Electricity Management in Distribution system by using of FACTS and smart grid technology

Ms.Payal A.Patil[1], Prof. Rajkumar Verma[2]

[1] *Post Graduate Student, Department of EE, Padm. Dr. V.B.K.C.O.E., Malkapur, S.G.B.A. University, Maharashtra, India*

[2] *Asst. professor, Department of EE, Padm. Dr. V.B.K.C.O.E., Malkapur, S.G.B.A. University, Maharashtra, India*

[1]patilapayal@gmail.com

[2]oneraj24@gmail.com

***Abstract*-The paper shows how the utilize of FACTS improve elasticity in power transmission and distribution, increasing ability of transmission corridors to combine renewable power manufacture ,the power network of future be required to protected., direct –effective and environmentally friendly . The combination of these three tasks be able to talked with the help of thoughts smart solutions as well as progress technologies. Transformation of the electric power network is mid to national efforts to raise energy efficiency, change to renewable sources of energy, decrease greenhouse gas emissions, and make a suitable economy that ensures success for present and upcoming generations. About the world, billions of dollars are creature useless to make elements of what finally will be "neat" electric power network.**

Key words: FACTS, Power system efficiency, Smart Grid.

I. INTRODUCTION

The term "FACTS" (Flexible AC Transmission Systems) covers several power electronics based systems utilized in AC power transmission and distribution[1]. FACTS solutions are particularly justifiable in applications requiring rapid dynamic response, ability for frequent variations in output, and/or smoothly adjustable output. Under such conditions, FACTS is a highly useful option for enabling or increasing the utilization of transmission and distribution grids and intertypes. In green field projects, AC plus FACTS will likewise in many cases prove attractive and cost effective in relation to other options.

Smart grid facts: Building a smart grid involves transforming the traditional electricity network by adding a chain of new, smart technology. It includes smart sensors, new back-end IT systems, smart meters and a communications network. Smart grids provide instant information about the network to make it more efficient and help reduce interruptions, support more renewable energy and give households greater control over their energy use.

Smart grid is generally launch to be used on electricity networks level, which is in the form of the power plants and wind farms all the way to the users easily use

Electricity in homes and businesses level [2].. Smart grids Improve quality of utilization and operating efficiency, Provide accommodations for storage options and all Generation, it offers power excellence for the variety of needs in a modern digital economy. Smart grid respond to stem problems and recognize automatically avoid or mitigate power supply, power excellence difficulties, and service disturbances is escaped through Self-healing characteristic which respond to the distributed system. Smart grid generally operates robustly against cyber and physical -attacks and expected tragedies. it permit new products, services, and markets.

II. TYPES OF FACTS

FACTS devices can basically be sub-divided into three groups:

• Shunt devices such as SVC (Static Var Compensator) and STATCOM

• Series devices such as Series Capacitors and Thyristor Controlled Series Capacitors(TCSC)

• Dynamic Energy Storage devices.

III. VALUABLE BENEFITS

With FACTS, a number of valuable benefits can be attained in power systems:

1. Dynamic voltage control, to enable limiting of over-voltages over long, lightly loaded lines and cable systems, as well as prevent voltage depressions or even collapses in heavily loaded or faulty systems.
2. Increased power transmission capability and stability of long power corridors, without any need to build new lines. This is a highly attractive option, costing less than new lines, with less time expenditure as well as impact on the environment.
3. Facilitating connection of renewable generation by maintaining grid stability and fulfilling grid codes, as well as making room for the additional power in existing grids.
4. Facilitating the building of high speed rail by supporting the feeding grid and maintaining power quality in the point of common connection.
5. Maintaining power quality in grids dominated by heavy industrial loads such as steel plants and large mining complexes.
6. Enabling the implementation of Smart Grids.

   Several examples of these benefits are demonstrated in the paper by means of current or recent installations of FACTS devices in various parts of the world.

IV. IMPROVEMENT OF POWER SYSTEM STABILITY

By Placement of FACTS Controllers in an integrated power system networks. While small signal and transient instability phenomena are mostly related to synchronous generators and their control, voltage stability is mostly related to network and loads. Voltage stability can be defined as the ability of a power system to maintain voltage magnitude at all buses within acceptable limits after the system has experienced a disturbance. The loss of equilibrium between load demand and load supply is the main cause of voltage instability, which results in unacceptable low voltages across the network[3].Voltage instability phenomena often appear as a sudden decrease of voltage therefore called voltage collapse. Many loads supplied by a power system are controlled in such a way as to have some sort of restorative behavior. Large industrial motors drives, thermostatically controlled heating loads, tap-changing transformers are examples of loads that respond to disturbances trying to restore their power consumption. This restorative action has the effect to further increase the stress on an already stressed system. In particular reactive power demand could increase beyond the available capability, leading to the intervention of limiting protections such as over excitation limiters in Synchronous generators.

