



Visionaries 2016

New Era of Contestable Energy Markets

— Solution for Power Market Reforms —

The Japanese domestic market is seeking new energy services in anticipation of the full liberalization of retail markets and the separation of generation and transmission that will accompany power market reforms. Along with the entry of new players from a variety of different industries, these changes are also giving rise to numerous challenges, including reducing cost through management efficiencies, acquiring and retaining customers, and maintaining a security of supply that delivers a level of reliability among the best in the world. Hitachi already supplies a wide range of products and services, from generation to distribution and consumer markets. As customers and markets become more diverse in the future, Hitachi aims to contribute right across the value chain through solutions that draw on knowledge of IT.

Applying Strength in IT x OT in New Market

Power market reforms promoting the liberalization of the electricity market in Japan are making steady progress. The first stage of reform was the establishment in 2015 of the Organization for Cross-regional Coordination of Transmission Operators, JAPAN (OCCTO). The OCCTO has already commenced business, with activities that

include nationwide monitoring of supply and demand and management of grid interconnections. The second stage of reform (the full liberalization of retail markets, to commence in April 2016) is to be followed by a third stage involving the separation of generation and transmission.

The imminent full liberalization of retail markets includes complete deregulation of pricing and will permit even households and other small



Shigetoshi Hayashi

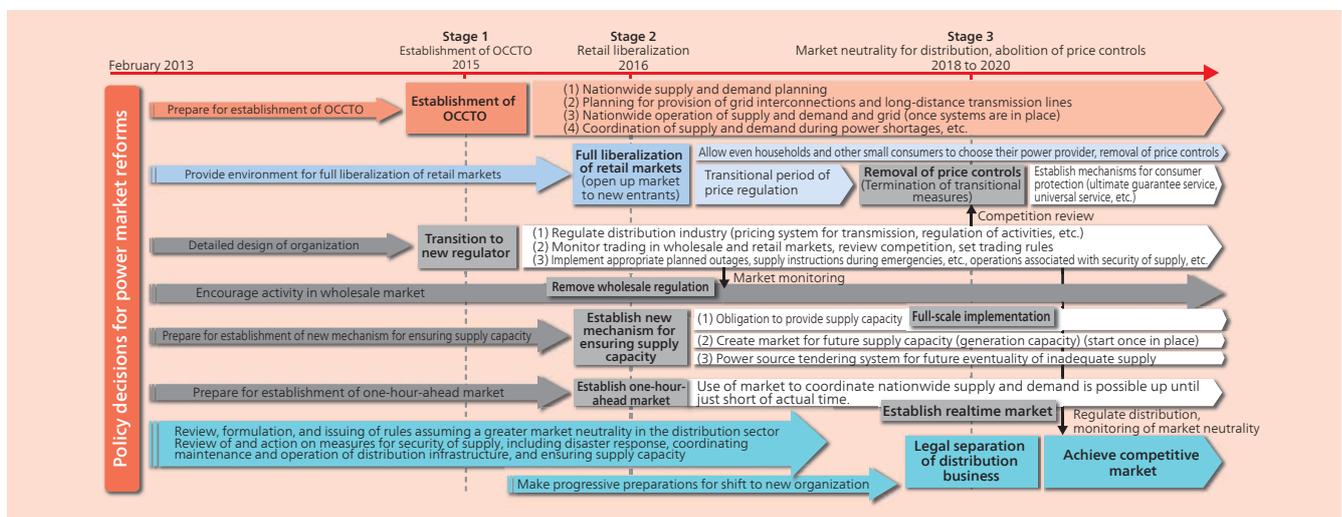
trillion yen will provide a level playing field open to both the general electric power providers (existing power companies) that already supply electric power in their respective regions of Japan and electric power providers that operate on a different scale (known in Japan as *shindenryoku*, meaning new power), both of which will be treated as power companies. In other words, the power market reforms will quickly lead to vigorous competition in the electric power market, presenting providers with a new business environment in which they need to consider competition as well as maintenance.

