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Inspiring Young Engineers to Establish Stand-Alone Micro-Grid Enterprises for the Mitigation of Power Crisis and Unemployment in India

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Abstract: ***This paper is a clarion call to the young Indian engineers to create and develop new micro-grid enterprises for the mitigation of unemployment and energy crisis in the country. Over 70% of the Indian population lives in villages with majority leading life in abject poverty and energy crisis at locations remote from the cities. The development of the nation cannot be complete unless the energy needs of this large and important segment of the citizenry remain inadequately addressed on the plea of unaffordable cost of electricity infrastructure and transmission losses at their locations. The purpose of this Paper is to exhort young engineers to focus their energy on the development of undeveloped and underdeveloped regions starving due to energy crunch and shun the craze to accept underemployment in the metro cities. By doing so, they shall have the economic benefit to avail soft loans, subsidies and tax-holidays for developing new solar enterprises for the mitigation of energy crisis and provide employment to the Millions. They shall also benefit the society by preventing erosion in the environment and ecology and have the pride of transforming an energy starved India into the one with self sufficiency and on the road to progress.***

Keywords: energy crisis, fossil fuels, renewable energy, Unemployment, entrepreneuring in energy

1. Introduction

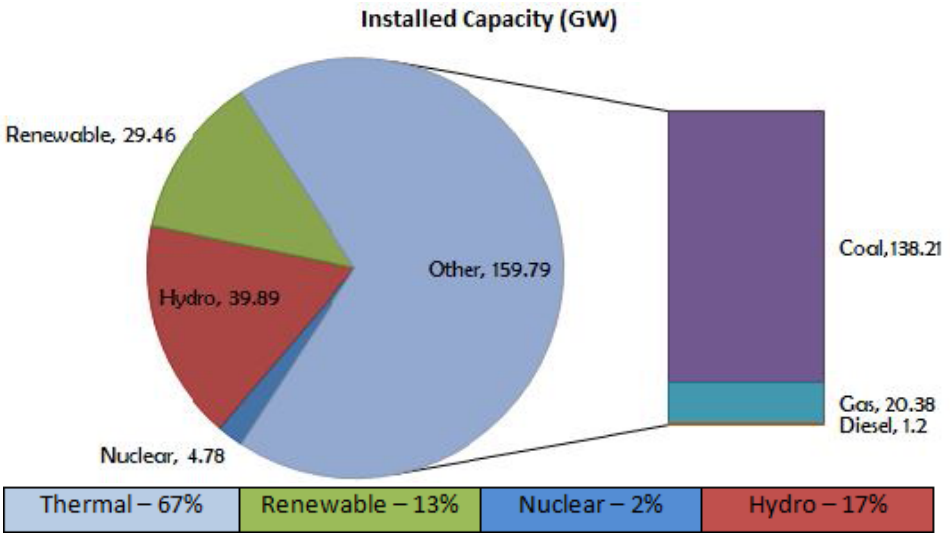
Electricity is the life-blood of a modern civilized society. To think of socio-economic development without electricity is like having a day-dream impossible to realize. Producing energy without disturbing environment and ecological balance is thus the basic challenge for the engineering fraternity of our times. The nation expects engineers to rise to the occasion and abridge electricity shortage in villages with their distinct sense of responsibility, entrepreneurial skills and vision. The engineering skills, acumen for entrepreneurship and vision of the younger breed of engineers shall lead the nation to development, upgrade quality of life of the masses and create industry even in small villages. Creating Solar micro-grid enterprises with high efficiency is the need of the hour. (Even the prospects of creating isolated micro-grids with other renewable energy sources must be explored in remote areas and new micro-grid systems developed; but the emphasis here is on the development of isolated or 'off grid' solar grid enterprises). The country is blessed with abundant solar energy by the 'Sun-God' who seems eager to help the younger generation of engineers to establish solar grid enterprises in every nook and corner in the villages where connectivity with the main grid is not economically viable. This is being said because the geographical location of India allows the country to receive well over 5000 trillion kWh of pure solar energy each year, which is far beyond the annual power consumption of India. With the help of the solar cells and solar panels it is possible to generate electricity in areas where connectivity to the central grid is impracticable due to economic reasons. Even the Government of India is keen to provide attractive facilities like soft loans and financial subsidies to the micro and small solar enterprises. it is high time therefore for the Indian engineers to turn the tables by transforming present energy crisis into a unique opportunity and make this country a prosperous nation free from energy crisis and eradicate unemployment through their engineering and entrepreneurial skills.