V. RESOLUTION REGARDING SMART GRID

WHEREAS, The Energy and Independence and Security Act of 2007 (EISA) establishes as policy the demonstration and deployment of a smart grid; *and* The American Recovery and Reinvestment Act of 2009 provided funds to support these smart grid initiatives; *and* The Federal Energy Regulatory Commission (FERC) issued a Smart Grid policy statement prioritizing the National Institute of Standards and Technology's (NIST) development of smart grid interoperability standards (as mandated in EISA); FERC encourages the development of interoperability standards consistent with cyber security and reliability standards in four prioritized functionalities (wide-area situational awareness, demand response, electric storage, and electric transportation); FERC's policy statement established an interim rate policy for smart grid investments; and the areas highlighted by FERC's policy statement overlap with State commissions' jurisdiction; *and* The White House, Department of Commerce, and the Department of Energy have repeatedly stated that the Administration considers the smart grid an essential element of America's job growth, energy independence, and future as a global economic leader, and emphasized .

The urgency of developing smart grid standards; *and* The Department of Energy has released funding opportunity announcements for smart grid investment grants and demonstration projects that will spur investment in smart grid, and require applicants to provide at least 50% cost share for any selected project, which cost share might be recovered through utility rates; *and*

WHEREAS, Various States and commissions are pursuing smart grid projects and deployment according to the needs and interests of their constituents; *now, therefore be it*

RESOLVED, That the Board of Directors of the National Association of Regulatory Utility Commissioners, convened at its 2009 Summer Committee Meetings in Seattle, Washington, recognizes the smart grid's potential to revolutionize the nation's energy grid; *and be it further*

RESOLVED, That NARUC agrees that to be most effective, the federal policies and standards that guide the deployment of the smart grid should be based on the following principles:

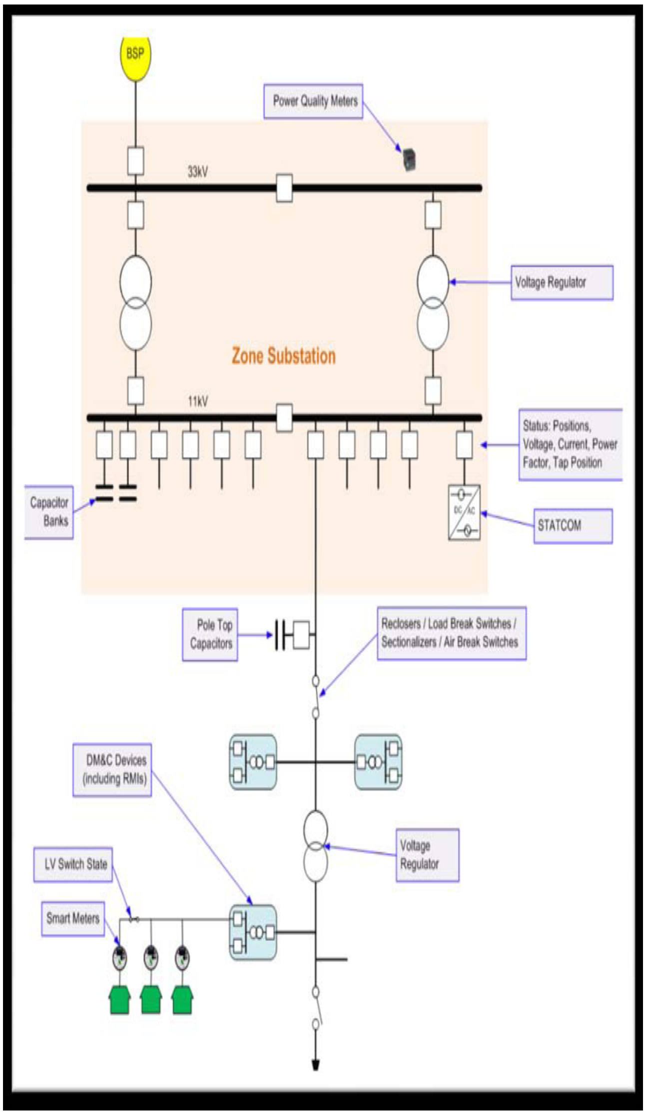

Fig.1-Smart grid substation platform.

