

Influence of Solar Power in Smart Grids

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Mr.Swaminathan and Mr.Umashankar study the influence of Solar Power in Smart Grid and the Interaction between the two.

Innovation and modernization with new trends is being introduced in almost every field of science and technology. To the exception the power grid management across the world is not updated with the technology enhancement. Today's grid is outmoded (Most of the grids are designed and installed before the era of microprocessors) and suffering from reliability issues. The Grid control and optimization is modernized in a slow pace all around when compared to the pace of technology advancement. This is mainly due to the huge infrastructure investment involved.

Now we are in the era of Smart Grid, hence lot of research and development activities in smart grid are under progress. The educational institutions and multinational companies are aggressively working on the smart grid concepts and non-conventional energy exploitation towards the green globe environmental cause for the future world. The core concept of smart grid is about integrating the Information Technology and Electrical utility for the benefit of consumers as well as industry.

A smart grid is a system that is adaptive, interactive, secured, supports bi-directional energy flow and has no geographical or organizational boundaries.

Salient features of Smart Grid

- Intelligent Metering and better Reliability
- Improved Interoperability of appliances and equipments connected along with the infrastructure serving the Grid.
- Better demand and response control deployment.
- Active consumer participation by enabling control over consumption and associated costs over a wide network.
- Distributed power generation and grid interaction from all sources of energy like Wind turbines, Solar panels and so on.

- Consumer engagement with resources to solve power crisis.
- Environmentally friendly by maintaining the ratio of renewable generation to total generation and emission control.

With the implementation of smart grid technology, the penetration level of renewables may rise to 40%, demand-response to 20%, consumer generation increase tenfold, and generation, transmission and distribution asset utilization rise about 30%-50%.

Solar and Smart Grid

The benefits of smart grid can be enhanced through the integration of non-conventional energy sources like Solar, Wind and Biomass power plants. Solar power takes the prominent position among all other sources due to its continuous availability and cost effectiveness. Solar energy is available in abundance. The light energy insolation from sun in a day is sufficient to power the energy needs of whole world for 365 days.

In recent days, the solar photo voltaic cell manufacturing costs have come down due to the encouragement form Government in the form of subsidy; this in turn reduces the cost of solar power generation. Because of the promotion and go green initiatives, the number of solar power plants is on the raise and hence the total installed capacity of solar power plants. It is estimated that by 2015, the total installed capacity of solar power will be 33.4 GW.

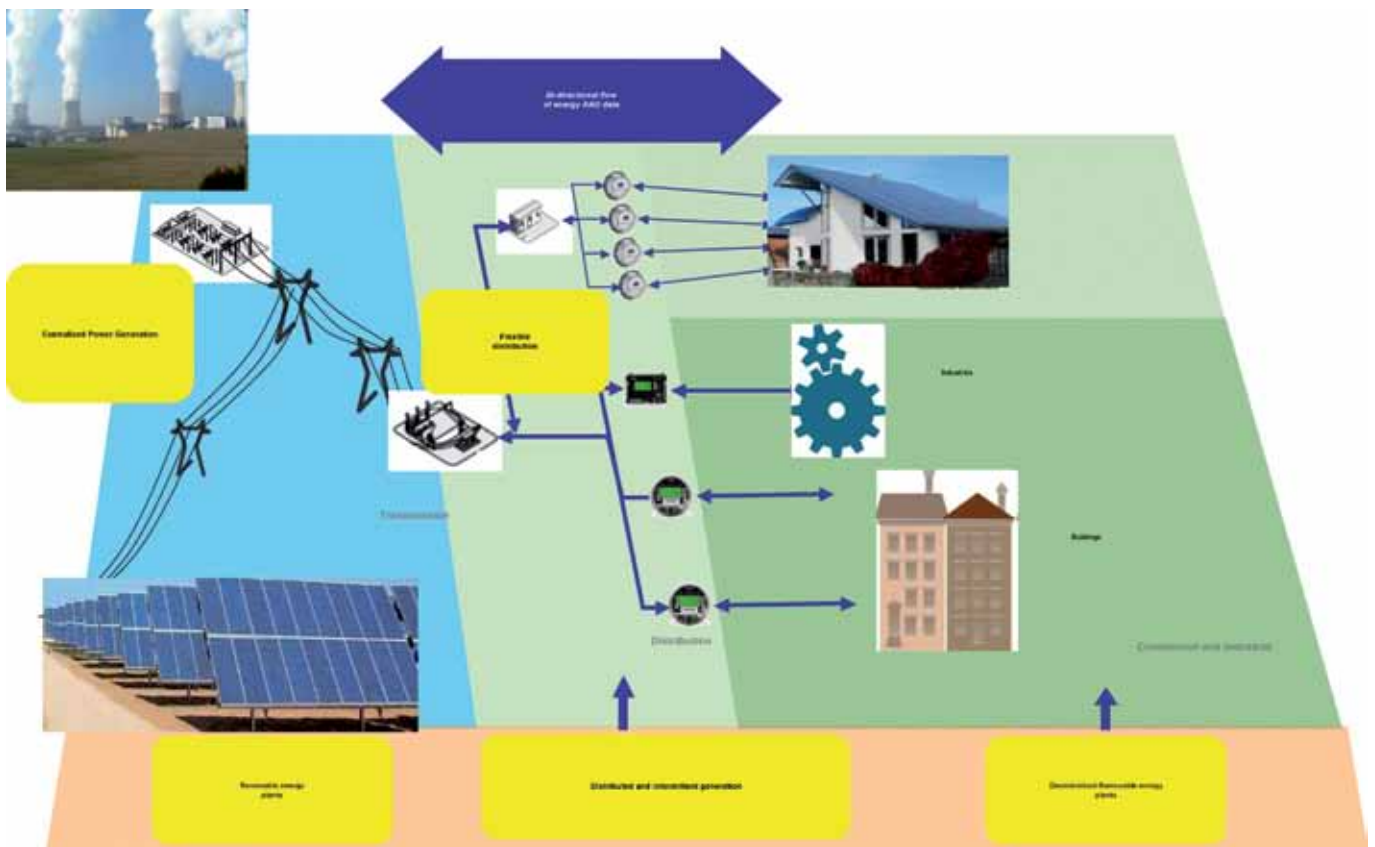
Further the Smart Grid technology will open up more opportunities for solar power by providing a new energy value chain, linking renewable and conventional power generation to reduce CO₂ emission, and enhance utilization through reliable operation. The presence of Smart Grid will help to streamline the distributed solar power generation using rooftop solar arrays to

