

## Smart Grids: opportunities and challenges

*Dr. Mustapha Taoumi*  
*Clean Energy Technology Expert*  
*EU – Clean Energy Technology Network*  
*Email: m.taoumi@gmail.com*



The basic structure of the electric power grid has remained unchanged for more than hundred years. Indeed, the existing power generation infrastructure is not able to keep pace with growing power demand. Also, the methods of power delivery to consumers are also outdated and extremely inefficient.

Smart grids will enable new sources of energy (mainly Renewables Energy) and new forms of demand. They can help us keep the lights on at minimum cost to consumers, while creating jobs and enhancing economic growth. They can support our low carbon transition and create opportunities for consumers to play an active role in the energy system alongside generators, suppliers and network companies.

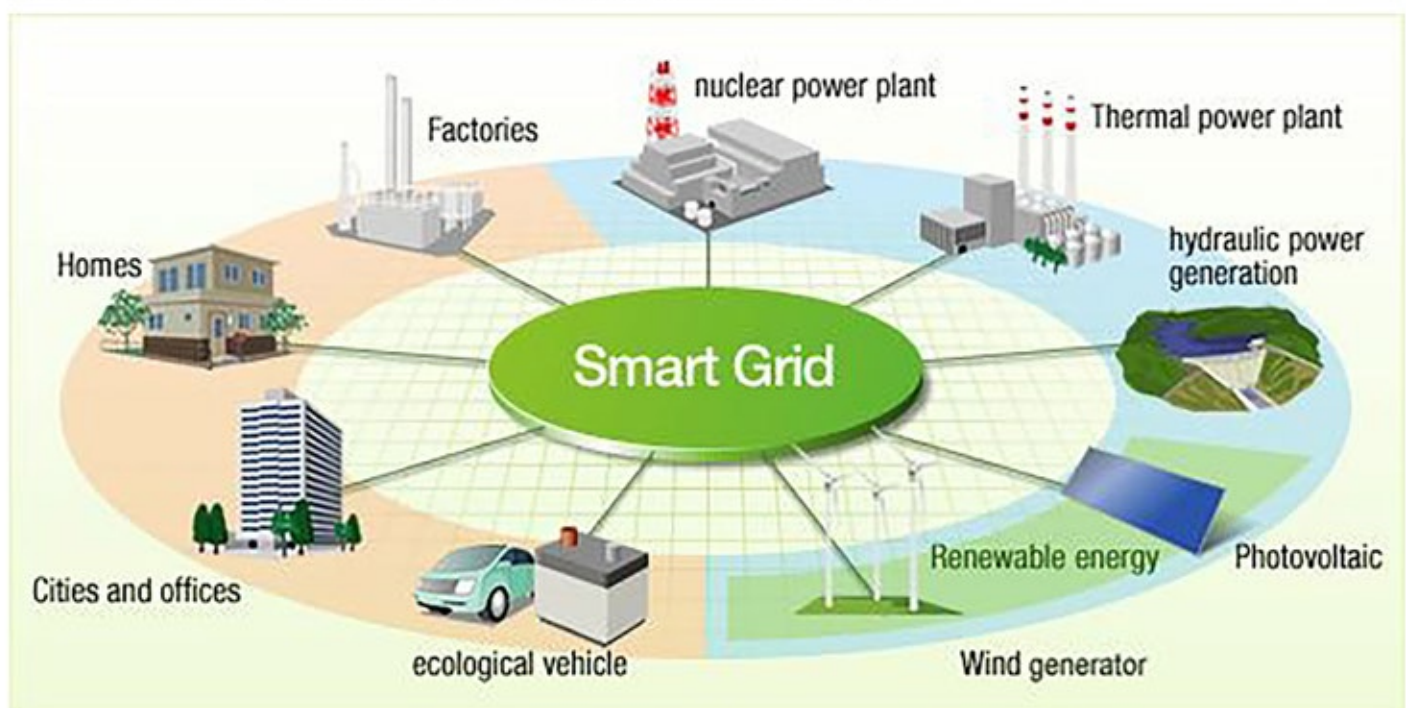
On the other hand, the electric grid in its current state is falling behind the 21st century technological advancements and energy demands while the current trends in energy supply and use are unsustainable-economically, environmentally and socially.