1. Smart grid policies and standards should enhance interoperability consistent with ensuring cyber security and maintaining or improving reliability.
2. The development of smart grid standards can best be achieved through a partnership among the States, the federal government, and industry. State commissions play an essential role in evaluating smart grid deployments; early deployments will influence the emergence of de facto and de jury standards.
3. Smart grid standards and policies should seek to achieve maximum consumer, reliability, and environmental benefits and to provide opportunities for innovation,

consistent with providing utility service to consumers at fair, just, and reasonable rates.

4. There is inherent value within the State regulatory process and the manner in which it balances the needs of the utilities, the grid system, and consumers.
5. State commissions have jurisdiction over the elements of smart grid improvements that are within their vested authority; FERC should not authorize cost recovery for smart grid investments that are within the State commissions' jurisdiction; FERC and the State commissions must prohibit double cost recovery for the same investment.
6. Smart grid standards should enable a common semantic framework and provide for cyber secure interoperable communications through open protocols and standards (including Internet-based protocols and standards) if available and appropriate.
7. Smart grid policies and standards should be flexible and together with RTO policies and tariffs, should accommodate various State regulatory contexts, retail rate structures, and policy goals.
8. Smart grid policies and standards should promote a flexible, non-proprietary, open infrastructure that is up gradable to avoid excess costs as a result of obsolescence.
9. Smart grid policies should encourage interoperability of the electric grid and information services to foster a vast array of resources and information services.
10. Smart grid policies and standards should balance the costs of the smart grid with the benefits of the smart grid and the costs and benefits should be quantified to the extent possible.

VI. SUBSTATION SECURITY WITH STRATEGIC ZONE OF PROTECTION

Smart grids collect a wealth of intelligence, beginning at the edge with Intelligent Electronic Devices (IEDs) that collect valuable information such as fault location[5], relay targets and customer usage in increasingly fine granularity which then is transmitted to the central control area to support the smart grid. Protective relays, meters, remote terminal units, LTC/regulator controllers, and predictive maintenance equipment also are becoming rich sources of data that can be made readily available to remote users. This new information requires increased communications bandwidth and a secure strategy for transporting the information to its destination points throughout the utility. As power utility stakeholders address the challenges of creating end-to-end security for their smart grids, operations groups can benefit from a "Zones of Protection" strategy protection relay engineers have employed for some time to keep utility grids and equipment safe from fault and system unbalances

VII. SMART GRID BENEFITS

There are two reasons to create a national smart grid. First, today's grid needs to be upgraded because it is aging, inadequate, and outdated in many respects—investment is needed to improve its material condition, ensure adequate capacity exists, and enable it to address the 21st-century power supply challenges. Status quo is not an option. Secondly, the benefits of the smart grid are substantial. These benefits will result from improvements in the following six key value areas

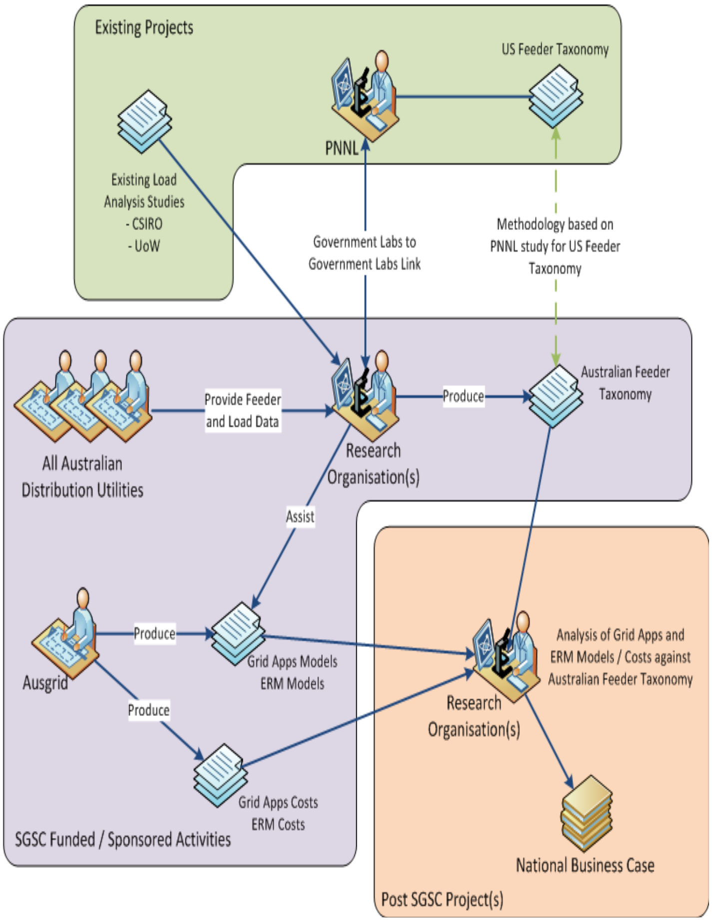

Fig.2- benefits of smart grid technology.

