Support of Core Business Processes in a Utility by Integrated IT Solutions

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SUMMARY

The world of information technology (IT) in the utilities is still characterised by islands of automation. That means IT systems are installed to solve a certain task (or a number of tasks) in many cases for only one department. With the ongoing development in IT over the last decade, it is possible to build up integrated IT solutions, designed to solve the needs of the utilities and help them to optimise their business processes. This is necessary especially in a deregulated market environment to improve the competitive position.

SITUATION IN THE UTILITY MARKET

With the introduction of deregulation in the energy markets all over the world, utilities are forced to cut their costs dramatically. Therefore productivity enhancement has become a key word in the utility market. New IT solutions can improve business processes and utilise synergies for cost reduction.
To become fast and flexible in a competitive environment, utilities need IT solutions covering not only one specific task but supporting complete business processes. Many of this business processes in a utility have the necessity to use more than one IT system. So utilities will need integrated IT solutions to increase their productivity.
The deregulation of the energy markets also causes structural changes in the utility world. The traditional vertically organised utilities have to unbundle their operations in the areas of generation, transmission, distribution and supply. Competition takes place in the areas of generation and supply. The operation of transmission and distribution networks however is based on a natural monopoly.

The degree of unbundling depends on the market model chosen. In Norway distribution network operation and supply had to be separated into different legal entities. This was done to guarantee equal access rights for all suppliers, including pure energy trading companies. As it looks at the moment this strong separation will not be introduced - at least for the next few years - in Germany and other European countries.

Vendors of utility IT systems have to adapt to the changes of their customers. This requires a modular set of applications in the segments of generation, network management, energy trading, customer management and business operations (fig. 1). Very important is the understanding of the utility core business processes, to be able to deliver IT solutions which solves the needs of the different types of utilities in the deregulated market environment.

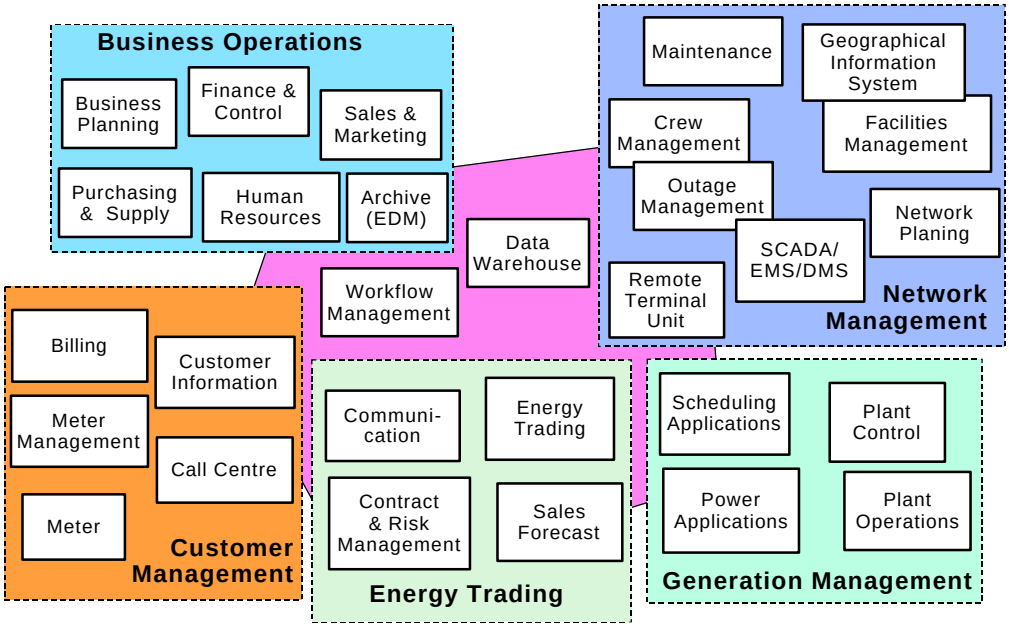


Figure 1: Segmented IT landscape to serve different types of utilities

IT NEEDS OF UTILITIES

Powerful Customer Management

More than ever before, utilities have to be more customer driven. Today utility companies have demanding requirements to the Customer Information and Billing Systems. As terminology show billing is only one part which they still did in past. This kind of systems become the focus of attention and are a company's most valuable asset. Today, successfully managing even greater numbers of customers and even greater volumes of customer information in the utilities sector requires a completely new way of thinking - a truly customer oriented approach to satisfy the demands of the consumer.

The most fundamental requirements for the Customer-Driven-Company in the utility market are:

- boosting competitiveness through cost management and concentration on core business
- customer orientation through the companies strategic orientation towards existing and prospective customers.

