



CLEAN ENERGY POWERS LOCAL JOB GROWTH IN INDIA

Increasing energy access, clean energy development, and job creation are national priorities for Prime Minister Narendra Modi's government. As India faces rising fuel prices, threats to energy security, and the impacts of climate change, renewable energy offers a critical solution. India's solar and wind programs have already catalyzed remarkable growth. In just four years, India's solar market has grown more than a hundredfold, exceeding 3 gigawatts (GW) of installed solar energy. India recently increased its 2022 grid-connected solar energy target by five-fold to 100 GW from 20 GW. India is also the world's fifth-largest wind energy producer, targeting 60 GW of wind energy by 2022. With 250 GW of total installed energy currently and a need for much more power, scaling up solar and wind energy projects can power India's economic growth and create jobs.

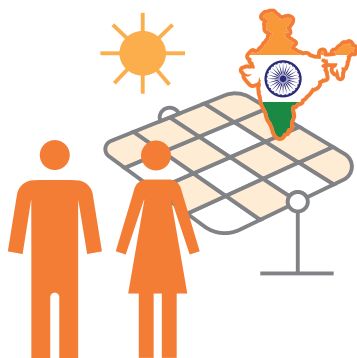
The new solar and wind goals are ambitious targets that can provide much needed energy access and can create enormous employment opportunities for India's growing workforce. Highlighting the job creation opportunities that a scaled-up clean energy market offers in India, analysis by the Natural Resources Defense Council (NRDC) and the Council on Energy, Environment and Water (CEEW) estimates that solar photovoltaic (PV) projects built in India between 2011 and 2014 created approximately 24,000 full-time equivalent (FTE) jobs—solely from commissioned projects currently producing electricity. The wind sector has created about 45,000 FTE jobs so far, according to government estimates.

Despite limited data, solar and wind renewable energy is estimated to have created nearly 70,000 FTE jobs in India so far.

If India achieves its new target of 100 gigawatts (GW) of installed solar energy by 2022, as many as 1 million FTE jobs could be created. Approximately 183,500 FTE jobs would be generated if India were to reach its target of installing 60 GW of wind energy capacity by 2022. Looking ahead, solar and wind companies in India can support the clean energy market by reporting their projects' job creation numbers.

CLEAN ENERGY CREATES JOBS FOR INDIA

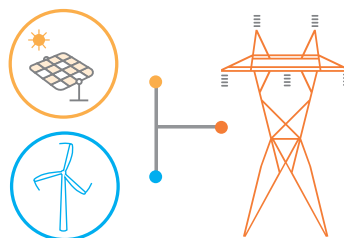
Clean energy = full-time employment. Tens of thousands of Indian citizens are employed by clean energy industries, directly and indirectly. This is great news for India's growing population and workforce.



Between 2011 and 2014

24,000

full-time jobs were generated through solar photovoltaic (PV) projects alone.



Grid-connected solar and wind energy is estimated to have created nearly **70,000** full-time jobs in India so far.

If India achieved its target of **100 gigawatts (GW)** of installed solar energy by **2022**

as many as

1,000,000

full-time jobs would be created.





Cleaning solar panels in Rajasthan.

The NRDC-CEEW analysis demonstrates the staggering economic impact that the projected growth of the renewable energy market can have across the country. However, because companies in India do not often report the number of jobs created by their projects, scant data exists on clean energy's economic impact on employment. In this rapidly evolving industry, the lack of data limits informed decision-making by policymakers and financiers alike. For example, as a part of the analysis, NRDC and CEEW have developed three scenarios projecting how many short term and long term jobs would be created through the 100 GW solar goal, depending on the project type (rooftop, grid-connected large-scale, or solar parks). Because this enthusiastic solar target can result in abundant job creation of varying degrees, policy development should factor in job-creation data to contemplate which mix of project types results in the highest economic opportunity for Indian workers, among other considerations.

One immediate and easy solution is for companies to voluntarily provide job creation totals in project announcements and press releases. By providing the number of jobs created when a new project is commissioned, Indian solar and wind developers would match international business practices and show the benefits that growing solar and wind energy markets have for local workforces and the Indian economy. Government policies supporting skills development are directly linked with data on employment statistics, as the clean energy market scales up to reach India's ambitious targets of 100 GW of solar energy and 60 GW of wind energy by 2022.