2. A Call to Create Standalone Solar Microgrid Enterprises in Remote Areas Without Electricity

The younger generation of Indian engineers is urged through this Paper to join hands and transform this country submerged in electricity crunch into the one having surplus electric energy. This preposition can become reality as the geographical location of India allows it to receive well over 5000 trillion kWh of pure solar energy each year, which is far beyond the annual power consumption of this country. The present day energy crisis in almost every state and union territory is mainly due to our overdependence on fossil fuels which have limited availability and have to be imported for our energy needs. As on 31.12.2013, India's energy generation which stood at ~234 GW, the thermal power accounted for 67 %, Hydro 17%, Renewable energy 13% and Nuclear 2% (Figure 1). To become a surplus energy State, India's energy basket needs to transition from coal dominance to the dominance of solar energy and other renewable energy sources. This shall reduce our fuel import bill and the problems related to the degradation of energy and ecology of the country will disappear by the change.

It is for this reason that the Government of India (GoI) has created a separate Ministry named the Ministry of New and Renewable Energy Resources (MNRE). This precisely is the reason that soft loans and tax-holidays have been provided to the solar energy enterprises. The author exhorts young engineers to take advantage of this one time opportunity for the establishment of off-grid solar energy enterprises to save masses from energy starvation and create new employment

avenues in the country. Micro-grid enterprises in villages can transform hitherto stagnant, socially inactive and unproductive villages into small hubs of cottage industry and make these villages economically developed, productive and prosperous.



Source: central electricity authority (CEA)

Figure 1: All India Installed Capacity as on 31st December 2013 9 (Note: RES include SHP, BP, U&I, Solar and Wind Energy. Installed capacity in respect of RES (MNER) as on: 30.09.2013)

3. Why Standalone Micro-grid is an Advantage

The Standalone Solar Micro-grids are an ideal alternative to grid electricity in remote villages with adequate exposure to sun that do not have grid connectivity. And since micro-grids are independent entities, they can also be controlled and managed without presenting threats to the central grid system and without the problem of transmission and distribution losses, load imbalance and environmental hazards or ecological imbalance of any kind. The profile of a standalone solar micro-grid comprising solar panels with suitable connections is shown in Figure-2.

Off-grid application is one of the major Indian renewable energy priorities. Such application not only eliminates the need for fossil fuels but also makes significant contribution by reduction in the consumption of these fuels causing CO_2 emissions. As such, the strength and potential of Standalone Solar Micro-grids lies in their ability to generate power in decentralized power mode which has the advantages of production at consumption points and does away with transmission losses from the generation point as well as eliminating land and environment related concerns and problems.

Figure 2: The Profile of a Standalone Solar Energy Micro-grid – No Environmental Pollution

The standalone micro-grid is not always solar. In general, it can be based on one or more renewable or non-renewable energy sources, suitably connected as shown in Figure (3). Following are typically the components in this type of Standalone micro-grid involving hybrid sources of total capacity generally less than 50 MW. Apart from the Energy Sources the stand-alone Micro-grid system can have Storage Systems which may typically comprise Hydrogen batteries, Fuel Cells, Flow Batteries, Super Capacitor, Pump Storage or Fly Wheel storage energy to take care of the electricity interruptions and loads which in the rural dispensation can typically be domestic single phase, Commercial: 1- Phase, Agriculture/Irrigation: 3- Phase loads etc.

4. Judicious Mix of Engineering and Entrepreneurial Skills for Successful Entrepreneurship

The Engineering entrepreneur amalgamates technological skills with acumen for entrepreneurship thus nurturing traits and skills related to business. The prospective individual

must acquire the knack and ability to gage environment and identify what is in the best interests of the enterprise keeping the business environment in mind. Entrepreneurship involves risk taking, innovation and applying knowledge and skills to set up new ventures or diversify from the existing ones. Entrepreneurship adds significant value to the economy by creating wealth and generating employment. India has a rich tradition of Entrepreneurship and the more it is nurtured in the younger generation, the more developed the economy of the country will be. The younger generation has shown more interest in entrepreneurship in recent years which must be encouraged at all costs for our national economy to grow.

