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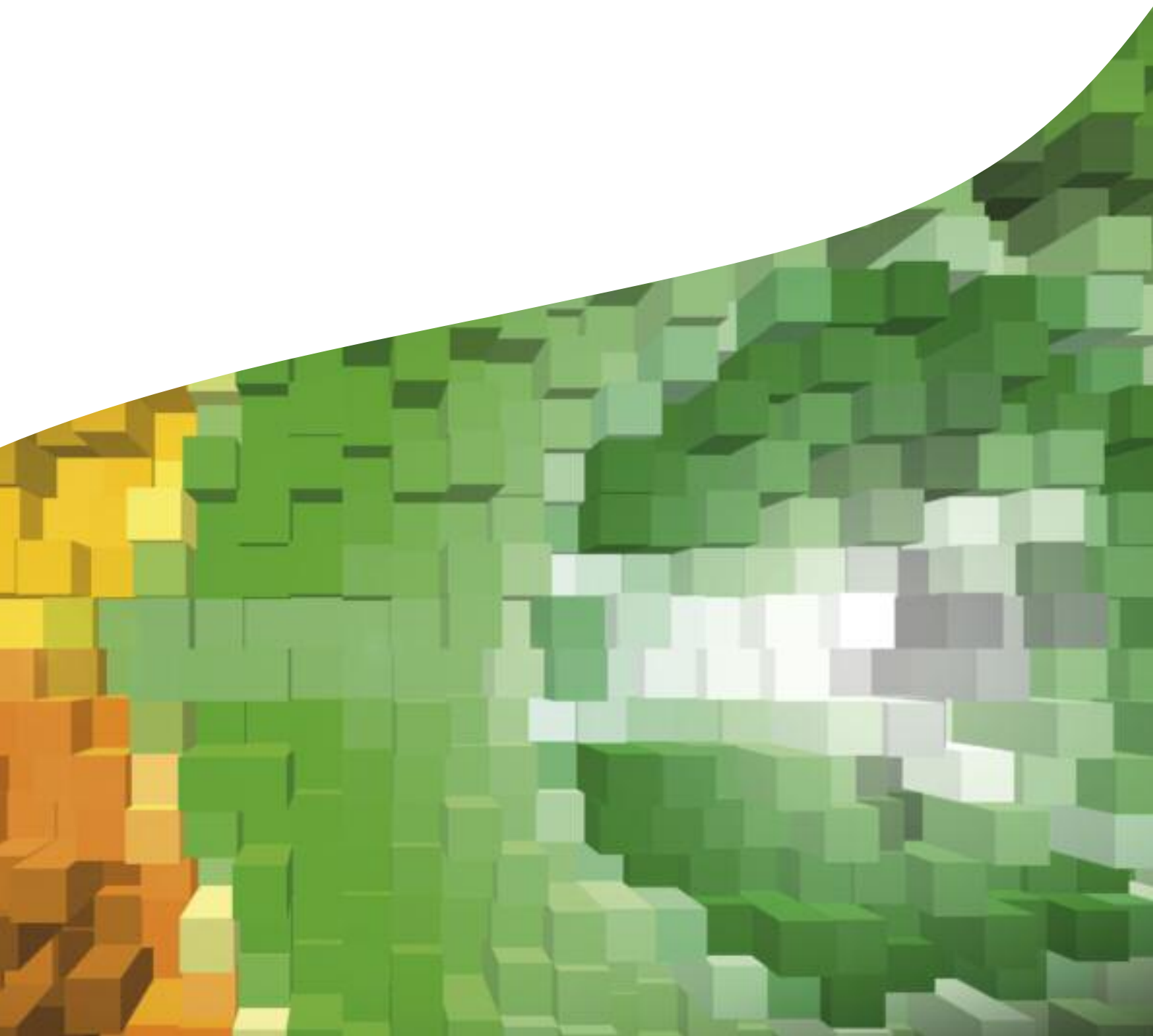
TechnoVision 2012 For the Utility Industry

Point of View by Doug Houseman



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2020

Sitting in the train, Michel realizes that the lights might still be on at home. Taking his mobile phone out of his pocket, he quickly queries his avatar and asks for the status of power in his apartment as well as the latest power prices applicable. The avatar—a small software engine—pulls information from the home control system, the utility company, the weather agency, and the home security system. The avatar reviews the information and reports back that the lights in the kitchen are still on and that the (per unit) cost of power will be at its peak during the day (the temperature is expected to set a new record high for the day). Michel hits a few quick keystrokes and turns off the lights and reviews his program for saving money on power. He determines that he can save additional money by opting to allow his energy provider to drain the battery on his car during the day today and recharge it on Friday night (he will not need the car until Saturday). A few seconds later, Michel knows that he has done what he can to reduce his power consumption and minimize his bill for the next few days. As Michel boards the train and electronically pays for his journey through his mobile phone, the avatar tells the apartment to bring the temperature down to a reasonable level, having turned off all sources of electricity consumption during the day. Since Michel worked late and is boarding one of the last trains of the day, power prices have already dropped and so the home control system begins the process of cooling the home. As the train gets closer, the avatar enables the media devices in Michel's home and returns the television and cable boxes to their previous state so that Michel will not need to spend time resetting equipment that has been turned off during the day. Watching the power price, the avatar projects that the price on Friday night will be higher for power than currently; it starts recharging the car battery. Michel checks his phone and finds that his apartment used just 3 kilowatt hours (kWh) of electricity during the peak period, down from his old habits of using more than 10 kWh when he was away from home. This reduction on a critical peak day is saving Michel more than €7 a day (assuming a flat rate of €1 per kWh), more than enough to buy a dinner on the weekend or maybe upgrade his phone to a newer model with a voice activation system. For Michel, letting his power retailer set up the control system and provide him with an avatar was almost painless. For the environment, it was priceless. It has had very little impact on his lifestyle, other than giving him more money to spend at weekends.

