MAKING USE OF THE ROOF: EMPLOYMENT GENERATION FROM HERO MOTOCORP'S 80 KW ROOFTOP SOLAR PROJECT IN HARYANA INDIA

As prices of solar photovoltaic (PV) electricity approach grid parity with fossil fuels, solar PV is rapidly becoming an economically viable source of electricity. The escalating costs of electricity from coal, gas, or diesel-based generation, coupled with attractive government rooftop solar programs, are motivating leading companies to take advantage of their roofs to generate electricity for industrial and commercial applications. As companies are learning, not only do rooftop solar projects increase reliable energy supply, but they also create much needed jobs. This report takes a close look at clean energy employment generation, using the Hero MotoCorp's 80 kW rooftop PV project in Haryana, installed by Hero Future Energies, as an illustrative example.

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With India's largest motorcycle company opting to install solar panels on its factory roof to power production, the Hero MotoCorp project demonstrated the benefits of solar energy and created local jobs during the rooftop solar installation. Across the 25-year project life, **the 80 kW rooftop project at Hero's motorcycle factory generated a total of 2.71 full time equivalent (FTE) jobs**. In the first year of operation, during the business development, design and pre-construction stages, the employment opportunity totaled 1 FTE. The construction phase generated a further 1.2 FTE. For the 25-year operational life of the project, cleaning resources will total 0.53 FTE annually while maintenance will total 0.019 FTE of activity every year for a highly trained maintenance engineer. The Hero MotoCorp project profile shows that a higher skill level is required of workers constructing rooftop projects because of the expertise needed to install PV panels on rooftops as compared with ground-mounted projects.

ROOFTOP PROJECT INSTALLATION AND COMPANY MOTIVATIONS

Motivated by the opportunity to test rooftop PV as an energy source and gain experience in the burgeoning solar market, the larger Hero Group decided to pilot a rooftop system on its Haryana Hero MotoCorp factory in 2012. Hero Future Energies, a company also under the Hero Group umbrella, acted as the engineering, procurement, and construction (EPC) contractor for the rooftop PV project.

For financing, Hero MotoCorp utilized the central government's 30 percent capital subsidy program for PV plants under 100 kilowatts peak (kWp). Applying for and receiving the subsidy took approximately six months. Once Hero MotoCorp received the subsidy, construction took about 30 days.

The PV system has been providing power to the factory since September 2013, and the company reports that it has been performing well. Since commissioning, the PV system has been running on 15 percent system efficiency, which translates to a performance ratio of roughly 78 to 80 percent, generating 52,304.64 kWh of power over a period of 6.7 months from September 22, 2013 installation through April 4, 2014. Table 2 summarizes the current status of electrical demand and supply at the Haryana factory. Given the quick success with the 80 kW in its Haryana facility, the company is considering installing an unsubsidized 1 MW rooftop solar PV project at a facility in Neemrana, Rajasthan.

In addition to the direct benefit of reduced prices of electricity that Hero MotoCorp receives, the rooftop solar system has several other advantages to the company. A rooftop PV system is quick to install, reduces system losses compared with grid-based distribution, and creates local jobs and local economic development.[1] The rooftop PV project created highly skilled and unskilled jobs during business development, design, pre-construction, construction, and maintenance, as analyzed below.