Hitachi already supplies the electric power infrastructure market with mission-critical systems and other components that feature high reliability and performance. Hitachi is also involved in work related to the reforms, including winning an order from OCCTO for a nationwide coordination system. Recognizing the growing diversity of customers and markets, Hitachi has also established its Energy Solutions Company as part of a new organization that seeks to strengthen its sales engineering functions, which have adopted a “market in” approach.

Shigetoshi Hayashi (Senior Director, Service Platform, Smart Information Systems Division, Information & Telecommunication Systems Company, Hitachi, Ltd.) made the following comment about the background to these developments and Hitachi’s activities associated with the power market reforms.

“Hitachi has largely dealt with the electric power industry on a ‘product out’ basis, meaning the supply of components and other products. Taking note of the upcoming changes in the electric power business, it is now looking to supply solutions that are better able to help customers overcome

(low-voltage) consumers to choose their power company. The retail market of approximately 7.5



Timetable for power market reforms (Source: Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry). The plan is for reform to proceed in three stages: the establishment of the OCCTO, the full liberalization of retail markets, and the separation of generation and transmission.



Teruo Ogata



Mitsuko Yoshimoto

challenges. To this end, Hitachi is undergoing an ongoing shift toward supplying solutions, with the entire company working together, and with “collaborative creation” as a key word. The Smart Information Systems Division will embed itself in customer workplaces to supply solutions that make sophisticated use of information technology (IT) and big data. Along with its involvement throughout the value chain that runs from generation to distribution and consumer markets, Hitachi as a whole intends to respond to the needs of the new market by utilizing its strengths in combining IT with control and operational technology (OT).”

Drawing on Accumulated Know-how

The three objectives of the power market reforms are to maintain security of supply, minimize electric power tariffs, and maximize consumer choice and business opportunities for providers. In the case of the full liberalization of retail markets, households and other small consumers are concerned with how much their power bills will fall, so the objective likely to be of most interest to them is that of minimizing electric power tariffs. Electric power companies, on the other hand, are interested in reducing costs by making their operations even more efficient.

“Acquiring and retaining customers through the establishment of diverse tariff options and support structures for customers are important challenges, just as much for the new power companies. Hitachi is placing high hopes on IT for helping overcome these challenges.”

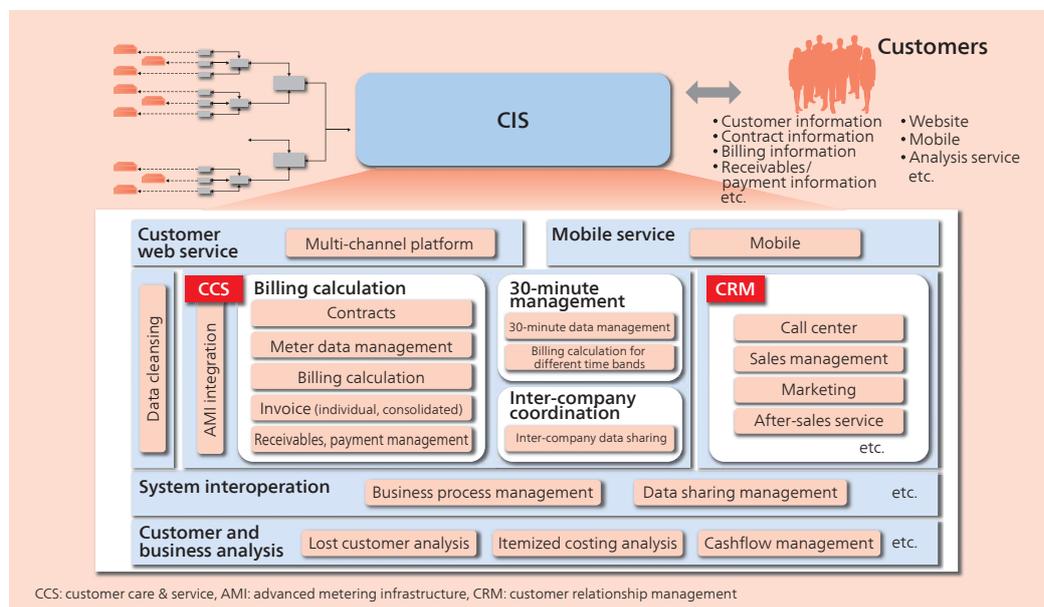
This comment looking ahead to future changes was made by Teruo Ogata (Director of Energy Solution Department 2, Energy Information Systems

Division, Energy & Transportation Information Systems Division, Information & Telecommunication Systems Company, Hitachi, Ltd.).

