Updation of Industrial Sector by using Smart Grid Technologies and Applications

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Abstract:

Smart Grid is an electrical network which is useful in now-a-days very effectively in transmission side and mostly useful in distribution side. By using this technology and applications, we can increase the industrial productivity like reducing of power consumption, electricity metering and improved security in industries. In this paper, we can discuss how smart grid can coordinate the all consumers which are related to industries and how industrial sector can be updated by this smart technology.

Keywords: Smart grids, electricity consumption, demand response, power systems, energy efficiency, electricity markets, ancillary services, ADR.

Introduction

Now-a-days, the smart grid technology working very efficiently like in controlling mechanism, coordination with other sector to reduce complexity in recent industries and also other sectors.

Factors affecting the existing industrial sector:

1. Electricity demand increasing rapidly due to shortage of electricity recently.
2. Increasing of losses in transmission lines.
3. Less efficiency in existing industries due to more losses and drawing more power at peak time (Not managing peak demand).
6. Less technological advancements in recent industries.
7. Requirement of more reliable electricity as it can withstand for critical loads also.
8. No efficient equipments are using in recent industrial sectors (Replacement of equipments are highly impossible if any problem exists).
9. The initial cost and capital cost of industries are very high.

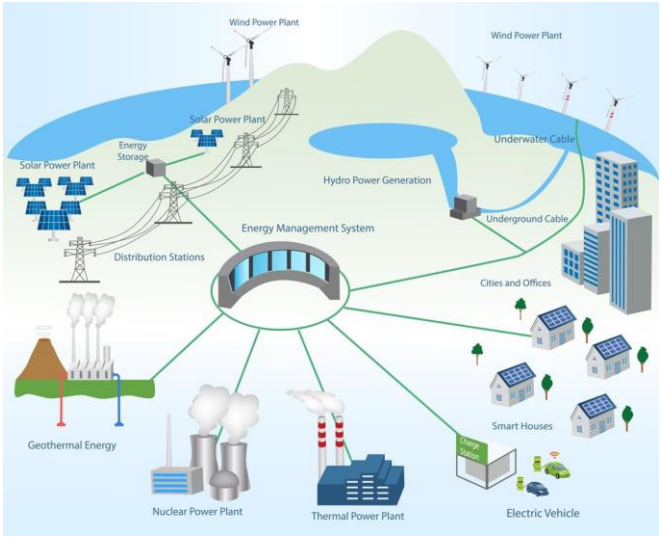
Factors affecting with the Smart grid technologies:

1. After power disturbances, it is easy to restore the electricity and reusable.
2. By using this, operations and management cost will be reduces and overall cost of the consumers also reduces.
3. Peak demand will reduces which is used to get low electricity rates.
4. By this technology, coordination between consumers and generation systems (including renewable sources) will be increases.
5. Security for the system will increases and self monitoring will be available for the system.

6. controlling of internal mechanism due to this technology like self healing property.

7. Better communication is available i.e., two ways for better efficiency and regulation.

Smart Grid Architecture:



By using this technology, providing greater information to consumers for the choice of electrical supply, to maintain and improve the system reliability, security and quality of supply.

Smart grids are being pursued in order to address

Several challenges associated with today's power and energy systems. They are:

1. Harmful gases reduction:

Carbon dioxide emissions and green house gas emissions are responsible for the harmful gases production and these are the factors useful for largest production of harmful gases.

2. Economical growth:

In a recent days, service providers are paying more high prices for electrical supply which is imported from the other grid connected neighbors at the time of shortage of supply at peak demand. So, to overcome this problem we are going for smart grid technology because of reduce peak demand and financial savings for the consumers.

3. Reliability:

Now-a-days, the equipment and transmission lines are becoming aged and due to this complexity also increase in transmission lines. With this technology, we can update the equipments and lines like monitoring each and every point with controlling mechanism to improve reliability in system.

