologies surveyed. These findings can be used to increase awareness about the potential for DRE job creation and stimulate discussion about how to develop the energy access workforce. The deployment of DRE systems for energy access is emerging as a major opportunity to

create jobs, which is critical as India's unemployment challenges deepen. In India, young men and women between the ages of 15 to 24 comprise over 25% of the working-age population, but also 60% of the unemployed [1]. This research was conducted in collaboration with the Council on Energy, Environment and Water (CEEW), the campaign's local research partner.

## 2. DRE Policy in India

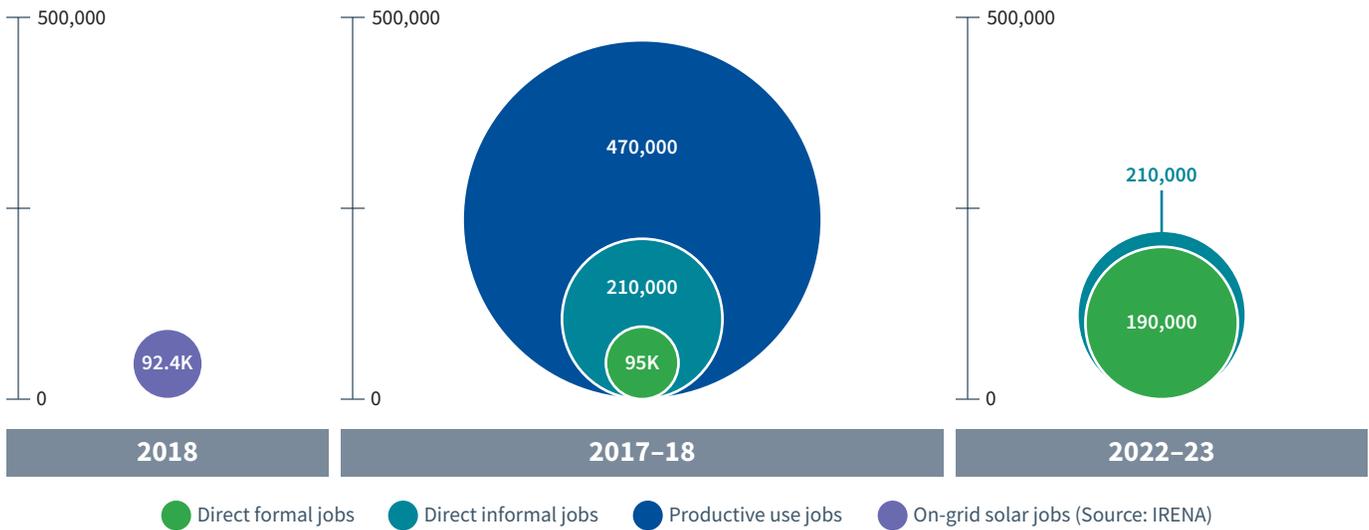
As of June 2019, according to official government estimates, less than 20,000 rural households remain unelectrified in India [2]. The country's ambitious Saubhagya scheme has significantly improved electrification rates, although the quality, reliability, affordability, and short duration of supply continue to present challenges. In fact, only 40% of on-grid electricity users in India are reportedly satisfied with the quality of supply [3]. This leaves a critical need to supply consumers across urban, semiurban, and rural parts of India with reliable power at stable voltages. DRE technologies, which allow for more efficient generation and distribution of electricity to end users, could have a large role to play in improving rural energy access.

The Indian government recognizes the need for high-quality energy access and shows continued support for the expansion of DRE solutions even as electrification rates rise. In January 2010, the Jawaharlal Nehru National Solar Mission was launched to promote solar energy technologies in India. In Phase I, the mission's target was to deploy 200 MW of off-grid solar, including various DRE technologies such as solar lamps, SHS, solar street lights, and solar water

**TABLE 1. ESTIMATED OVERALL DRE MARKET POTENTIAL IN INDIA BY 2022**

Technology	Total capacity or units deployed in 2017–18	Estimated Market Potential in 2022–23	Estimated Market Potential in 2022 (in US\$ billions)	Sources
Solar lanterns	6,365,000 units sold	0.9 GW	5.3	CLEAN 2018 [4]
SHS	335,000 units sold	320,000 units	0.14	GOGLA 2019 [5]; CLEAN 2018 [4]
Solar water pumps	32,645 units sold	16.3 GW	60	CLEAN 2018 [4]; BNEF 2017 [6]
Solar-powered telecom towers	N/A	3.5 GW	12.5	CLEAN 2018 [4]
Street lighting	620,200 lamps installed as of 2018	3.5 GW	15	CLEAN 2018 [4]; MNRE 2018 [7]
Standalone/grid-tied rooftop solar	10 MW installed	40 GW	N/A	CLEAN 2018 [4]; CEEW and NRDC 2017 [8]
Mini-grids	3.5 MW operated	500 MW	N/A	SPI 2017 [9]; MNRE 2016 [10]
Total off-grid solar PV	N/A	64.7 GW	65.8	N/A

**FIGURE 1. DRE SECTOR EMPLOYMENT ESTIMATES AND PROJECTIONS**



pumps [11]. By the end of Phase I in 2013, a total of 252.5 MW were installed. In Phases II and III, the targets were to install 1,000 MW of off-grid solar by 2017 and 2,000 MW by 2022 [7]. Thus far, India has deployed more than 2.5 million solar lamps, more than doubled solar street lights, and increased SHS units deployed by 50% [12].