The customer information systems (CISs) used for customer management, billing, and revenue management in the retail sector are one such example. With a wide range of companies entering the electricity business, the CISs that form a vital part of their IT systems will require not only support for numerous different billing options, but also functions such as system integration with OCCTO that were not applicable in the past. This means that even existing power companies will need to reconfigure their CISs. The reality is, however, that the schedule for power market reforms leaves very little time for this system migration.

Mitsuko Yoshimoto (Director of SAP Business Solution Department, Enterprise Package Solutions Management, Enterprise Solutions Division, Information & Telecommunication Systems Company, Hitachi, Ltd.) describes as follows the strengths that Hitachi can offer companies in this predicament.

“Whereas system development for a retail CIS typically takes three or more years, these systems need to be up and running by April 2016 so the company is undertaking to complete the reconfiguration process in only 20 months. These difficult conditions will provide an opportunity for the company to show the strength of the know-how it has built up through past involvement in the implementation and maintenance of CISs for large power companies. The company is utilizing its experience in SAP*1 enterprise resource planning (ERP) implementation at more than 410 companies to reconfigure power company CISs using an



Overview of SAP solution supplied by Hitachi. The solution meets the diverse needs of new and existing power companies.

SAP IS Utility solution that is specifically targeted at the energy sector, and also intends to provide business intelligence (BI) tools and other utilities capable of analyzing customers in greater depth to deliver solutions that meet the needs of both new and existing power companies.”

With the ultimate design of the market still unclear, along with the challenge of minimizing investment in the electricity business, the configuration of a CIS in a short time period is a major undertaking. Accordingly, Hitachi is providing each customer with tailored solutions, including expanding sales of packaged products designed for the Japanese market in addition to the SAP solution.

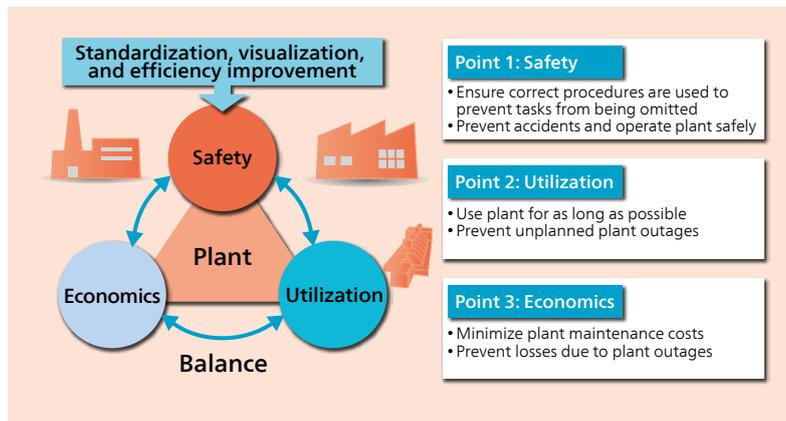
Generators, meanwhile, are seeking to boost their competitiveness through measures such as maintaining power plant operation at a high level and adopting more advanced operation and maintenance practices while also helping ensure security of electric power supply.

Mr. Hayashi states, “These initiatives are another area where IT and OT are intimately intertwined. Even if sensors are used to collect data, it is only with the power of IT that advanced solutions become possible, meaning that an even closer fusion of IT and OT is required. Along with supplying an integrated enterprise asset management (EAM) solution for equipment maintenance, Hitachi has also started work on asset performance management (APM), in which the data on equipment condition and operation collected by EAM is utilized to ensure appropriate equipment maintenance.”

