Utility Consulting

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Amid the regulatory transformation that is revolutionizing the utility market, reliability and economics stand out as *the* factors driving financial and operating performance. To get the best return on their assets and perform at the highest level, utilities are turning to solutions that integrate the domain competence of consulting experts with the very latest software tools. New methods for optimizing performance costs have been developed in the course of several recent projects undertaken by ABB.

Utility Consulting expertise and experience has become a key factor in the business performance of electric utilities, independent power producers and industrial companies. Consulting work in which ABB has been engaged covers a broad spectrum, and includes:

- Forecasting of demand growth for distribution companies
- Planning for system reinforcements to maintain system reliability
- Technical due-diligence in support of mergers and acquisitions
- System impact evaluation for new independent power producers
- Benchmarking of utilities' relative global 'best-in-class' peer groups
- Asset evaluation and reliability-centered maintenance planning
- Evaluation of utility workflow management and real-time IT infrastructure
- Business process consulting and change management

The ABB Utility Consulting global business unit is a team of over one hundred systems, IT and business consultants with presence in the United States, UK, Germany and Spain. Backed up by over 2500 product and system specialists in locations close to our customers, it has the capability required to implement system solutions for utility customers worldwide.

Changes for the better

Just as the rest of the power industry has changed dramatically within the last decade, the art and science of transmission and distribution planning is fundamentally different from what it was ten years ago. Deregulation and performance-based regulations are changing the framework within which planners and system operators work. Consideration has to be given to new technologies on both the load side and the supply side. The changes cover the spectrum of regulatory policy, technology, competition and industry economics.

In recent years, a strong global economy has resulted in demand growth in most companies' service territories. In

the majority of companies, even those with overall flat growth, there are pockets of relatively strong load growth in the system for which planners must specify the infrastructure. More than ever, utility planners need to be aware of the equipment installed in the system, as well as its current condition.

Generally, customers also expect a level of reliability as good as, or better than, the reliability they have been used to in the past. An increasing number of customers operate businesses today that are sensitive to reliability and the quality of service. It is therefore important for utilities to have the tools to systematically analyze cost/performance trade-offs within the financial constraints imposed on them. Similarly, the benefits of available funds should be maximized. This often implies changes to standards, guidelines and procedures.

Interpreting such changes and developing new optimization methods and state-of-the-art software to assist utilities in meeting these challenges is where ABB has vast experience. In just the last five years, new methods for optimizing performance costs have been developed that allow the domain competence of consulting experts and software tools to be integrated in a web-based data warehousing tool. These new methods let us focus on the most cost-effective ways to obtain maximum performance for a system and utilization of assets.

The following two examples show how ABB's experience can be the key factor in creating optimal, cost-effective solutions for customers based on key performance indicators.

Reuniting Berlin

On March 5, 1952, as a result of the politics of the time, the electrical supply system of Berlin was divided into two sections, one for the eastern and one for the western zone. Now, more than four decades later, the two networks, like the two halves of the city, are reunited, having been incorporated in the German interconnected grid. For *Berliner Kraft- und Licht (Bewag) AG*, the utility responsible for running the network in the western half of the city, joint operation of the two networks posed certain problems. Besides the obvious need for standardization – different system philosophies had developed over the years – it was also apparent that a concept was needed for the city's electricity supply in the longer term.

Investigations were carried out to find an optimal concept for the reunited distribution networks of Berlin that took all factors into account. Bewag and ABB formed a joint planning group to develop the approach. Its main objective was to make the two networks more compatible so that the city would be able to cope with future electricity demand.

One of the issues looked at especially closely was the reliability of the downtown area networks, and at ways to increase it without making any basic changes to the supply concept. In particular, it was necessary to find out if, and what, additional investments might be required to achieve the goal of higher reliability.