Table 1: Hero MotoCorp PV-Rooftop Project Details

Project Name	Hero MotoCorp
Engineering Procurement and Construction	Hero Future Energies
Location	Dharuhera, Rewari District, Haryana
Policy	MNRE Pilot Scheme for Large Scale Grid Connected Roof Top Solar Power Generation
Date of Commissioning	September 22, 2013
Solar PV System Information	
Size	80 kilowatt (kW)
Solar Panel Supplier	HHV Solar, Crystalline Silicon PV
Inverter Supplier	SMA Solar
Financing	Equity financed by Hero MotoCorp
Solar Potential	100,050 kilowatt-hours (kWh)/year
Generation to Date	52,304.64 kWh (September 22, 2013 to April 4, 2014)
Total Project Cost	Rs 80 lakh ($130,654) (not including 30% MNRE subsidy)
Employment Generation	
Highly Skilled/Senior Management	0.44 FTE, or 5.5 FTE per megawatt
Skilled Labor	1.04 FTE, or 13 FTE per megawatt
Total Employment during Construction	1.2 FTE, or 18.5 FTE per megawatt
Total Life Cycle Employment Generation (Highly Skilled + Skilled + Unskilled Activity)	2.7 FTE, or 33.75 FTE per megawatt
Expected Project Operating Life	25 years

Table 2: Summary of Electrical Supply For Hero Moto Corp

Utility Supplier	Haryana State Electricity Board
Contracted Demand from utility supplier	4000 kVA
Captive Power Plant 1	6 MW – 2 units of 3 MW, on site Natural Gas Fired Power Plants
Captive Power Plant 2	11 MW – 5 units of 2 MW, and 1 unit of 1 MW, on site Diesel Powered Plants
Rooftop PV Plant	80 kW used for lighting and ancillary supply

About Hero Future Energies & Hero MotoCorp

Hero Future Energies is a group subsidiary of the Hero Group, created in 2012 with an objective to establish itself as an independent power producer focusing on renewable energy from solar, wind, and hydro power generation. In its short duration of operating, Hero Future Energies has developed a portfolio of 37 MW of wind energy projects in Rajasthan. Hero Future Energies has been awarded a total of 30 MW ground-mounted projects in the recently announced bids under the National Solar Mission Phase 2, Batch 1. The company plans to install these projects in the state of Madhya Pradesh.[2] The company has ambitious plans to develop 1 gigawatt (GW) of renewable energy assets by 2016.

Hero MotoCorp Limited (Formerly Hero Honda Motors Ltd.), based in India, is the world's largest manufacturer of two-wheelers, including motorcycles. Hero MotoCorp is the flagship company and a part of the $5.6 billion Hero Group, a well-known industrial conglomerate in India with diversified interests including aluminum die-casting, information technology, and financial services. In addition to the Haryana PV installation, Hero MotoCorp installed a 100 kW captive rooftop project at a facility in Gurgaon in 2011. The company is also currently investigating investment in a 1 MW solar PV system at a facility in Neemrana.

Both companies are subsidiaries of the larger Hero Group.

