SAP for Utilities driving Energy Efficiency for Everyone

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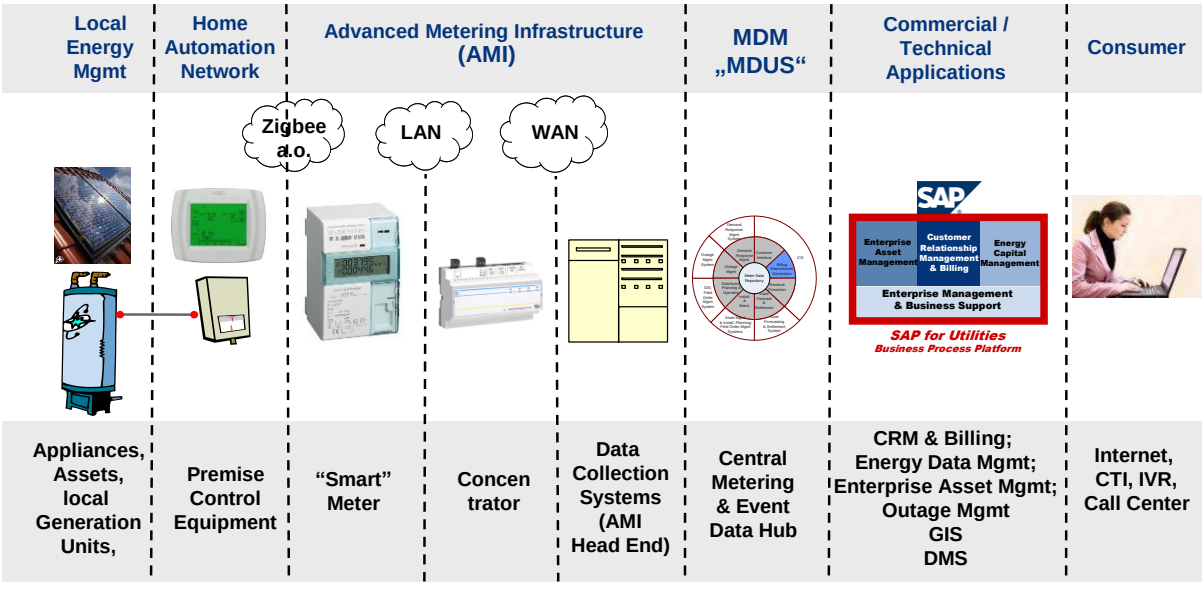
Reserves of increasingly expensive fossil fuels will be exhausted in the foreseeable future. This, combined with the dangers and costs of global warming, presents society with an extraordinary, difficult, prolonged, and expensive challenge:
New technology for energy generation, transportation and distribution of energy to consumers, and automated control of end devices needs to be developed with the aim of achieving the greatest possible energy efficiency and installed with a level of quality, safety, and reliability that enables their use on a mass scale.

Energy generation
Fossil fuel power plants are gradually being replaced with a higher number of smaller, distributed renewable energy sources ("distributed generation") that are often owned by private investors or commercial investors from outside the utilities industry.

Transportation and distribution of energy to consumers
The current infrastructure for transporting and distributing energy is being enhanced to form a fail-safe "smart grid" with optimal load balancing. The main element is an IT network to monitor and control the power grid. Advanced metering infrastructures (see diagram) are the most important part of the smart grid. They connect smart meters and sensors in the numerous premises and distributors in the grid to central data hubs – known as Meter Data Management (MDM) systems – and thus enable a bi-directional real-time communication within the smart grid and high-speed communication with the utility companies' technical and commercial application systems.



The AMI Enterprise System Structure

End devices and customer installations
Energy-intensive devices, such as air conditioning, are being replaced with more energy-efficient versions that can be controlled remotely. Control can be exercised using central commands of the Utility that are sent via the Smart Grid and the local Smart Meter to the programmable thermostat of the air conditioning.

This vital development focuses on consumers – businesses, public sector organizations, and the many private households. Consumers need to change their behavior so that their "my electricity comes out the socket" attitude gives way to more responsible energy use. They need to understand that the time and costs that they have to invest in the new technologies will be worth their while. Although consumers certainly care about protecting the environment by helping reduce CO_2 emissions, the deciding factor for them is the cost savings generated by reduced energy consumption. However, this requires the technical systems that control the smart grid and via Smart Meters finally the local Home Automation Networks (HAN) to be integrated with the information system responsible for customers, utility contracts, and billing. Without the immediate and tight cooperation of a CRM & Billing System it is not possible to offer the technology to consumers or bill them for the new services.

