

The Future of the Smart Grid – Market Scenario

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Abstract

The smart grid is a way to better facilitate and manage all those flows and transactions into a cooperative, collaborative, transitive, reliable system. A National Smart Grid Mission has launched in order to effectively implement the goals conceived in the Smart Grid Roadmap. Apart from this Ministry of Power is working on the blueprint for a National Smart Grid Mission that will be launched in 2014. The Smart Grid of the future will offer access to reliable and quality power to all at affordable cost i.e. targets to achieve objective of “Access, Availability and Affordability of Power for All” Realizing the growing importance of Smart Grid technologies in the Indian power sector, the Ministry of Power (MoP) released the “Smart Grid Vision and Roadmap for India” at the Power Ministers Conference in Delhi on 10th Sep 2013.[1] Smart Grid does not cause blackouts to become more frequent. In fact, the current electric grid is rapidly approaching its limitations, and Smart Grid innovation will increase grid efficiency and help meet the increasing stress of growing demand on existing, aging infrastructure. Smart Grid technologies applied across the grid will contribute to fewer and shorter brownouts and blackouts.[2]

Keywords – smart Grid, V2G,

I. INTRODUCTION

Basically, the smart grid is a way to better facilitate and manage all those flows and transactions into a cooperative, collaborative, transitive, reliable system. Electricity is definitely cheaper than all other forms of energy and it is the cleanest at the user end. If electricity can be supplied at least during morning and evening hours the quality of life improves beyond description. Besides if quality power can be assured, consumers need not invest in voltage stabilizers, inverters and other standby power arrangements which are all sunk cost in the economy. The Smart Grid will help faster restoration of the grid in case of faults or disturbances. Smarter systems will help integration of renewable energy to the grid and Time of Use (ToU) tariff will offer choice to consumers to reduce the electricity consumption during peak hours which will bring considerable savings in their bills.

The key problems hindering the growth of the power sector are Transmission and Distribution (T&D) losses, fuel shortage, land availability and environmental issues. Other problems being restoration of the financial health of distribution companies and improving their operating performance. These problems need to be addressed for the development of Indian power sector. Smart Grid technologies could help to address many of these issues effectively. Let's have quick look on advancement & technologies adopt by various country in the world.

II. V2G TECHNOLOGIES

Vehicle to grid (V2G) technologies have been in development since the beginning of the modern electric vehicle era, but are only now beginning to emerge in revenue-generating applications. The term V2G refers to a suite of hardware and software technologies that enable plug-in electric vehicles (PEVs) to participate in grid services, such as ancillary services markets, or the operation of microgrids. PEVs can provide services to the grid by changing the rate at which they consume power or by providing power back to the grid. V2G technologies enable participating PEVs to both communicate with and have charging events managed by the grid operator when plugged in. Vehicle to grid (V2G) technologies have been in development since



Fig.1 Conceptual Model

the beginning of the modern electric vehicle era, but are only now beginning to emerge in revenue-generating applications. The term V2G refers to a suite of hardware and software technologies that enable plug-in electric vehicles (PEVs) to participate in grid services, such as ancillary services markets, or the operation of microgrids. Navigant Research forecasts that global V2G-enabled PEVs servicing the ancillary services market will grow at a compound annual growth rate (CAGR) of 64.3% from 2013 to 2022 as mentioned below in fig.2. Fleet acquisitions will set the foundation of this market.

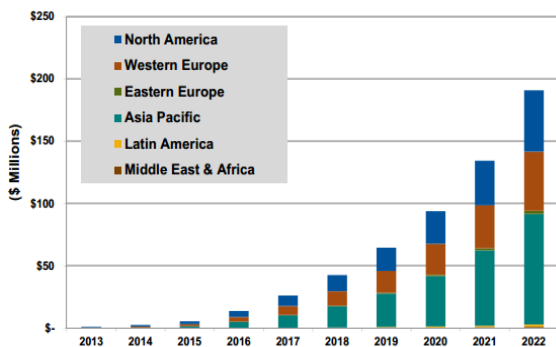


Fig.2 V2G frequency regulation revenue by Region: World Markets:2013-2022

Honda joined a demo project for experimental vehicle-to-grid (V2G) technology that it hopes will provide a potentially valuable energy storage resource to electrical grids as well as more cost effective ownership of electric vehicles. The Honda technology builds on research at the University of Delaware and supported by NRG Energy.