Similarly, for mini-grids, the Ministry of New and Renewable Energy (MNRE) drafted the *National Policy on Renewable Energy Based Mini and Micro Grids* in 2016 to deploy 500 MW worth of mini-grid systems [10]. However, given the success of the Saubhagya scheme in meeting household connection targets, experts debate the likelihood of achieving this mini-grid target. Indeed, the MNRE and key stakeholders are reevaluating the role of mini-grids. The future of mini-grid market growth will depend on many factors, including whether the government’s mini-grid target is revised and whether mini-grids are eventually integrated into other government subsidy schemes, such as that for solar water pumps [13], [14].

Regardless of the fate of the draft *National Policy on Renewable Energy Based Mini and Micro Grids*, Uttar Pradesh and Bihar have adopted mini-grid policies [15], [16]. This paves the way for public-private partnerships supporting integrated energy systems. Private sector mini-grid deployment is also expected to grow. To date there are more than 3.5 MW of mini-grids installed across the country through Smart Power India (SPI), one of the major mini-grid programs in India [9]. By 2023, SPI projects that a total of 60 MW of mini-grids will be in operation [13]. Actual deployment may be higher, as Tata Power, India’s largest integrated utility company, continues to integrate mini-grids into its rural development strategy [17].

In recent years, the Indian government’s policy focus has shifted towards the deployment of solar water pumps. By 2023, the government is expecting to subsidize the 1.75 million solar water pumps through the Kisan Urja Suraksha evam Utthaan Mahabhiyan (KUSUM) scheme [18]. With strong policy support, the market potential for solar water pump is estimated at US\$ 60 billion [6].

### 3. Employment Estimates

Continued demand for more reliable and higher quality power, along with the public-sector schemes highlighted above, have created a large market for DRE technologies in India, requiring a local workforce to sustain the sector [19]. A total of 36 companies across the DRE sector responded to our survey in India. We estimate this is roughly a 10% response rate. Despite the low response rate, India’s sample of respondents include many major companies in the sector. Future iterations of the survey will attempt to achieve higher response rates to minimize the margin of error. See our main report for a detailed account of the survey’s methods and limitations [20].

According to the results of our survey, in 2017–18 the DRE sector provided 95,000 direct, formal jobs, similar to the workforce of the on-grid solar sector in India. According to the International Renewable Energy Agency (IRENA), the entire solar sector employed about 164,400 people in India in 2018, and among them, 92,400 jobs were in on-grid applications [21]. According to a 2018 estimate by the Clean Energy Access Network (CLEAN), at least 41,868 new jobs were created in 2017–18 in India in the DRE sector, excluding C&I [4].

**TABLE 2. DIRECT, FORMAL AND INFORMAL JOB TRENDS BY TECHNOLOGY TYPE**

Job category	Direct, formal	Direct, formal	Direct, informal	Direct, informal	Productive use
Years	2017–18	2022–23	2017–18	2022–23	2017–18
Pico-solar appliance and SHS	92,000	86,000	210,000	200,000	470,000
Standalone and grid-tied C&I	770	1,600	190	400	N/A*
Solar water pump	1,500	10,000	N/A*	N/A*	N/A*
Mini-grid	630	90,000	57	8,200	950
<b>Approximate total</b>	<b>95,000</b>	<b>190,000</b>	<b>210,000</b>	<b>210,000</b>	<b>470,000</b>

Estimates rounded to two significant figures.

\* Survey or market insight data unavailable.

The DRE sector is not only employing as many people as older, more established, energy sectors, but also has a large impact on the informal sector. In particular, it has a substantial impact on rural employment, especially through the creation of productive use jobs among end users. In 2017–18, we estimate the DRE sector employed about 210,000 informal workers and accounted for 470,000 productive use jobs.

The DRE sector is still nascent and the employment footprint is expected to increase by almost 100% in 2022–23. A significant share of this growth would be attributed to rapid expansion of the mini-grid market: 500 MW by 2022–23, as set out by the MNRE [10]. However, many sector experts are skeptical about these targets. For instance, the Minda Foundation estimates only 50% of the original goal will be achieved. By 2022–23, SPI estimates that about 30 MW will be deployed by mini-grid companies in its portfolio, and that the same might be deployed by other private-sector companies for a total of 60 MW installed industry-wide in this time frame [13]. We use these expert projections to explore a range of future scenarios.

Under a high mini-grid penetration scenario, where 500 MW is installed by 2022–23, the study estimates that the DRE sector in India would provide more than 190,000 direct, formal jobs, with about 210,000 informal workers in the sector. Under a low mini-grid penetration scenario, where 60 MW is installed by 2022–23, the DRE sector would provide 110,000 direct, formal jobs, but roughly the same number of informal workers. According to the India survey data, informal job impact is driven by the pico-solar and SHS companies, which is why the mini-grid sector’s growth does little to change future projections. As such, depending on the future of mini-grid market penetration, the DRE sector’s direct, formal jobs footprint will vary widely while informal jobs will likely hold constant.

## 4. Sector Trends

Despite the wide employment impact of the DRE sector, there are important nuances that can be understood by disaggregating jobs according to company type. For instance, some company types offer longer-term jobs than others, require different skill sets, and have different levels of participation among women and youth. In the following sections we build a workforce profile for each company type to highlight key characteristics.