The world's leading CRM & Billing system for the utilities industry is part of the *SAP for Utilities* solution portfolio. *SAP for Utilities* is currently used for billing of approximately 650 million electricity, gas, and water contracts – and this figure is rising. The integration of *SAP for Utilities* with smart grid technology is both an opportunity and an obligation for SAP.

In conjunction with leading utility companies and innovative partners for smart grid technology, SAP formed the AMI Lighthouse Council in North America as a forum of co-innovation for the integration of AMI systems with *SAP for Utilities*. The council's members came up with a specific, standard definition of the processes in the form of use-case descriptions. These processes run through all of the system levels shown in the diagram. Here are a few examples:

- On-Demand Read
  A utility company's call center can read consumption data from smart meters online. Alternatively, consumers can access this information themselves using a self-service on the utility company's Internet portal.
- Utility Reconnects Customer
  Utility company employees can use a software transaction to reconnect the electricity or gas supply of an unoccupied premise after being notified that a customer is moving in or has paid his or her outstanding bills.
- Price Signal
  A utility company can use the AMI system to send pricing information to a premise's smart meter, enabling the consumer or a local energy management system to optimize electricity consumption.

The members of the AMI Lighthouse Council recognized the strategic importance of the interface between MDM and *SAP for Utilities*. For each use case, they developed a model of cooperation between the two systems. In this model, MDM acts as a gateway to the AMI systems and all of the smart meters installed within them. The ideal basic functionality for an MDM system in conjunction with SAP for Utilities has been developed. It is known as "MDUS" (Meter Data, Unification, and Synchronization). *SAP for Utilities* acts as a cockpit that is used for all commercial and administrative transactions related to consumers' use of the new smart grid technology. Communication between the MDUS system and *SAP for Utilities* is based on services.

A very strict, preferably nonredundant definition of responsibilities for both systems is necessary to ensure that the architecture for system collaboration is kept as simple as possible. Unnecessary complexity hinders cooperation at different system levels between the back-end systems and the millions of smart meters. It also results in inconsistent data, system downtime, poor performance, and high maintenance costs. MDUS is an indication of the principle – which is systematically followed by the AMI Lighthouse Council experts – of keeping cooperation between the MDUS system and *SAP for Utilities* as simple as possible.

Meter Data: the MDUS is the system of record for consumption values, meter readings, and event values, receiving this information directly from the data collection systems (AMI head-end systems).
Unification: This term refers to the need for MDUS to work with the AMI systems of various manufacturers and generating companies and make the different characteristics transparent for back-end systems such as SAP for Utilities.
Synchronization: For a lot of other data that is required, MDUS is not the system of record and it therefore has to obtain this data from the appropriate back-end systems. Synchronization refers to the need for MDUS to obtain this data from back-end systems such as SAP for Utilities and synchronize both itself and the AMI head-end systems to which it is connected. Such data includes, for example, meter and device master data, the unique point of delivery (PoD) number of each premise in a deregulated market, energy product and rate information, and status information for smart meters (disconnected, load reduced, and so on).

The companies in the AMI Lighthouse Council use *SAP for Utilities* for customer management, energy data management, and billing. The tried-and-tested *SAP for Utilities* solution portfolio provides a broad range of functions and has been implemented around the globe. One of the goals of the cooperation between the members of the AMI Lighthouse Council was to use the use cases mentioned above to define all of the functional enhancements required in *SAP for Utilities* to support smart grid technology. The SAP software must support all the features of smart meters, such as detailed consumption measurement, electronic meter reading, automatic dis/connection, service changes, direct notification of local disruptions, sending of text messages to customers or control signals to local end devices, and much more. It must also support the many new energy products in marketing, sales, and the billing process, which are designed to encourage consumers to save energy. This led to a very extensive development project, the result of which is the new *SAP AMI Integration for Utilities* software. Partners' MDUS systems of course also require further development to enable the use cases to be implemented collaboratively. The two systems communicate on the basis of services. Providing the services in *SAP for Utilities* makes it easier for the AMI/MDUS partners to carry out the developments needed for the integration.