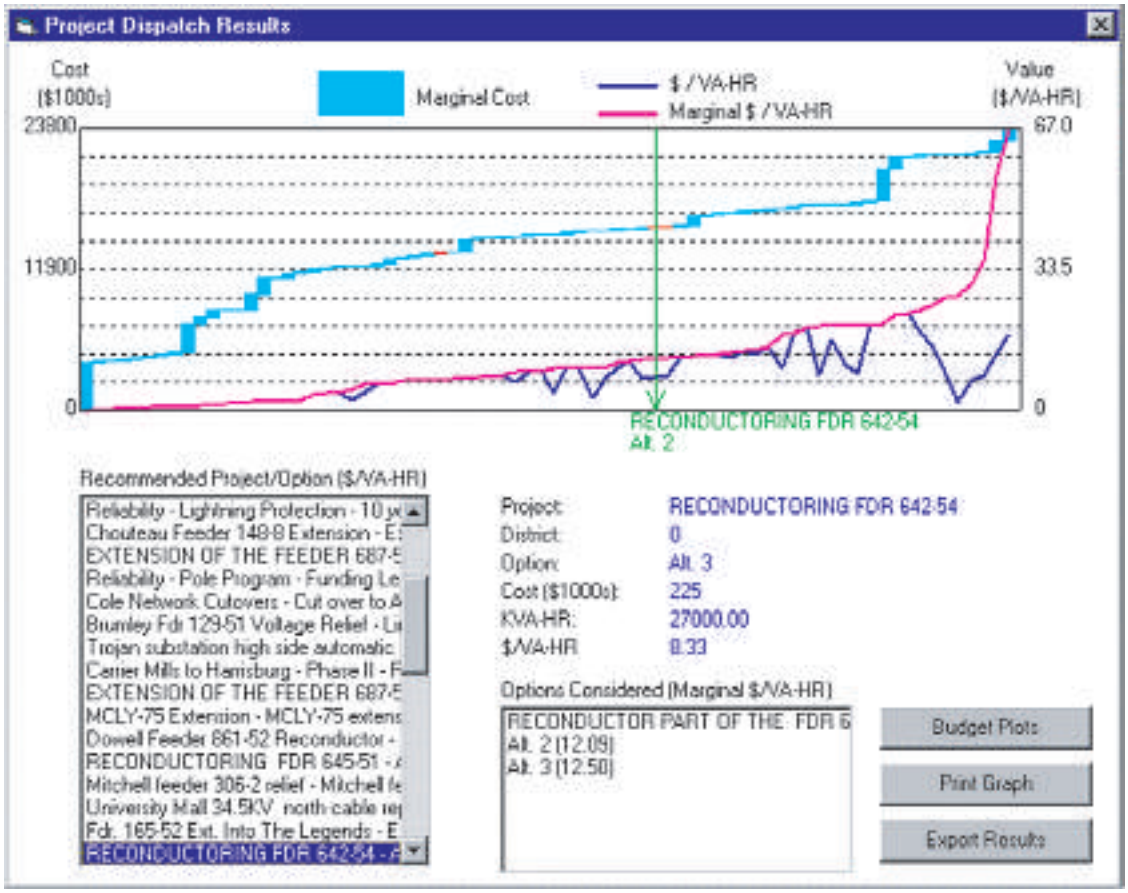
With the help of advanced mathematical modeling of the system components and special programs for the calculations, certain system components were loaded beyond their conventional nominal power. This showed which components could be utilized more economically. As a result of this study, Bewag decided to increase the capacity of transformers and underground cables used in the networks.

Utility gets results

The second example involves an electrical utility company providing power to several regions in Europe. In order to benchmark some of their guidelines, practices and power quality indexes, they wanted a comparison with utilities in Germany and the United States that would identify 'best practices'. To this end, studies were carried out in the areas of maintenance, transmission and distribution planning, and engineering and operations.

In addition to providing a benchmark for these four areas, ABB undertook reliability calculations for the utility's power distribution system. This was done to obtain a baseline for its distribution design practices at the time, as well as an on-site diagnosis of certain facilities.

ABB found differences between the utility's practices and typical practices in Germany and the USA, especially in the maintenance area. It was seen that a



Distribution transformer density data, imported from a utility's transformer load management program and used in load forecasting

change in procedures could result in considerable cost savings without significantly affecting reliability. The study also recommended use of some of the newer probabilistic approaches to system planning which help minimize the cost of new investments.

