Executive summary

Network utility companies are facing a combination of challenges posed by forces outside their industry and their control. These forces will create a pattern of change that will transform the way the industry operates and create significant opportunities for newcomers.

The drive toward deregulation in some countries and the expectations of the financial markets are placing increasingly heavy pressure on utilities companies to cut their costs. At the same time, utilities are being faced by new technologies that could disrupt the way they do business and open the door for new market entrants that could pose significant threats to their long-term futures.

Because the timelines for the introductions of these technologies are still unclear, utilities must consider how to position themselves to make sure they can respond flexibly to the threats and opportunities available from this new technology and the threats that new entrants will pose to them as incumbents. At a time when all expenditure is subject to intense scrutiny, high levels of operational service must still be maintained. Any investments made in inappropriate areas now may severely limit the potential for success in the future.

This white paper reviews the key regulatory and technological issues facing utilities, outlines the six key areas that can be addressed to improve efficiency and examines the practicalities of alternative technologies and their implications. It ends by demonstrating two realistic and cost-effective ways, through field workforce mobilization and asset lifecycle management, that utilities can begin the journey toward an on demand operating environment that is designed to transform the industry and deliver tangible and long-lasting benefits.

Costs, costs, costs

Utilities companies everywhere are facing increasing pressures to cut costs. Three concurrent issues are causing these pressures:

- Deregulation
- Regulatory trends
- Financial markets’ expectation.
This pressure to reduce costs comes at a time when utilities are also being expected to maintain high levels of operational service. The recent spate of high-profile power outages that hit parts of North America, Scandinavia, the U.K., Indonesia and Italy highlighted the reliance of modern economies on a secure and reliable supply of electricity and demonstrated the economic and social implications of such a failure in supply. Public opinion openly questioned whether the failures were linked to an ongoing pressure to cut costs.

In Europe, this pressure is being exerted at a time when markets are being deregulated. Across the European Union (EU), electricity and gas services are to be unbundled. As a result, those customers who are not yet free will be on the move, and the challenge for utilities will be to retain existing customers and attract new ones. By the middle of this year, commercial users will be able to switch suppliers, and domestic users will be given the same freedom by 2007. Monopoly businesses are likely to be separated and will be measured and regulated as standalone entities. In this new environment, with customers free to move, they will have to generate returns that meet the expectations of their owners and their shareholders.

However, in the EU their ability to raise prices will be severely limited by independent regulation. In Ireland, Italy, Norway, Spain, the Netherlands and the U.K., we already see utilities working to a formula that effectively reduces their income year by year. Additionally, utilities in Ireland, Spain and the U.K. already face financial penalties from their regulators for poor performance and the Netherlands plans to introduce similar strictures. These penalties have a direct effect on the bottom line for companies. Regulators are also using comparative benchmarking between different companies to drive lower-performing utilities to match the performance of their more efficient peers.

In North America, the move to deregulate at the retail level has all but stalled; as a result of the collapse of Enron and the fallout from the California market collapse. At the wholesale level, deregulation has stalled due to a classic battle between State Utility Commissions and the Federal Energy Regulatory Commission. Powerful lobbying groups have effectively blocked proposed rules to move to a nationwide single market.
In Canada, deregulation varies province by province. As a result of increasing power prices, the Ontario Government overturned deregulation and an open market due to public sentiment in an election year. In the western provinces, deregulation continues to advance.

As a result of the chilling of deregulation and the collapse of the energy and marketing trading marketplace caused by Enron's demise, the focus of North American energy and utility companies has returned to optimizing the performance of physical and human assets and operational efficiency. The glitz and glitter of foreign acquisitions, merchant energy plants and energy marketing and trading as growth engines has faded. Companies are now focusing on the regulated portions of the business, energy production and utilities energy delivery network.