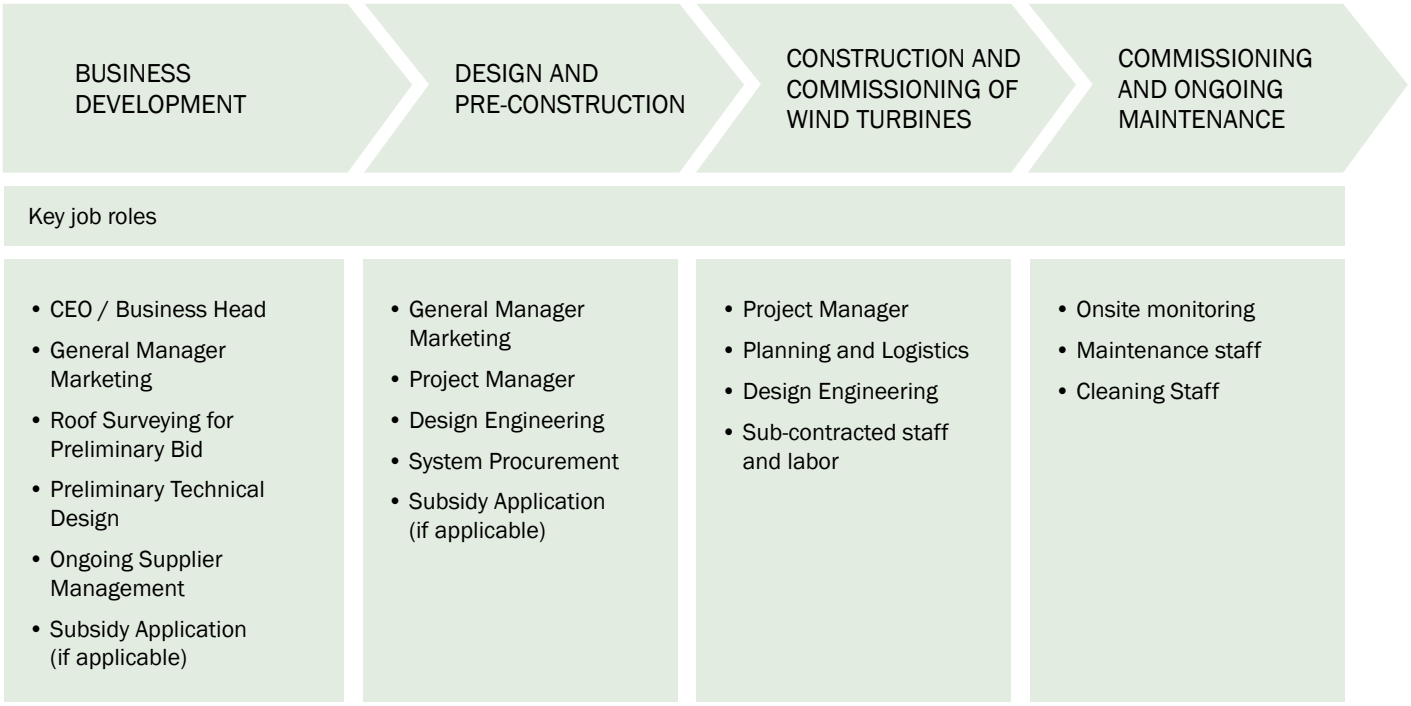
Government Policies for Rooftop Solar PV Systems

Policies of the central government as well as states and cities are expanding in India for commercial, residential, and industrial application. To build the rooftop solar market, the Ministry of New and Renewable Energy (MNRE) offers a capital subsidy program for large-scale grid-connected rooftop solar PV power generation for systems up to 100 kilowatts peak (kWp) in size.[3] In April 2013, the Solar Energy Corporation of India (SECI) offered a tender for demonstration projects for large-scale grid-connected rooftop solar projects in selected locations, including Harayana, where Hero MotoCorp is located.[4] A key stated objective for SECI is to facilitate a reduction in diesel consumption and dependency on grid power.

Several state and city programs are adopting rooftop solar policies. For example, the state of Gujarat allocated 5 megawatts (MW) of rooftop PV systems under its Gandhinagar Solar Rooftop Solar PV project and has announced plans to allot an additional 25 MW in five cities across Gujarat.[5] And policies are not limited to commercial applications. Tamil Nadu, for instance, announced a residential rooftop solar scheme under which the first 10,000 consumers to set up 1 kilowatt (kW) systems will get a subsidy of Rs 20,000 from the state government, in addition to the central government subsidy of Rs 30,000. New Delhi and other municipalities are also considering programs.

Solar PV Panels Installed on Hero MotoCorp Factory Roof

Stages of a PV Project Installation Process



The process of developing the Hero MotoCorp rooftop solar PV project can be divided into four phases:

- Phase 1: Business Development
- Phase 2: Design and Pre-Construction
- Phase 3: Construction
- Phase 4: Commissioning and Ongoing Maintenance

PHASE 1: BUSINESS DEVELOPMENT

The business development phase of the rooftop solar project was carried out by a cross-functional team at Hero Future Energies that included two marketing staff (the assistant general manager and manager of marketing) and four technical staff (senior design engineer, design engineer, project manager, and deputy project manager). In general, the marketing team for rooftop solar PV development spends a majority of its time converting leads to actual sales, making the business case for solar rooftop to potential clients. If there is sufficient client interest, a preliminary bid is prepared on behalf of the client, with a shadow analysis that provides an accurate estimate of the potential for solar electricity generation from a rooftop PV installation at a given site. The Hero Future Energies team reports that in a typical year, it gets from 80 to 100 initial inquiries for rooftop PV installation, of which 5 or 6 convert into project installation, or a ratio of about 1:20.