The handling of consumption values transferred from the smart meters to MDUS as load profiles is paid particular attention in the collaborating solutions. Consumption is measured at 15-minute intervals, resulting in around 3,000 meter readings per month and meter which prorates to 36 billion readings per million smart meters per year. Storing these quantities efficiently and cost-effectively is feasible, but processing them for billing or analysis purposes is not feasible without measures that enable for very high volumes at lowest costs. Normally – as is the case with the numerous private customers – *SAP for Utilities* requests the MDUS system to send the process-relevant values only, so in case of preparing the billing process it sends the billing-relevant values. It uses a format specification (as if executing a query on a business warehouse) to tell the MDUS how to pre-aggregate the basic interval data. In the case of a time-of-use product for instance, the format specification requests the sum of the 15-

minute values to be aggregated over the various time-of-use buckets. Since consumers do not constantly switch between energy products (rates), MDUS offers an excellent opportunity for optimization: It uses the time between two data requests (like monthly or quarterly in billing) to perform the preaggregation for each day immediately after it receives the daily consumption values as basic interval data from the AMI data collection systems. If it then determines that the format specification in the call from *SAP for Utilities* deviates from the format specification in the previous call, it deletes the preaggregation, since no longer applicable, and performs it again dynamically.

The new SAP AMI Integration for Utilities software has been available since November 2008 and is based on enhancement pack 4 for the SAP ERP application as well as the SAP Customer Relationship Management (SAP CRM) 7.0 application. U.S. utility company Consumers Energy, headquartered in Jackson, Michigan, has made a prototype infrastructure available that contains all of the system levels shown in the diagram above: smart meters from several manufacturers, various data communication methods, systems from various AMI and MDM manufacturers (including the AMI Lighthouse Council members eMeter, Itron, and OSIsoft), and the current release of *SAP for Utilities*. This provides an excellent framework for comprehensive test and pilot operation, in which the AMI Lighthouse Council members are heavily involved.

The AMI Lighthouse Council (which has now expanded to include nine large utility companies and three AMI/MDM manufacturers) will continue its work in the coming years. This form of cooperation has proven that it is the best option for innovative topics such as this one. This was also the reason behind the decision of the Advisory Customer Council Utilities (ACCU) to form an AMI/Smart Grids working group. The ACCU is a user group, limited to 20 members, that represents international utility companies that work with SAP to define the future requirements for *SAP for Utilities*. Due to the high level of interest, the ACCU decided to open up the AMI/Smart Grid working group to SAP customers that are not ACCU members as well as to market-leading AMI/MDM partners. It includes those partners that are already members in the North American based Lighthouse Council, but also new ones such as Landis&Gyr.

Both customer groups are very keen on cooperating with SAP and its partners. And for SAP, there is more at stake than simply the revenue that it earns from selling the new software. By cooperating with its customers and partners, SAP is helping millions of companies and hundreds of millions of private consumers improve their long-term energy efficiency by reducing their carbon footprint and saving energy costs. Continuous development of the collaborative solution will soon turn the visions of a few years ago into reality:

- Smart meters measure energy consumption electronically and provide a high level of detail (for example, every 15 minutes).
- Customers can use Internet self-services to access their daily consumption values as well as proposals on how to improve energy efficiency.
- The rates for new energy products reward customers that save energy, particularly during periods of peak demand.
- There is less of a need for consumers to call the utility company in the event of a power failure because the smart grid immediately identifies the cause and its effects (the affected premises).
- Utility companies enable consumers to take part in demand response activities. Here, consumers permit an independent system operator to automatically reduce the operation of devices that consume a high level of energy (such as air-conditioning or

manufacturing facilities) or even to switch them off if necessary in case of a grid overload and risk of an outage.

- Renewable energy sources, for example a windmill or solar field, operated by a private community or a non-utility business, are connected to the grid and become part of the overall supply system. The operator concludes a contract with the utility company saying, that the energy produced is first used to meet the operator's own requirements. The utility company buys any surplus energy at market rates and, conversely, sells energy to the operator at market rates if the operator has not generated enough for itself.
- Consumers charge their electric vehicles at charging stations anywhere on the continent and the costs later appear on their electricity bill (energy roaming).
- Private energy producers can trade the energy that they generate on Internet marketplaces.