In case this was not enough, another critical issue affecting utilities lies in the changing attitude of financial markets to the industry. To be blunt, utilities are no longer seen as a safe bet. A combination of factors has brought this about, and the individual reasons vary according to the geographic location of the business. They include: wholesale market volatility, the disappointing results of investments made by utilities in the Latin American and other continental markets, poor stock market performance everywhere, stricter pension fund arrangements and continued forecasts of sluggish economic growth. Faced with a finite number of customers in a monopoly market, utility companies have no chance to grow organically. They can only grow by acquiring other businesses – but they are under pressure to spend less. What's more, in the view of the market, many have not yet delivered enough synergies or benefits from previous mergers and acquisitions. Utilities stocks have underperformed market indices and the response of market analysts has been cool. They have told clients to maintain or reduce their holdings.

Faced with this potentially damaging nexus, utilities are being forced to act. As we shall show in the next section, their choices are limited to six key actions. However, there is room for improvement and potential benefits to be had from implementing some or all of them.
**The six key areas**

There are six things that energy and utility companies can do to help themselves to improve the productivity of their core distribution business. Each of the six areas of focus build upon each other like bricks in a wall to form a strong interconnected response to the issues they face.

**Figure 1. The six key areas.**

![Diagram of the six key areas](image)

*Source: IBM Business Consulting Services.*

**Regulation.** The first and most basic area is the regulatory framework within which the business must operate. Utilities must seek to set the best agreement they can with the regulator. Then, operating within that agreement to optimize returns, there are five core components of the business that can be addressed.

**Asset lifecycle management.** Efficiently managing the planned work that happens on the network can have a direct link to making savings in your supply chain, the amount of maintenance-related work that you have to do and the overall reliability of the network. Utilities need a clear and coherent asset strategy and a capital plan. As we will show later, in asset lifecycle management gaining fast access to accurate information is the key to making informed decisions and cutting costs.

**Customer satisfaction.** It might seem obvious to say that the simplest route to customer satisfaction is to maintain high levels of operational service and avoid network outages. In truth, people often judge organizations more by how they behave when things go wrong than when they go right. With freedom of movement for customers now either a reality or an imminent prospect, utilities would do well to concentrate carefully on this area of concern. Utilities need realtime control, effective network management and efficient customer relationship management if they are to...
respond well to the reactive requests of customers who are reporting faults or asking for work to be done. Wherever possible, the planned maintenance of asset lifecycle management should be integrated with reactive work. Again, this is an area that calls for accurate and timely information.

**Service delivery:** Getting your service delivery right can be a consequence of effectively integrating planned and reactive work programs – providing you manage effective delivery of the work that has to be done. Utilities need to drive out the inefficiencies in the delivery process. The key to efficiency and reduced costs lies in a mobile-enabled workforce that can travel straight from home to the first job of the day, and start work when they get onsite. Further, the just-in-time delivery of materials to the job site so that crews never have delays caused by unavailable materials will drive an additional 5-10 percent in crew direct activity. Eliminating wasteful “depot time” at the start and end of each shift will eliminate enormous amounts of cost. The capture and sharing of information is very important – whether there is an internal labor force or a collaborative effort with third-party providers.

The diagram below shows how integrating asset, maintenance and work management is the first step in a circle that is designed to put management back in control and create benefits throughout the organization. Improving service delivery can result in performance gains of more than 25 percent.

**Figure 2.**

Integrate asset, maintenance and work management processes by sourcing better asset data and exploiting continuous improvement opportunities. Better asset/replacement decisions result in higher reliability factors at lower cost.

Integrate asset, maintenance and work management

Effective asset management decisions

Improve data and information

Improve the effectiveness of the workforce by improving the delivery of resources to the field – right person, right job, right time.

Improve quality of service by managing appointments and providing visibility of work.

Improve tracking and management of performance and SLAs.

Improve materials and logistics planning by integrating work/workforce and materials planning processes.

Improve commercial leverage by exploiting opportunities from improved control over asset management processes.

Source: IBM Business Consulting Services.
Supply chain. The development of work requests is the starting point for the supply chain. Research shows that the data captured in the work request (such as project type, scope, and equipment required) often comes too late to be of any use for formal planning purposes. The unpredictable nature of demand, isolated functional departments and the lack of powerful, accurate analytics causes inventory (and therefore cost) to build up along the supply chain like a clogging artery. Utilities should focus on getting materials from the manufacturer, and deploying them straight to the point of use and keep them off their inventories for as long as possible. The benefits of vendor-managed inventory have been limited to the simplest of items, such as nuts and bolts in stores. One utility has decided not to stock any item that can be shipped within 48 hours. Utilities are giving up between 10 percent and 15 percent of the available cost savings in their supply chains because they haven’t gone as far down the same route as manufacturers of motor vehicle and fast moving consumer goods.