### 4.1. End-user Product Providers

We define end-user product providers as companies that sell pico-solar appliances, SHS, and other small, off-grid appliances directly to customers. End-user product providers are the job engine of the sector. In 2017–18, they employed 92,000 people and sold more than 6.7 million products, contributing to about one-third of global sales [4], [22]. End-user product providers alone account of 97% of total DRE jobs created in 2017–18, and are the biggest contributor to job creation in the informal sector, providing more than 210,000 informal jobs and 470,000 productive use jobs in 2017–18.

As the market continues to mature and on-grid electricity access improves, there will likely be a shift towards appliances and SHS with higher generation and storage capacity. As a result, while the average capacity of units sold will increase, total product sales may ultimately see a decline [5]. This would have an impact on employment as most jobs within the sector are created in sales and distribution. We estimate that by 2022–23, the end-user product providers will provide 86,000 direct, formal jobs, but that the number of informal jobs will remain constant around 210,000 because of the predicted decline in overall unit sales.

About 40% of the direct, formal employees in these companies are engaged in sales and distribution activities, while another 23% are dedicated to servicing products after sale. The bulk of these direct, formal jobs (85%) are full-time and long-term, or lasting more than a year, as the average employee retention period is 39 months.

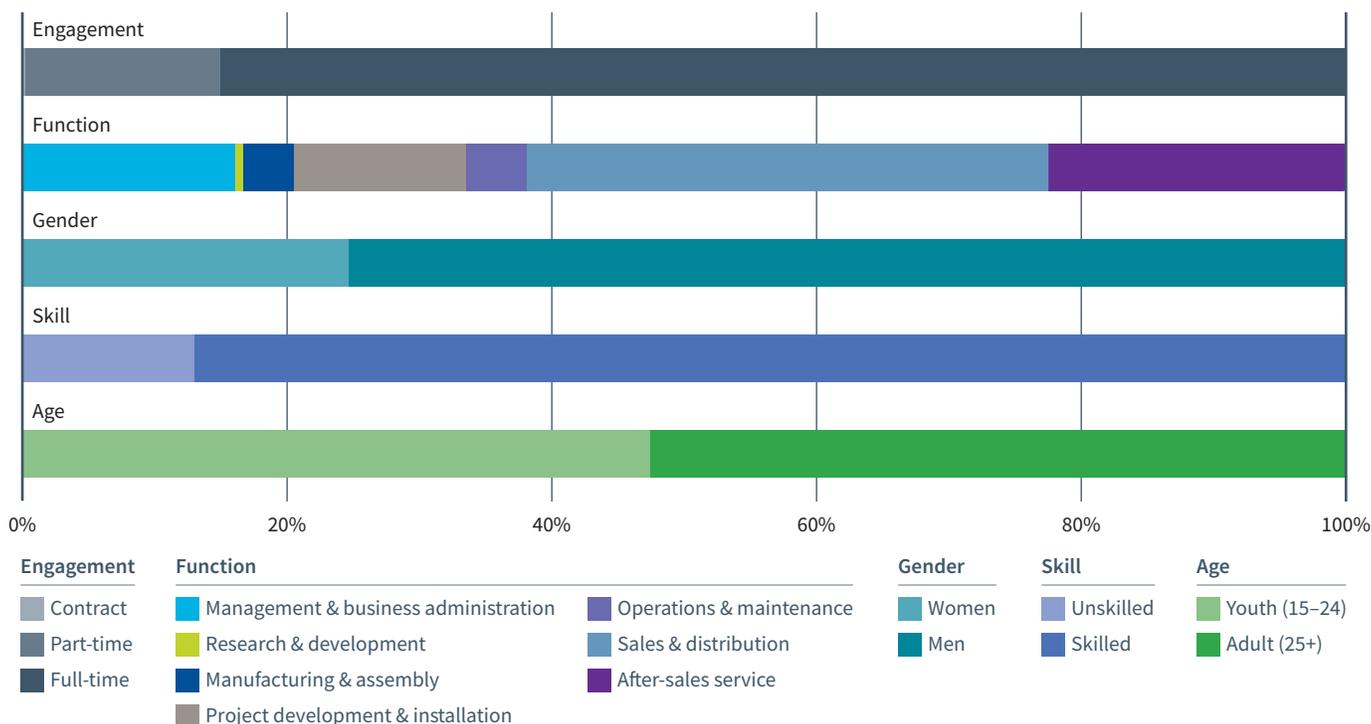
Employment for women, especially rural women, is critical in India as 31% of unemployed people nationally are women [1]. On average, women hold only 25% of the direct, formal jobs provided by end-user product providers, in line with the 23% average for this company type across the three countries surveyed. In the global renewable energy sector, women comprise 32% of the workforce and, in India specifically, women reportedly make up just 11% of the rooftop solar sector's workforce [23], [24]. End-user product providers clearly engage far more women through informal work, with 60% of their informal workers being women, often as sales agents.

Jobs created by end-user product providers are mostly skilled. About 86% of the direct, formal jobs reported by these companies are skilled, as compared to global renewable energy industry, where less than half of its workforce is skilled [25]. The sector also has strong participation from youth, or people between 15–24 [26], who constitute half the end-user product provider workforce.