SOLAR AND WIND MARKETS PROVIDE HUGE EMPLOYMENT OPPORTUNITIES

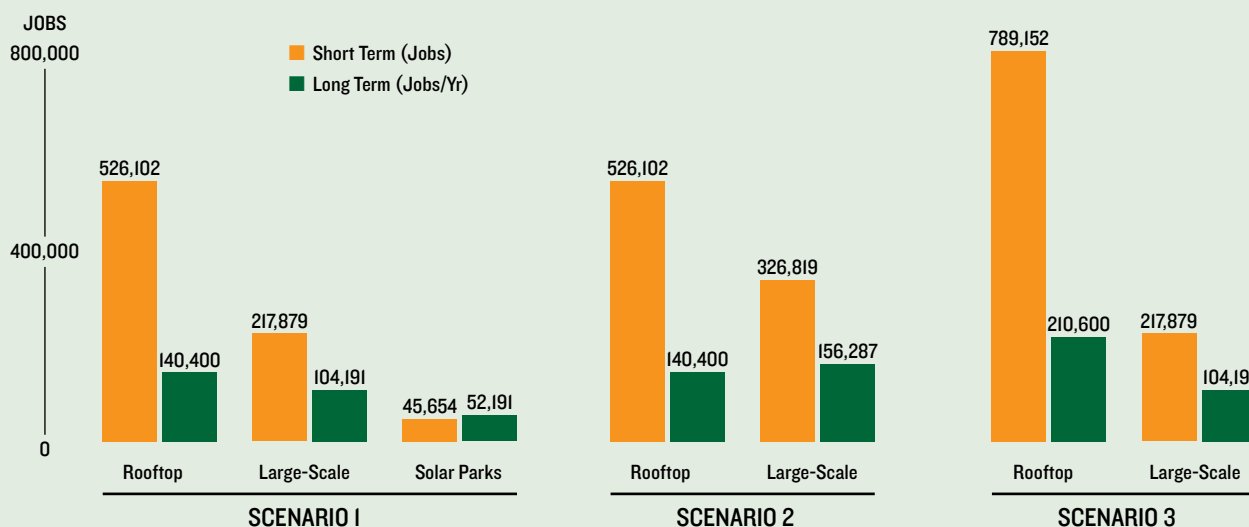
The rapid expansion of clean energy installations creates green jobs and supports local economies. Analysis of international markets has shown that renewable energy technologies are generally more labor-intensive than more mechanized fossil fuel technologies and can provide a tremendous opportunity to create local jobs for a young and growing workforce. Although there is scant data on the job creation totals for renewable energy in India due to a lack of data reporting by companies, preliminary data show major job growth potential and an estimated 70,000 jobs already created.

This analysis shows that there are already tens of thousands of workers in India employed in clean energy industries, both directly and indirectly. If India achieves its 100 GW solar target and its 60 GW wind target by 2022, hundreds of thousands more local workers would be trained and employed to support this rapidly expanding market, with ripple effects on local economies across India. The NRDC-CEEW research includes calculations for project planning, construction, installation and operations, and does not include manufacturing jobs—another significant jobs opportunity. These calculated jobs numbers demonstrate the compelling economic benefits of a robust clean energy market.

Up to 1 Million Jobs Solar Jobs by 2022

The Indian solar sector has the potential to generate up to 1,000,000 jobs (excluding manufacturing) if India achieves its targeted 100 GW of grid-connected solar power capacity by 2022. NRDC and CEEW's analysis presents a range of scenarios that take into consideration whether this 100 GW goal will be supported through more emphasis on larger solar parks and grid-connected large-scale 5-10 MW projects or smaller, more labor-intensive rooftop projects, with varying short-term and long-term job projections depending on the types of projects installed. The three scenarios show that not only does the targeted amount of solar power matter when developing policies to support clean energy growth, but also the type of solar project. The Indian government has recently focused on the creation of "ultra mega" solar parks, concentrated zones of solar project development that ease permitting and avoid some transmission losses, but could create fewer jobs than other project types. If energy access and "24/7 electrification" are two of the ultimate aims of this ambitious 100 GW solar goal, then the government should consider to what degree labor-intensive rooftop solar projects are also prioritized.