Support functions. Utilities also need to look at their information systems, human resources and financial controls and information to support more efficient operations. IBM has structured solutions and propositions to be able to address each of those point needs for the customer, to help ensure infrastructure effectiveness.

Disruption, enabling technologies, new entrants and the changing landscape

The third component of the immense industry change is alternative technology – or to be more accurate disruptive technology – something that changes an industry in such a way that previous competitive and business rules no longer apply. In the past we have seen how distributed computing and the laptop have superseded mainframe computers and how digital technology transformed the recorded music industry. In such cases, businesses have to learn to understand and embrace the new technology – or be swept aside by it. Although much of the technology of the network utilities has remained unchanged since they were built in the last two centuries, the environment is now changing rapidly. New micro-power technologies include fuel cells, Stirling engines, micro turbines, solar, hydro, wind and biomass, (energy from the burning of organic wastes, standing forests, and energy crops).

Domestic Combined Heat and Power (dCHP) units (based on Stirling engine technology) are expected to be launched sometime in 2004. Like conventional boilers, these units produce heat and hot water, but they also use natural gas to generate electricity. This solution is more efficient than traditional domestic energy
solutions, as it avoids the electrical losses associated with power station conversion, transmission and distribution and makes use of the heat generated as a by-product. Any excess electricity generated can be exported to other local sources of demand.

In the longer term, similar domestic CHP units based on fuel cell technologies could become commercially available. It is not yet clear which fuel cell technology will dominate, but, in general, these would typically offer a higher power-to-heat ratio and therefore extend the market to smaller homes with a lower thermal demand and offer greater opportunities for the export of excess electricity.

Although the trends are clear, the time scales are not. However, as an approximate guideline, fuel cells in cars could be a daily fact of life by 2010, and General Motors estimates that it will have a million fuel cell cars in production by then.

Traditionally, startup costs and economics hamper the acceptance of new technologies but government pressures and incentives are starting to change the underlying economics of some of these technologies.

Not all governments have ratified the Kyoto Protocol, but the target is to reduce all emissions to 5.2 percent below the levels of 1990, by some time between 2008-2012. The EU is aiming for a target of 8 percent below 1990 and is introducing carbon trading schemes to aid the effort. Participants in carbon trading buy and sell contractual commitments or certificates that represent specified amounts of carbon-related emissions that either:

- Are allowed to be emitted,
- Comprise reductions in emissions
- Comprise offsets against emissions.

It’s not necessarily the traditional utility players who are going to capture the new market space. A number of non-utility players are investing heavily and driving forward aggressively. Shell is heavily involved in wind energy with projects in Spain, the U.K., Germany, the USA, the Netherlands, and in solar energy and hydrogen and fuel cell development. BP has roughly one-fifth of the world’s solar market and is also involved in hydrogen and wind energy. Sharp has been working in solar cells since 1959 and is the now the world’s largest manufacturer. Mitsubishi Corporation
is working in a joint venture on the development of hydrogen fuel cells with Shell and Johnson Matthey. Motor manufacturers have invested billions of dollars on the development of hydrogen fuel cells and now have concept cars and buses being tested. Sanyo and General Electric are two other household names with strong interests in alternative energy technologies.

**A new value chain**

The drive to reduce emissions and produce greener sources of energy presents domestic CHP technologies with a golden opportunity to become established. We believe that micro-power is poised to do to the energy and utility business what the personal computer did to the mainframe computing industry 20 years ago.

As a result of the trends we have outlined, the value chain for network utilities would change fundamentally. Local generation would displace large amounts of traditional generation capacity and reduce the role of the electricity transmission network, leading to the potential stranding of both generation and transmission assets within current investment horizons. The impact on the distribution network is less clear-cut. On the one hand, increased generation self-sufficiency within homes could reduce the need for electricity distribution, but, on the other hand, the export of surplus electricity generated would create new challenges for distribution businesses requiring the active management of two-way flows of electricity.