Since the project developer and the EPC company were part of the Hero Group, the business development phase was faster for the Haryana rooftop project than a typical project with an EPC company engaging with a commercial or industrial client. The table below summarizes the staff resources, their activity, and the approximate time consumed in this stage for the Hero project.

Table 3: Phase 1 Resource Requirements

Resource	Key Activities	Duration
Head of Sales/Assistant General Manager, Marketing	Relationship management, proposal review, sales closure	1 day
Marketing Manager	Relationship management, proposal review, sales closure	1 day
Project Manager	Site visits to survey roof, coordination with design team	2 days
Deputy Project Manager	Site visits to survey roof, coordination with design team	2 days
Technical—Senior Design Engineer	Drawing system design specifications	2 days
Technical—Design Engineer	Drawing system design specifications	2 days

PHASE 2: DESIGN AND PRE-CONSTRUCTION

Once the project received management approval, technical specifications were finalized on the basis of detailed inputs from the installation site. A procurement manager worked closely with the design team and purchased system components based on design specifications. However, once the design and procurement process was completed, the company could not start construction activity immediately due to a delay in approval of the 30 percent capital subsidy given by MNRE. Table 3 summarizes the key activities for this phase of the project, along with estimates of time spent by key resources involved.

PHASE 3: CONSTRUCTION

Once the subsidy disbursal had been made, construction activity was completed in a period of 30 days. A project manager was primarily responsible for project execution according to specifications developed by the system design team. Hero Future Energy subcontracted construction activity to a local service provider familiar with the local market, suppliers, and contract skilled labor. Unlike a typical grid-connected project, there was little or no requirement for unskilled labor in the construction activity for the rooftop PV project.

PHASE 4: COMMISSIONING AND ONGOING MAINTENANCE

Upon completion of construction activity, a technician from the inverter supplier completed system commissioning and the system began generating electricity on September 22, 2013. Ongoing routine maintenance involves daily cleaning by Hero MotoCorp staff, preventive maintenance, and biannual inspection by an engineer to ensure optimum performance.

Table 4: Phase 2 Resource Requirements

Resource	Key Activities	Duration
Head of Sales/Assistant General Manager, Marketing	Overall coordination	2 days
Marketing Manager	Interfacing with client, team oversight and coordination	2 days
Project Manager	Project management of drawing of electrical and civil design for the PV installation	10 days
Technical—Senior Design Engineer	Preparation of civil and electrical design for the PV installation	10 days
Technical—Design Engineer	Preparation of civil and electrical design for the PV installation	10 days
Business Development/ Procurement Manager	Vendor coordination and procurement of PV system based on specs: issue inquiry, negotiation of quotes, placing of order	20 days

Table 5: Phase 3 Resource Requirements

Resource	Key Activities	Duration
Head of Sales/AGM Marketing	Overall team and construction activity oversight	3 days
Marketing Manager	Management on construction site, coordinating with client, coordinating with design team	3 days
Project Manager	Overall project management and coordination	25 days
Technical—Senior Design Engineer	Updating of system design for PV installation	4 days
Technical—Design Engineer	Updating of system design for PV installation	4 days
Business Development/ Procurement Manager	Civil design, on-site verification and coordination with draftsman	3 days
Subcontractor Team		
Project Manager	Day-to-day management of skilled and unskilled labor, procurement of construction materials.	30 days
Skilled Labor	8 skilled laborers to carry out civil works	30 days

