

Smart Grid

ATS Development Direction and Solution

1 The Need for Smart Grid

1.1. The Emergence of Demand

Today, we see changes that are and will be happening to the electrical power industry in the way electricity is generated, distributed, and utilized. The global warming effects, the depletion of fossil energy sources, the growth boom of developing countries, and the size of human population and middle-class society have led to the need for new methods in power generation and utilization. This is a necessary and eventual change for an industry within which there has not been any basic reformation during its 120 years of development. Indeed, the electrical industry is still the same in terms of power generation and distribution as it was 120 years ago when it was first invented by Edison and Tesla; if these two were still alive, without doubt they would not find themselves new to today electrical projects.

Currently, power distribution almost exclusively means meeting demand by increasing supply. The power industry, with an exclusive business right given by State regulations, has the responsibility to provide an abundant source of energy to everywhere at all times, serving the societal and economical growth of the nation. On the one hand, it cannot be denied that the power industry has played an important part in promoting human societal growth within the 20th century and certainly in centuries to come. On the other hand, power companies in operation has not been able to create sufficiently strong incentives for consumers, governmental regulators and even themselves to take the difficult first steps in developing and operating a power system highly efficient in production, distribution, and utilization.

However, during the last 5 years, there emerge many important factors that can influence and promote reformations in how the suppliers and consumers operate their power system. These factors include:

Laws and Regulations:

The issue of energy conservation, energy independence, and global warming has been a top concern for many governments around the world. A range of policies, including tax and energy legislation, designed to minimize fossil fuel combustion is considered globally. For instance, in the United States, support for the smart grid became federal policy and the establishment of a Federal Committee overseeing the modernization of the power system has led power companies to consider incentives for Smart Grid research, power utilization efficiency, and demand response support. Indeed, this particular legislation has been able to focus the attention of the entire nation on Smart Grid development. \$4 billion USD from the US 2009 stimulus package and \$4.5 billion USD from the US Department of Energy is reserved to finance Smart Grid projects in the fiscal period 2009-2010. Currently, countries in the region such as Thailand, Singapore, and South Korea have also established National Committees to oversee their Smart Grid development programs.

Global Climate Changes:

Humans are coming to realize the negative effects on the environment created by the combustion of fossil fuels in power generation. As natural disasters become more frequent while their destructive impacts intensify, more and more effort is put into the development of programs and methods for the reduction of CO₂ emission. The global warming effect resulted from the current method of power consumption is forecasted to exceed the Earth's sustainable limit by 2050, the human population at which time is estimated to be 9.5 billion. The Earth's temperature is balanced by its natural laws similar to that of human temperature; our normal temperature is 37°C, and only a 0.3 to 0.5°C increase is enough to signify diseases. According to a forecast for the end of the century, the average temperature of the Earth can increase by 6°C, not taking into account the positive feedback cycle created by CO₂ emission when the Earth is warmed up. Humans need to take immediate action to reduce the negative effects of fossil fuel combustion on the Earth's climate so that the temperature increase by the end of this century is only 2-3°C instead of 6°C, even though it is still doubtful whether the earth can even bear this 2-3°C increase. It is clear that Noah did not wait until it rained to start building his ark.

Consumer Demand:

Consumers nowadays not only consume more power with increasing yearly power peak (which, in Vietnam, is in the range of 14 -15% per year) but their demand for power quality is also rising due to the increase in standards of living and the widespread use of inexpensive electronic devices. In addition, there is a growing demand amongst consumers for the ability to self-monitor their own power usage data instead of receiving a nondescript electricity bill at the end of each month. Researches have shown that when customers can monitor their own power usage, they tend to reduce their power consumption level by 5% to 10%. A two-way communication between power companies and customers facilitating better understanding between these two parties is a mutual need; however, it is only up to power companies to implement this Smart Grid system.

Aging Infrastructure and Investment Shortage:

Many power plants and grid have become old after 20-30 years of operation, being designed for power distribution in gone-by era. Power companies tend to reduce investment in this infrastructure and have difficulty in identifying reliable investors to ensure the appropriate development in centuries to come.