## 4.2. Project Developers, Installers, and Mini-grid Operators

Project developers and installers are defined as companies that generally work with larger projects ranging from a few hundred watts to a few kilowatts. The survey estimates that a project developer and installer employs 81 people per MW deployed. In 2017, the CEEW and Natural Resources Defense Council (NRDC) estimated that 25 job-years are required for every MW of rooftop solar deployed [8]. Both estimates show that DRE is generally more labor intensive than utility-scale solar. Our study estimated that project developers and installers provided about 770 direct, formal jobs and 190 direct, informal jobs to deploy 9.5 MW of standalone and grid-tied solar in 2017–18. CEEW and NRDC estimated the rooftop solar sector added 6,749 jobs in 2016–17 and will continue to add more than 10,000 jobs per year. By 2022–23, the sector will provide 1,600 direct, formal jobs, and 400 direct, informal jobs. CEEW and NRDC, on the other hand, estimate that it will take 237,980 job-years of work to deploy 40 GW of rooftop solar energy by 2022–23 [8]. Survey data shows that 85% of these direct, formal jobs are full-time. Average retention is 19 months, the shortest among all types of DRE companies.

**FIGURE 2. END-USER PRODUCT PROVIDER WORKFORCE PROFILE**



Project developers and installers draw less heavily from sales and distribution talent as compared to end-user product providers. Instead, these companies are dependent on engineers to design and develop PV systems and construction workers to install projects on site. The survey data shows that 30% of their workforce is dedicated to project development and installation and 26% to manufacturing and assembling.

The percentage of skilled workers in these companies is high. About 79% of the reported jobs are skilled. The study by CEEW and NRDC confirmed that about two-thirds of the workforce in rooftop solar is skilled [8]. And many of the unskilled jobs are contracted, indirect jobs. Women make up 25% of direct, formal employees within project developers and installers—about the industry average. Youth also make up a large share of the workforce, about 44%.

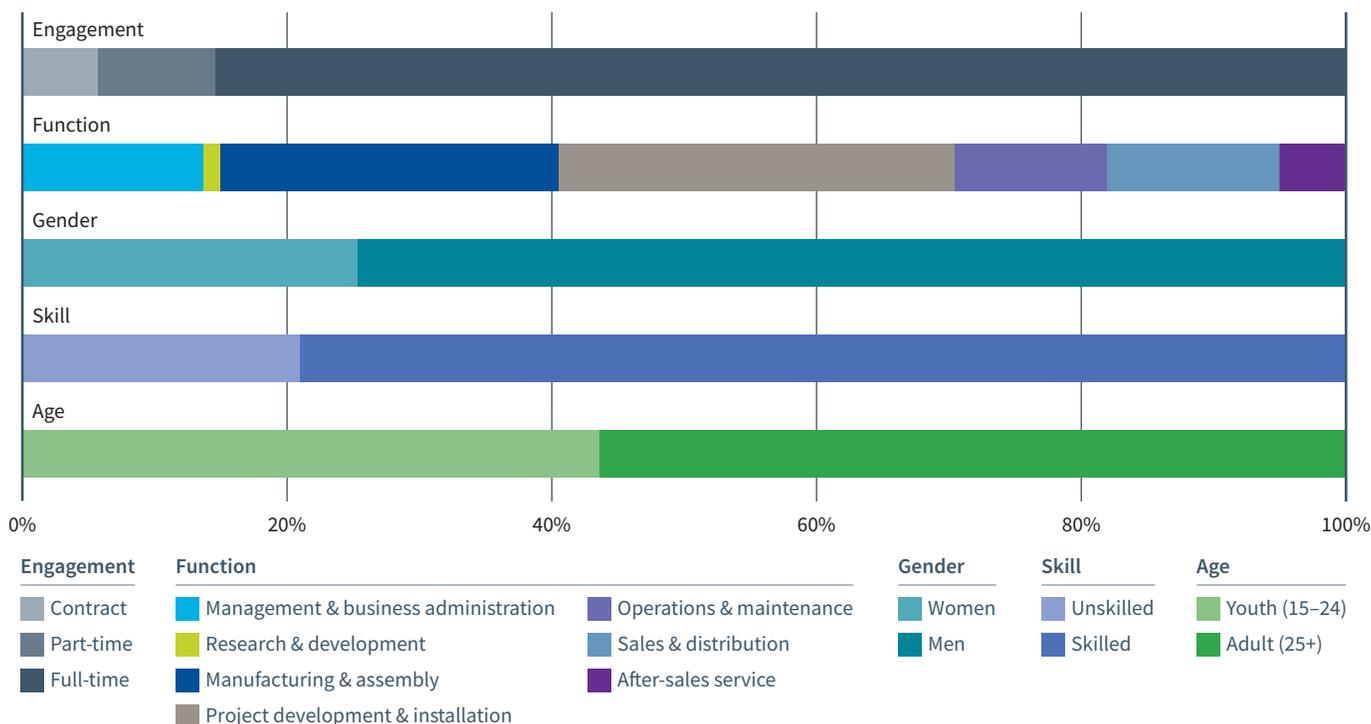
Mini-grid operators are private companies that operate and maintain mini-grid systems and are responsible for electricity sales as an integral part of their business model. Mini-grid operators and project developers and installers are analyzed separately for understanding job trends because their business models and revenue structures differ, as do their contracting and hiring behavior.