Introduction

In the IT industry, five years is a very long horizon; it represents more than two generations of change in the industry; in some cases, even three. Major software vendors release new versions of key software platforms every 12 to 24 months. Hardware that is cutting edge one month is commodity six months later, and laggard a year after release.

For the utility industry, the future can be seen through two sets of lenses: The first is the typical IT organization, supporting business operations. This part of the organization is working hard to put in place many of the key strategies for "TechnoVision." The other set of lenses needs to look beyond the enterprise (typical back office, data center, or professional worker) into the field that the industry operates in. This space understandably moves at a different pace than the office. The asset base in utilities is typically more than 30 years old, which is about half its useful life. It is not unusual to find devices acquired in the 1950's that are still in use. Specialized skills and certifications are required in order for a potential candidate to qualify for a majority of positions in such organizations. Many tasks are still manual, with little or no communication between different departments or locations. For example, in the city of Chicago, fewer than 2,000 sensors control all of the electricity for more than five million customers. Knowledge of what is happening is very limited in the field; the best sensor today is the customer with a telephone. Even IT systems move slower (many parts of the system are still running on dated DEC VAX platforms, hardware platforms that have been out of production for more than 15 years). Reliability has been the driver for change in this part of the industry; only when the reliability of newer technology is proven over current technology, and has a lower Total Cost of Ownership (TCO), does it begin to gain a toehold. Acquiring totally new systems to replace aging ones can take decades—from drawing board to deployment.

This slow pace is changing. With global warming, carbon reduction, aging workforces, and several other challenges, utilities have no choice but to modernize. Nowhere is this more apparent than in California, where for 15 or more days each summer, the power company has no choice but to switch off power to some of its customers for hours at a time. If the current work in Iraq on the electrical system is completed and left intact, Baghdad will have more reliable power in the summer of 2008 than San Francisco. Roughly a third of the total carbon output in the world is created by electricity generation. With a push to reduce carbon, the existing electricity industry will be strained to both cut carbon and support the annual growth of 1.2 to 1.4 percent in consumption by existing customers, not to mention the growing global population that will further increase demand. In China, the answer is to build 100 Megawatts (power for about 200,000 Chinese homes) of new coal-fired power-plant capacity each and every day. In India, the answer is to create new economic zones that will add 80,000 megawatts of coal-fired power plants over the next 15 years. Given current trends, these two countries will be the two largest users of coal in the world.

If everyone knows that coal is harmful for the environment and that cleaner methods for power generation are required, why do some countries continue to build coal-fired plants? The answer is simple. Coal is cheap, easy to find and locally available. And, technologies to harness power from coal are mature and proven. In summary, coal has all the elements that the next-generation utility needs to minimize risk and provide reliable power to their customers, allowing for environmental safety and health concerns. Nuclear power takes too long; wind and solar sources of energy are variable and expensive to harness; biomass demands too much land to produce—the challenges with alternative sources of energy go on and on.

The question that needs to be answered is: Can technology break this vicious cycle of growing demand and declining supply of conventional sources of energy? Or just accelerate it as people buy iPods, large screen televisions and other power-hungry consumer devices?

Introduction to TechnoVision 2012

The story at the beginning of this document is based on a technology vision of the future, which is in turn based on trends that we see today in cutting-edge segments of the market. This is not pure science fiction, but rather how people are beginning to operate on a day-to-day basis. We are seeing vastly different skills in the market among young professionals who are entering the workforce today—they are thinking very differently about how a business should operate and how to connect with companies and customers. The basis of our "TechnoVision" is seven technology clusters.

Technology creates freedom throughout the layers of an organization primarily due to the following technology clusters—six real, and one virtual (Open Standards and Service Orientation) that underpins all of the others:

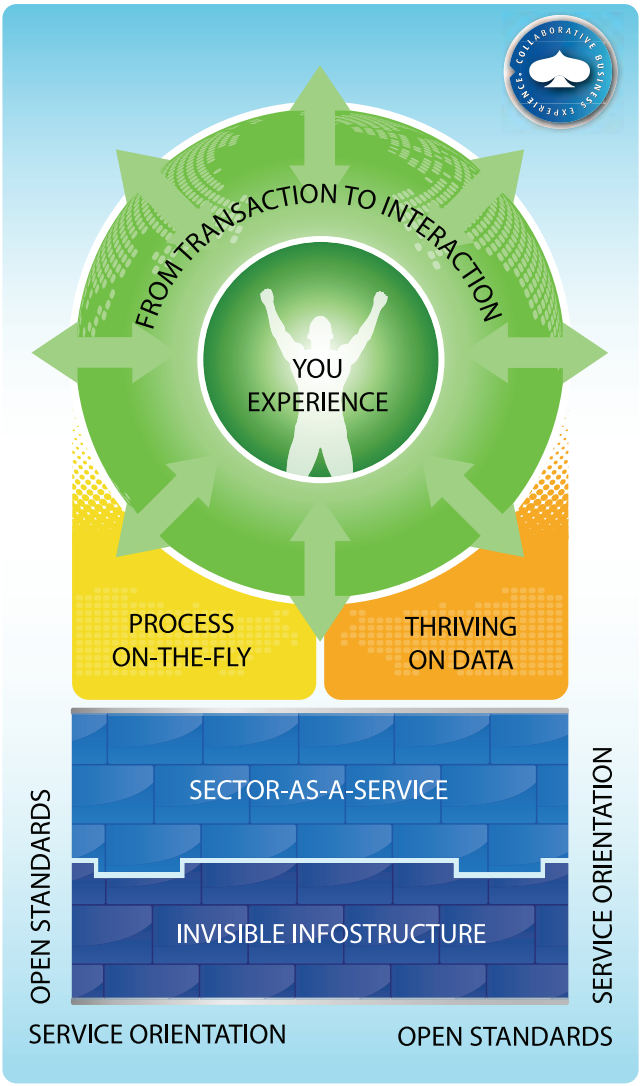
1. The **You Experience** cluster introduces a new generation of user interface technologies and Internet-based collaboration platforms that make for a compelling, highly individualized experience. Through it, users connect freely to the outside world to act, interact, collaborate, co-create, learn and share knowledge. It's "You, the people" who are driving this global shift.
2. The shift from **Transaction to Interaction** involves organizations and individuals in a steady, continual rhythm of learning, experiencing, creating and collaborating. "Changing the game" and creating new value and growth through business innovation is the challenge here, with markets, players and consumers constantly shifting positions. Global "open" markets, where the information on what is for sale and by whom is transparent and available, vastly increases competition from the level experienced in the existing localized "closed" markets built around long-term relationships among a handful of buyers and sellers.
3. **Processes** will be assembled **on-the-fly**, by orchestrating the building blocks of underlying services. Organizations will need to change their processes in near real-time to quickly reflect and accommodate changes in the business ecosystem. The underlying information systems that support and enable these processes must consist of fine-grained, configurable services that can be freely composed and orchestrated into new solutions.
4. Detailed insight into crucial data is a necessity for organizations that want to navigate a constantly changing, information-rich environment. Enterprises that know how to connect the use of data to their strategic objectives are literally **Thriving on Data**. These organizations are continually reading, analyzing and reacting to information inside and far outside the company boundaries. Intelligence will be an integrated, fully embedded part of the desktop of every worker in a company, supporting real-time decisions on the spot wherever and whenever they are needed.
5. **Sector-as-a-Service** will help organizations focus on differentiation by providing standard and non-differentiating business services "on tap". This is achieved through little-customized implementations of standard software, through the generation of systems out of reusable industry reference models, and by stabilizing and then "service-enabling" the existing legacy systems. Delivering business services through a SaaS (Software-as-a-Service) approach is just a further step towards supplying integrated business services—including processes—as an in-sourced or outsourced business process utility.
6. **Invisible Infostructure** is the end-state of infrastructure as we currently know it, using virtualization, grid and automated management technologies to deliver infrastructural services—including all facilities to securely capture, store, exchange and process (inter)company information—as a commoditized, preferably invisible, utility. Eventually, even core business services will merge into it, creating a true "business infostructure". An invisible infostructure captures and supplies information as if it were via the ether.
7. **Open Standards and Service Orientation** are the key movements that underpin the other clusters, making it a "virtual" or "meta" cluster. As more organizations rely on intelligence from outside the corporate perimeter, open standards for

"boundaryless" information flows are a necessity, both horizontal (infrastructural) and vertical (industry-specific). But open standardization is also crucial in the area of shared methodologies, frameworks, tools and even certification of skills and competences.

Far-reaching standardization and simplification is supported by loosely-coupled, easy-to-combine services. Service Orientation is the ubiquitous design principle that shapes solutions throughout the technology clusters.

Each of the technology clusters represents a shift. The combination of these shifts is driving the evolution of technology and of its applications, with major impacts on individuals, organizations, the economy and society at large. Essentially, many of the technologies and trends that are found (see Figure 1) in the bottom technology clusters (Invisible Infostructure and Sector-as-a-Service) help companies free themselves of the burden of having to spend a disproportionate amount of time and resources ensuring business control and compliance to rules and regulations. They form the organized foundation on top of which flexibility and insight (through Process-on-the-Fly and Thriving on Data) are differentiating and creating new value. Opportunities for this are often found in the outside world, in which predefined, predictable transactions evolve into a continually shifting "ecosystem" or "smart business network" of interacting players (From Transaction to Interaction, and materialized in highly individualized You Experiences). It is the capability to freely sense opportunities and subsequently collaborate that will determine success.