The services offered to customers could also change significantly. Rather than simply selling electricity and gas to households, there is likely to be a shift in emphasis to energy services – the long-term provision of energy-efficient solutions to provide domestic comforts, such as warm rooms and hot water. In the future, customers may enter into a single contract for a bundle of services. However, the services to achieve this could include the financing, installation and maintenance of a domestic CHP unit, the installation of insulation, and the sale of electricity and gas. Customers would benefit from a single supplier interface, reduced energy bills, increased reliability, avoidance of capital investment and the transfer of risks such as boiler failure.

These arrangements would also have significant attractions for suppliers. Not only would domestic CHP schemes be likely to benefit from financial incentives, they would also benefit from increased rates of customer retention, brand enhancement and opportunities for product bundling. Suppliers may also be able to exploit some trading and arbitrage opportunities as a result of the generation of surplus electricity. These trading opportunities will increase significantly as domestic fuel cells, with high power-to-heat ratios, become commercially available.
Before such a vision can become a reality, a number of institutional and technical barriers will need to be overcome. In order to fully exploit the potential of domestic CHP, energy companies would need to have much more information available to them, regarding the operation of their networks and the flows of electricity along them. They would need to find cost-effective technical solutions that enable them to aggregate and dispatch electricity remotely, and measure the flow of electricity both into and out of domestic premises.

The evolution of pervasive devices and nano-technologies may help companies to overcome these technical barriers. Traditional instrumentation and control vendors are pioneering the all-digital sensor. This sensor is self-calibrating and self-diagnosing. It will place a trouble call to a technician whenever problems are predicted or encountered.

The development of these technologies would have significant implications for utilities’ asset management functions, allowing them to monitor the condition of their assets remotely on a realtime basis. However, these technologies would also enable utilities to reposition from the passive management of distribution systems to the active management of bidirectional distribution flows. Miniature sensors deployed throughout an entire transmission or distribution network would give utilities access to data and information previously unavailable to them. Not only would the realtime energized status of distribution feeders speed outage restoration, but phase-balancing and line loss would be easier to manage, helping to improve the overall operation of the distribution feeder network.

The issue facing utility companies is to position themselves to be able to stay flexible and responsive to the challenges ahead – but not to over commit themselves by investing inappropriately. Increases in dCHP and renewable generation will lead to the risk that renewable investments will be stranded. Disruptive technologies will reduce the amount of electricity distributed but will require more connections to the network.

In our view, the likely timeline for all this looks more like 2010 than the more bullish estimates of 2005 that some analysts have predicted. Whenever it arrives, there is a significant potential here. For example, one million homes each with a 5 kilowatt generator would equate to 5 gigawatts, which is around 7 percent of the total installed capacity in the U.K. Utilities need to think about their strategy now in the light of coming changes.


**Between a rock and a hard place**

No one yet knows which technology, from the likes of wind, solar, fuel cell or Stirling engine is going to emerge as the winner. However, simply waiting and seeing is not a viable option. Utilities have to understand the implications of these technologies, continue to cut costs and still maintain the same high level of operational efficiency. They really are between a rock and a hard place.

With a lack of clarity on the timelines, utilities have to maintain their options for flexibility by preserving their existing investment in technology. To stay flexible and responsive it’s important to know as much as you can. Utilities need, at least, to know their intended strategic direction. To do that, they need ever more information about their individual assets, and that calls for the pervasive collection of data. As we have seen, the introduction of new technologies will only result in more and more devices being put on the network. To record the condition of assets, and advise utilities of work that needs to be done, information has to come back into a central repository where it can be used meaningfully. And that can only happen if the utility’s business applications are integrated closely to each other. Only by getting these issues right are utilities going to get the relevant, accurate, information that they need if they are to have high-quality analytics that will allow them to have the information to make the right strategic decisions for the business. Utilities can then understand how to build, invest or change the network, but still remain within an acceptable level of risk.