Power Quality Issues and Non-technical Loss:

Using identified solutions for ensuring power quality and based on data storage, power companies can devise more appropriate solutions to harmonic and disturbance sources from the aspect of industrial solutions. For developed countries, to reduce non-technical loss is one of the top concerns. Non-technical loss includes:

- + Power theft
- + Damages or abnormality of metering devices, leading to disputes
- + Long payment collection cycle

With the capability for direct connection with devices and data exchange with management systems, power companies will be able to achieve their goal in minimizing non-technical loss, which amounts to approximately 30-40% of total loss in business operation of the power industry.

1.2 Why we need Smart Grid:

With respect to the existing power system in Vietnam, the reasons leading to the need for Smart Grid include:

- A demand for efficient power distribution and power utilization. Clearly Vietnam, in its development, not only needs the existing power companies but also requires the construction of more power plants. The amount of electricity saved due to the development of Smart Grid can be seen as an additional source of power for capacity balance. According to world-wide statistics at the present, the cost of saving 1kWh is approximately 1.7 cent, whereas the cost of generating and distributing 1kWh is about 7 cents. Areas where Smart Grid can provide us with short-term solutions include:
 - Improving operation efficiency of power plants;
 - Minimizing technical loss occurred in power system operation;
 - Reducing Vietnam's Energy elasticity from 2 as of the present to 1.1 – 1.5, equal to those of other countries in the area;
 - Reducing the average amount of energy consumed per \$1 GDP;
 - Reducing non-technical loss.
- Creating a culture of energy saving and conservation in the society.
- Facilitating the development of renewable energy sources and decentralized power generations to abate CO₂ emission.

In order to achieve the above-mentioned objectives, we need a power system and an operation and business procedure able to pinpoint power plants that need to improve their efficiency and able to encourage the development of new energy sources, such as: solar power, wind power, and biomass, at suitable locations. This new system will promote reformation in the way power is utilized, with the first change being the improvement the load graph and the development of new industries and demand for power saving devices. The system mentioned here is Smart Grid.

Basic Recommendations:

In order to develop Smart Grid swiftly for the benefits of both power providers and consumers as well as to create changes in the current energy saving and conservation culture, we need clear, immediate, and long-term programs and policies from the government. The main recommendations are as follow:

- The Ministry of Industry and Trade need to study and promulgate regulations, law documents, and policies necessary for the development of Smart Grid, providing ample incentives and clear requirements for involved organizations, power companies, and power consumers regarding investments in Smart Grid.
- Setting specific objectives for each power plant and each transmission company. Distributing targets for improving efficiency in power production and distribution.
- Requiring the immediate deployment of necessary Smart Grid components, starting from SCADA/EMS/DMS systems. Auditing and analyzing power plants' operation efficiency, power metering management infrastructure, power utilization efficiency, power consumer data system, etc.

- The power industry needs a system that can provide real-time data (5 mins, 15 mins, 30 mins or 1 hour) on the cost of power production and distribution to power consumers and involved organizations.
- Consumers or their representatives need to be able to access real-time data (5 mins, 15 mins or 30 mins) on their power consumption, creating the opportunity for 2-way communication between power companies and consumers. Initially, we need to deploy this system for major commercial and industrial units.
- The Ministry of Industry and Trade and the Electricity Regulatory Authority of Vietnam (ERAV) need to finalize specific regulations for the efficient and effective planning, development, and operation of the power system.
- A working group and, later, a steering committee need to be established to oversee the deployment of Smart Grid system in Vietnam. The regulatory task of this working group or committee includes resolving technical and technological issues, coordinating the actions of involved parties for their mutual interest, and finding and distributing investments from ODA fund and from organizations supporting clean energy and working against climate changes.

2 Smart Grid Basic Design

Up to now, there is no individual or organization who can confidently name the technologies that will be used for the future Smart Grid. However, we can identify the main features of Smart Grid as follow:

- Automatically restoring network in cases of power blackout
- Preventing deliberate attacks against the system
- Supporting the development of decentralized power generations (power generation, energy conservation, demand reduction, etc.)
- Supporting development of renewable energy sources
- Providing the ability to improve power quality and power distribution reliability
- Optimizing the efficiency of power system operation in order to reduce production, transmission, and distribution costs as well as investments expenditure in new or improved power systems.
- Serving as a basic tool for Power Market operation.

