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## Studies on entrepreneurship opportunities in solar energy sector for employment generation

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**Abstract**

This study discusses the present scope and future prospects of opportunities for entrepreneurship development in solar energy sector. Solar energy is becoming a promising and viable source of alternative energy not only from the generation of power point of view but also with regards to the protection of environment due to its abundant availability and cleanness. Its importance is also increasing day by day because of decreasing price in solar panel, enhanced usage in various sectors and a sustainable source of energy. Therefore, in the rising industry of solar power generation, job prospects would rise through entrepreneurship development.

**Keywords:** cucumber, boron, yield, quality, konkan

**Introduction**

In the rising industry of solar power generation, job prospects are on the rise too. To accomplish the 20000 MW installed capacity targets under Jawaharlal Nehru National Solar Mission (JNNSM), solar energy business will need a projected requirement of about 4, 00,000 people by 2022. There are options in production and development implementation and NNNSM is a real prospect for start-ups. Once the Government steps up the scope of the domestic solar manufacturing business, we will see an increase in the industrial sector. There is possibility of undertaking various field works for the growth of the sector. It has more to do with linking systems like solar panels, batteries, charge controllers, inverters and the consignment in fixing up power plants. In the absence of universal electricity access across the country, the dream of digital India, e-commerce, e-governance, smart cities and developed economy shall remain a farce and impossible to realize. Government of India has therefore recognized the importance of solar energy as one of the sustainable sources of energy under National Action Plan for Climate Change (NAPCC). NAPCC aims to derive 15% of its energy requirements from renewable energy sources by the year 2020. Various policy measures, such as preferential tariff or fixed tariff or feed-in tariff, excise duty exemption, and soft loan, have been implemented to achieve the above-mentioned target. The growth in the solar power generating industry represents many new opportunities for the entrepreneurs. One does not have to obtain an engineering degree or some other technical background to seize upon these opportunities in this industry. They can spread the entire value chain from PV cell production manufacturing to management of the national energy grid system. The opportunities include original equipment manufacturing, PV manufacturing, PV product testing and delivery, PV cell installation and servicing, new energy storage devices, mobile solar energy based appliances, management of the solar energy supply to the national grid system, development of alternative materials to produce wafers or semiconductors, energy usage monitoring devices, development of heating and cooling systems, development of new hot fluids for cogeneration or electrical turbines systems, and many others. All of the opportunities can be categorized into three major categories associated with the energy generation value chain such as to reduce the cost of power generation, improve the speed and reliability of power generation, and expand the opportunities to apply renewable, sustainable energy technology to new applications across the value chain. Some general examples of these opportunities are shown in Table 1. Each area of the value chain offers business venture opportunities that can create value using one or more of the three major categories and enhance universal electricity access for all as electricity is essential for human comfort, efficiency and basic needs like lighting, cooking food, cooling

homes, earning a living and utilizing health and education services etc. Due to the continuous increment in electricity demand day-by-day, Indian power sector is interfacing some challenges to maintain the balance between the power generation and demand with suffering from supply constraints and shortages in power. For maintaining the ratio of generation and demand of power, moving from conventional sources to non-conventional sources is not only an option, it is a necessity. The importance of using solar as energy source in India's perspectives in not only to increase power generation, but also to expand energy reliability with considering the environmental, social, independent and financial benefits properties.

### Entrepreneurship opportunities

Entrepreneurship' is one of the principal mechanisms for the mitigation of unemployment and under-employment amongst educated youth. For success, the prospective engineer entrepreneur must coordinate knowledge and skills and keep abreast of the technologies, business market, skill requirement and fiscal policy issues related to the solar energy business. In addition, the engineer entrepreneur needs to do lots of homework for site selection, check proximity of the enterprise to transport facilities and power evacuation for establishing a micro-grid enterprise. Attention must be paid on the cost, durability, effectiveness and the design of the important components, such as the solar inverter, transmission and distribution equipment and supporting switchgear and equipment which ought to be geared up as per demand and the local market. The entrepreneur should vigorously survey the human resource requirement and keep a database of the organizations willing to provide financial and technological assistance to the prospective entrepreneurs on convenient terms. The prospective entrepreneur must try to be partner with reputed companies and institutions to develop mechanisms and maintain profitability and human resource development for entrepreneurial operations. Suggestion for the solar - based enterprises is made, especially due to the availability of solar energy in abundance all over the country by virtue of its advantageous geographical location. India lies on the equatorial belt of the earth bestowing 250 to 300 clear sunny days in a year with annual global solar radiation from 1600 to 2200 kWh/m<sup>2</sup> and equivalent energy potential of about 6, 000 million GWh per year. Energy from the sun can alone suffice more than the electricity needs of this country. Solar energy is a clean, emission free, renewable and environment friendly energy resource, abundantly available in India. The more it is harnessed to produce electricity, the better it shall be for larger electricity access on a countrywide

scale. The country must gradually prepare itself to bid a good bye to the use of fossil fuels for electricity due to escalating costs of the imported fuel and the environmental degradation caused by the GHG and NO<sub>x</sub> emission generated by the fuels which has become a burning issue for the country's climate and sustainability. Optimal harnessing of solar energy for electricity can make this country the world leader in energy and bring this nation on the map of developed economies which all Indians should continuously strive for.