**A business lead technology strategy is vital**

To achieve this, the technology strategy for issues such as remote devices, mobile workforces, and business applications needs to be led by the business. A business-led technology strategy is vital. There is a fundamental need to build a mechanism that allows clear dialog about value creation between the business and IT and so close the gap between technology and the business. Technology can no longer be operated as though it is separate from the business. Utilities need to operate in an integrated way to release value from their businesses, with the help of technology, where appropriate. Some companies are already starting to do this.
Flexibility is the key. For example, there might be a breakthrough in pricing or a particular government incentive; utilities need to be in a position where they can adapt reactively and very quickly to reposition the business. Integrating these two previously separate strategies calls for an IT strategy flexible enough to align itself to changes in business strategy. This allows the business to work seamlessly with its partners and respond to changes. Utilities can focus on and manage asset management as a core competency to reduce the amount of work and the investment in the network; this will deliver better returns for them. The utility becomes, in effect, an information and knowledge-based business that can keep up a relentless pressure and focus on cost.

**The on demand environment**

IBM is making an investment in the on demand environment for utility networks so that they can have the type of technology landscape that will allow them to respond as these changes occur.
Figure 4. Figure 4 describes the operation of a utility company and the relationships that exist between its systems, its people, customers and suppliers. The environment looks complicated, but it's essentially a series of blocks that fit together to form a coherent and thoroughly connected business operation. At the top of the diagram, we see the five key areas of business from asset management to infrastructure that we discussed earlier. These are served by a number of industry-specific vertical applications and are connected to each other by the deployment of cross-solution business processes. These processes generally touch on various parts of the business. For example a customer reporting a fault would trigger interactions among asset records, information about materials, financial information and customer records. The adaptors that IBM builds create bridges between applications that are designed to eliminate the need for rekeying and the occurrence of human errors.
Traditionally, industry-specific applications have been poorly integrated with each other. In the IBM model above, an integration hub sits at the heart of the operation and manages and checks the flow of information among the business processes, applications, the asset management system, employees, customers and third parties. For example, if an employee working on an HR system enters the wrong personnel information about another employee, say the wrong tax district, the system would check the data entered against the payroll system and reveal an anomaly. In this example, the quality and cleanliness of data is improved in real time. The information captured is accessible through portals and via an executive dashboard that gives management access to high-quality analytic data.

As we have shown, there is an overwhelming imperative for change in the utilities industry that is being driven by changes in technology and legislation. Given the constraints they face, how do utilities move from where they are now to the kind of paradigm described above? They should begin where they will get the biggest impact for their expenditure. There are two obvious starting points.

The first lies in improving the efficiencies and effectiveness of the direct labor pool. Major European utilities have field workforces of up to 20,000 people. Mobilizing the workforce and claiming back the lost first and last hour in the depot could produce an enormous saving. And, when you have mobile devices deployed to employees, the quality of the information that you start to get back from those employees into your asset management system is much better; therefore, the quality of your data improves. By improving your asset management capabilities you will also see an improvement in the quality of the information you get back from your devices and a closer integration between asset management and the rest of the business. As we show in the next section, these two approaches bring proven benefits.
Case study

Mobile workforce implementation

For National Grid Transco (NGT) the key to achieving significant improvements in productivity lay in Project Quarterback, a radical plan to mobilize its U.K. gas distribution business’s field-based workforce. NGT, which delivers around half of the UK’s energy needs and runs Britain’s national gas emergency service, faced an exacting regulatory review and the need for dramatic business transformation. NGT must comply with the industry regulator’s price control review for 2002-7, which demands a reduction in controllable operational expenditure of 25 percent over five years, with two-thirds of the savings delivered before the end of 2004.

NGT’s plan was to equip its workforce with a technology platform that could help the business achieve a radical change in operating performance and efficiency, and a significant improvement in data quality that would maintain or even enhance its safety regimen.

Transco’s large, mobile, field-based workforce is responsible for:

- Responding to publicly reported gas escapes
- Repairing mains and service gas lines
- Replacing gas mains
- Carrying out meter work
- Maintaining the gas distribution network.