The new Customer Information Systems (CIS) must thereby fulfil the following tasks:

- ensure customer satisfaction by putting the customer in the centre of all activities. With the possibility to select his supply company a customer expects from his service company faster and better information and also a better service delivery.
- increase productivity by optimising the relevant business processes. This enables the utility company to save costs, to increase the service-level and also to improve customer satisfaction.
- be flexible for adaptation to changing requirements in terms of market, functionality or corporate organisation. In future it should be possible to reflect changes directly in the CIS (e.g. new types of contracts with very flexible timeframes).
- implement a huge number of different tariffs to become more customer oriented.
- bill any kind of services offering from utilities to their customers.

The integration of an CIS with an Call Centre is another element to act in a customer driven way. By integration it is possible to show all important customer data on the screen during incoming calls. That makes the response to the call more competent and more efficient.

Integration of Business Operations

In Enterprise Resource Planning (ERP) systems lot of utility companies using standard application software coming from software companies like SAP, Oracle, BaaN etc. The business management components like financial management, cost controlling, balance calculation, asset management or human resources do not differ much from solutions in other industries. But there are sector specific solutions necessary for an optimal support of the business processes within a utility.

All relevant figures regarding the business management situation of the company must be accessible at every time. Flexibility, openness, Internet capability and process orientation are the most important requirements for modern ERP solutions.

Essential for the company success is an integration of ERP system with the other applications of the utility IT landscape (fig 1). This enables utilities i.e. to manage assets through their entire life cycle or to develop products and services that attract and retain customers in a highly competitive marketplace.

Only integrated solutions enables utilities to monitor, plan and develop their business on a entirely new level. Future IT solutions will have to provide up-to-the-minute facts and figures required to respond dynamically to the increasing management information demand. An ERP system which is integrated with the other segments of the IT landscape puts the utility firmly in control of the key business processes.

Flexible Energy Trading solutions

Utilities need to have the necessary IT systems to offer, sell, request or buy energy either via bilateral contracts or at the spot market. Additional applications are necessary to handle and optimise the large number of contracts and for the management of risks.

Important for energy trading solutions is the communication with the trading places and the trading partners. To ensure equal access for all market participants standard procedures are required. The spot market in Scandinavia - Nordpool - uses an extended EDIFACT protocol based on X.400. In the USA the transmission capacity is offered and sold via Internet. According to the regulation authority every transmission utility has to use an OASIS (Open Access Same Time Information System) node for this purpose.

The traditional load forecast for a network area is replaced by a sales forecast for a certain customer base. The algorithms or neural network methods used stay the same as today.

New systems for risk management are already introduced in Scandinavia and the USA. They help the market participants to limit the financial risk of the physical energy trading as well as for dealing with futures.

Today the rules are not yet fixed in all already deregulated energy markets. Therefore the most important requirement for energy trading systems are flexibility and openness. These systems have to be adapted regularly to new requirements of the regulation authorities or agreements between the market participants.

Important: Network Management

Also the technical IT systems have to be adapted to the deregulated market environment. Only slightly affected but still important are Geographical Information Systems (GIS) used for the documentation of the network (geographical maps and facility data). Network control

centre systems are faced with a number of additional requirements:

- guarantee equal and non discriminating network access for all market participants;
- interface to energy trading;
- economical congestion management with billing according to origin;
- calculation of wheeling costs
- proof of the contracted supply quality
- improvement of customer service
- large number of different communication interfaces.

To make network operation more efficient, improvement of specific business processes is necessary. The network maintenance costs can be reduced by 30% or more with event driven maintenance of the equipment like circuit breakers or isolators. Therefore data from the control centre (switch counters, transformer overload hours) are needed in the maintenance system. Effective crew management for maintenance work and fault clearance can reduce repair and outage times.

With a common data management, considerable cost reduction can be achieved [1]. Today many data are entered and maintained separately in several technical IT systems (SCADA, GIS, Network Planning). In addition these data are also partly required in commercial IT systems (e.g. asset accounting). Integrated data management and optimisation of the data entry and data maintenance processes can save up to 50% of the related costs.

Data Warehouse solutions

The changes in the energy markets require storage and evaluation of a much higher amount of data than it is necessary in a traditional environment. This affects especially two areas within the IT systems of a utility:

- Customer data: They are the basis for sales and marketing strategies. With good quality data, better tariffs and services can be adapted for different customer groups to improve sales;
- Control centre: the operational data are the basis for energy trading and cost optimised network operation.