Table 6: Phase 4 Resource Requirements

Resource	Key Activities	Duration
Inverter Technician	Commissioning of inverter upon construction activity completion	1 day
Preventive Maintenance and Monitoring Technicians	Routine monitoring of performance of PV system, and preventive maintenance	5 days per operating year
Unskilled Cleaner	Cleaning of PV system on alternate days throughout year	130 days per operating year

EMPLOYMENT GENERATION IN ROOFTOP SOLAR PROJECTS

Based on employment estimates from the Hero Future Energies and Hero MotoCorp, we calculate that the 80 kW rooftop solar PV project generated a total of 2.71 full time equivalent (FTE) jobs over the 25 year expected lifetime of the project. This total included 0.44 FTE total for highly skilled personnel during the first year of the project, including business development, design, sales, procurement, and project management. In addition, 1.2 FTE jobs were created in the form of one-time jobs for construction and installation of the rooftop PV system. These construction jobs are considered skilled because workers must possess vocational training in order to perform the tasks required for rooftop PV construction and installation.

Most of the highly skilled activity is related to the phases from business development to commissioning of a project. Once the project has been commissioned, the only highly skilled activity associated with it is preventive maintenance and monitoring. Consequently, for the entire 25-year project life cycle, 0.019 FTE of activity is involved for a highly trained maintenance engineer every year. A total of 0.53 FTE of unskilled resources are required annually for cleaning activity over the 25 years that the plant is operational, making the life cycle total for highly skilled, skilled, and unskilled jobs 2.71 FTE.

METHODOLOGY FOR CALCULATION OF EMPLOYMENT GENERATION

This employment profile is based on personal interviews with Hero MotoCorp and Hero Future Energies teams that worked on the 80 kW rooftop project. Some of the estimates, particularly relating to time spent on business development, procurement, and vendor management activities, are rough approximations, as these teams work on several projects simultaneously and it is difficult to isolate the time spent on a single project. Besides the specific jobs discussed in this profile, a number of additional job roles are created by solar PV grid-connected projects in secondary and tertiary roles. These jobs, directly and indirectly connected with solar PV (including manufacturing and supply of system equipment such as inverters, cables, trackers, and other parts), are not included in this analysis.

CONCLUSION

More and more companies are looking to offset their spending on diesel backup power and erratic grid-based electricity supply by installing rooftop solar PV systems. The Hero MotoCorp project shows that creating local jobs in the process can be an additional benefit to maximizing its rooftop with solar panels. For the 80 kW rooftop project at Hero's motorcycle factory, the total 35-year lifecycle employment is 2.7 FTE jobs. Rooftop solar PV installation process is quick and presents employment opportunities for a skilled workforce. National, state, and city policies need to be strengthened to accelerate rooftop solar installation to provide greater access to clean energy while also generating greater employment in India.

ENDNOTES

1 Rocky Mountain Institute, *EmPower: Accurately Valuing Distributed Energy Resources*, September 2013, http://www.rmi.org/elab_empower (accessed April 10, 2014).

2 Hero Future Energies, *Solar Power*, http://herofutureenergies.com/heroenergy/frontend/www/en/project_solar-10.html (accessed April 10, 2014).

3 Solar Energy Corporation of India (SECI), *MNRE Pilot Scheme for Large Scale Grid Connected Roof Top Solar Power Generation*, http://seci.gov.in/upload/uploadfiles/files/pamphlet_PV1.pdf (accessed April 7, 2014).

4 SECI, *Pilot Scheme of MNRE for Large Scale Grid Connected Roof Top Solar Power Generation*, http://www.mnre.gov.in/file-manager/advertisement/adv_seci_april2013.pdf (accessed May 17, 2014).

5 Gujarat Power Corporation Ltd., *Solar Rooftop Project—Gujarat*, http://www.gpclindia.com/showpage.aspx?contentid=110 (accessed April 9, 2014).

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