NGT’s long-established, paper-based processes were incapable of supporting the radical changes needed to transform the business. The concept of a technology-enabled mobile work force had been successfully tested during a regional pilot, and the price control review provided the incentive to implement it nationally. The pilot demonstrated that an IT solution in all its complexity could be designed to deliver all the benefits, while maintaining the simplicity of front-end processes to make it easy to use by the workforce. The pilot also proved that the field force could adapt to, and enjoyed using, laptops.

Implementing mobile workforce technology would allow NGT to schedule and dispatch work to engineers equipped with ruggedized laptops and personal digital assistants (PDAs). General Packet Radio Service (GPRS) technology could then be used to collect realtime data in the field, automate back-office processes and support business-to-employee connectivity.
NGT’s executive opted for a strategic solution based on the Advantex system from MDSI in Canada. Advantex offered proven “workhorse” reliability, functionality and, crucially, the scalability required for a system that would need to connect to nearly 8,000 field users. With this move came the adoption of a full lifecycle approach to implementation, with the program assuming responsibility for managing the end-to-end process from definition of business requirements through design, testing and delivery of the resulting system, to coaching the business to achieve optimum benefits from the system. This reflected the increased complexity and criticality of design inherent in the expanded scope of the strategic solution.

Over 18 months, NGT worked with more than 50 IBM Business Consulting Services consultants to implement Project Quarterback, which became known as QB<sup>5</sup>. The role drew on the consulting team’s extensive track record in the technical and business change aspects of technology implementation, both with NGT and elsewhere, and specifically, in its hands-on experience of mobile workforce projects.

IBM also provided subject matter experts from a wide range of our portfolio of skills, including:

- Program and project management
- Process design and improvement
- Supply chain management expertise
- Change management and organization design
- Technology solutions design
- Systems integration
- End-to-end system testing
- Training.

QB<sup>5</sup> is set to become one of the world’s largest utility applications of Advantex, with 7,000 connected users and a potential for 2,000 more. Only Telkom of South Africa has more connected users (over 13,000), but NGT’s configuration provides considerably more functionality to meet the requirements of a range of gas distribution processes.
Quarterback revolutionizes the way that NGT carries out operations in its Gas Distribution Business. The solution addresses common improvement themes behind each of the different business needs and types of work, driving benefit through:

- Maintaining, and even improving, safety performance in the field through the availability of accurate, realtime information
- Effective work allocation from optimized planning and scheduling, decreasing the amount of travel to increase the amount of work spent on the job
- Dispatching work to teams in the field, removing the need to return to depot to collect work instructions and equipment
- Removing a multitude of paper forms, each of which must be returned to regional centers and then entered manually into control systems
- Removing errors through manual rekeying of records by collecting realtime data directly at source
- Implementing a single, consistent suite of national processes and ways of working
- Connecting the staff in the field with the business, providing them with direct access to company information that until now has been invisible.

In real terms, within the networks business alone, this equates to:

- The ability to work on 287,000 more gas leaks and pipeline repairs every year
- Response to more than 100,000 gas leaks calls annually
- Replacement of the 4.5 million paper forms currently completed in the field
- An annual reduction of more than 15 million miles in the distance driven by frontline response teams, saving 2.7 million liters of fuel
- More than 2.6 million working hours enabled to be reallocated every year to repair more gas leaks
- Attendance at 315,000 more meter appointments every year.

QB\textsuperscript{5} also provides comparative data on team performance, giving a new and greater level of field team performance. In this way, QB\textsuperscript{5} provides the engine for a new performance management framework and is a key enabler for a shift in performance and the delivery of value.
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About IBM Business Consulting Services

With consultants and professional staff in more than 160 countries globally, IBM Business Consulting Services is the world’s largest consulting services organization. IBM Business Consulting Services provides clients with business process and industry expertise, a deep understanding of technology solutions that address specific industry issues, and the ability to design, build and run those solutions in a way that delivers bottom-line business value.
References

1 Stirling Engines (designed by Robert Stirling in 1816) work by the expansion and contraction of gas, to move a piston, when heated and cooled from external sources.


5 Ibid.

6 Ibid.