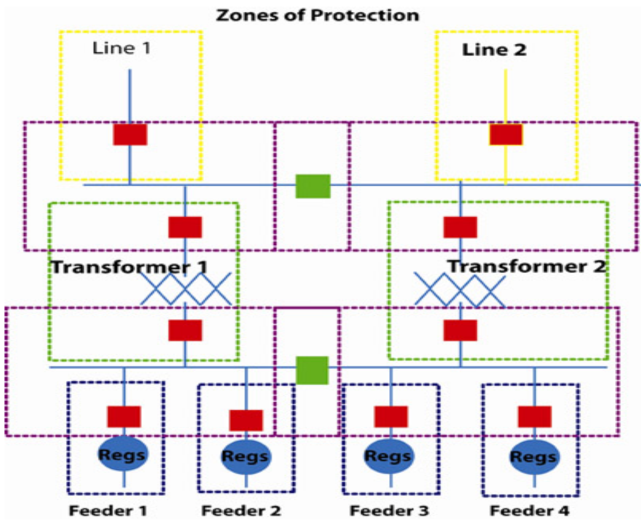

Fig.3-By Technology protection zone.

1. **Reliability** — by reducing the cost of interruptions and power quality disturbances and reducing the probability and consequences of widespread blackouts
2. **Economics** — by keeping downward prices on electricity prices, reducing the amount paid by consumers as compared to the "business as usual" (BAU) grid, creating new jobs, and stimulating the U.S. gross domestic product (GDP).
3. **Efficiency** — by reducing the cost to produce, deliver, and consume electricity
4. **Environmental** — by reducing emissions when compared to BAU by enabling a larger penetration of renewable and improving efficiency of generation, delivery, and consumption
5. **Security** — by reducing the probability and consequences of manmade attacks and natural disasters
6. **Safety** — by reducing injuries and loss of life from grid-related events

The following technology solutions are generally considered when a smart grid implementation plan is developed:

- Advanced Metering Infrastructure (AMI)
- Customer Side Systems (CS)
- Demand Response (DR)
- Distribution Management System/Distribution Automation (DMS)
- Transmission Enhancement Applications (TA)
- Asset/System Optimization (AO)
- Distributed Energy Resources (DER)
- Information and Communications Integration (ICT)

Fig.4 identifies the relationships among these technology solutions and the key value areas. This "many-to-many" relationship illustrates the synergy of smart grid solutions, an affect that must be considered when the scope of the smart grid is planned to ensure the benefits are optimized.

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation.

Inadequate Grid Infrastructure: For India to continue along its path of aggressive economic growth, it needs to build a modern, intelligent grid. It is only with a reliable, financially secure Smart Grid that India can provide a stable environment for investments in electric infrastructure - a prerequisite to fixing the fundamental problems with the grid.

IEEE Standards Association (IEEE-SA) have for smart grid development in India- India is ranked as the third largest market for smart grid investments. Smart grid is a strategic area of focus for IEEE Standards Association (IEEE-SA). Through India Smart Grid Task Force, an initiative of Ministry of Power, India, IEEE-SA have been able to create an initial momentum in this area. The India Smart Grid Task Force is an inter ministerial group and serves as a government focal point for activities related to Smart Grid.

To drive the smart grid development in India, IEEE-SA is dedicated to working with industry professionals, academia and government officials. A Standards Interest Group (SIG) for India has been formed as the first step and it provides a platform for the Indian technical community to participate in global standards development. As one of the world's leading standards development organizations, IEEE-SA acts as a catalyst to bring standards developed in India on a global scale. In addition to standards development, IEEE-SA is focusing on creating awareness and educating about smart grid through various workshops and panel discussions across the country. Efforts are being made in India to create a collaborative environment which will work towards setting global standards wherein deployment of interoperable technologies using the Smart Grid will become a reality faster.