### Rebates and concessions to prospective entrepreneurs under the national solar mission

A lot of opportunities exist for young engineer entrepreneurs to avail special incentives, subsidies and tax benefits from the Government side as MSMEs and Energy entrepreneurs to make them active partners in developing country's economy by enhancing electricity access in rural areas. The Jawaharlal Nehru National Solar Mission (JNNSM), offers a 10-year tax holiday for photovoltaic (PV) and thermal solar plants getting completed before 2020, reduced customs duty and zero excise duty on specific capital equipments, critical materials and project imports in addition to the grant of loans at cheap interest rates. These concessions and subsidies are meant to meet the challenges of ecologically sustainable growth, energy security and for fulfillment of the target of solar energy in villages and grid connected power by the National Thermal Power Corporation fixed at 100, 000 MW and 15, 000 MW respectively by the year 2022. The young engineer entrepreneurs must carefully understand the perspective, policies and incentives and its implications for deriving optimum benefits in order to make their ventures business oriented and profitable.

### Existing skill gaps in solar PV and thermal systems

Solar PV and Solar Thermal based renewable energy generation in India currently contributes significantly to the employment opportunities in the renewable energy sector. Considering the JNNSM targets, there would be a multi-fold increase in employment opportunities in this sector. Employment opportunities in solar PV and solar thermal based RE systems require qualified mechanical and electrical engineers, semi-skilled and non-skilled workers for installation and commissioning, technical staff for the operation and maintenance, project managers, etc., The following skill gaps (Table 2 ) in solar system need to be fulfilled to strengthen the solar sector in the coming days. Entrepreneurs are to take challenge to abridge the gaps in creating avenues to become a part to the growth of solar industry.

**Table 1:** Opportunity areas for entrepreneurial activities in solar sector

Equipment to Manufacture PV cells	PV Cell Manufacture	PV Cell Installation	Energy Generation	Energy Capture and Storage	National Grid Management	Regenerative Technology Development	Cross Value Chain Opportunities
Source or manufacture equipment	Semiconductor materials improvement	Cell installation commercial, residential	Conversion from traditional technology to solar energy	Storage systems	Monitor energy flows	Improve collection efficiency	Training of customers, employees, etc.
Product testing	Reduce cell size -Thin wafers - Nanotechnology	New applications -HVAC -Home appliances	Scale-up opportunities for existing systems	Improve capture efficiency	Energy trading and arbitrage opportunities	Value chain cost efficiency	Operating procedures, manuals development
Manufacturing operations improvement	Lower Manufacturing costs	Support services Maintenance and repair Warranty			Transmission Network Management	New materials technology	Value chain integration and consulting service

**Table 2:** Function-wise Skill Gaps in Solar PV and Solar Thermal Systems

Solar (PV & Thermal)		
Solar	Research and Development	Knowledge and exposure in advanced areas like wafer technology, semi conductor technology. Design skills in installing building integrated PV (BIPV) in buildings
	Project Development and Consultancy	Lack of awareness and experience in handling concentrated solar collectors (CSP).
	Manufacturing	Low skills in module assembly System integration in solar PV
	Construction and Installation	Installation and commissioning of solar thermal systems (SWH). Third-party installers are not skilled in erection Grid integration of mega watt scale solar PV power projects
	Operation and Maintenance	Shortage of skills in trouble shooting of circuitry of solar PV lanterns and home lighting systems
	Marketing	After sales service, customer care Techno-commercial analysis of mega projects in on-grid solar PV

### Conclusion

The solar PV on-grid sub-sector is now at the growing stage in India. With the Jawaharlal Nehru National Solar Mission (JNNSM), a scheme of the Government of India, the installed capacity is estimated to reach 20 GW by the year 2022. This would create enormous employment opportunities in the country. During last five to ten years, India is facing a big problem with the shortage of electricity. Government of India predicted that the total power demand will expand to 400,000 MW at the end of 2020. It needs enormous additions in capacity of electrical generation to meet the demand and to maintain the progress in the electricity market economy of the country. Considering the large potential, easy availability and other inherent characteristics of solar power, Government of India has given more emphasis on promotion of solar power in Indian power scenario. Currently India is in the top ten ranked countries in the world for investment, capacities addition and creation of job opportunities in solar power. Solar power can also provide a better economical scenario after successful implementation of solar mission for all states of India, especially for some underdeveloped states, where the potential of solar power generation is very good but not utilized till date. From the above discussion, it is concluding that the solar power takes an important role in the future power development in India due to the major initiatives and dedication at Government level.

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