In the future, if mini-grid penetration is high, mini-grid operators may shift the DRE sector’s workforce skill demand. In 2017, the total capacity of mini-grids in India was at least 3.5 MW, providing about 630 direct, formal jobs, 57 informal jobs and 950 productive use jobs. By 2022–23, with MNRE’s ambitious plan to expand the sector, as much as 500 MW worth of mini-grids may be set up [10]. Under this high mini-grid penetration scenario, the mini-grid operators would provide more than 90,000 direct, formal jobs. Under a low mini-grid penetration scenario of 60 MW worth of mini-grid energy, 11,000 direct, formal jobs would be provided [13].

The informal jobs projection under the high mini-grid penetration scenario is 8,200 jobs, more than the 980 informal jobs projected with the low mini-grid penetration scenario. This highlights the fact that mini-grid companies provide significantly more formal than informal work opportunities. The jobs created by mini-grid operators are mostly full-time, and long-term jobs. Average retention in mini-grid companies is 47 months, the longest among all types of DRE companies.

This rise of mini-grids would also create a growing demand for operations and maintenance (O&M) talent, as mini-grid operators employ 40% of their workforce in O&M. While most mini-grid

**FIGURE 3. PROJECT DEVELOPER AND INSTALLER WORKFORCE PROFILE**



companies still engage in developing and installing projects, many of the jobs are created as indirect jobs outsourced to upstream engineering, procurement, and construction companies. In terms of gender balance, mini-grid companies barely employ women: they comprise a mere 2% of direct, formal jobs as compared to an average of 23% across the DRE sector.

### 4.3. Manufacturing, Upstream Supply Chain, and Sector Service Providers

Finally, the DRE sector is supported by a group of companies and organizations such as PV and inverter manufacturers, equipment importers and exporters, metering companies, training centers, and microfinance institutions that create indirect jobs. Very few of these companies responded to our survey, so these results cannot be generalized.

Among the manufacturing and upstream supply chain companies that did respond, 27% of their direct, formal employees are working in manufacturing and assembly while 26% are working in project development and installation, likely because the sample did not capture larger PV and inverter manufacturers in the country, but instead smaller players who are engaged in a broader range of

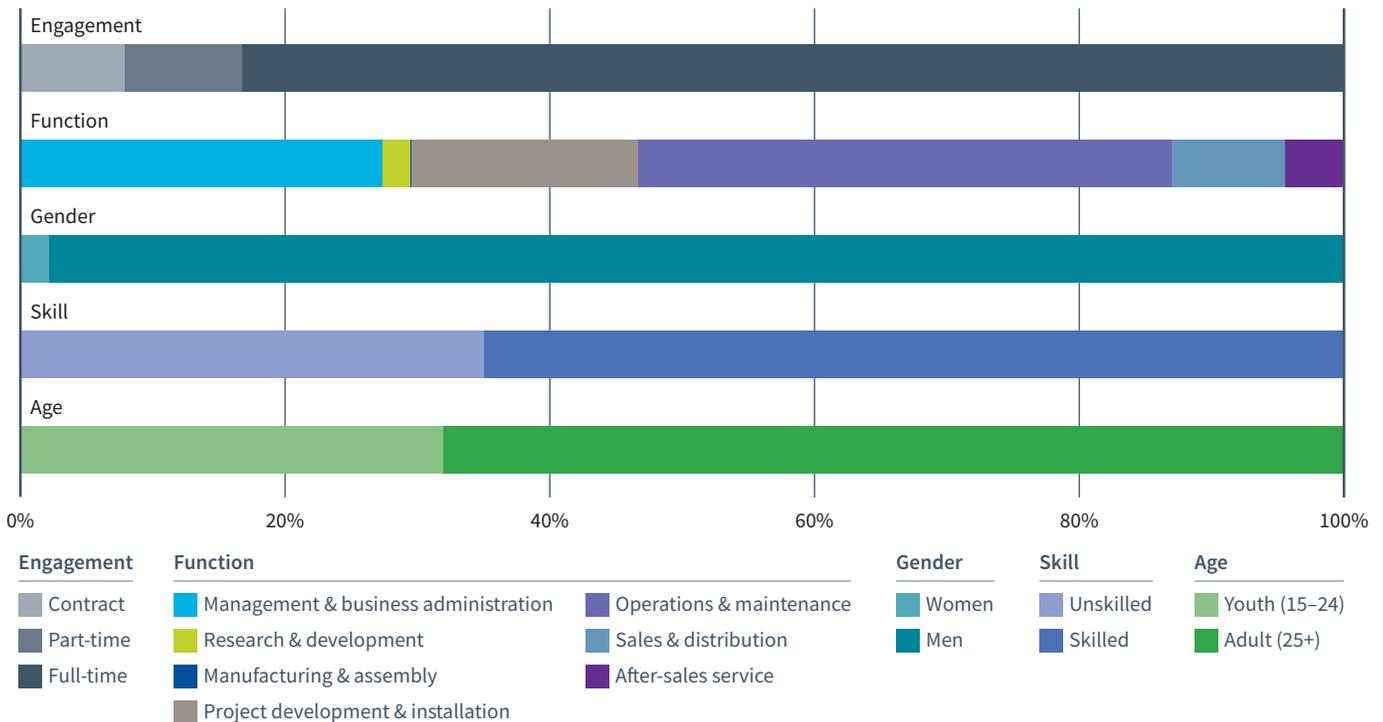
activities. In terms of gender balance, the manufacturing and upstream supply chain companies are hiring more women than the industry average, with women accounting for 37% of direct, formal jobs. These companies also employ a highly skilled, young workforce, at 80% and 68%, respectively.