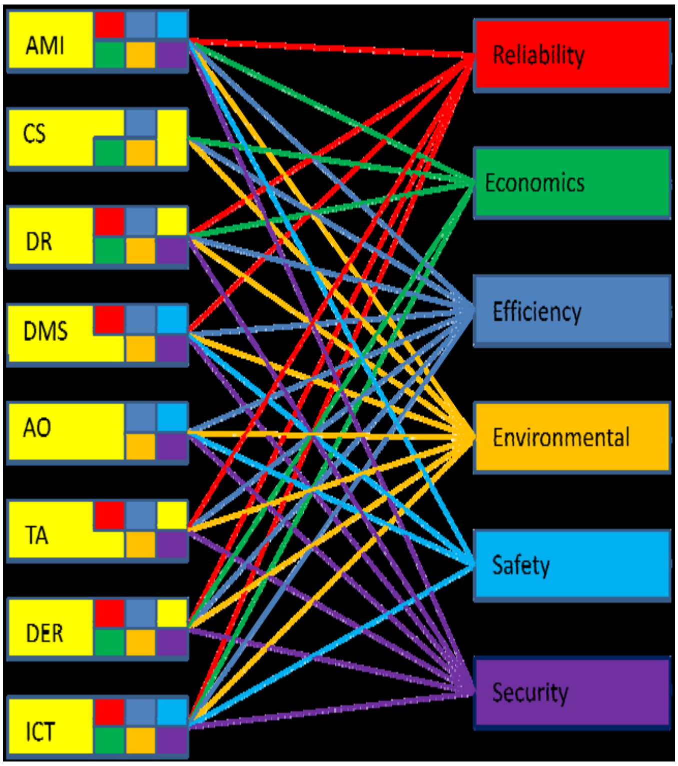

Fig.4 - Technology Solution — Key Value Area Relationships

VIII CONCLUSION

We consider our smart-grid technology is a ideal calculation to the present market that we are trying to enter. Our product boasts many features greater than something out on the market. The base line is it will develop safety in the place of work. Our client analysis targeted security as one of the largest concerns in a potentially risky in place of work and we consider we planned a product with just that in mind. Our combination of unique sensors as well as the simplicity of being able to integrate it with the Flex Zone will translate into a successful result in the market. "FACTS" (Flexible AC

Transmission Systems) covers some power electronics based systems utilized in AC power transmission and distribution

REFERENCE

[1] N.G. Hingorani, L. Gyugyi: "Understanding FACTS", IEEE Press, 2000

[2] Tarry Singh, Pavan Kumar Vara "Smart Metering the Clouds" 2009 18th IEEE International Workshops on Enabling Technologies: Infrastructures for Collaborative.

[3] T. Van Cutsem,"Voltage instability: phenomena, countermeasures, and analysis methods," *Proc. IEEE*, vol. 88, no. 2, pp. 208-227, Feb. 2000.

[4] Sponsored by the Committees on Electricity, Energy Resources and the Environment, and Critical Infrastructure Adopted by the NARUC Board of Directors July 22, 2009

[5] Industrial Ethernet Posted by: Jim Krachenfels on July 24, 2012

[6] Understanding the Benefits of the Smart Grid June 18, 2010

[7] IEEE Standards Association (IEEE-SA) smart grid development in India

[8] T.J.E Miller 'Reactive Power Controll in electric system'

[9] Padiyar K.R. "FACTS Controller in power transmission and distribution.

[10] R.Mohan and R.K.Varma "Thyrister based FACTS Controllers for electrical transmission system IEEE Press

[11] Kaplan, S. M. (2009). Smart Grid. Electrical Power , transmission: Background and Policy Issues. The Capital.Net Government Series. Pp. 1-42.

[12] U.S. Department of Energy, "An introduction to Smart Grid", 2009

[13] www.smartgrid.ieee.org

[14] www.smartgrids.eu

[15] www.epri.com

[16] Li, H.; Jiang, Y.; Qi, L. A Novel Hierarchical Section Protection Based on the Solid State Transformer for the Future Renewable Electric Energy Delivery and Management (FREEDM) System, IEEE transactions on smart grid,issue99,page1-9,2012

[17] Lloret,Jaíme,Gilg, Marc; García, Miguel; A Group-Based Protocol for Improving Energy Distribution in Smart Grids , IEEE International Conference on Communications (ICC), 2011.

[18] Leeds, David J., "The Smart Grid in 2010: Market Segments, Applications, and Industry Players ," (July 2009),Greentech Media. http://www.greentechmedia.com