Figure 1: The seven technology clusters of TechnoVision 2012



Utilities Under Pressure

Generation of electricity is under pressure from people worried about global warming, and the ability to deliver it is under siege from the aging infrastructure that is in place today. The ability to continue to deliver more and more low cost electricity is in doubt in many parts of the world. The wholesale renewal of the electric infrastructure will have to take place over the next decade. During this renewal, the industry will have to determine how to integrate large numbers of renewable energy sources, live with the variability of those sources and find a way to reduce peak demand without destroying the quality of life for their customers. Businesses will make decisions about where to locate or relocate too based on the cost and quality of electricity. The changes will be some of the most radical the industry has ever undertaken and in many cases practices that worked in 2000 will no longer be recommended in 2015. Add to this that the vast majority of the work force that was in place in 2000 will retire before 2012. The new workers will lack some of the fundamental understanding of what is in place today, since they were not around when it was built, but they offer a chance to radically change the way the industry does business by being trained differently as they enter the industry. We lack the schools today to teach enough people how to be electric industry workers and the industry will struggle with the lack of qualified, experienced people for the next decade. To meet the goals of global warming and carbon reduction almost all fossil fuel electric generation facilities will have to be shutdown by 2020. The question is will the industry be able to develop an answer with new technologies to supply the reliable power society has come to expect?

Sources of water in much of the developed world are over-utilized and getting worse; more than one in three people around the world do not have access to safe drinking water and for those that do, the ability to consume all they want is rapidly disappearing into the past. In Australia, water will limit the number of people that the continent can hold, limiting growth, population and future options for people who live there. Even without global warming, Australia has hit the limits for growth from a water standpoint. Los Angeles and other western cities are not immune to this issue either; watering bans and rapidly increasing prices for water around the world are all pointing to significant challenges that mankind needs to address. In some parts of the world, sink holes are devouring parts of towns as ground water is not replenished at the rate of extraction and the land sinks; in some parts of Texas, the land has sunk more than two feet on average; some sink holes have consumed entire neighborhoods and farms. The estimate in Egypt is that some areas will take more than 1,000 years for the ground water to recover from the last 100 years of farming.

On the gas front, even the UK, which has been a net producer of natural gas for more than 50 years, is becoming a net importer. Prices in the UK used to be isolated from the world market, and gas was the low-cost heating and cooking fuel—it was even used to make electricity in many parts of the country. Today, the UK is building import facilities as rapidly as possible. These facilities will tie the UK directly to the world price of gas and petroleum, making it even more susceptible to the whims of the global market. The major producers of gas are all struggling to increase natural gas production to meet demand. Not only do people want more gas for heating and cooking, but power companies have switched to gas to produce electric power (in many cases the electricity is used to heat and cook) driving up demand faster and the price of gas even higher. More than any other utility, gas is subject to political considerations. Much of the global supply is in countries that have governments that are less stable than the European Union; alternative sources of energy are used as international leverage.

Industry Drivers

People

The utility industry is changing rapidly. Globally, more than 50% of employees in the industry at all levels in 2002 will have retired by 2012—the largest turnover in staff in the industry since the early 1970s. This is as a result of hiring and growth of the industry at the end of World War II and an average period of 30-35 years that most people have as a career in the industry. The void will be met by a new generation of people with a very different view of technology, similar to the dislocation that happened in the 1970s. Additionally, regulators are pushing changes to the industry configuration—mergers, acquisitions and unbundling are being caused by changes in the compliance laws and regulations that govern the industry. These shifts will in turn change how utilities operate and how they communicate. In many cases, the changes will cause significant increases in the complexity of operating what is a real-time network. In the office, more than 50% of employees who work for a company will not have been employed in the industry in 2004. In field operations, that number may be as high as 70%. Academic institutions that have not offered degree programs to support the industry since the 1980s are gearing up to create a new generation of employees for the industry.

Regulation and Compliance

Regulation is changing as well. Ordinary people do not care where their power, water or gas comes from; the source should be invisible to them. They do not want restrictions on what they can consume or when nor do they want the price to rise. Regulators are walking a tight rope, trying to balance the need for more consumption with one to protect the environment as well as make the infrastructure as transparent (to the consumer) as possible. In the US, a proposal to build new windmills in the North East encountered more than 12 different regulatory bodies with the power to impact the project. The result: after more than five years into a project that everyone agreed offered a greener, cleaner alternative, the project stalled because a few people did not want to see windmills near their backyard. Similar regulatory issues exist in much of the world.

Regulators also have to deal with keeping the cost down. Regardless of who you talk to, the reality is that coal-fired generators are still cheaper to build and operate than any other source other than very large hydroelectric dams. The sites for dams are mostly taken (and they have their own issues with regulators and environmentalists), so coal is the fuel of choice for most new projects where reliable power is required. Regulators are forced to allow new coal-fired power plants and then try to offset them with wind and other renewable sources, but they then have to deal with the backlash from the few who live near the sites that are picked for renewable sources. They have to deal with rising costs for gas, coal and other fuels, and the upward pressure it puts on the cost of electricity and gas. Some customers have seen price increases of more than 100% in the last two years. To keep prices down, regulators are reducing all the other allowed costs in the industry, slowing the pace of change by starving investment in many areas of the world. Some regulators are realizing this is an issue and directing investment in specific areas to try to improve efficiency. Today, the industry provides the highest reliability ever in the developed world with the smallest number of employees since World War I to more customers then ever before. The industry does this using one of the oldest infrastructures (in terms of average age) ever. The question is can regulators keep the balance of affordable water, gas and electricity with high reliability and minimal environmental impact? It is not a job for the faint hearted!