Handling of such high volume of data leads to the introduction of Data Warehouse solutions. The first Data Warehouse solutions for generation companies with applications for generation scheduling and energy trading are already in operation in Scandinavia (fig. 2).

Sales and marketing activities of the utilities will also require Data Warehouse solutions with specific applications. They have to work closely with the existing IT environment. IT solutions from the already deregulated telecommunication market can be used as basis, but the applications must be adapted to the specific requirements of the utilities.

CONNECTING THE TECHNICAL AND COMMERCIAL IT SYSTEMS - EXPERIENCES WITHIN EWE

EWE with headquarters in Oldenburg supplies electricity in a territory of some 19,000 km² to more than 1 million customers in the Ems-Weser-Elbe region. More than 560,000 customers in the service areas Ems-Weser-Elbe, east Brandenburg and the island of Ruegen are supplied with natural gas in a territory extending over some 23,000 km². EWE has approx. 2400 employees and in 1998 had sales of about DM 3.7 bn.

Brief

EWE`s power cables and pipelines in the Weser-Ems region are documented in essentially the same way in some 75,000 as-built plans on transparent films in different scales. The ground plan information has been collected over the last 10 years on CAD systems and more than 94% is currently available in digital form (DXF format). The energy networks have been manually entered on the transparent films.

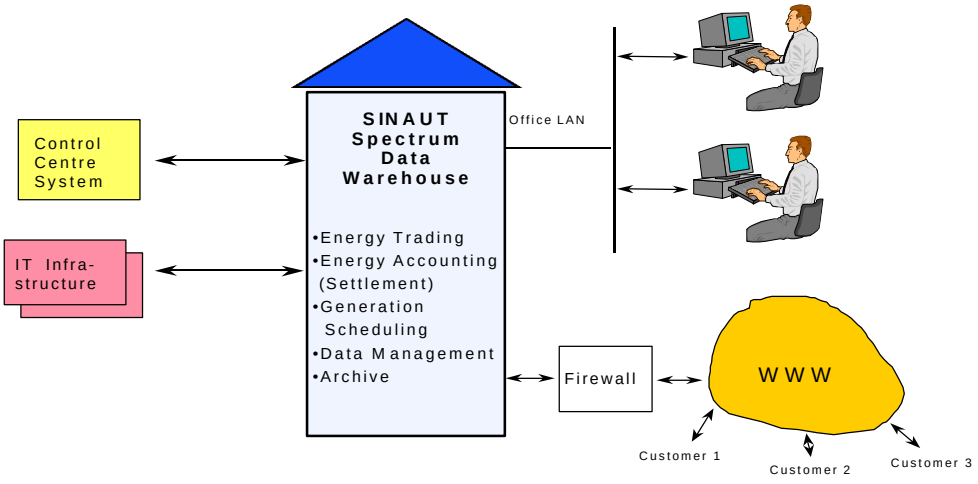


Figure 2: Implemented Data Warehouse solution

Microfilming is used for distribution of the plans within the company down to the service vehicles of the district foremen's offices.

The following alphanumeric information systems based on ORACLE are in use at EWE:

- EBIS (electricity)
- GBIS (gas)
- ABIS (waste water)
- EASY (SAP R/3 based customer accounting system)
- SAP R/3 (various modules)

The first task consists in transferring the existing as-built plans as quickly and inexpensively as possible to a GIS.
In parallel the data in the existing alphanumeric information systems continue to be kept and maintained there for the time of introducing GIS. Additional alphanumeric data, e.g. on house service connections, are to be collected and managed in the GIS.

Outline concept

Logging of the 75,000 as-built plans using conventional means by a digitizer would require approx. 8-10 years with 28 work places for data entry. For a rapid transfer of the plans in digital form and cost saving it was decided to scan the as-built plans in the form of microfiches and to transfer them into the GIS.
The advantages of a GIS, such as rapid access to a set of plans independent from scale and pages, is being made available, in particular, to employees on site. For this reason the microfilming in the Weser-Ems area has been replaced by a mobile PC based information system.

Employees in the operating departments and in the district foremen's offices using a mobile GIS can retrieve the necessary plans on their local PC's e.g. by entering the address (place, street, street number). In the service vehicles the plans are available on a notebook. Output of the plans in A3 format, in the same way as from microfilms, is also possible at the office PC's as well as to print plans in A4 format in the vehicles.

