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# Role of IoT in 'Make in India'
# Roll-out of Smart Grid Technology in India for Harnessing Solar Energy

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**Abstract:**

Echoing the clarion call of the Government of India, 'Make in India', the Board has identified a very contemporary topic 'Role of IoTIn Make in India'. 'Make in India' initiative encourages national, as well as multi-national companies to manufacture their products in India. Indian Engineers & Technologists have an important role for realizing the mission 'Make in India'. The government has struck the right note by earnestly pursuing the skill development to ensure that skilled workforce is available for manufacturing. Entwining the important application of 'IoT" in 'Make in India' initiative, the author proposes introduction of 'IoT' in Harnessing Solar Energy for the development of the nation. The world energy consumption is 16TW [1]. The sun gives 23,000 TW every year. This manifests in terms of many forms like hydro-power, biomass, wind, tidal, etc. Besides this, the photosynthesis uses the major power of solar energy. Thus, the solar energy is capable of meeting the world's energy requirement for anytime to come. On a hot, sunny day at room the sun sends down roughly 1KW (the power of a toaster) for every square meter of the ground. The only challenge is to make it cost effective so that it can be easily marketed to individual households and organizations. The need is to efficiently manage this initiative so that the awareness and importance is transferred to the remotest locations, wherever the population exists. To make it saleable and cost-effective, the technology needs to be enhanced in order to produce higher benefits with lower cost. Power from photovoltaic cells has, fundamentally, raised doubt about the basic for huge, incorporated power stations. The quickly falling costs point to a noteworthy change from the unified grid topology to one that is profoundly conveyed, with power being both produced and devoured upright at the points of the grid. In this paper, the author proposes a, roll-out of smart grid innovation for India which infers a principal re-building of the power administrations industry, and have shared their experience, views and knowledge on how IoT assumes a vital role in the improvement of solutions for upgrading solar administration.

Access this Article Online

http://heb-nic.in/cass-studies

Quick Response Code:

Received on 20/02/2019
Accepted on 25/02/2019 

In this paper, the author tries to draw the focus on Internet of things (IoT). As we connect to an ever increasing number of things to the internet, we set out on a long and brave journey making another industry called "The Internet of Things (IOT)"[2]. It drives the things to the next generation by interacting in an advanced way with the smart devices (for example, sensors, handheld PCs), with actuation and automation services[3]. Besides customers and equipments, IoT encourages devices to send and receive data to and from applications and programs with the assistance of an advanced telecommunication technology and protocols. The term, IoTincorporates the hardware, software and telecommunications, which can make public services and human activities increasingly effective.

'Make in India' initiative has immense capacity in altogether turning around the operational efficiency of the country and IOT is the specialized base behind it. Internet of Things inputs the required knowledge into fundamental building blocks of the nation and aides in making it smart. IoT helps in enhancing the living standard of the citizens and transforming urban areas with the assistance of technological solutions by enhancing public transportation, upgrading infrastructure, online billing and payments, making more efficient and cost effective municipal services, encouraging sustainable energy sources, lessening traffic clog, empowering top notch medicinal services, online customer services and providing uninterrupted power supply providing better facilities and security to the citizens.

We can connect the roads and traffic lights, weather sensors, building management system, utilities and motorway and road management systems together, making a "Smart City".

Smart Cities will revolutionize our living style. It will accelerate decision making, make new business opportunities and thoroughly change the association with how we interact with innovation and technology. Some say that this "new world" will threaten our jobs as redundancies follow automation and robots take over from human jobs, others say that you will still need someone to design, install and maintain those robots, either way there is wholesale and fundamental change underway.

With reference to electric power, over 75% of the complete energy is consumed by the urban communities on the earth today and are for the most part in charge of 60% of the world's absolute greenhouse gas emissions. The demand for continuous access to power, for example 24×7 is expanding day by day. To fulfill the increasing demand, sustainable power source organizations have been significantly expanding the capacity. As indicated by World Wind Energy Association, combined limit in the wind energy segment has expanded from 24 GW in 2001 to 370 GW in 2014[4]. Consequently, the advancement of energy efficiency and low-carbon energy programs are necessary for the urban areas. IoT assumes a vital role in the advancement of solutions for upgrading the renewable energy management. IoT driven developments, for example, electrification of demand, flexible generation, demand visualization and smart grids that can achieve the required results from energy infrastructure in urban areas.

As the solar power industry in India encounters remarkable development, the requirement for firms working in this space to redesign their IT networks and the need for further utilization of proactive monitoring tools grows.

Much appreciated partially to various key factors, incorporating rising consumer interest for clean energy, recently accessible tax incentives and declining commodity costs, India is currently one of the biggest markets on the planet for solar photovoltaic power and that demand no signs of decreasing. As indicated by the most recent insights from the Ministry of Renewable Energy, India's overall capacity has achieved 329.4 GW, with renewables representing 57.472 GW by 14 June 2017. 61% of the sustainable power originated from wind, while solar contributed almost 19%[5]. Substantial hydro capacity installed was 44.41 GW[6] by 28 February 2017 and is administered independently by the Ministry of Power and excluded in MNRE targets.