Among the sector service providers who responded, such as research, advocacy, and awareness-raising organizations, gender balance is well established. Women make up half of the workforce in these organizations. These organizations need 38% of their workforce in management and business administration. The required workforce is also highly skilled: about 96% of the workforce is skilled, yet only 6% are youth. This is because sector service providers generally comprise a small number of highly experienced sector experts to carry out research and advocacy work. Therefore, skill level is high and youth participation is low. Due to the lack of market estimate data future projections were not possible.

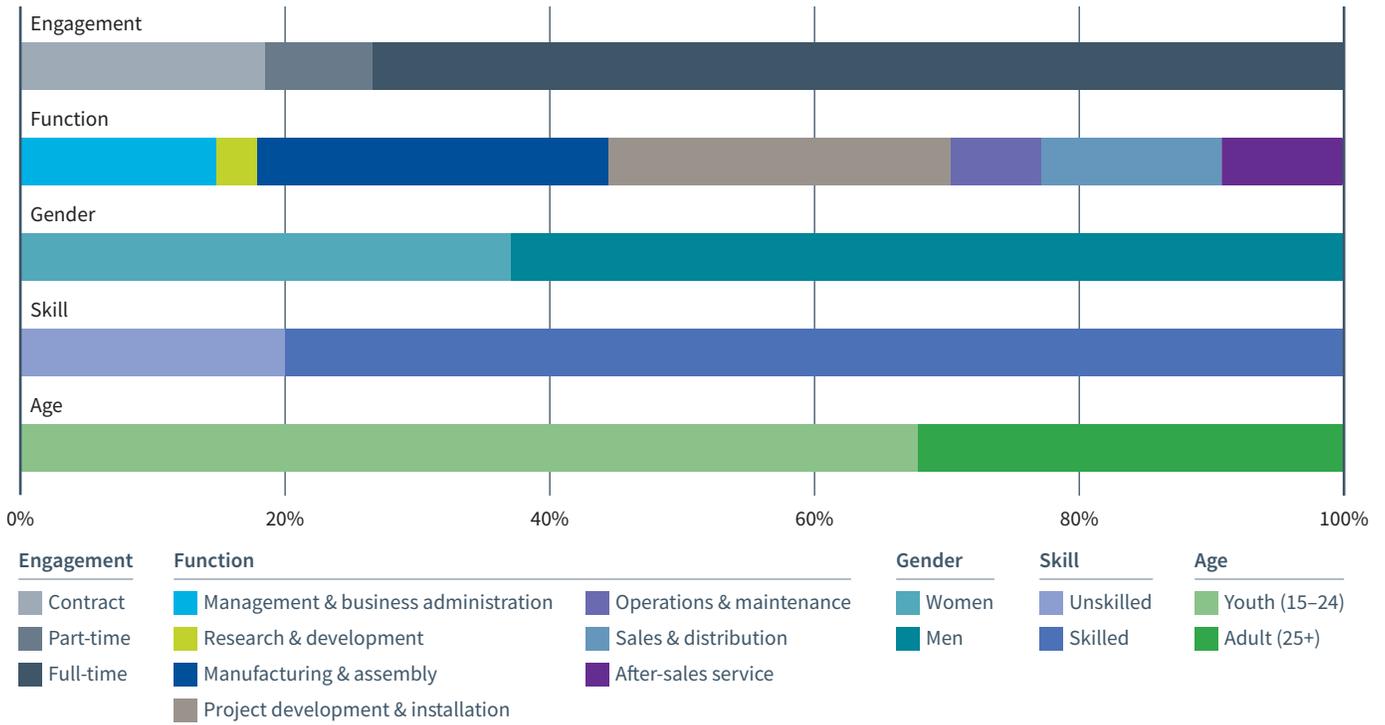
## 5. Skills Needs

The DRE workforce is highly skilled. The survey results show that 82% of direct, formal DRE jobs in India are skilled as compared to