Method for transferring the EWE as-built plans

The method for transferring the EWE as-built plans breaks down as follows:

1. Scanning the microfiches and loading the scanned data by using automatic methods like plan number recognition and control point recognition;
2. Loading existing base map card in DXF format;
3. Base map processing by using automatic methods to link existing addresses (place, street, street number) automatically in batch mode with graphic elements (buildings);
4. Use of pattern recognition software to pre-process the scanned data (automatic process) in order to reduce interactive post-processing on the screen to a minimum*;*
5. Post-processing of the supply network on the screen to get the scheduled data structure; post-processing of the dimensioning is being waived in order to achieve a further reduction in expenditure (dimensioning remain in the raster format).

Prospects

With the solution described above all the graphic data and a part of the alphanumeric data is available in all EWE departments and service vehicles which already means a big support of business processes. The GIS is the base for next steps to a highly integrated IT solution.

The next task will be the upgrade to the standard software SICAD UT-X for electricity, gas, water and remote heating. The advantages of a standardised product are:

- protection of investment,
- shorter time for implementation (customising instead of complete development),
- reducing the cost for software maintenance and extend the life time of the system by upgrading to following releases.

With the new solution it will be possible to realise the integration of the existing alphanumeric systems EBIS, GBIS and ABIS into the GIS. The advantages are:

- all graphic and alphanumeric data of a supply network will be available in one system (GIS) for maintenance, planning and calculation of networks;
- reduction and integration of the self-developed systems EBIS, GBIS and ABIS into one standard product will reduce maintenance costs.

To avoid the costs for parallel data processing in the control centre system and in the GIS a data link will be developed between these systems.

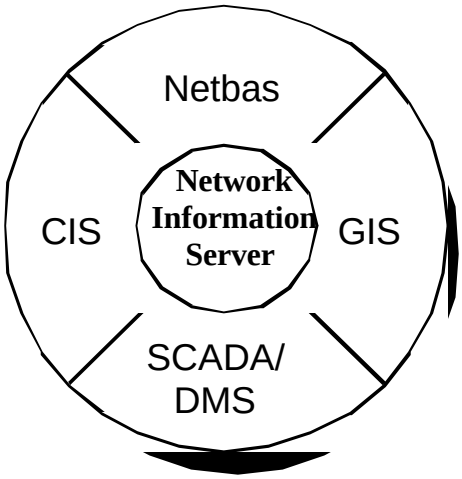
The next steps will be:

- the realisation of a link to the Engineering Data Management system (EDM) to get more detailed documentation of the technical equipment;
- the integration with SAP R/3 PM which is technically supported by the product chosen;
- the link to the customer accounting system EASY based on SAP R/3 will be realised via the address (place, street and street number); similar to EASY a link to the customer database will be realised via the address for sales purposes;
- the geographic data will be made available to the control centres of EWE and to the Call Centre to support customer care.

With the integrated IT solution described above the core business processes will be highly supported. The plan was set up to finish the implementation of this IT solution at the end of year 2001.

INTEGRATED IT APPROACH AT VIKEN ENERGINETT

Viken Energinett - formerly part of Oslo Energi - is the distribution network operator for the city of Oslo. The company supplies electric power to approximately 300,000 customers. With the changes in the market following deregulation, Viken Energinett has constantly been re-engineering their operation to meet those new market conditions. One interesting comment was that Viken Energinett has seen more changes within the last 2-3 years than they saw in all of the previous 30 years.



CIS - Customer Information System.
DMS - Distribution Management System
(SINAUT Spectrum)
GIS - Geographical Information System (Intergraph)
Netbas - Facilities Management data base (Powel data)

Figure 3: Network Information Server at Viken Energinett

Viken Energinett was building a new integrated control centre which should be used for HV, MV and LV (420kV – 0.4kV) network monitoring and control as well as to serve the purpose of a Trouble Call Centre. In the new control centre, which is a result of merging three older ones, a total of only sixteen operators are needed as compared to the previous operation where twenty six operators were needed. Overall in the organisation the work force has been reduced and processes have been improved to increase profitability.

Areas to utilise integrated IT solutions

Viken Energinett recognised the fact that in order to compete effectively in a deregulated market they had to become very efficient and effective in their operation and serving the customers. To achieve this goal one of the key part was to manage the information flow, its availability in a timely manner and accuracy of data across the entire organisation. The basic requirement for the project was to integrate various existing and new systems in such a way that the information needed by the user can flow from a given system to its ultimate destination without manual intervention. In other words, if the user needs a piece of information and it is not available locally, it is the advantage of the integrated solution to obtain this information from the enterprise network. To facilitate smooth exchange of this information between systems, the concept of the Network Information Server (NIS) was developed (fig. 3).