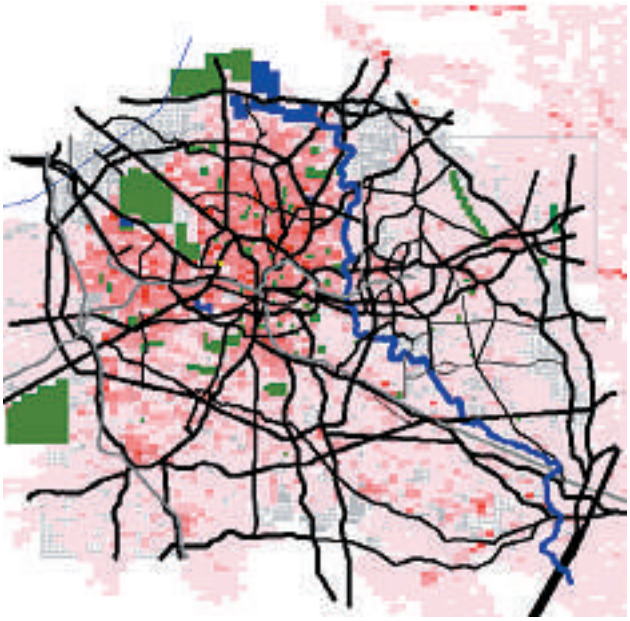
After receiving the study results, the utility indicated that it was "very impressed by ABB's ability to set up a cross-border team in such a short time to cope with a challenging project with a very tough deadline."

Business processes and asset utilization

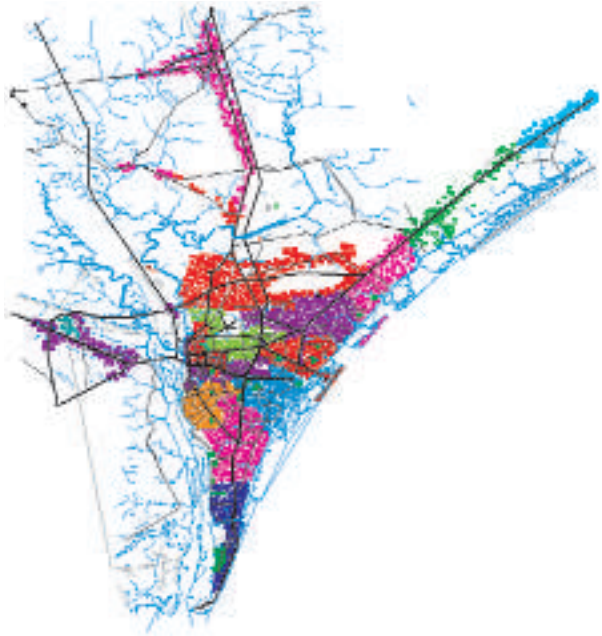
In another example, ABB instituted 'budget-constrained' planning policies and methods appropriate for a regulated US 'wire company' operating in a competitive environment. The project included:

- A review of all engineering planning and budgeting procedures, reliability requirements, engineering criteria, planning guidelines, and appropriate standards, as well as planning, budgeting and engineering results from the past ten years.
- Development and implementation of a new planning/budgeting/project prioritization method based on marginal benefit/cost optimization using customer service quality costs as well as budget cost as an element of performance evaluation.
- Design of an entirely new planning process and organization, compatible with the new planning methodology and tailored to the company's new goals and needs.
- Seminars and workshops for over 220 engineers, managers and supervisors from 14 operating districts, to convey the concepts and skills necessary to implement the new approach.

Another project undertaken by ABB involved investigating the operations and maintenance history and procedures of a Texas utility's underground distribution and transmission cable systems in the Dallas, Fort Worth and DFW airport service areas. The investigation included reliability assessments of the transmission and distribution systems using a network model. Also included were inspections of parts of the utility cable



Load forecast study performed using a commercially available GIS database as starting point



Screenshot taken from a budget-constrained planning software simulation

networks, substations and pumping stations, as well as interviews with utility operations, engineering, and maintenance personnel. The investigation further included a review of utility standards, guidelines and documentation relevant to the operation of the cable network.

Power system performance research

Another area in which ABB is active is in research into power system performance and the development of new technologies for its improvement. In one such project, named 'Wide Area Disturbance', we examined, among other things, voltage instability, overload and out-of-step.

Based on this, we developed a new algorithm for estimating the proximity to voltage collapse. The method employs only local measurements – bus voltage and load current – and is simple enough to be implemented in a numerical relay. The relay's estimation can be used for a number of applications, for example to enhance local controllers (SVCs, etc) or to direct load shedding. Alternatively, the estimation can be sent to a computing center as support for system coordination.

Other completed projects, eg 'Robust Control of FACTS Devices' and 'Control of Nets, Drives and Converters', have examined the algorithms for damping power oscillations under uncertain operating conditions. Uncertainties included transmission outages and varying load profiles. New algorithms and software for centralized and decentralized robust controllers were developed and tested by means of simulations on realistic system models.

Backing up ABB's consulting business is domain expertise and field experience accumulated over decades in the power industry, plus a global presence that allows us to bring best practices from all over the world together to help our utility customers improve their business performance.

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