To ensure dependable and sustainable supply of electricity, a modern power grid is necessary which will be smarter. This new technology ensures effective control of electric supply and demand using information technology, and assures the potential use of eco-friendly power generation.

Furthermore, implementation of Smart Grids concepts and infrastructure can be a better tool to develop greener and digital power.

### Smart Grids: Approaches

Around the world different approaches are being adopted and a wide variety of technologies and services are being demonstrated driven by national and regional business drivers.



- In the US peak load reduction technology and dynamic pricing tariffs are being pursued.
- In Europe emphasis is on improving energy efficiency and reducing emissions through decentralized production.
- In the Asia-Pacific region China is modernizing and improving grid reliability and Australia and New Zealand are exploring new techniques for load management.
- Other countries also actively pursuing smart grids are Brazil, Mexico, South Korea and Japan.

Basically, Smart Grid as a new infrastructure for supplying power will leverage ICT technology to improve the reliability of power supplies, promote the mass introduction of renewable energy and optimize energy use by consumers.

Based on a power supply network which is responsible for supplying power, and a communication network which supervises and controls the facilities that constitute the power supply network, ICT technology will allow power consumers to upgrade their energy management across power generations.

Overall, Smart Grids will enable high-quality power to be supplied in a highly efficient manner and thus promote a rich, safe and low carbon society.

## Advantages

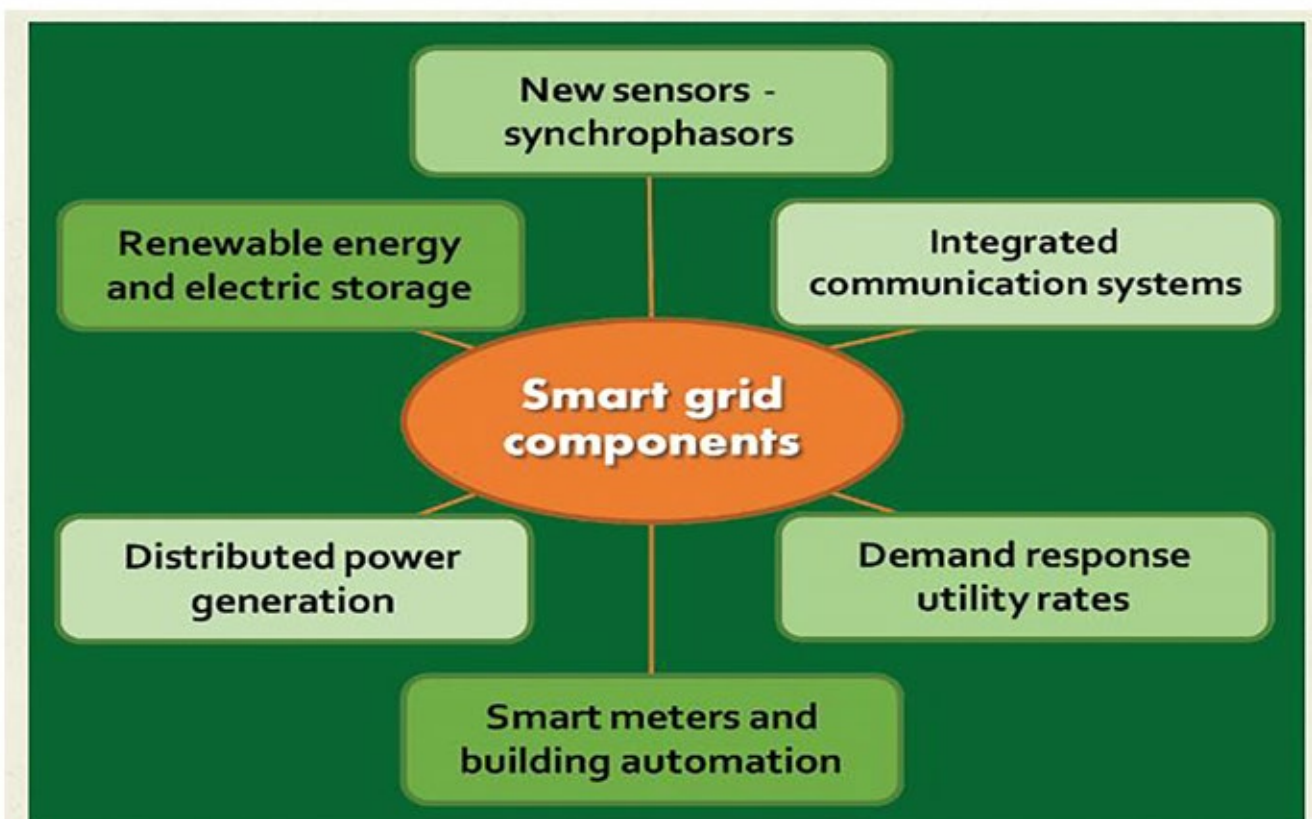
### For Power Companies:

- Enables rapid and automated incident response.
- Makes frequency regulation easier and increases grid stability and power quality.
- Ensures Load Leveling.

### For End Users:

- Distributed Generation more cost-effective, and the consumer can sell back the excess of electricity to the grid
- May decrease cost of electricity for consumers
- Enables the smart, programmable operation of important systems or appliances

## Smart Meters and Smart Appliances





While the smart grid components comprises the ability to integrate renewables and storage systems as well as integrated communication systems, the current system of energy metering as well as billing still uses electromechanical and somewhere digital meter which consumes more time and labour. Billing inaccuracy is also considered as an issue for many consumers, which increase the number of complaints that the utility/distribution company have to overcome.

By introducing smart meters and smart appliances the following issues would be addressed:

- Smart energy meter gives real power consumption as well as accurate billing
- It provides real time monitoring of electricity uses as it is less time consuming and cost effective
- Smart appliances networked and programmed into grid demand so power companies can directly modulate load balance and demand
- Many communication methods, not all require new infrastructure

### Smart Grids: Challenges

Despite the benefits of smart grids, some challenges remains as barriers to their implementation such:

- New infrastructure to communicate in both directions is required;
- Electricity prices for consumers require adjustment from fixed price to real-time pricing;
- Security is another key concern and smarter grids lead to increased vulnerabilities from intrusions, error-caused disruptions, malicious attacks, destruction, and other threats. As the electric grid network is key to the operation of a country, cyber-security is a key topic;
- In the smart grid area there is a need for standards for interoperability and safety. Standards are voluntary in Europe and are developed by industry and market actors. The European Commission and EFTA have issued the Smart Grid Mandate M/490 which was accepted by CEN, CENELEC and ETSI;

- Behavioral changes and Data Management are required to facilitate the introduction of smart grids and customize its applications throughout the whole power system.

### References

1. SMART GRIDS AND RENEWABLES, A Guide for Effective Deployment, working paper, IRENA, 2013
2. Saleh, M. S.; Althaibani, A.; Esa, Y.; Mhandi, Y.; Mohamed, A. A. (October 2015). "Impact of clustering microgrids on their stability and resilience during blackouts". 2015 International Conference on Smart Grid and Clean Energy Technologies (ICSGCE): 195–200. doi:10.1109/ICSGCE.2015.7454295.
3. "Federal Energy Regulatory Commission Assessment of Demand Response & Advanced Metering" (PDF).
4. "Smart Grids European Technology Platform <http://www.smartgrids.eu>". smartgrids.eu. 2011.
5. J. Torriti, Demand Side Management for the European Supergrid Energy Policy, vol. 44, pp. 199-206, 2012.
6. "The History of Electrification: The Birth of our Power Grid". Edison Tech Center. Retrieved November 6, 2013.
7. European Commission (2012), "Commission Recommendation of 9 March 2012 on Preparations for the Roll-out of Smart Metering Systems", <http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:073:0009:0022:EN:PDF>.
8. European Commission (2012), Joint Research Centre, "Smart Grid Cost-Benefit Analysis", <http://ses.jrc.ec.europa.eu/smart-grid-cost-benefit-analysis>.