

Communications for Energy Conservation

Vineela Malae, Dr.M.V.Bhaskar Reddy

Abstract: The carbon foot prints are produced due to ecological and/or environmental impact of green house gases. Consumption of higher energy is one of the factors to increase the intensity of carbon. To get rid the problem i.e., the consumption of the higher electricity, the upcoming smart intelligent grid technology can be gainfully utilized to reduce the consumption of electric energy which ultimately reduces the carbon-foot prints.

In this paper, I express my sight and different views of the others, how and what extent of the smart-grid technologies could reduce the carbon-footprints.

Keywords: Smart grid, carbon foot prints, emissions, electricity, smart grid potential

1. Introduction

The intensity of carbon footprint is increasing day by day, which is one of the factors to causes the environmental pollution. Here we are considering and studying one of the factors for causing to increase the carbon foot print, i.e. conservation of electrical energy. It must have to decrease the use of electrical energy and also avoid to wasting of it. Here the identified problems are 1) How to reduce the carbon foot print 2) How to conserve the electrical energy-these two are interdependent and 3) How to get a good quality of power? The present grid technology and the related distribution system, a significant percentage of generated power is lost before it reaches the point of consumption. Here the problem is how to minimize the lost of energy during transmission and distribution. An updated technology is needed to solve this problem.

The interesting thing in these studies, are some of the identified problems are inter-reliant. If we reduce the use of electrical energy it leads to decrease the carbon foot print which is one of the aspects to protect the environment. Next the attention task is conservation of electrical energy. The difficult part of this is how to decrease the use of electrical energy and also to work for effective fruitful communication. Calendar days are not increasing but the customers and consumption are increasing day by day .The author intention is to decrease the total consumption of energy without depending the number of users and simultaneously to get a good quality of power. Here the mission is which technology is needed for this operation for the conservation of energy with cost effective and how to develop the quality of contact throughout the world.

The hard tasks are to conserve the energy and also to use of renewable energy. One of the main problems with the renewable energy is difficult to plan it is because whether the wind may blow or not and the sun may shine or not. For conservation of electrical energy to install smart grid Technology this will help to minimize the wastage of current. The US government (Jan, 2009) said

that they are planning to install 40 million smart meters and to set up 3000 miles transmission lines [1].

It is basically turning the electrical grid into a new network which uses microprocessors and software to work competently and to connect generation of renewable energy. It means that the smart grids make use of wireless sensor networks, software and calculating the how much energy is utilized by the consumer, accordingly, the customer should adjust their habits to minimize the consumption. In the end we want smart grid technology to cut down the consumption of the electrical energy to fight against global warming.

Mainly, the power generation resources are fossil fuels. The power produced, are not fully utilized and loss of power is heavily occurred and they are not taken proper precautions to overcome the problem. Further, they are not developed the grids at suitable distances. Moreover, transmission lines are very, very longer distances which causes the heavy loss of energy through transmission and they are not developed about the generation of power from the renewable sources. Initially we have not divided the source of energy types like 1) energy from wind 2) energy from solar system 3) energy from tides 4) energy from fossil fuels.etc. Along with the existing energy we have to make compulsory to use some percentage of renewable energy by making a law throughout the world to make the balanced distributed types of power.

The governments all over the world have been forced to think about the climate changes with introducing of proper motivational programs on smart grid Technology .Moreover, reducing the use of energy (fossil fuel energy) it also trim down the use of fossil fuels which protects not only the atmosphere but also the earth crust.

A smart grid technology is an understanding concept to know about the micro consumption of power it ensures reinforcing the global competitiveness and entirely to accommodates clean energy and probably reduce the carbon foot print. The efficiency, safety and reliability of the electricity transmission and distribution system can be improved by transforming the current electricity grids into an interactive (customers/operators) service network or the smart grid [3].

Advanced Metering Infrastructure (AMI) provides consumers with the ability to use electricity more efficiently and provides utilities with the ability to monitor and repair their network in real time. The AMI gained some grip in the industry suggesting the accuracy and process improvement of meter reading and its control and suggesting for managing power quality and asset management. [3]

The coming electric grids will be integrated by using the available alternate forms of energy resources. It means that, the design of the grids may need to change to install smart grids. To carry this work and to make the design, it is not a single discipline and it needs a multidiscipline and also it requires from the help of concern governments. The interdisciplinary research approach

needed in many fields those are 1). Advance systems engineering courses such as intelligent systems and Adaptive Controls, and controlling the design of the new tools. 2) Attract the producers of the electricity by giving some subsidies from the government part. 3). Ecological sciences [4].