Technical solution of the IT integration

To meet the demands of a deregulated market, it is necessary to establish a flexible technical solution founded on strategic choices. Therefore as starting point a bottom up analysis of the business was done. As a result of this analysis it was clear that the new system being implemented at Viken Energinett needs to function in a way that they will be able to provide optimal benefit to the users.

To ensure that the designers and implementors of the overall strategy of enterprise integration had a clear picture as to what was needed by the users and what could be delivered by these systems, a thorough analysis of various operational practices was necessary. To perform this analysis, the Use Case Analysis tool was chosen [2].

Each system project is unique, to some extent, in its environment and requirements. Hence the way Use Cases are used must be adapted to the project. Use Case analysis at Viken Energinett was used for capturing the specific analysis details that did not fit into a Functional Specification. These details are however necessary for design and implementation of the system. Use Cases themselves also become a means of communication of information between various partners implementing different systems at Viken Energinett.

In order for various systems in the Enterprise to communicate with each other, a common basis had to be established for exchange of information. To achieve this a unique identifier was assigned to each item or piece of information. Since the DMS already had a mechanism for unique identification of each piece of equipment in the electrical network, this concept was extended to the enterprise. DMS has the concept of assigning a unique Technological Address (TA) to each item, hence TAs were established for each piece of information that needs to be or could be exchanged in the enterprise network. Each piece of information has an identified owner (a person or a department). The owner is responsible for maintaining and updating and communicating the changes to the rest of the organisation. This is very different from the past since there was no owner identified for each piece of data. Approximately 40% of the data in the entire system is updated/ transported through the NIS.

The basic principles upon which the NIS is built are outlined here:

1. It is the responsibility of the sub-system to inform and make available to other sub-systems any changes in its own data.
2. In the inter-system data exchange process, it is the responsibility of the receiving sub-system to pick up the data from a pre-defined location.

3. When an exchange of data results in changes in the receiving sub-system's object identities, it is the responsibility of the receiving sub-system to acknowledge the changes by reporting them back to the NIS.
4. All exchange of data between systems, physical (Data Exchange) or logical (Look-up/Queries), is to go through a common point to all sub-systems. This common point is the NIS. In the context of information exchange, each system interfaces with the NIS only.
5. The contents and structure of the exchanged information is defined by the needs and requirements of the receiving sub-system.

To handle the overall work flow in planning, operation, outage management etc., Viken Energinett plans to implement a Work Order Management System. This will be tightly integrated with the logical database, making an effective workflow throughout the organisation and creating documentation during the process.

Results achieved from the integrated IT solution

In addition to reduced need of operators, the new control centre has achieved or expects to achieve several positive results due to the integrated IT solution. However, with integration projects of the complexity that Viken Energinett is dealing with, it can not be expected that all the efficiency results appear as soon as the technical solution for the integration is ready.

The status of the integration project at Viken Energinett can be summarised referring to figure 3.:

1. Implementation of the different interfaces is more or less completed and the functionality is verified.
2. The integration between DMS/SCADA and Netbas is in operation. Due to the integration, the system is now able to automatically calculate energy not delivered (END) and duration of outages for any LV feeder in Oslo and export the results to a reporting system in Netbas. Also, technical information residing in Netbas is available in the SCADA system by selecting objects and sending a query to Netbas.
3. GIS maps (dgn.files and Oracle tables) from a small part of Oslo are imported into the SCADA system. So far this is only used for functional testing and operator training. Establishing the GIS is a separate project that started with scanning of paper-maps. All the maps are now scanned and digitised and the system will be converted to a new platform. Additional data will be entered before the system is completed during year 2000.
4. In order to utilise the integration with the CIS system, there is also a big project going on where the logical connection between the customers and the "delivery points" in the electrical network is being established. This project is also expected to be completed during year 2000. So far this is tested for the same part of Oslo as for the GIS system.
5. Due to the strong focus on these integration projects at Viken Energinett, the quality of the data in the different systems will be considerably improved and the know-how of these systems will also be better within the company.

It can be concluded that the integration of the IT systems will be a very good basis for an efficient operation of the electrical network and for a high quality customer service. For Viken Energinett all the benefits and efficiency potentials of the integrated IT solution can be utilised when all the data is made available at the end of year 2000.

CONCLUSION

Competition due to the deregulation of the energy markets and the privatization of the energy sector in several countries force the utilities worldwide to increase productivity and profitability. To become faster, flexible and more productive, utilities have to reengineer and improve their business processes. Support of the business processes by integrated IT solutions improve the competitive position of the utilities.
As seen in the two examples shown in this paper, the implementation of an integrated IT solution has to be stepwise. The increase in productivity and the cost saving is manifold and start in an early project state.

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