Technology

The change in technology in the utilities sector is greater than any other industry—except maybe the IT industry itself. For the first time ever in 2007, the venture capital community made the utility industry the third largest sector in terms of venture capital investments—after Health and IT, the rate of growth in utilities investment is the fastest for any industry. More than a dozen new funds have been announced in 2008 to look at the utility industry and its needs; after all, it is a multi-trillion dollar opportunity for renewal in the next decade, and the investment in the utility sector globally will probably exceed any other industry for capital investment. Technology changes range from changes in the way that wires are made, how they are

placed, and how they are maintained, to generation of power and beyond. No part of the industry is immune from technology change. In Japan in the last decade, utilities have spent more on the renewable component of their business than any other industry, and it shows—Tokyo is the most modern water, gas and electricity grid in the world, with reduced losses from leaks, lesser outages from grid problems, and reduced amount of maintenance required for the grid. In short, Tokyo used a strong infusion of funds to leapfrog the rest of the world, and provide tens of thousands of jobs during a time when the economy was struggling. Unlike Los Angeles, Tokyo is ready to support the needs of her citizens for the next 20-30 years, because she has strongly embraced new technologies. Capgemini, working with CEATI and EPRI, has identified more than 400 technologies that will impact some part of the utility industry over the next decade.

The utility industry is not only ripe for a technology revolution, but is being driven towards it by the changes in the environment that it exists within. Leaking water pipes, power outages and other problems cannot be tolerated in the future. Steep increases in prices are also not acceptable either. This means the industry has to find ways to change in order to provide better operations and maintenance, without breaking the bank on capital investment—a tall order for an industry that has been one of the most conservative since the 1960s.

TechnoVision in the Office

The office is the easiest place to start. Like other industries, most workers are concentrated in the office and do similar work to that found in other heavy engineering companies. Engineering, customer billing, call centers and other standard services dominate the office portion of a company in the sector. The seven clusters all apply here without issue, and in many cases they can be rapidly put in place with standard tools and techniques.

1. You Experience

Younger professionals are already familiar with user interfaces that confuse and slow down many older counterparts. First person games that place the user directly into game scenarios is standard fare for younger computer users; they excel in them. Young engineers are showing how they can use such simulated interfaces to virtually "walk" along the piping system in a newly designed plant, looking for problems, or to navigate other 3-D models looking for issues or answers. In one such case, the interface was used to review pipe x-rays to find spots in pipes that needed work during an overhaul. In other cases, young engineers are collaborating on online platforms like Second Life to create new designs and ideas that go on to form the basis for system improvements in the utility industry. One such collaboration resulted in the design and layout for a volunteer group to put a set of windmills in place in Africa to support a group of villages. No one member of the group had all the right answers, but by using Second Life and a Wiki, the group was able to attract the right people to solve the problems they were encountering. The windmills were installed in the spring of 2008 with the expected results. Consider an experimental class, where special glasses (think Robocop!) are issued to new students so that they have an ability to receive training as needed while working on fixing issues with equipment. The younger the student, the easier it is to leverage technology in this manner for just-in-time training. The issue now is to bite-size and tag the training for more requirements of the job. In the long run, the on-demand training could reduce the time it takes for a worker to be effective from three years to under a year.

2. From Transaction to Interaction

In the example above, some of the advanced students added cameras and microphones to their uniforms at school. They decided that the "canned" training material provided did not fit the way they worked and filmed new segments with narration. These segments were originally deemed unacceptable by the training staff, but have been put into the library, based on the informal sharing that was done by the authors. The result is that this new training content has been more than twice as effective as the material built by professional trainers. In the procurement world, exchanges were the rage in the late 1990s when the Internet bubble was still growing. Today, the idea is to have buyers and sellers work with each other in collaborative forums. There are a number of companies that are using commerce tools that provide a collaborative environment so that vendors can tap into the experts in the company and determine the real needs of the buyer. In almost every case, the procurement environments are run and operated by the buyer—not the supplier—and they are heavily controlled, limiting their effectiveness for collaboration. In two cases where the environment was opened up to more collaboration, the buyers ended up with new suppliers and better prices. The surprise was that the equipment sourced was also a better match to the company's needs. As more complex engineered products are procured through these kinds of systems, the need to collaborate will grow, so that the end result will match the needs of the buyer. And as the ability to share 3-D and other models grows, the ability of suppliers to

1. You Experience: Direct impact examples	
Design	New Computer Aided Design (CAD) software interfaces and quality assurance methods used by engineers to visualize new and existing designs
Engineering	Team work applications that allow distributed teams to work together to solve problems as they emerge. Rapidly drawing engineers into the field virtually to approve changes in work orders or to solve problems
Clerical/ Accounting	Tools to allow people to arrange their working space in the most efficient way possible—as an extreme example, think of a first person shooter for an auditor moving through expense records

provide better bids, lesser cost overruns and fewer missed completion dates will occur. This is not to say that using the tools will mean that the initial bid will be cheaper, rather that it will be much closer to right for the project in question.

3. Process-on-the-Fly

In the industry, nothing causes the need to rethink how things are done more than a major natural disaster. Even with planning and drills, there is always a need to rethink what is happening on the fly. In New Orleans, the real problems did not start until almost a full day after the hurricane had passed. In many cases, people thought that the city had only suffered minor damage. That turned out to be false because of delayed reaction to the failure of dikes and floor walls. The consequence was that New Orleans was mostly underwater; pumps and other devices that should have dewatered the city were inoperable. Many plans did not work as they were designed to. From a program management view, there was little that could be done for New Orleans, but Florida learned from the experience. A few months later, when a late season storm tore apart already weakened poles, the result was that Florida Power & Light Company (FPL) had planning in place to allow for an ad-hoc solution. The storm, not expected to do much damage, knocked down more poles then any other storm of the season. FPL used web conferencing and other tools to reach out to other utilities and get replacement poles sent. Not only were the poles the right length, they also had the right equipment attached when they arrived, saving hours on each pole. The engineering and procurement teams were able to reach out to their counterparts at other utilities and get fully equipped poles shipped within hours, reducing the time it took to bring customers back online and setting a new record for power restoration.