At present the Denmark people realized and using the renewable energy at the rate of 40 percent of its electricity from wind turbines of various sizes distributed throughout this nation's grid. Denmark offers some interesting lessons about how to handle huge amounts of distributed generation, an input trend likely as the grid becomes more refined [2].

2. Related Events

2.1. The carbon footprint - outlook

Alternative energy (or) renewable energy sources is not destroyed and it is alternative to traditional sources. Fossil fuels/ or nuclear power must be consumed (gas or coal in energy grids, oil for transportation and uranium in nuclear energy) to produce energy. The vehicle to grid (V2G) concept means of storing energy and releasing it back into the electric grid on demand [5]. Climate change is a global problem. All countries in the world work together to install both the energies alternative energy and low emission energy. The following table shows the total world energy consumption and generation [5].

Table. 1 Type of resources

Type of resource	The world energy consumption in %	The world energy generation in %
Combustible Renewable and Waste Energy	10.6	-
Hydro	2.2	16.1
Nuclear	6.5	15.7
Gas	20.9	19.6
Oil	34.3	6.7
Coal	25.1	39.8
Other	0.4	2.1

2.2. The concept of carbon emission reduction (smart grid) technology

One of the greatest threats in front of our society is global warming. It is a collective responsibility of all the nations to reduce the carbon foot print. The research teams and the industries of the concern field to help to overcome this challenging problem, is to save the universe from pollution of the carbon footprints. The societies have to focus on carbon emissions not for the increasing the generation of electricity. Electrical energy is more expensive is some sort of price on carbon. Governments also think to introduce variable tariff depends what kind of energy is utilized by the customer. The price of electricity generated by the fossil fuels is expensive it is because of the carbon foot print. The alternative method is to install the smart grid technology in the conventional grids to reduce the consumption of energy.

The electric industry is to build unbiased, convert from centralized to non-centralized and much

interact with the consumers. The smart grid technology undertake to modify the whole business model and also it reduces the consumption of energy ultimately it decreases the carbon foot print. The smart grids symbolize for a vision of up grading the digital distribution system and extensive distance transmission grids by using robust two-way communications, advanced and superior sensors and distributed computers to improve the efficiency, reliability and safety of power delivery and use [6].

This sort of technology helps to reduce the energy consumption and load balancing via distributed generation and it mainly helps to reduce the carbon foot print.

The central concept of smart grid is to include screening, analyze, control and communication competence, to the national electricity delivery grid system, to make best use to reduce the energy utilization and causes the reduction of carbon foot print. Furthermore, it is found to take new technologies like plug-in hybrid electric vehicles, different kinds of distributed transmission, cosmological energy, smart metering, lighting management systems, distribution computerization, etc [6].

Smart Grid is increasingly seen as a means to facilitate climate friendly renewable energy sources (renewable) and to enable efficient use of electricity. For example, modern electrical networks can link wind and solar power with electric cars. A consequence of Smart Grid is a drastic increase in use of electronics in the power system [7]. This makes the satisfactory function of electrical and electronic equipment vital for realization of a robust Smart Grid.

2.3. The smart 2 grid technology (putting 'smart' into smart grid)

The European Government's are planning strategically to make compulsory the carbon emission reduction targets. The UK itself alone is planning to reduce, 34% of carbon footprint by the year 2020 and up to 80% by the year 2050. The function of the smart meters is to transmit and receive the detailed data of the energy use. This sort of two-way strategic exchange of message, the consumers can play a far more active role in the supply chain by taking higher control over their own energy consumption and also the carbon emissions and to know power price.

Smart meters can only make available or supply for the function of their intelligent, provided, if it is supported by a flawless communication structure which provides bidirectional transmission of consumption and control data in real time. This can be done exactly by the broadband power line (BPL). This technology is already widely put in operation in one of the major European countries, Germany. The BPL technology is based on just like internet protocol based communication platform. Here, each ray of power becomes broadband based data interface and the power grids change into the intelligent systems. The BPL can works straight away with any measuring device (meter) from any hawkers.

In terms of savings point of view, it is a merit and involves low cost. Remote metering will give a detailed picture of power consumption. Supplier can introduce marginal price tariffs at non-peak hours. It avoids, to

reduce, the consumption during the peak hours by the consumers. Significantly, BPL is not a stationary technology it means that additional smart grid applications can be executed in a phase wise manner. In future the power grid net works also used to balance the load management via automatic and help to regulate the load by the user such as domestic devices etc [8].

Distributed net work operators (DNOs) in UK are owned by a small number such as Scottish power, EDF etc. They are the licensed one distribute electricity in their ear marked region. DNOs are in a major position to take advantage of on the benefits of BPL. UK is taking an important step in the direction of reducing the UK's carbon footprint through a joint venture of DNOs and BPL by supporting the combination of different kinds of renewable energies [8].