JOB CREATION SCENARIOS TO ACHIEVE 100 GW OF SOLAR ENERGY IN INDIA BY 2022



SCENARIO 1, 40 GW ROOFTOP, 40 GW LARGE-SCALE PROJECTS, 20 GW SOLAR PARKS

reflects the job creation potential based on MNRE's recently proposed mix of project types to achieve the 100 GW goal. If this recent policy shift towards creating vast solar parks is realized, with a balanced approach that also encompasses a significant amount of rooftop solar, this scenario could create a potential 789,000 short-term FTE and 296,000 long-term FTE jobs, totaling more than 1,080,000 FTE jobs by 2022.

SCENARIO 2, 40 GW ROOFTOP, 60 GW LARGE-SCALE PROJECTS

shows the short and long-term job creation potential if the government's policy approach focused primarily on 5-10 MW grid-connected large-scale projects rather than solar parks. This scenario create a potential 850,000 short-term FTE and 296,000 long-term FTE jobs, totaling more than 1,140,000 FTE jobs by 2022.

SCENARIO 3, 60 GW ROOFTOP, 40 GW LARGE-SCALE PROJECTS

shows the job creation potential if rooftop solar is prioritized and makes up the majority of solar installations by 2022. Of the three scenarios presented, this scenario reflects the most jobs potentially created due to its focus on labor-intensive rooftop solar. This scenario could create a potential 1,000,000 short-term FTE and 310,000 long-term FTE jobs, totaling more than 1,310,000 FTE jobs by 2022.



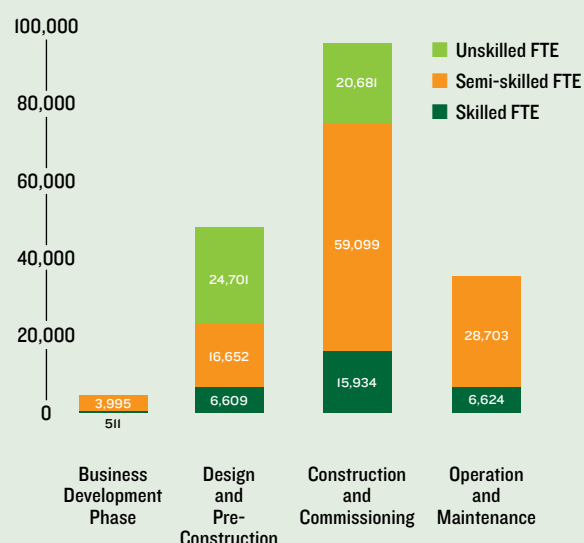
Solar panels at a National Solar Mission-commissioned power plant at Jaisalmer, Rajasthan.

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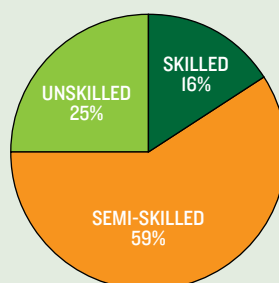
More than 180,000 Wind Jobs by 2022

The Indian wind sector has the potential to generate much needed employment for the growing workforce, up to 183,500 FTE jobs (excluding manufacturing) if India achieves its targeted 60 GW of wind power capacity by 2022. According to NRDC-CEEW estimates, the majority of jobs created by the Indian wind energy sector by 2022 would be in semi-skilled and unskilled roles: nearly 59% FTE jobs for semi-skilled personnel and 25% FTE jobs for unskilled workers. 81% of these projected jobs would be one-time roles such as construction, and 19% would be permanent jobs.