2. From Transaction to Interaction: Direct impact examples	
Training	Peer-to-peer training, delivered just in time
Purchasing	Movement from 90 day plus long Request For Proposal (RFP) to an interactive process where each vendor can respond to individual queries in real time and interact with the key buyers in the organization. Moving beyond the electronic commerce systems of today that are largely unwieldy
Customer Service	The ability to share information between different locations in the organization and even beyond, with customers themselves impacting how they use services

3. Process-on-the-Fly: Direct impact examples	
Emergency Coordination	Rapid process creation that can assimilate partners to solve emerging problems with procurement and delivery
Demand Management	Combining needs of key customers together for a coordinated load reduction between them to minimize production impacts. Allowing each to see the process impacts of power cuts
Water Treatment	Seeking synergy between health providers and water companies to track issues with water-borne illnesses and allow the utility to stop supply from impacted areas until pipes could be flushed. This allows rapid segmentation of the water system and minimizes impact of a disease epidemic or contamination

4. Thriving on Data

Data has been the bane of most utilities companies; not that they have had too much, but rather they have had too little. For example, not enough data to understand why a piece of equipment failed, and why a customer had no water or power, or not enough data to segment problems and understand the impact. This is changing in the field and the office is now looking to catch up. Vattenfall, which has installed more than 1 million new meters in the field, is now reaching out to discuss how they use the new-found windfall of data. They receive more data in a single day from a meter than they used to get in three years. The question now is, "What can they do with the data to make the investment in sensors pay off?" The use of data is making it possible to determine what needs to be done in the field and communicate the plan to workers in the field. It makes it possible to look at the spare parts inventory and determine if some spare parts are in short supply before a crisis arises. It allows the team working in the call center to reach customers with repair messages even before they pick up the telephone and complain. A video showing this was a major hit when Xcel Energy first created it in 1999, but the project never delivered on the promise. Vattenfall is starting to show how to deliver on this and other promises. Not only did the tools for the data have to get better, but the tools in the field had to get better as well in order to realize the Xcel vision.

Data will come not only from inside the company, but outside as well. In trading and risk management, companies that rely on their internal information only tend to leave more than 20% of the potential profits on the table for their trading partner, making them popular partners to trade with, but minimizing the value of their trading organization. In one case, Duke Solutions subscribed to river water temperatures and knew that a neighboring utility was going to have to limit power generation on a

very hot week. This power production curtailment led to a 500 times increase ($30 - $15,000) in power prices for a short period of time. Duke, having two days warning with the external information, was able to supply the demanded power, and at significant profit. The knowledge of what data might be important and systems to monitor that data resulted in a two day payback on a project that took more than two years to bring to life. By being able to receive and process external data in a short enough period of time to make it practical for operations, Duke was able to plan and execute in a way that none of its competitors could and provide critical services to neighboring utilities when they needed it most.

5. Sector-as-a-Service

The International Electrotechnical Committee (IEC) embarked on a path in the late 1990s to develop an industry standard model for data—the Common Information Model (CIM). IEC CIM is the basis now for many packages that are entering the market or going through major upgrades. Prior to this work, as well as an effort carried out by a group of mid-sized utilities on an industry interface standard called Multispeak, the sector lacked a framework to have a discussion about Sector-as-a-Service. However, with these two standards beginning to make major inroads into standard off-the-shelf packages, it becomes reasonable to assume that some day most key office software will be offered in a standard format, ready to run either onsite of offsite. With major implementations of standard software running at between $50 and $100 a customer, this change is needed in the industry. If, say, a customer has a $100 monthly bill and the regulated profit in the bill is between 8-10%, implementing a software package costing $100 per customer means that it will take up to 13 months for the enterprise to recoup its investment for that customer. In an industry that thrives on steady and known returns to shareholders (utility stocks are known as "widow and orphan" stocks because of steady dividends); it is not possible to do this very often and remain in charge of a utility. With a number of major software packages (Financials, Customer Billing, SCADA, Smart Metering, Demand Management, etc.) needing updates in many utilities, getting to a low-cost implementation package will be critical to keep people from losing their jobs. In one case, the regulator in Michigan is asking for reasons for cost overruns from both major utilities in the state on similar projects, in which both had overruns and very dissimilar price tags—an issue the regulator wants to understand. Being able to hand off routine, non value-added processes where differentiation is not going to make a big difference to the profitability of the company will allow them to focus on the key things that really make a difference to profitability and service to customers. In the case of PSE&G when the regulator forced it to disaggregate, the decision taken was that the office functions would move to a shared service format. The in-sourced organization provides most of the key office functions with a very standard way of working. Each organization was given the ability to contract elsewhere after 18 months if they could find a lower cost solution that provided the same quality of shared services. In more than 5 years, no part of what the shared service center does has departed to an outside