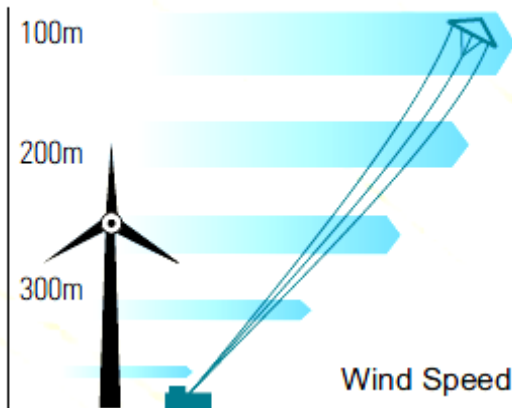


Fig.3 Altitude & Speed domain

III. DIRECT CURRENT DISTRIBUTION NETWORKS SCENARIO

According to a new report by Navigant Research, loads being served by today's alternating current (AC) power grids are increasingly natively DC. In fact, according to some estimates,

approximately 80% of loads in commercial and residential structures are now DC. Given the enormous political and policy support for inverter-based native DC power sources, it makes sense to reduce DC-AC-DC conversion losses and integrate DC distribution networks into power supply infrastructure. Or so goes the argument on behalf of DC.[3]

(a) Understanding Direct Current

There is heated debate today about the advantages and disadvantages of DC. Here are just a few of the myths that need to be debunked, according to DC advocates, in order for this class of power distribution equipment to become mainstream:

- DC requires large conductors and can only be transmitted for a few meters at a reasonable cost. Again, this applies to the majority of systems deployed today at the 12V, 24V, or 48V levels, but it does not hold true at the 380V medium voltages now being developed for distribution networks.
- If a network is run off of DC batteries, this eats up all of the efficiency gained by the DC current. While there is some validity to this fear, it is equally true that this may be an appropriate tradeoff for a reliability gain that can reach 1,000%.
- Arc flash is an unacceptable hazard for DC. Again, new technologies, such as magnetic arc breakers and switched interlocks, can address these safety concerns at a relatively modest cost.
- AC is safer because the voltage crosses zero at either 50 or 60 times per second (i.e., 50 Hz or 60 Hz AC grids). This is only true if the current is not leading or lagging. While components are currently more expensive to address such issues, these extra costs can be offset by large cost savings at the higher voltage distribution level due to a 10% to 15% gain resulting from simplicity in system design.

(b) Market Forecast Overview

ironically; the most successful markets profiled in Navigant's report are low-voltage (24V and 48V) DC systems for telecom towers. Increasingly, those towers are becoming anchor loads for networks expanding into village power systems with formats unique to the developing world, especially India and Africa. In fact, the Asia Pacific region is the clear market leader in DC distribution networks today with approximately 116 MW of annual online capacity, more than 98% of this in the telecom/village anchor market segment. Demand for mobile phones in this region and need for rural electrification in densely populated countries such as India leads the overall DC network market. The market story line for the Rest of World region

echoes that of Asia Pacific, with an even more extreme dominance by telecom/village power systems. Given that this broad geography includes Africa -- the focus of current philanthropic and non-governmental organization (NGO) activity related to mitigation of energy poverty -- this should come as no surprise.

As per the conservative scenario, the revenue that will flow to the four segments of the DC distribution network markets profiled in Navigant's report starts at \$2.5 billion in 2013 and will increase to \$24.1 billion annually by 2025 as shown in fig.4.

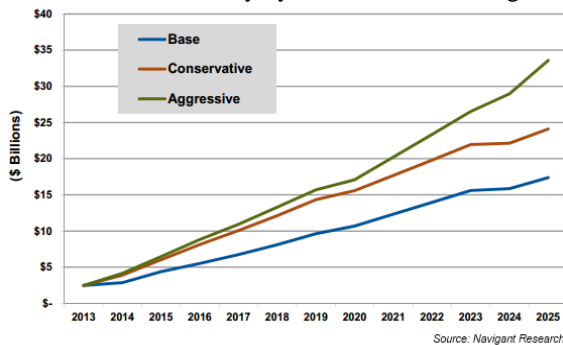


Fig.4 DC Distribution N/w Revenu

IV. Conclusion

Smart Grids are undoubtedly the “energy internet” of the future. The engagement and cooperation of all stakeholders (regulators, utilities, vendors, customers, etc) is a vital first step. Everybody has to work together and move at the same speed. It will take India a few years to realize the full impact of Smart Grid when a utility control room operator can regulate an electric meter in homes.

References

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