In order to achieve progresses in resolving challenges facing the existing power system, power companies need to focus on the following four areas:

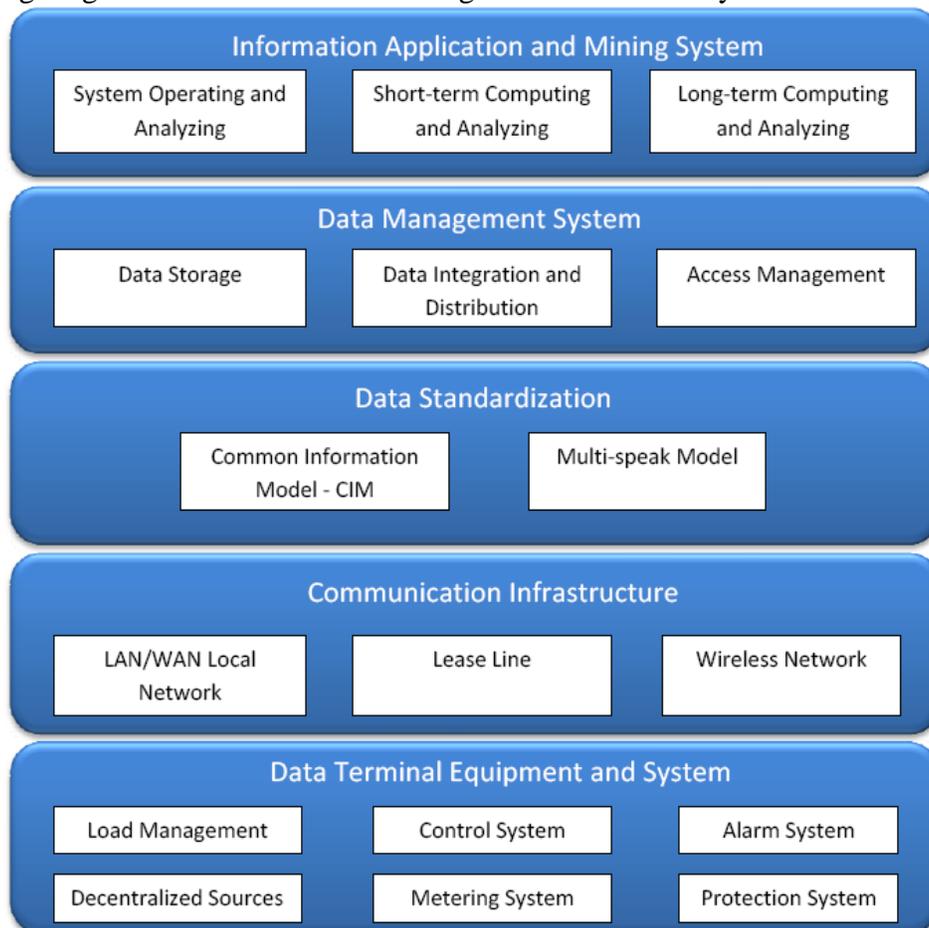
- **Data Collection:** Data should be gathered from various sources in the power system (protection system, control system, electrical meters, I/O sets, etc.), from power consumption data collecting devices in factories and even in the home of consumers, and from non-electricity information sources such as the Meteorological Department. Data can be collected by using 21st century advancements in information and communication technology.
- **Analysis and Forecast:** The collected data mentioned above, which in a system of 2 million power consumers is estimated to amount to 22GB/day, is to be analyzed for use in management and business operation. For the purpose of power system operation, the analysis is done based on real-time or closed real-time data. For business purpose,

historical data is used. The real-time and historical data is furthermore utilized in long- and medium-range forecast, assisting in the process of schedule setting, development planning and operational procedures designing.