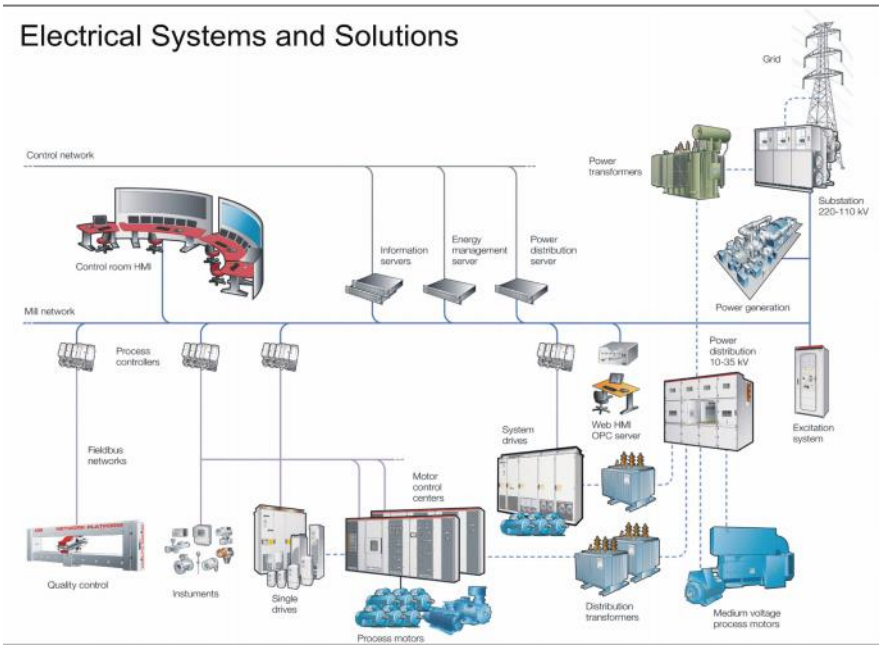
4. Improvement of security:

By this technology, security of the system will increases due to using of smart devices which we are using for the controlling and monitoring mechanism because of getting accurate system. To save energy for customers, the smart grid provides many opportunities like remote controlling devices in domestic services to reduce the electricity bill.

Overview on recent Industrial sector:

In recent days, industrial sector network developing a lot with the help of smart grid technology and already industrial sector is updating with more highly intelligence and efficient equipments, but sometimes it's getting more complexity due to more initial and

operating cost. So, by using this smart updating in industrial sectors, the efficiency, productivity and reliability will increases day-to-day.



Industrial networking communication

Most of the industries are updating with the smart grid because it is very desirable in this industrial sector which can form a wide smart grid. These industries can be coordinated with other generating sources like renewable energy sources also. At heavily loaded distribution side also, smart grid will be very useful.

Now-a-days, all distribution networks, communication network can together form a smart grid distribution network.

Coming to consumer domain, we have categories like residential, commercial and industrial. In residential areas also, we can use this smart grid technology like in electricity bill or smart metering because in residential areas, we can't use this other than this. But coming to commercial and residential, this technology will be very useful because consumption and production is very more compared to residential. So, by using this technology for large consumption and production sector we can more efficient productivity compared less consumption areas. In this sectors also, this technology scope is in a limited value depending upon our requirement of supply.

In this, we will see about the usage of electricity in industries with different specifications for different sectors and industry relevant electrical markets like their manufacturing and consumption facilities in their respective markets because the loads which we are using in industries are different from each other. It means industries using high voltage supply and also normal supply for production side and supply system side. So, firstly we have to recognize where this has to be used and how we can use this technology efficiently to get more productivity.

In this, we will give a description on automated demand response in industries with respect to the smart grid applications. By using demand response, we can analysize the industrial sector updating, mainly used for communication purpose (two way purposes to get more efficient output) and automatic controlling mechanism.