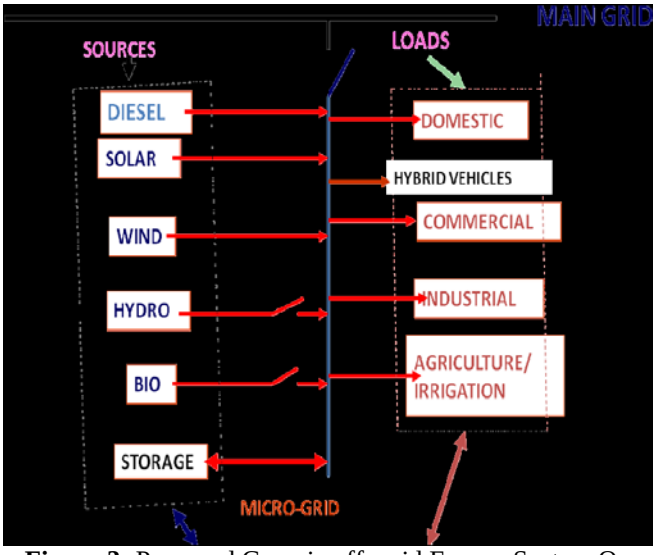


Figure 3: Proposed Generic off- grid Energy System On Micro Grid Operation

5. Two in One

As is already said, the Engineering Entrepreneur is more than just the engineer. In addition to the skills of engineering, one must be resourceful enough to cater to the public needs and create wealth in the process. The entrepreneurial skill keeps one alert to sense the environment and encash from ideas wherever possible. By definition, the Entrepreneur is an individual who efficiently and effectively combines the four factors of production namely, the land (natural resources), labor (human input into production using available resources), capital (any type of equipment used in production i.e. machinery) and Enterprise (intelligence, knowledge, and creativity). Entrepreneurship is often difficult and tricky, as many of the new ventures fail for want of clear perception of the opportunities by the organization. However, given the self discipline and the determination and willingness to learn these attributes one can always be imbibed to make oneself successful as entrepreneur.

6. Facilitators and Support Organizations - The Essentials to identify and nurture a budding entrepreneur

At the very initial stage the prospective engineer entrepreneur may need guidance relating to the project report preparation, deciding location and layout of plant, making selection of men and machinery, sensing competition level and exploring marketing and other aspects relating to the enterprise. One must also be fully aware of the various types of finance facilities including Government assistance and subsidies. The entrepreneur should be able to consider financial aspects and comparative advantages of various Government subsidies and assistance especially when establishing enterprise in backward areas and the disadvantages related to the marketing activities and transport cost and problems of raw-materials and other issues.

Young engineers and managers constitute the most deserving target group for this support under the umbrella of MSME (Ministry of Small and Micro Enterprises of the Government of India) due to their technological education, background and skills. For the purpose of facilitation, the MSME classifies industries as below:

Classification	*Manufacturing Enterprise*	*Service Enterprise*
Micro	upto Rs. 25 lakh	upto Rs. 10 lakh
Small	above Rs. 25 lakh and up to Rs. 5 crore	above Rs. 10 lakh and up to Rs. 2 crore
Medium	above Rs. 5 crore upto Rs. 10 crore	above Rs. 2 crore upto Rs. 5 crore

However, MSME is not the only facilitator for helping people to set up a new enterprise. The prospective entrepreneur should initially focus and identify various Departments and support agencies for the proposed enterprise and make a studied decision on the idea conceived. There are many other Ministries in the Government which directly or indirectly help prospective entrepreneurs to translate their ideas to materialize for the promotion of economy and public good. For instance, the Ministry of Non Renewable Energy resource (MNRE) of the Government of India is one such organization to support electricity ventures. The support functions required for small industries may inter-alia include finance, preliminary training in entrepreneurship or some specialized aspects needed to establish and operate an enterprise. For example, SIDBI (www.smallb.in) and NABARD (www.nabard.org) act as facilitators in finance matters. Other organizations like NSIC (www.nsic.co.in), NIESBUD (www.niesbud.nic.in) provide skill training and entrepreneurship training in some specific areas. There are other support organizations like SIDO (www.mssewb.org) and SISI (www.dcmsme.gov.in) providing specialized assistance to the entrepreneurs. The exact menu of the support required shall vary from case to case and individual to individual and no single prescription can help each and every entrepreneur. The author would therefore advise a careful study of by the prospective entrepreneur about what is required to be achieved and what is available in the menu and strike a fair balance between the two by taking a studied and judicious decision as it is only the entrepreneur who will bear the brunt as outcome of the decisions ultimately.