*1 See “Trademarks” on page 140.

Advanced Supply and Demand Management to Help Ensure Stability of Supply

One of the objectives of the power market reforms,



Overview of Hitachi Enterprise Asset Management, which provides company-wide optimization of assets by using EAM to standardize, visualize, and improve efficiency of plant and business processes and to strike a balance among safety, utilization, and economics.

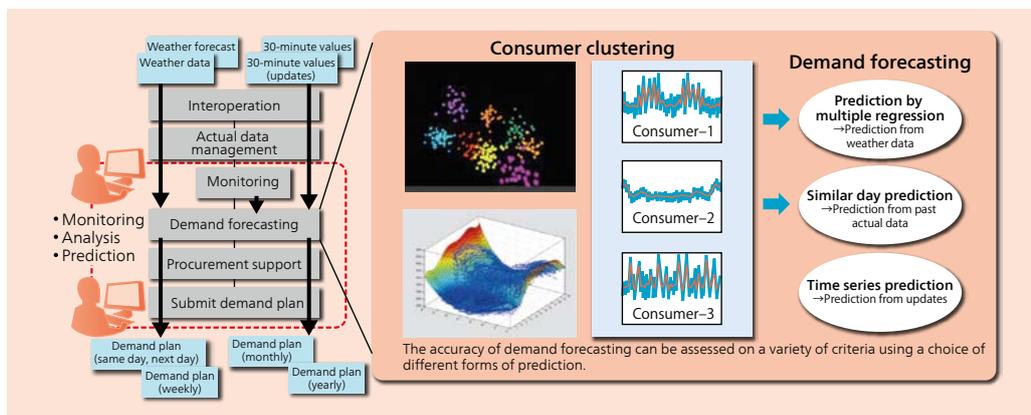
stability of supply, is also essential to society as a whole. Under the new regime, OCCTO will work with new and existing power companies to monitor and maintain the balance of supply and demand for electric power throughout Japan, issuing instructions to generate or reallocate power in the event of supply shortages. The power companies, meanwhile, need to produce supply plans for their generation and retail businesses. In this, the problem of managing supply and demand is an important consideration.

Ikuo Shigemori (Director of Energy Solution Department 1, Energy Information Systems Division, Energy & Transportation Information Systems Division, Information & Telecommunication Systems Company, Hitachi, Ltd.), who is engaged in the development of a supply and demand management solution for new power companies, makes the following point.



Ikuo Shigemori

“Power quality suffers when supply and demand get out of balance, with a worst-case potential to result in a major power blackout. As the effect of instability becomes greater when the number of consumers served by each company is relatively



Example solution for managing supply and demand. The solution comes with standard functions for core supply and demand management tasks, with useful functions being progressively added to keep up with ever-changing legal requirements and market needs.

small, more detailed management of supply and demand is required.”

The greater the error in demand forecasting when power companies produce their supply plans, the more they are exposed to imbalance costs*2, inevitably leading to diminished profitability.

Mr. Shigemori further adds that, “In response to this challenge, Hitachi has developed solutions that can promptly and accurately manage supply and demand in response to ever-changing conditions, using a choice of different prediction techniques that include the use of air temperature, sunshine hours, and other weather data.”

*2 Payment by power companies based on the difference between planned and actual power use.

Looking Ahead to Separation of Generation and Transmission

Further power market reforms are planned, with the separation of generation and transmission set for 2020. This is to occur through legal separation, whereby the distribution arms of power companies are to be spun off as separate entities. The administrative functions of accounting, procurement, and coordination will also need to change in response to these developments.