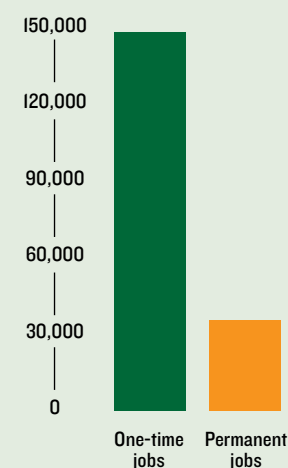
BREAKDOWN OF JOBS BY TYPE



PERCENTAGE BREAKDOWN OF JOBS BY TYPE



ONE-TIME JOBS AND PERMANENT JOBS



Wind turbines on Nargund Hill in Karnataka.



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The NRDC and CEEW analysis has found unequivocally that renewable energy creates local jobs, which drive economic development. Although hampered by severe data scarcity, preliminary research and analysis shows that from 2011 to 2014, grid-connected solar energy development employed approximately 24,000 FTE workers during the Solar Mission's first phase. Similarly, wind energy development created more than 45,000 jobs by 2012, based on government estimates.

Even more impressive, if the government reaches its national goal of deploying 100 GW of grid-connected solar energy by 2022, up to a projected 1,000,000 FTE jobs would need to be created to construct and operate these solar installations. The training of a "solar army" of 50,000 workers through government programs, as Prime Minister Modi has recently called for, will indeed be needed. Additionally, a projected 183,500 FTE jobs would be generated to reach the new Wind Mission target of 60 GW by 2022. Our analysis shows much more extensive training efforts would be required to provide enough skilled and semi-skilled workers to keep pace with this considerable undertaking. The 100

GW target is only for grid-connected solar energy, but off-grid solar also presents a tremendous power resource and jobs opportunity for villages across the country that cannot feasibly be reached by the grid and existing infrastructure.

Unlike international markets, Indian companies do not regularly report job numbers, making it difficult to accurately measure job creation. However, the local job opportunities created by renewable energy projects offer a powerful economic rationale for the government and public to support more solar and wind power. In order to truly realize the potential for employment opportunities from solar and wind energy, Indian industry should strive for greater transparency regarding the impact of clean energy projects on job creation. As an easy solution, Indian companies can voluntarily provide their projects' job creation numbers in press releases and project announcements. The government agencies and local companies could also collaborate on skills development in order to ensure that progress made toward energy and ecological security also helps India address its need to generate jobs for its rapidly growing workforce.

International Best Practices for Reporting Jobs Data

As our review of currently available project information in India made clear, solar and wind company press releases and announcements in India rarely mention estimated job creation numbers. In several other countries, businesses and governments regularly track and report both temporary and permanent jobs created by renewable energy projects in press releases and other media outlets. Here are excerpts from published press releases for solar and wind projects internationally:

"First Solar suggests that the project will create \$192 million in pay for approximately 400 construction positions over the three-year build" in California.¹

The 128.5 MW Templin Solar Power Plant in Brandenburg, Germany "took four months for construction, creating approximately 400 jobs."²

"South Kent Wind created approximately 500 jobs during construction and 22 full-time permanent positions for ongoing operations and maintenance. A total of 99% of the workforce was comprised of workers from Ontario [Canada]."³

NRDC's partner organization, Environmental Entrepreneurs (E2), tracks job announcements from companies; government programs; the media; and other sources through its initiative "Clean Energy Works for Us."⁴ E2 can then take this information and provide in-depth analysis of how renewable energy is driving economic growth and creating clean jobs locally, even on a state-by-state basis. If companies in India provided this same basic level of information, policymakers, lenders, and other stakeholders could make more informed decisions.



Wind turbines at Gamesa-Renew Power's 85 MW wind project in Jath, Maharashtra.

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1. Eric Wesoff, "Topaz, the Largest Solar Plant in the World, is Now Fully Operational," GreentechSolar, 24 Nov. 2014: <http://www.greentechmedia.com/articles/read/550-megawatts-AC-to-be-exact> (accessed 28 January 2015).

2. "Templin Solar Power Plant, Germany," Power-technology.com, <http://www.power-technology.com/projects/templin-solar-power-plant/> (accessed 5 February 2015).