2.4. The pacific northwest national laboratory (PNNL) –outlook

As for the report of PNNL (Pacific Northwest National Laboratory) from the department of energy's by installing of smart grids in the conventional grids decreases the carbon emission up to 12% by the year 2030. This report illustrates a direct link between the smart grid and carbon foot print. The intelligent grid reduces the consumption of energy and emissions of carbon by using directly a new technology and indirectly by using renewable energy. It is estimated that 442million metric tons the carbon emissions is prevented to allow in the atmosphere in every year by upgrading the conventional grids by using the smart grid technology. In the view of the Pratt, PNNL research scientist, the main aim is to make the grid into smart is to prune the carbon emissions, conservation of energy and to accommodate more renewable [9].

Direct mechanism reduce electricity consumption and carbon emissions and where as the indirect mechanism reduces the cost of deploying and operating efficiency and renewable. By combining the effects of both the mechanisms it leads to reduce the carbon foot prints by a very substantial percentage of 12 or more than it.

2.5. An over view of association of british bookmakers (ABB) UK

The United Kingdom's (UKs) conventional power grid is based on large centralized energy stations, it has executed very well in releasing secure and reliable energy over the years. Meanwhile the UK Government decided to implement to use the energy from renewable resources by 15% of the total energy required to UK by 2020, Nevertheless, the existing grids to be modified as per the new technology. For example, energy will be produced from offshore wind farms in the North Sea or the North of Scotland or from community based district heating schemes. At present it needs the intelligent grids which can receive the energy from all the sources of the different types of energy which supplies the power with less carbon foot print [10].

In view of the ABB philosophy of smart grid which includes four types of elements. 1) HVDC light, 2) FACTS, 3) WAMS and 4) Distribution net work management [10].

HVDC light is a patented one to ABB for a high voltage direct current technology which stands for the voltage source converters (VSCs) and it is confirmed that it is an environmentally free from the carbon footprints, a way to design the flow of energy transmission and distribution system for the system of underground cable or net work interconnection or submarine link.

Flexible AC Transmission Systems (FACTS) can help to improve the capacity of existing transmission networks and also it can enhance the security, capacity and flexibility of power transmission systems [10]. The consumers of the energy will get more current with a minimal impact of the environment.

WAMS Wide area of monitoring system technology is to monitor the grid power flow and to develop to know how it behaves in all the situations to be dynamic control. Phasor measurement units (PMU's) is an electronic device installed throughout the energy grid to provide highly accurate time stamping, the data supplied by each PMU is corresponding to the equivalent time stand[10].

The advantages of WAMS: The grid workers contain the ability to securely 1) optimize the design capacity of their transmission property 2) optimize the savings of the either decrease or remove the revenue losses from the outages of transmission system. 3) allow more rapid and co ordinate recovery after outages.

The above three elements of the intelligent grid focus mainly on the transmission network ,different types of renewable energy resources and energy storage devices like large batteries, flywheels, compressed air etc and so on to help to maintain the delivery of supply with security[10].

DISTRIBUTION NET WORK MANAGEMENT:

There is a pressure on the government to adopt feed-in-tariff schemes which it promotes the small scale renewable energy production. Consider an example a cultivator of a form house using a connection with 11kv If he install a small collection of three 6kW wind turbines of distributed energy storage or a mixed energy (Different kinds of renewable energy- single wind turbines, wind farms, solar PV on houses, waste to energy and biomass etc)[10].

ABB stands assist to expand guidelines and suggest skill solutions based on its wealthy global experience in the power efficiency region. The agreement made by the two parties ABB and MIIT (Ministry of Industry and Information Technology) to work closely and to arrange different programs like energy efficiency seminars, technology trainings, to visit onsite to rectify the problems and consultancy, etc, to help small and medium sized enterprises (SMEs) gain logical information and technological knowledge to apply energy conservation and reduction of emission.

Mr. Koch said ABB is a pioneer in the power competence technology field in the UN Climate Change meeting in Copenhagen, stands in an only one of its brand position to contribute to this by serving industries which put away more than 70% of the total energy in China. ABB

Power can be transferred from one grid to another needed one without building a new power grid by using a HVDC Technology. This approach reduces the

power loss through transfer and it indirectly helps to reduce the carbon footprints.[14]

3. The potential of smart grid

A group of authors elucidated different mechanisms by which the smart grid technological system could reduce carbon footprints. The report provides additional information to the research in each smart grid area.