- **Monitoring/Managing/Controlling:** Data collected and analyzed are processed into useful information for the operation and management of power systems as well as stored for different purposes as required in regulations for electricity management and distribution. For business purposes, these informations are used in indentifying power consumption level and computing payment cost for consumers and parties involved in the power market.
- **Development of Two-way Interaction System between power providers and consumers:** The three steps above will have a minimum effect on consumers if they do not have appropriate devices to participate in power saving activities. In truth, this is the most costly area in the Smart Grid system. It is estimated that the world will spend approximately 20 more years in perfecting this area, providing Smart Meters and devices facilitating two-way interactions between consumers and providers.

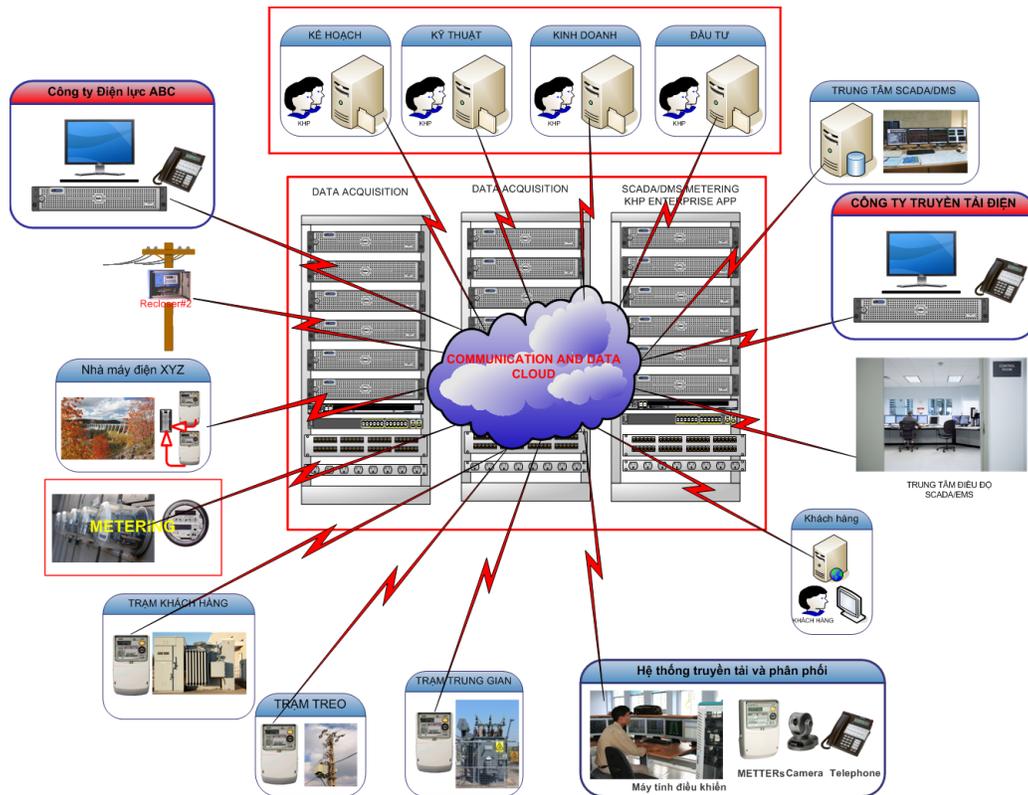
Some components of Smart Grid are already installed in the current power system. Nevertheless, we still need to spend more effort in order to turn the existing traditional power system into a true Smart Grid system, for Smart Grid is not only about software or hardware device updates.

The following diagram illustrates the basic design of a Smart Grid system.



3 ATS Products and Solutions

The below diagram gives an overview the Smart Grid solution proposed by ATS.



Products ATS has the experience to supply include:

- Substation Control and Protection Integrated System @Station, conforming to IEC61850 standards.
- @SCADA+ system, compatible with CIM/IEC61968/IEC61970.
- Integrated Metering Information System @IMIS, compatible with various types of meters.
- Historical data management system.
- Data collection and management system on various information network platforms.
- Web-based application system, allowing users to integrate to third-party suppliers.

The above-mentioned products were introduced in the September, October, and November issues of Electricity Magazine.

For more information, please email: thaita@ats.com.vn or call the hotline: +84 913201168.