5. Sector-as-a-Service: Direct impact examples	
IT	Ability to rapidly add or change an application package in the enterprise and rapidly interchange information for new needs
Smart Meters	For smart meters, many companies need a fraction of the data that can be produced and they are not data warehouse specialists; this will allow third parties who specialize in massive data management issues to provide the service in a transparent fashion
Disaggregation	Utilities have traditionally been vertically orientated, up to and including manufacturing their own equipment. In traditional BPO or outsourcing, the service provider takes a whole process, which is usually the beginning or end of the process. In the future, they will be able to take a step or two out of the middle—like receiving and inventory management out of warehousing

4. Thriving on Data: Direct impact examples	
Trading	Ability to navigate internal and external data sources and tie them together based on today's needs to find hidden opportunities
Warehousing	Ability to navigate old versions of databases to find where lost inventory might be hiding to solve an emergency—rapidly reaching into archives that are today completely unavailable
Planning	Linking seemingly unconnected databases together to predict changes in load in an area using information such as consumer spending, appliance efficiency trends, census data, building permits and land use planning
Engineering	Discovering hidden information on the location of buried services by being able to navigate online local newspapers and other unstructured data to find information on where work was done and when, and then correlating it with digital versions of old street maps

company and they have driven down the cost of the standard processes, each and every year.

6. Invisible Infostructure

In the office, an invisible infostructure will be critical to the future. The robust set of technologies that represent plumbing for an organization will need ever higher capacity, lower energy consumption and higher throughput. It may be invisible to the average user, but the people who maintain it will find that key critical components will make all the difference in the world to how the infostructure performs for the average user. In the industry, security requirements are rapidly increasing as governments and regulators are working hard to make sure that people are safe and their source of heat, light, water and life is secure. Secure data hubs to share data between all market participants in a country or Virtual Private Networks that offer employees the opportunity to telecommute, are critical pieces of the infostructure for the future utility. Green data centers that consume up to 70% less power and peak, and shift the cooling load to off-peak times, are important to minimize the impact on hot days. A poorly maintained infostructure helped hide the growing issues with the grid in the United States until the grid crashed in August 2003, and with it, the power for more than a quarter of the population of the United States and Canada. Done right, the infostructure can offer much more in the way of capability in a much more reliable fashion.

7. Open Standards and Service Orientation

It goes without saying that most of the companies in the industry have to exchange data both inside and outside the industry. Standards like IEC CIM and Multispeak, as well as the Open Financial Exchange (OFX), offer the ability to rapidly move data between enterprises with little overhead cost. Moving to industry standard packages, whether from major vendors or from industry consortiums, is also important so that the cost of research and development is shared between large numbers of customers. Platts and other data providers have accepted standard data formats for trading and other external financial information, reducing the cost to everyone. In a number of locations, standard data hubs are in place. One of the first, in Ontario, Canada allows all market participants to reap the benefit of the exchange, reducing transaction costs to market participants and ultimately to end customers.

While no single one of these changes is radical, the whole chain of changes taken together is. Let us look at an example:

An engineer discovers a need for a new pump to move water from a deep pit to a new pipeline on a construction site. Working with other engineers—both inside the company and elsewhere—the specifications are developed and published to the general public. Interested suppliers are able to interact with the engineer to provide potential specifications and fine-tune proposals. The accounting team can review and shortlist potential suppliers, ruling out suppliers that have potential delivery issues. Once that is done, the proposal process can proceed in an interactive basis, including live video of similar equipment in operation. The pump can be purchased, shipped, received and installed, and payment processed. This looks like a routine purchase today, but without TechnoVision, the process would typically take weeks. In a test of new technologies, the process listed above took less then 96 hours, without extraordinary effort from the participants involved, to complete the transaction. More than a dozen suppliers participated in the trial. In the office, the TechnoVision starts by accelerating the bottleneck processes and moves from there into integrating the skills of young workers into the industry, improving overall productivity.

6. Invisible Infostructure: Direct impact examples	
Call Center	Infostructure allows call center agents to work from home without having to commute
Meetings	Transatlantic meetings and workshops can be held in multiple locations using tele-presence systems, reducing international travel and increasing available working time
Energy Efficiency	More efficient data centers and IT-related devices reduce energy consumption for the first time since the 1960s, despite an exponential growth in IT use

7. Open Standards and Service Orientation: Direct impact examples	
Peer to Peer Power	Micro Generators will be able to effectively participate in the energy market without having to use aggregators or force incumbents to buy power from them at fixed prices
Accounting	Rapid setup of new suppliers and automatic updates of credit and performance information
Customer Accounts	Movement of customers from using checks and credit cards for payment to direct payments from bank accounts—synchronized to customers receiving pay from their employers

TechnoVision in the Field

While TechnoVision will bloom rapidly in the office, in the field it is a different story. Not that the field would not greatly benefit from TechnoVision, the question is if the pace of deployment of individual building blocks required to deliver TechnoVision into the field can be sustained. In this case, the field comprises all the generation plants, high (and low) voltage networks as well as field engineers that maintain the networks.

1. You Experience:

With the high turnover of field workers, it is highly possible to deploy new interfaces and capabilities to the field for collaboration and productivity. You read the example of the training story that started in school in the previous section. Now translate that into the field with trained field engineers, using just-in-time training to support all of their work and therefore avoid a need to set up large numbers of skill categories and/or certification programs. There is nothing wrong with certification or skill groups, but when they grow to the point that only one or two people in the company can do a task, it gets very unreliable and risky. If a skilled individual is unavailable for any reason, the task may not be accomplished and leave consumers without water, heat or lighting. In the new world of training-on-demand, general certification and on-the-job assistance from training video snippets will mean that many more people will be able to complete a task successfully than is the case today.