3. Pattern Energy, "Samsung and Pattern Energy Complete Canada's Largest Wind Project, South Kent Wind," press release, April 14, 2014, patternenergy.com/en/media/releases/samsung-and-pattern-energy-complete-canadas-largest-wind-pro/, accessed January 28, 2015.

4. Environmental Entrepreneurs, "Clean Energy Works for Us," "Select a State" interactive graphic, cleanenergyworksforus.org/ (accessed January 28, 2015).

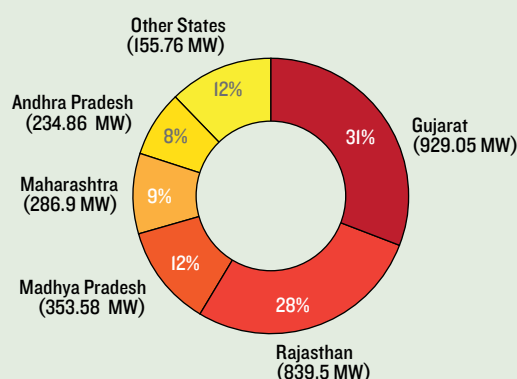
Indian States Leading the Way Towards a Clean Energy Future

The following leading states boast the most installed capacity of solar and wind energy so far and are primed to benefit from continued policy and financial support, and the resulting local economic impact, of clean energy. All but one of the top five solar leaders are located in the sun-drenched northwest of India. All top five wind leaders are located along India's windy west and southeastern coasts.

SOLAR PV INSTALLED CAPACITY LEADERS

(as of December 2014)*

Gujarat	929.05 MW
Rajasthan	839.50 MW
Madhya Pradesh	353.58 MW
Maharashtra	286.90 MW
Andhra Pradesh	234.86 MW

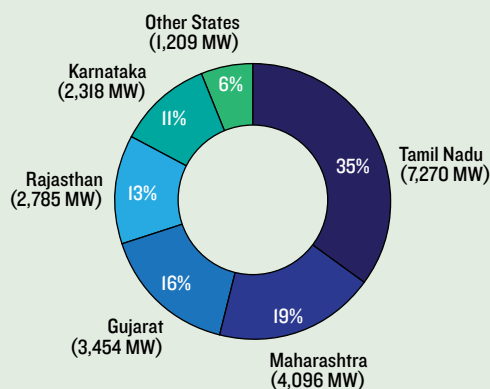


* Government of India, Ministry of New and Renewable Energy, "State Wide Installed Capacity of Solar Projects Under Various Schemes as on 15/12/2014," mnre.gov.in/file-manager/UserFiles/State-wise-Installed-Capacity-of-Solar-PV-Projects-under-various-Scheme.pdf, (accessed January 28, 2015).

WIND INSTALLED CAPACITY LEADERS

(as of January 2014)**

Tamil Nadu	7,270 MW
Maharashtra	4,096 MW
Gujarat	3,454 MW
Rajasthan	2,785 MW
Karnataka	2,318 MW



** Government of India, Ministry of New and Renewable Energy, "Annual Report 2013-2014," mnre.gov.in/file-manager/annual-report/2013-2014/EN/index.html, (accessed January 28, 2015).

FINDINGS AND RECOMMENDATIONS TO SCALE CLEAN ENERGY

As India looks ahead to address the pressing issues of meeting rising energy demand, increasing energy access, providing jobs for a growing population all while addressing the crisis of climate change, supporting increased clean energy is a key priority for the Indian government. Demonstrating the enormous jobs potential and economic impact makes a case for creating more policy support for the country's solar and wind energy markets. Information on job numbers is useful to market investors and the broader Indian public who stand to benefit from increased clean energy and energy access. Increased transparency on employment numbers for clean energy projects enhances policy support for the solar and wind markets, increases lender confidence and supports the need for skill-development for energy access.

As India moves toward its 2022 solar target of 100 GW and develops its 60 GW Wind Mission, the Indian government should have the opportunity to consider the employment opportunities created by the solar and wind industries when designing and implementing clean energy policies at the state and national levels. By reporting their projects' jobs numbers, clean energy companies in India would be helping show the positive economic impact of renewables on India's workforce. It also creates a baseline of employment numbers to quantify future growth of the robust market.