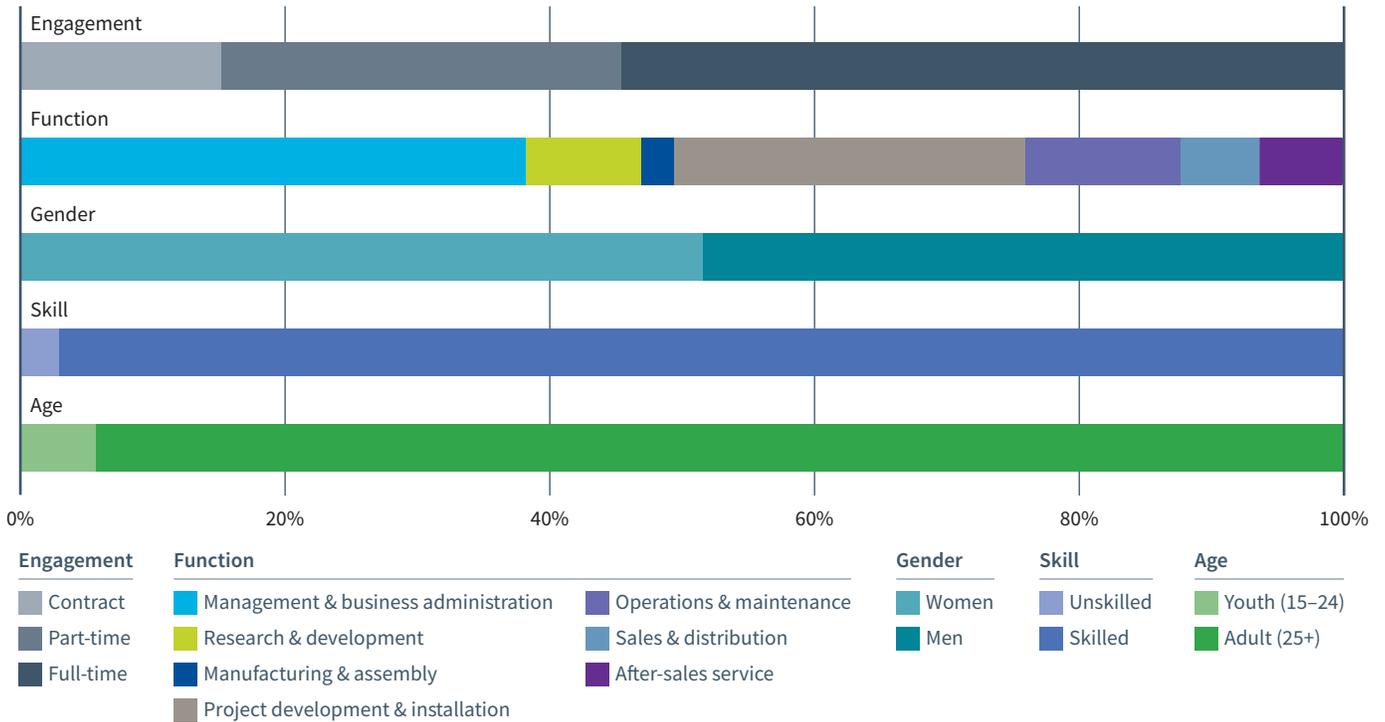
**FIGURE 4. MINI-GRID OPERATOR WORKFORCE PROFILE**



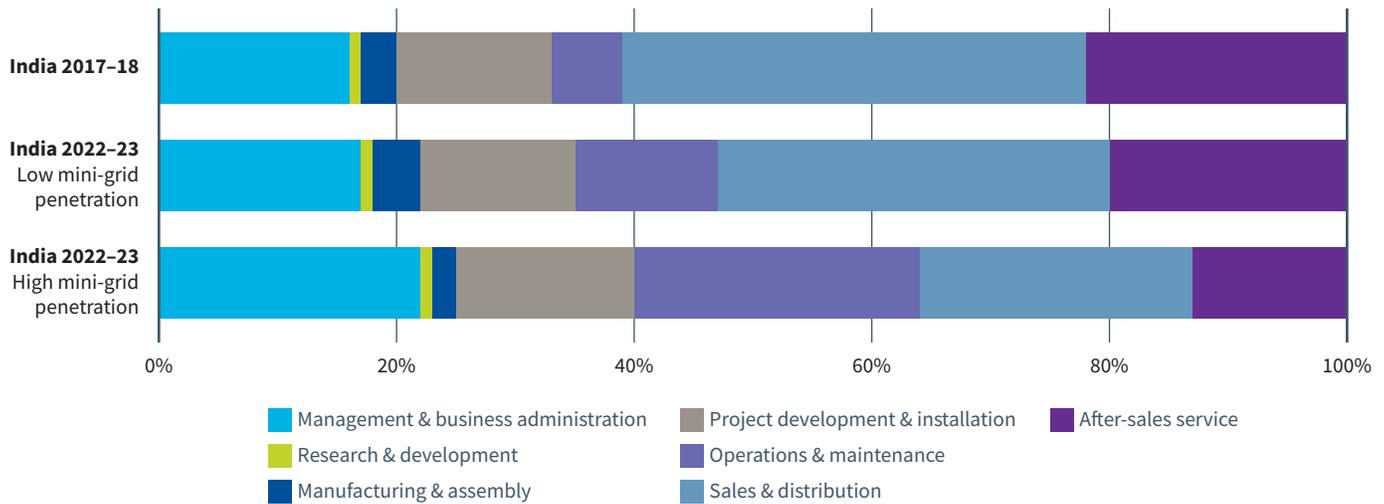
**FIGURE 5. MANUFACTURING AND UPSTREAM SUPPLY CHAIN WORKFORCE PROFILE**



**FIGURE 6. SECTOR SERVICE PROVIDER WORKFORCE PROFILE**



**FIGURE 7. CHANGE IN SKILLS NEEDS BETWEEN 2017–18 AND 2022–23**



less than 50% in the global solar industry and about two-thirds in India’s rooftop solar sector [25], [8].

Currently, 39% of direct, formal DRE jobs are in sales and distribution, because end-user product providers are the job engine of the sector, relying heavily on large sales and distribution networks. Following that, 22% of the sector’s workforce is in equipment servicing and 16% in management and business administration.