Mr. Ogata states, “As large power companies have a large investment in existing administrative systems, the key lies in finding efficient and effective ways of preparing for 2020. Hitachi has experience in upgrading customers’ administrative systems through both the use of ERP systems and scratch development, which allows customers to choose the approach that best suits their own

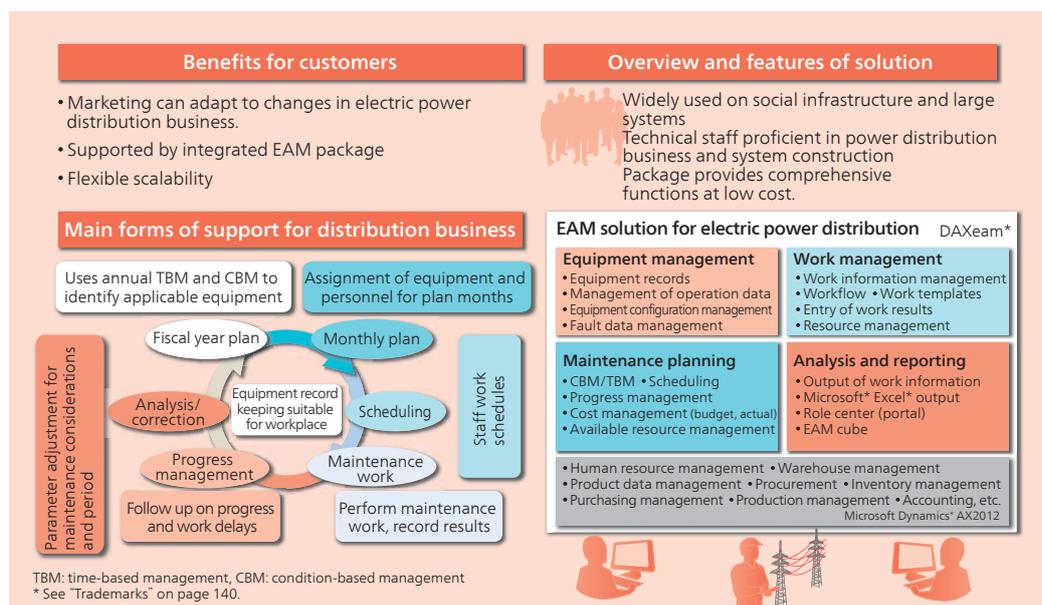
strategy.”

Maintaining the reliability of the transmission and distribution infrastructure will be important once the separation of generation and transmission has taken place, with the large amount of equipment replacement that is to occur during this new era posing a major challenge. As the transmission and distribution infrastructure built in response to the rapid rise in demand during the 1960s is now all coming due for refurbishment or replacement, there is a need to reduce and spread the associated costs. The number of items to be dealt with is huge, with power poles in the region served by Tokyo Electric Power Co., Inc. alone numbering as many as six million, and with transformers, switchgear, and other transmission and distribution infrastructure also to be included.

Mr. Ogata states, “In terms of security of supply, the huge volume of distribution equipment coming due for replacement is a problem that cannot be put aside. In response to this problem, Hitachi offers solutions based on IT. Specifically, its aim is to help overcome the challenges by supplying an EAM for electric power distribution that utilizes information from smart meters, power sensors, and other sources for such purposes as monitoring loads and prioritizing maintenance based on the level of equipment deterioration.”

Fusion of Energy and IT

What benefits can be expected from the power market reforms? Considering the objective of maximizing consumer choices and business opportunities for providers, the ability of consumers to choose their electricity provider will lead to differentiation among power companies on



Overview of EAM solution for electric power distribution. The solution uses an EAM and proven technical capabilities to support cost optimization and maintain the reliability of distribution equipment.

price, service, and added value. It is anticipated, for example, that companies will offer bundles that include such things as loyalty points, package discounts, and energy services.