Given the huge jobs opportunity presented by expanding solar and wind energy markets, prioritizing policies that remove barriers to growth is also key. With a lack of affordable and accessible financing obstructing these markets during this critical scaling up phase, innovative financing instruments and policies can break through to attract investment and support solar and wind market growth. With strong leadership from government and companies, India can support and enable a needed surge in the clean energy sector to sustainably power its future and help mitigate climate change's worst impacts.

OVERALL FINDINGS

1. Currently, the full range of economic benefits of employment generated by India's clean energy industries are largely unknown due to a lack of reporting by solar and wind companies.
2. As many as 1 million FTE jobs could be created if India achieves its target of 100 GW of solar energy by 2022. Approximately 183,500 FTE jobs would be generated if India installed 60 GW of wind energy by 2022. Availability of job creation numbers can guide policy decisions as the framework is developed for how India will achieve targets through its Solar and Wind Missions.
3. Policy support through innovative financing mechanisms and instruments such as green banks and green bonds could help reduce the high cost of capital available to scale renewable energy projects.

KEY RECOMMENDATIONS

1. Solar and wind energy companies in India can match international business practices by simply reporting a project's job creation numbers in their press releases or related announcements. For example, a solar or wind company announcing the completion of its latest project could include this information in its press release: "This project created approximately XX jobs during construction and XX full-time permanent positions for ongoing operations and maintenance."
2. As NRDC and CEEW's analysis and scenarios show, rooftop solar projects are more labor-intensive and can create more jobs. In addition to solar parks and large-scale projects, promoting distributed generation technologies such as rooftop and off-grid through targeted policies can go a long way towards employing India's growing workforce and achieving the government's goal of 24/7 electrification through clean energy. Government agencies and local companies could also collaborate on skills development to train this growing workforce.
3. To support the enormous job creation potential of reaching its solar and wind energy goals, the Indian government and business leaders can prioritize the availability of affordable capital through innovative financing interventions such as green banks and green bonds.

Focus on Jobs: Three Examples of Clean Energy Leaders

Spotlighting specific clean energy projects shows the positive economic impact of solar and wind energy. Local communities are key beneficiaries of employment from wind power projects during the project's operations and maintenance phase. For example, out of a total of 438 FTE jobs created by the Gamesa-Renew Power 85 MW wind power project in Maharashtra, 20% were generated for local residents in semi-skilled and unskilled roles. Kiran Energy's 20 MW solar power plant in Rajasthan, which generated 180 FTE jobs, demonstrates the huge employment potential of solar power as well.

Rooftop solar PV is another major opportunity, presenting a viable alternative to diesel backup power for companies and generating local skilled employment. Hero MotoCorp, the world's largest motorcycle manufacturer, has already installed an 80-kilowatt rooftop PV project in Haryana and is looking to add solar PV to other manufacturing facilities.

Wind turbines at Gamesa-Renew Power's 85 MW wind project in Jath, Maharashtra.



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Kiran Energy's 20 MW Solar Plant in Jodhpur, Rajasthan.

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Solar PV panels installed on Hero MotoCorp's factory roof in Haryana.



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www.nrdc.org/international/india/renewable-energy-jobs.asp



Reenergizing India's Solar Energy Market Through Financing

www.nrdc.org/international/india/files/renewable-energy-solar-financing-report.pdf



Creating Green Jobs: Employment Created by Kiran Energy's 20 Megawatt Solar Plant in Rajasthan, India

www.nrdc.org/international/india/files/renewable-energy-solar-jobs-kiran-IP.pdf



A Second Wind for India's Energy Market: Financing Mechanisms to Support India's National Wind Mission

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Making Use of the Roof: Employment Generation from Hero MotoCorp's 80 kW Rooftop Solar Project in Haryana India

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Solar Power Jobs: Exploring the Employment Potential in India's Grid-Connected Solar Market

www.nrdc.org/international/india/files/renewable-energy-solar-jobs-report.pdf



Creating Green Jobs: Employment Generation from Wind Energy in India

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Surging Ahead: Scaling India's Clean Energy Market Through Jobs and Financing

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