The Ministry of Power has reported that no new coal-based limit expansion is required for the 10 years to 2027 past the 50 GW under various phases of development and prone to come online somewhere in the range of 2017 and 2022[6] The goal-oriented targets would see India rapidly getting to be one of the main efficient green energy producers on the earth and outperformingvarious developed nations. The administration expects to accomplish 40% combined electric power capacity from non-fossil fuel sources by 2030[7].

The IoE affirms that 99% of things in this world are detached and considers what might be conceivable if we were to intelligently connect all of these, says Cisco Canada President NitinKawale. That would be genuinely amazing! Simply consider how progressively our world has effectively improved since the previous 10 or 20 years by essentially connecting just less than 1% of things.

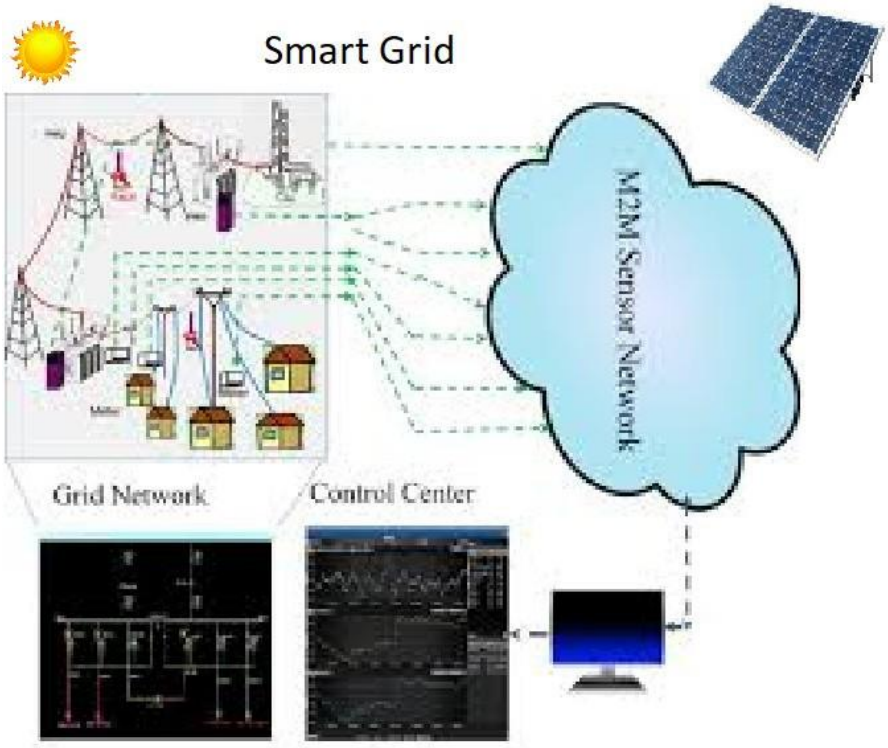
Moreover, Kawale stated that one of the IoT's greatest commitments to energy industry firms is in the domain of big data and predictive analysis. Since these sensors gather tremendous measures of information, organizations can utilize those data streams to acquire granular oversight over their establishments. In addition, data analysis tools can offer associations the chance to utilize information from the past and present to more precisely foresee future results.

While these patterns might be bonus for C-level officials at solar energy firms, IoT and predictive analytics may not be appreciated by IT teams that are all of a sudden entrusted with managing more mission-critical resources. More sensors breaks even with more disseminated endpoints to administer, and the ascent of predictive analytics guarantees that different offices place more pressure on IT systems to perform.

To manage these dual threats, network oversight experts should use proactive monitoring tools furnished with out of band access. With these sorts of arrangements set up, IT experts working at solar energy firms can all the more effectively and successfully watch all endpoints and guarantee that each disseminated system endpoint is working appropriately. IoT and predictive data analysis can give tremendous development openings, however no activity can hope to prompt positive outcomes unless it is smartly managed and administered.

## SMART GRID

Figure 1




Technically a smart grid is the combination of several a smart object like smart solar meters, sustainable power sources, intelligent appliances and energy efficient assets. The key aspects of Smart Grid are solar power monitoring and control of the creation and dissemination of solar power[4].

The electrical sector has opportunities through the design, installation and maintenance of devices such as both way metering, storage and invertor-phone combination.

The cost of solar power is decreasing continuously as the volume of renewable power increases and the cost of panels go down. We must move the DC network and DC equipment.