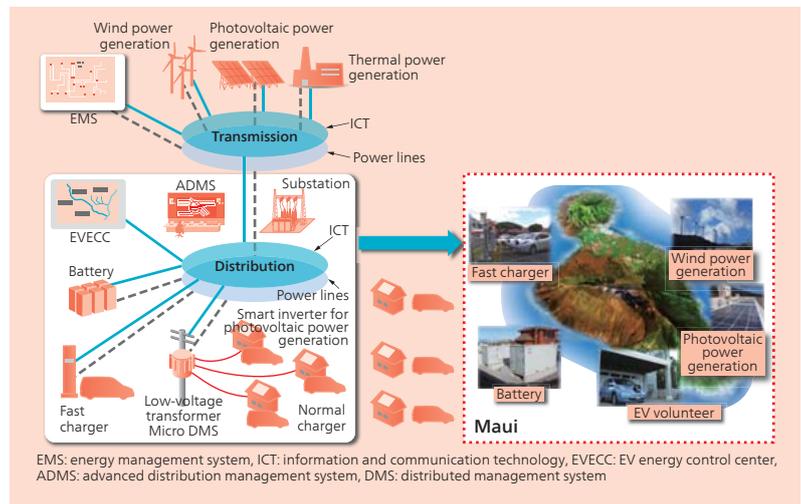
Ms. Yoshimoto states, “There will likely be some consumers who will base their choice of power company on a desire to use green power sourced from renewable energy. It should also become possible for consumers to obtain accurate energy consulting based on information such as data from the smart meters that are scheduled to be installed in all households by the end of FY2024. IT is seen as helping support consumers’ ability to choose.”

It is also highly likely that new markets for electric power business will emerge in Japan as they have in Europe and America. One example is “negawatt” trading, which the Japanese government expects to see broadly adopted. This involves the market trading of unused power, whereby consumers reduce their power consumption in response to requests. Typically, this is done by entities called aggregators acting as intermediaries and having consumers reduce their power consumption in response to requests from power companies. This reduction in power consumption when a request is received from a power company is called demand response (DR), with the consumers who make the savings being recompensed according to the amount by which they reduce their demand.

“While energy efficiency plays a central role in energy management in Japan, the USA in particular has a long history of DR, which has become a recognized means for utilities to cut costs. The establishment of a market for DR trading is being considered as part of Japan’s power market reforms. If this proceeds, it is anticipated that energy management (including DR) will become an active field, including the emergence of new players such as aggregators who serve as intermediaries in the DR market.”

This comment was made by Shinichi Kasai (Senior Manager, Infrastructure Solution Development Department, Energy Solution Systems Division, Solution Systems Division, Energy Solutions Company, Hitachi, Ltd.)

Hitachi has participated in demonstration projects in a number of countries where electricity liberalization has already taken place. One such is the Smart Community Demonstration Project in Greater Manchester, UK run by Japan’s New Energy and Industrial Technology Development Organization (NEDO). This project includes trialing the viability of DR. Hitachi is also participating with NEDO and others in the Japan-U.S. Island Grid Project (JUMPSmartMaui Project) in the USA. Mr. Kasai was involved in both projects and



EV batteries are being used on the island of Maui in Hawaii to absorb excess energy and control frequency fluctuations. The trial involves more than 200 EVs and 40 households in the Kihei area, with the ultimate aim of establishing a virtual power plant made up of more than 500 EVs.

comments as follows.

“The aim of the demonstration project in Maui is to use electric vehicles (EVs) to resolve the problems associated with installing a large amount of distributed power sources, such as photovoltaics and wind power. To mitigate frequency fluctuations and effects on grid voltage, the project links a central control system to control equipment installed around the grid and the consumer equipment used to control the use and charging of EVs to establish mechanisms for autonomous control in response to voltage or other abnormalities. This involves use of Internet of things (IoT) technology.”

Mr. Hayashi states, “These demonstration projects provide an opportunity to test technology and build up various knowledge and other know-how about how to respond to the changes in the operational environment associated with power market reform. Both projects place an emphasis on economic assessment and the establishment and verification of the business models required for commercialization, and we intend to offer the results of this work as solutions for the Japanese market.”

While the future remains an unknown with power market reforms having only just begun, a new era is beginning in which consumers can actively choose where they get energy. In the future, Hitachi intends to continue supplying solutions that help overcome challenges facing all of its customers along the energy value chain.



Shinichi Kasai