Electrical consumption by industries (EIA 2009)

Industry sector	Total electricity used (10^6 kWh)
Chemicals	207,107
Primary Metals	139,985
Paper	122,168
Food	78,003
Petroleum and Coal Products	60,149
Transportation Equipment	57,704
Plastics and Rubber Products	53,423
Nonmetallic Mineral Products	44,783
Fabricated Metal Products	42,238
Machinery	32,733
Wood Products	28,911
Computer and Electronic Products	27,542
Textile Mills	19,753
Beverage and Tobacco Products	17,562
Printing and Related Support	13,089
Electrical Equip., Appliances, and Components	12,870

Overview of Smart Grid Technology

Now-a-days the smart grid technologies are widely increasing in various applications, but this technology is mostly using in communication purpose and industries to get high efficiency. Actually, this technology is already existed in years ago, but this applications are widely using in commercial, residential and industrial sectors. Mostly, in industrial sector this technology is using more because of large consumption and large productivity compared to residential sectors, as consumption is very less.

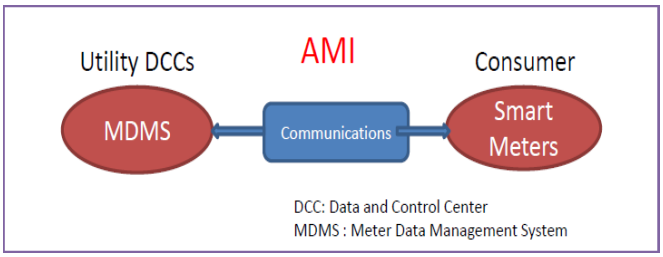
However, these smart-grid-like applications have not been easily replicable. This technology is increasing on two way communication due to customized solutions. Industries are not updated also in recent days so many industries are following the old methods like not using latest technologies for their production.

The investment required for development of many existing energy management applications has been used for facilities with large loads in any purpose. By considering the cost, industries can build up their productivity by coordinating with national grid system to improve reliability and efficiency of output from renewable energy sources. With recent developments, the technology used to entry for smart grid applications is being reducing. These technologies can provide a variety of facilities can take advantage of multiple ones to industries. We will discuss in this paper about automated demand response, which discussed more extensively in the following technologies discussed below.

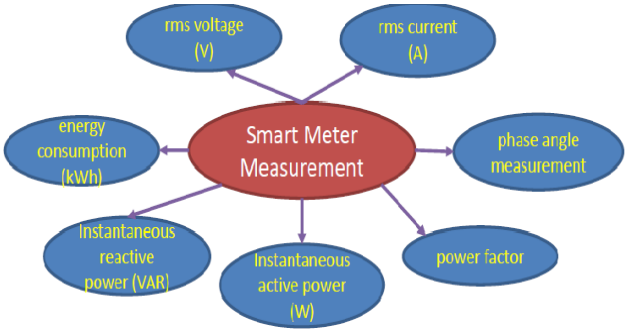
1. Advanced Metering Infrastructure (AMI):

This advanced metering infrastructure is the network which connects the smart meters, meter data management system (MDMS) which is useful for networking system.

AMR network is used to read utility output for the wireless links. It is useful for network where the wireless connection is available. This network helps in reducing the cost for meters like in billing purpose.



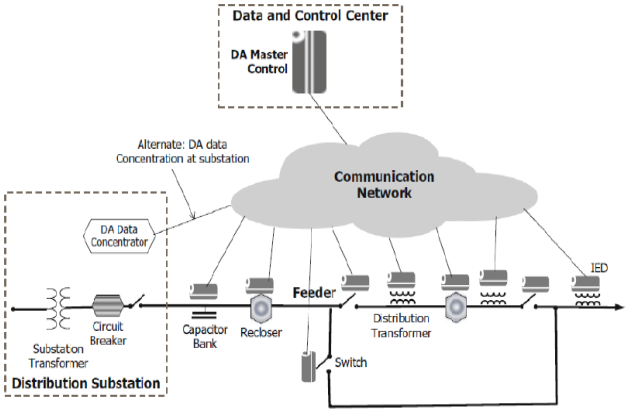
Smart Meter Measurements:



Smart metering instruments measure periodic measurements like in intervals in time. It can indicate every hour and second to measure the energy consumption in terms of RMS voltage and current.