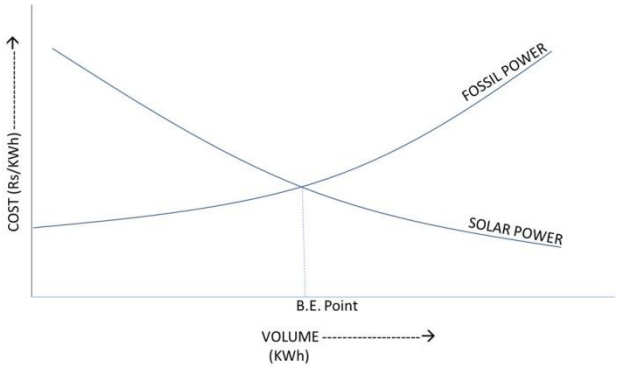



Figure 2

In Europe, Smart grid policy is organized as Smart Grid European Technology Platform[4], while in USA, the policy is described in 42 U.S.C. ch. 152, subch. IX § 17381.

In India too, there is a need to focus on the upgrades in electronic communication technology to determine the impediments and expenses of the solar grid. Earlier metering used to drive peak power costs to be averaged out and billed to all customers equally, but that's not the case today. The technological advance has removed those limitations, and now there is a need for more sophisticated control systems, to manage the connection of sources to the grid [5]. Power from photovoltaic cells are now calling for the imperative for large, centralized power stations. The rapid growth of the renewable technology point to a major change from the centralized grid topology to the distributed topology, with power being both generated and consumed right at the limits of the grid. Finally, distributed power stations also minimize the growing worries over militant attack in few nations that is less reliant on centralized power stations that were seen to be potential assault targets [5].

Author proposes a roll-out of smart grid technology for Solar power in India which leads to the basic re-engineering of the solar power industry.

## SMART GRID TECHNOLOGY

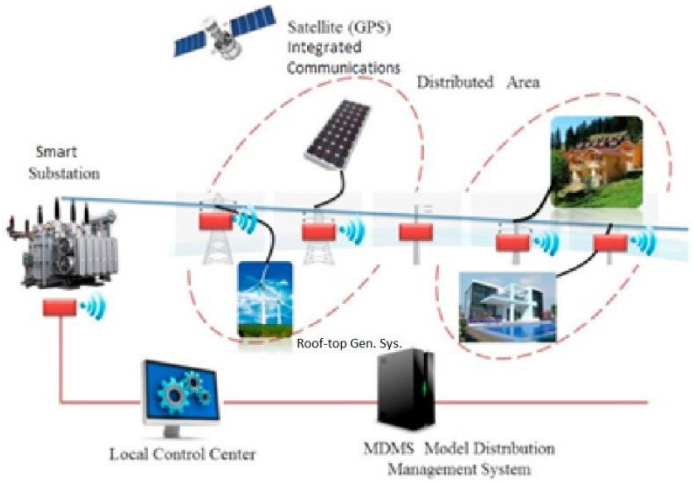



Figure 3

There are following fundamental technology used to derive the smart grid technology [6].

- Managing Solar Growth with proactive Monitoring
- Intelligent Appliances
- Smart Solar Substations
- Remote Monitoring of Conducting Cables
- Demand Response Support
- Integrated Communications
- Smart Power Meters (dual)

Smart Grid program that cross organizational boundaries, encompasses modern tools to effectively communicate using the interfaces such as e-Mail and web browsers. Most common uses would be to:

- Analyse and track inter-dependencies of projects and the activities within the project.

- Scheduling and tracking progress
- Detailed Cost calculations
- Publish progress reports,
- Publish individuals' task details,
- Handle changes, risks, and issues and manage the workflow
- Enforce controls, like, in the "checking in" and "checking out" of documentation.

Solar Smart Grid Management is the sum of measures planned and carried out to achieve the objective of leveraging solar power in the minimum cost while the comfort levels (in offices or dwellings) and the production rates (in grids or rooftops) are maximized. Solar management also includes on-grid, off-grid and hybrid setups. The appropriateness is determined in each case. This shows that how much solar energy should be used, what is the ideal consumption and how much solar energy can be saved for the grid.

The implementation needs to be pro-actively planned, executed, monitored and controlled with assessment of all the risks and issues. The above method as a whole is referred here as solar management.

## CONCLUSION

Roll-out of Smart grid technology in India will assume a vital role in modern smart world technology for harnessing solar energy. By using Internet of Things (IoT) technology in various sectors, we can create different intelligence services utilizing operational tools, consumer applications for online customer support, billing and payments, monitoring tools and predictive analysis tools. The development of most aspects of the smart grid for solar energy would be enhanced by integrating an IoT technology. Thus, it increases the quality of services to the customer and provides flexibility to the consumer as well as service provider.

## LIST OF ABBREVIATIONS

IOT Internet ofThings
MNRE Ministry of Renewable Energy
TW Terawatt
AC Alternating Current
DC Direct Current KWH
Kilo-Watt Hour AHr
Ampere Hour
UPS Un-interrupted Power Supply
PV Photo Voltaic
ROI Return OnInvestment
PLC Programmable LogicController
SCADA Supervisory Control and DataAcquisition

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