Direct mechanisms are mainly for the benefiting from the conservation effect of consumers being more aware about their own energy use, which include incorporating smart grid-enabled diagnostics in residential and commercial buildings; adding more plug-in hybrid electric vehicles to the market; and benefiting from the conservation effect of consumers being more aware about their own energy use. Indirect mechanisms are for cost effect, successful operations and renewable.

According to Pratt, the combined effect of both the mechanisms, it could reduce the electric grid's carbon foot print at a marginal rate of 12% or more, and also he added renewable portfolios, goals of 20% to 30% set for the electricity sector by the time frame of two decades in many states as a part of national carbon policy [11].

4. Mechanisms considered

Pratt et al led a team analyzed different mechanisms, by which the smart grid technique could reduce carbon emissions. They also proposed suggestions for future extensions for the findings to fulfill the goals for decreasing the carbon intensity in coming two decades. For this, research and development work for the smart grid funding being given by the department of energy (DOE) [12].

The smart grid-Direct and Indirect impacts: The smart grid impacts can be divided into direct and indirect mechanisms. The main function of the direct reduction is the smart grid itself generate to savings in energy and/or emissions consumed or by reducing generation requirements. Whereas indirect reductions are related to smart grid functions are producing cost savings. It concludes that both the mechanisms are involved the rate of reduction in the energy and carbon footprints up to 12% by direct mechanisms and up to the 6% by indirect by coming two decades [13].

5. Conclusions

The carbon footprint is not an individual problem but it is a global one. For the optimal reduction of the carbon footprint, the alternate and advanced newer cutting edge technology like a broadband power line (BPL) which have to connect geographically throughout the world to decrease the emission of carbon. The public awareness and counseling is an important thing for the conservation of the energy which reduces the carbon footprint. To know the proper utilization of the energy, it is on the shoulders of everyone to avoid the wastage of power. In addition, the government policies, also has to be amended. Further, each government makes it to compulsion to use all kinds of energy resources and make it to proportional ratio of each kind of energy. The entire nation encouraged to develop a multi distributed power

grid system in the different zones, towns or individual homes make into green areas to produce surplus energy which may use for further developmental activity of the society.

A global call given on Saturday, March 27 at 8.30pm Earth hour 2010 to save the earth by switch off the power for an hour. Really it is fantastic public awareness program and it is a sign of commitment against the global warming. Make all the cities to smart cities, towns to smart towns, villages to smart villages, homes to smart homes and finally it should be a smart nation, ultimately it will become a smart world.

10. References

- [1] FAQ: Smart Grid, earth2tech, <http://earth2tech.com/2009/01/26/faq-smart-grid/>, Jan 26, 2009, Katie Fehrenbacher.
- [2] Peter Asmus, Reinventing Electric Utilities: Competition, Citizen Action and Clean Power (Island Press, 1997). This article is adapted from a piece appearing in the May issue of The Electricity Journal, May Island Press, 1997
- [3] Transformation of energy systems: The control room of the future. Adrian Clark, Christopher J. Pavlovski, Jeff Fry
- [4] Smart Grid Design for Efficient and Flexible Power Networks Operation and Control, from IEEE Xplore, James A Momoh.
- [5] Global Warming, Alternative Energy renewable, <http://www.global-greenhouse-warming.com/alternative-energy.html>
- [6] Xu Wei , Zhou Yu-hui , Zhu Jie-lin, Energy-efficient Distribution in Smart Grid, March 02,2010 at utilizati 03:33:34 EST from IEEE Xplore.
- [7] Magnus Olofsson, Director-General Swedish National Electrical Safety Board, Kristinehamn, Sweden, Electrical power quality and utilization, 10th International conference, electrical power quality and utilization, Sept 15-17, 2009, Lodz, Poland.
- [8] Intelligent utility, @ where the smart grid meets business and reality, <http://www.intelligentutility.com/article/10/03/puttin-g-smart-smart-grid>
- [9] Pacific Northwest National Laboratory, the Smart Grid: An Estimation of the Energy and CO2 Benefits, Pamela Harrington, December 2009.
- [10] Peter Jones, Head of Technology for ABB Power UK, outlines the key elements that comprise ABB's approach to smart grids.
- [11] Smart grid conference, October 4- 6, 2010 - Los Angeles Convention Center, CA, Pratt.
- [12] The Smart Grid: an Introduction", prepared for the U.S. Department of Energy by Litos Strategic Communication
- [13] Smart grid could reduce emissions by 12 percent, January 28, 2010; Anne Haas, PNNL, (509) 375-3732/[PNNL report evaluates smart grids' impact on carbon emissions].
- [14] www.abb.com