2. Distribution Automation (DA):

In this, automation or coordination between all the functions and meters which is related to distribution system like collecting of information from the devices which are used in substation and feeders and data collection at customer side also. Overall we can define this automation as a data acquiring and by using that data we can control all devices automatically.

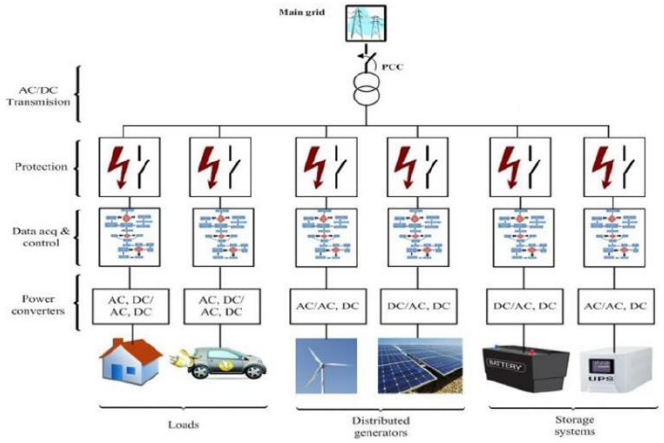


Feeder device in Distribution automation

3. Micro grid:

Coordination between the all interconnected loads and distributed energy sources make them as a single controllable unit with respect to the national grid which is used in emergency conditions. By this, we can control and protect at consumer side. Distributed generator is the main equipment in micro-grid but by using this DG, reverse current will

flows in total system. So by this protection and controlling ill become more complicated. It can operate both at island mode and grid connected mode.



Micro grid Architecture

Automated Demand Response:

By using all the responses, the operators and devices which we are using to get the maximum efficiency by reducing the energy consumption regularly at the peak load .We have to manage the loads and energy supply at the end of consumer terminals with respect to grid transactions with various time scale of responses and these are directly coordinated to utility customers.

The demand response is used to communicate the supply system to utility consumers i.e., sending and receiving of the response signals to the consumers. The main aim of this demand response is to control the total action automatically in various sectors without any manual interruption due to pre-programming controlling mechanism in the system. So, this automated controlling mechanism of the system for demand response is called as automated demand response (ADR).

This demand response consists of high flexible infrastructure to communicate the information and used to control the system between the system operator and the utility customers because of due to already setting of signaling/programming system for automated systems and automated servers. Up to now, demand response also has load reductions due to not managing of peak loads.

By using the ancillary services, demand response will going on updating process for faster response within the limits by that development will increases for industrial sectors because of automation is needed for many systems. By using this automated response, we can reduce the optimization problems, negotiation protocols for research and industrial sectors.

Automated demand response is not just for electrical loads. As distributed generation and storage become more widespread and by this, industrial processes are leading the way in this regard the demand management opportunities are increasing gradually. Generators and storage devices bring additional complexity; in particular a more holistic approach to automated demand response is needed.

Market oriented system and system oriented are the strategies that are using for the demand response which is applicable for industrial sector for updating.

The system-oriented demand response can send the efficient output to consumers from the power system operators, which is based on the system The reduction or load shifting compensation price is determined by the system operators or markets. The market-oriented demand response allows consumers to make direct response to price signals, resulting in

the changes of consumer behavior or consumption patterns. Typical DR strategies are integrated into an expert library and the reliable operation can be guaranteed with optimized scheduling. The implementation for commercial buildings and enterprises. The price is formed from the interaction market mechanisms between the wholesale and retail markets. Whether the system-oriented or market-oriented demand response, it will all serve to improve the elasticity of demand.

Conclusion:

While some demand response strategies are implemented by artificial approach, the automated demand response can dynamically adjust load in real time approach. Automated demand response will not involve any manual issues and it is used to respond with preprogrammed demand response strategy. Automated demand response can optimize the allocation of resources in load side, or to improve the reliability of the system. So, we can update the industries by using smart grid technology (automatic demand response).

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