feed electricity into the grid during daylight in order to meet the peak demand. This will result in individual house owners and business units investing in solar power generation and will find it comfortable to sell the power which they generate fed-back to the local power utilities and pay their energy bill, or even make a profit out of it. The evaluation of smart grid technology will influence a significant demand of solar power system and rooftop solar PV arrays that are Smart Grid compatible.

Today's conventional electricity utility involves centralized power generation, transmission, distribution, and consumption, which lacks in flexibility to distributed power generation. In future, the emergence of Smart Grid will allow seamless integration of power generation from distributed sources, such as rooftop solar PV arrays, along with traditional power generation plants of various capacity and size. The entire Electricity distribution network will be through an intelligent transmission and distribution topology.

Solar power is gaining more prominence with the introduction of micro grid and de-centralized power plants. The integration of Solar power generation in to Smart Grid will allow higher flexibility to have localized and right sized power plant with reduced transmission loss, less complexity, zero environmental concerns, and higher efficiency. During 2012 summer in Germany, the peak solar power generation touched 20 GW. The presence of micro grid is very much required in the wake of recent northern grid failure in India (largest power outage in history).

In reality still a long way to go for the deployment of the Smart Grid. The integration of existing technologies, with the new ones, and the integrated testing and validation of both technologies to demonstrate their benefits are very much important to arrive at a consensus among



Smart Grid - Centralized and Distributed sources with consumer integration.

all partner organizations. New standards must be developed and some of the existing standards would undergo changes. It is the time for all power sector manufacturers, utility service providers and individuals to start aligning towards smart thinking for the smarter grid. This ensures the future products and services cater the market demand that the new energy value chain is going to generate. This will benefit the society through green environment and the world with better economy by enabling the plug and play distributed energy resources.

Challenges and the Way Ahead

Some of the challenges related to Solar Power Generation are:

- High initial cost
- More dependant on sunny weather
- Occupies more space for PV panel installation
- Less efficiency in energy conversion

Continuous research and development are ongoing to tackle the challenges pertaining to solar power generation. The

Concentrated Solar Power plants (CSP), Solar power tower, Pokeberries coated fiber-based solar cells for improved conversion efficiency, transformer less inverter and Maximum power point tracking (MPPT) technology are some of the technological developments in solar power generation to overcome or to reduce the impact of the above listed drawbacks.

There are several international groups like IEEE (IEEE P2030), IEC (IEC 61850, IEC 61968/970, IEC TC57) are working towards development of guidelines and standards in association with the group of manufacturers for the future smart grid Technology. Among the above standards, IEC 61850 is originally designed for substation automation whereas smart grid application of IEC 61850 is also meant for Wide Area Phasor Measurements and Protection, SCADA Communications, Distributed Energy Resources, and Impact of meter models. The scope of Common Information Model can be extended to new Smart Grid Standards which define objects

and relationships.

The cost benefit of smart grid along with renewable energy sources through environmental impact is huge and hence the environmental benefits will generate billions of revenue every year. Every unit of energy saved by efficient performance of the smart grid will result in reduced expenditure on pollution controls at power plants. It has been found that benefits of the smart grids mainly depend upon System optimization and integration of renewables, whereas End-user energy management will contribute a least percentage.

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