About 40% of direct, formal jobs in mini-grid companies are in O&M. Thus, depending on mini-grid market penetration by 2022–23, the DRE sector would draw 12–24% of its workforce from O&M talents. More specifically, under the high mini-grid penetration scenario, the Indian DRE sector will employ as much as 24% of its workforce in O&M, followed by 23% in sales and distribution and 22% in management and business administration. On the other hand, under the low mini-grid penetration scenario, the sector would remain heavily dependent on sales and distribution of DRE products, with about 33% of the jobs in sales and distribution, 19% in servicing, and 17% in management and business administration. Mini-grid market growth thus has a strong effect not only on the total number of DRE jobs, but also on the future skills needs of the DRE workforce.

## 6. Conclusions

**The direct, formal workforce in the DRE sector may double in size between 2017–18 and 2022–23 if the mini-grid market continues to expand at a rapid pace.** In 2017–18, the DRE sector

provided about 95,000 jobs, most of which are from end-user product providers. With strong policy support, mini-grids may grow to become a major employer. Under the high mini-grid penetration scenario, the DRE workforce would provide 190,000 direct, formal jobs by 2022–23, almost doubling the current job number.

**In addition to direct, formal jobs, the Indian DRE sector has significant employment impact on the informal sector.** In 2017–18, the sector provided about 200,000 informal jobs and 470,000 productive use jobs, with a majority from end-user product providers. The number of informal jobs will remain relatively consistent, due to this market remaining stable with about 210,000 informal jobs serving the DRE sector between 2017–18 and 2022–23. This study lacks the data to make projections regarding productive use jobs.

**Government support of productive use applications such as solar water pumping could add about 10,000 additional jobs.** Between 2017–18 and 2022–23, the Indian government plans to deploy 1.75 million solar water pumps through the KUSUM scheme. There are many other decentralized productive use technologies entering the Indian market, such as solar farm machinery, solar cold storage, and solar drying, which also may dramatically increase the scale of productive use jobs.

**Skills needs will depend on the evolution of the sector, with an expected shift from sales and distribution to O&M.** Under a high mini-grid penetration scenario, the increase in mini-grid market share would see the demand for O&M rises significantly, from 6% of the sector in 2017–18 to 24% by 2022–23. Under a low mini-grid

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penetration scenario, the demand for O&M skills would still grow to 12% of the sector in 2022–23, with sales and distribution making up one-third of the workforce.

**Women’s participation in almost every type of DRE company is low, except for sector service providers. All companies in the DRE sector show high willingness to employ young people.** In particular, mini-grid companies have a poor gender balance, with women comprising a mere 2% of the workforce. Manufacturing and upstream supply chain companies have the highest youth employment rate at 68%.

The DRE sector in India relies on a young, highly skilled, long-term workforce. There is clearly opportunity to ensure the energy workforce of the future is prepared through increasing awareness of the employment opportunities and developing strong policies on education, training, women’s empowerment, decent work and social protection. This synopsis details the breakdown of employment estimates and workforce trends by technology and company type, and can be used to grow awareness and facilitate policy development. See the main report for detailed methods, limitations, and recommendations.

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## DEFINITIONS

- » **Direct, formal jobs:** Direct, formal jobs are those created through contractual engagement with an incorporated company in the DRE sector. For example, an IT professional or a project manager who is employed by a DRE company.
- » **Informal sector:** According to the International Labour Organization, the informal sector comprises all work for unincorporated enterprises and for which no complete accounts are available that would permit a financial separation of the production activities of the enterprise from other activities of its owner(s). Informal jobs can even be extended to include non-remunerative work of contributing family members, and thus can be difficult to bound definitively [27].
- » **Direct, informal jobs:** Informal jobs are created through contractual or non-contractual engagement with an incorporated company in the DRE sector. Informal employment in the sector takes on various forms—from long-term arrangements with companies (e.g. product retail) to commission-based sales activities. For example, a home business owner who works as a village sales representative for a SHS company [27].
- » **Indirect jobs:** Indirect jobs are those created by backward-linked industries or companies that serve and supply the DRE sector. That is, those vendors and suppliers who serve the DRE sector upstream or provide services for the DRE sector’s day-to-day operations either contractually or non-contractually. For example, indirect jobs are those created by an inverter manufacturer or an importer who supplies DRE companies. Literature on indirect jobs is cited where available.
- » **Productive use jobs:** Productive use jobs are those created by the DRE end users themselves as a result of newly-acquired or enhanced electricity access. For the purpose of this study, productive use is defined as any income-generating application of a DRE product or service [28]. For example, the new jobs created by the purchase of a solar milling plant. Productive use jobs are estimated through insights from focus groups and literature, as most surveyed respondents did not readily have data on jobs created by their product or service offers at the customer level.
- » **Full-time equivalent (FTE) job:** An FTE job is the equivalent of one employee working full time over the course of a year where full-time work is defined in accordance with the country context. Part-time and contract work is converted to FTE based on number of hours worked or length of contract. All estimates of direct, formal jobs are presented in FTE job terms. All other references to “job” outside of direct, formal employment do not assume full-time equivalency.
- » **Skilled workers:** Skilled workers are those who hold leadership, management, professional, technical, or associate professional positions. Their responsibilities typically involve the performance of complex technical and practical tasks that require an extensive body of factual, technical, and procedural knowledge in a specialized field, as defined by the International Standard Classification of Occupation (ISCO-08) Skill Level [29]. Workers in Skill Level 3 or above are considered skilled workers.

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