2. Transaction to interaction:

Working together to solve problems is critical; waiting for an engineer or contractor with specialized knowledge to appear onsite will tax the ability of the company to complete tasks and maintain service to customers. Allowing distant collaboration as in the case of FPL and going further to allow interaction with any professional as may be necessary is critical for future productivity. In the June 2008 issue of Harvard Business Review there is a discussion on liberating the steps in the business process so that they can be bought and sold by anyone. This is already happening in some progressive industry players like Asplundh, where they offer individual steps in the field process for purchase, allowing customers to decide how much of the field maintenance and construction they want to turnover to a third party contractor, and when they want to do so, allowing them to balance work between long-term skilled internal workforce and outside contractors. Engineers can be tapped on issues that do not appear in work orders and offer suggestions or solutions in near real-time, avoiding return visits or instances of customers receiving unreliable service.

3. Processes on the Fly:

If one has the capability to buy and sell process steps, then it becomes possible to try different processes rapidly in the field and determine the right steps, the right order and the right mix of internal and external staffing to complete the task in the minimum amount of time. With the cost of field work constantly growing (cost of material, labor, fuel, etc.), it is important to be able to rapidly assemble more cost-effective processes and teams. Done right, some utilities are showing a cost reduction of more than 30 percent on the old way of doing things—Aquarion Water has taken some of the biggest first steps and as a result has improved on their non-revenue water (leaks) while bringing down the overall cost of construction and maintenance. Water quality is up, while plant staffing is down and the reliability of the overall system is also up. In the electric industry, some companies are choosing to assemble work teams almost on the fly for construction jobs, and fully on the fly to deal with emerging outages, mixing and matching the right skills and equipment to get the job done quickly and cost effectively.

4. Thriving on Data:

With the advent of automated feeder switches, distributed energy resources and smart meters, the amount of data coming into the enterprise is growing by leaps and bounds, but more importantly, a few utilities are allowing their field teams to access this data directly, while still in the field. This allows the teams to understand what is happening and why, work through solutions on the fly, and analyze the impact of changes they are thinking about. Strong decision support software is being put into place by companies like the Southwest Water District in Florida, to allow operators to know the full impact of moving a flood gate or starting a pump. In Wisconsin, the ability to really analyze data coming in from the field and overlay real-time weather and satellite imagery on the

data makes it possible to determine where there are issues in the field with trees, loose splices and various other issues that impact reliability; however, these issues might not show up until the weather gets really nasty, making repairs that much more hazardous. In summary, by carefully analyzing the information that does come in from the field, prevention is possible, reducing overtime and safety issues.

5. Sector-as-a-service:

There is no question that there is a lot of change that will happen in the field for most utilities, nor is there any doubt with the notion that much of that change could be assumed by third party contractors. But more importantly, there is a growing contingent of companies that offer engineering documentation, red line update services, and other information support services remotely. These services are stepping up with online and real-time live chat capabilities as well as step-by-step support for people working in the field. In many cases, this is a lower-cost option than having a larger group of engineering staff, and it allows the core engineering team to focus on high value items that need to be completed. Need purchasing? Need logistics management? Both services are available directly from third parties as plug-ins to utilities' existing services. This is nothing new; most companies have been purchasing legal and audit services in this manner for decades. In the field, specialized services like horizontal boring have been outsourced for many years, keeping the utility from having to purchase the machinery outright.

6. Invisible Infostructure:

This is the biggest change for the field in the utility industry. There is almost no infostructure in the field and there is a growing demand for bandwidth. This demand is coming both from the crews in the field and the devices being deployed. Some utilities have decided to deal with the two issues together and some separately. In a few cases, a dozen or more initiatives are each trying to build an infrastructure to support that initiative, without looking at the broader context. This is the one place where it will be almost impossible for a utility to successfully be ready by 2012 (see Industry Drivers—People); rather, for most utilities to get to an invisible infostructure, it will take a significant number of visible towers and boxes. The challenge will be to keep a neighborhood from noticing these eyesores, and make the system run with a level of reliability that makes its function invisible to the user. Providing a common infrastructure that can accommodate mobile users anywhere in the service territory and also support fixed devices with a known latency (regardless of where users are and what they are doing) is a complex task. While the goal is to make the infostructure invisible to the end user, it is also important to build a robust infostructure with components that are highly reliable and have excellent bandwidth expandability. While it will be late, it needs to be right, robust and fast. It will be the enabler of how the enterprise makes money in the next 30 years.

7. Open Standards:

Use of open standards in the field will open up the ability to access necessary information to everyone working in the field. Today, that is done via hard copy printouts of several items. Even contractors with long-term ties to a utility find themselves carrying hard copies in the field. Some of this is bandwidth-related, but far more is capability related. Simple open standards will provide a low-cost path for contractors and others to participate in the field. Open standards like DNP-3 and 61850 provide the ability for companies to mix and match hardware vendors in the field in future, and to push data standards further into specialized hardware. In the long run, such standards will significantly reduce the cost of intelligent devices like smart meters and micro-generators.

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