The Government of India has already declared its avowed objective to accomplish Energy for all. This can only be accomplished if young engineers come up for establishing new off grid solar enterprises with adequate KWh capacity

to meet energy needs of the rural population. The Government policy focuses on eradicating energy poverty and energy crisis through public private partnership of which the small entrepreneur forms an integral part. Harnessing solar and other renewable energy resources shall bring the country nearer to its goal and create new job avenues for the local population.

A microgrid is an emerging area with very few players that suits a microenterprise and befits to be created and run by the young engineer. Micro-grid interventions present a potential opportunity to address the rural electrification needs through an Infrastructure standard solution. The Government of India has allocated funds for development of such enterprises through individual enterprises and social entrepreneurship under RVEP (Remote Village Electrification Programme), VESP (Village Energy Security Programme) and DDG (Decentralized Distributed Generation) Schemes. The focus of RVEP is limited to meet electricity lighting requirements for un-electrified as also electrified villages where supply is available for less than six (6) hours. Its implementation is through the State Nodal agency and for funding purpose it requires verification by Rural Electrification Corporation for approval of MNRE support. For social entrepreneurs micro-grids, The entrepreneurs are supposed to be on contract; build, operate, maintain and transfer basis for an initial term of 5 years; the term can be extended for another term or awarded to another party. The RVEP provides 90% capital subsidy and is linked to JNNSM (Jawahar Lal Nehru National Solar Mission) in the budget. The Scheme implemented through RVEP is an off-grid Project linked to JNNSM but has an ambitious target to make available 200 MW by 2013 and 2000 MW by 2022 through renewable sources. This scheme covers Off-grid small utility scale power plants in the rural areas and providing solar lanterns to households. Another Off grid energy scheme of MNRE is the VESP (Village Energy Security Programme) with focus on Total energy needs of rural communities which don't have access to grid connectivity. This programme is meant to answer domestic, commercial, agricultural, industrial and motive power needs of the rural community. The scheme provides Central Financial Assistance of CFA of Rs. 20000/- per household and is funded through coordination by the State Nodal agencies; – its developers are expected to be the NGOs and cooperatives implying that it needs social entrepreneurship to develop enterprises under this class. 90% capital subsidy is allowed to the entrepreneurs under the scheme. Another Scheme in vogue is from the Ministry of Power (MoP) under Off-grids by the name Decentralized Distributed Generation (DDG) for remote villages with population more than one hundred where grid connectivity is either not feasible or not cost effective. The entrepreneur must provide power for 6-8 hours per day for at least 25 days per month. The implementation of this Scheme is also through the State Nodal agency shortlist the prospective areas in consultation with State utility. 90% capital subsidy from central funds is available to the enterprises under this Scheme as well. The cost of spares for 5 years after commissioning (excluding cost of consumables and labour) is included as project cost for which capital subsidy and soft loans are provided to the entrepreneur.

7. Creating New Employment Opportunities

Development of solar enterprises has, apart from expanding energy availability has the potential to create new employment opportunities which shall be an additional contribution by the young engineer in making the nation prosperous. Some examples of the typical job profiles in the dispensation of solar enterprises are given here in the Table below:

Type of Job	*Organization*
Solar Energy Mechanic Energy Specialist Manufacturer & Marketer of Solar Lanterns and Solar Energy Based Systems	Center for Scientific Research (CSR), Auroville, India
Entrepreneurial Development & Funding	Indian Renewable Energy Development Agency (IREDA), Delhi, India
Manufacturer & Marketer (solar PV, biogas systems & accessories and wind turbines) Solar Energy Mechanic Energy Specialists Wind meteorologists Wind turbine engineers	Grameen Shakti (Wind & Solar), Bangladesh
Solar Energy Mechanic Energy Specialists (Solar Water Heating Systems) Mechanic	Renewable Energy Plan 2012: Government of India Initiative, India

8. Conclusion

The authors conclude by saying that like any other profession the entrepreneurship in energy is not without its perils and one must be careful enough to consider and fully verify every aspect (including contents of this paper) before choosing energy entrepreneurship as career. Entrepreneurship is not the cup of tea for those who seek a lucrative and comfortable career without hard work. However, it is asserted with surety that India's energy poverty provides a new opportunity to design new entrepreneurial strategy and design energy future for the people. Firstly the futuristic plans to create fossil fuel grid for the energy poor segment shall be leapfrogged to a clean and futuristic energy source by the introduction of standalone microgrid systems in remote villages. And secondly, it shall bring new employment opportunities in the economically backward region suffering energy poverty. This would also pave the way the world solves its twin problems of energy poverty and climate change in one stroke

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