

Empowering ideas 2011

A look at ten of the emerging issues
in the power and utilities sector



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Foreword

Welcome to the Empowering Ideas 2011 report for the Energy & Resources sector.

This is the second year in which the Global Energy & Resources group of Deloitte Touche Tohmatsu Limited has published its power and utilities report for the year ahead.

The end of the global economic crisis has forced electric utilities companies to confront new challenges. While the demand for energy continues to increase as a result of the growing global population, security of supply represents a major challenge. The reputation of nuclear energy was hard hit by the recent Japanese earthquake and resulting tsunami. While renewable energy continues to enter mainstream utilization, unconventional gas has become more economically attractive based on improved drilling technology. LNG and coal are abundant sources and remain important parts of many nations' fuel mix but coal could be helped by clean coal technologies and coal-to-liquids processes. Investments in renewable energy, in the form of solar, wind and geothermal resources, continue to increase at the expense of new build nuclear energy which, in many countries, continues to be a subject of debate. In heavily regulated markets, mergers and acquisitions may be one option for utilities to grow as organic growth prospects may be limited. Energy efficiency and demand side management programs offer a 'win-win-win' for governments, utilities and consumers. A clear trend is the growing importance of data analytics applied by power companies. Advanced IT techniques are helping power companies to analyse enormous data sets to create scenarios and make informed decisions.

The methodology for developing this set of issues and trends comes from interviews with Deloitte's most senior partners that serve clients in the power and utilities marketplace. I am most grateful to all of them that offered up their insights and expertise at a time when their time and attention was in high demand.

As economic growth increases demand for electric power, the power and utilities sector will likely experience challenging conditions during 2011 and into 2012. The issues and trends in this report may stimulate debate, inform of possible industry directions and may even help identify potential courses of action to deal with these challenges.

I hope you enjoy reading this year's report.



Peter Bommel
Global Industry Leader
Energy & Resources

Introduction

According to the International Energy Agency, demand for energy is expected to increase by more than 50 percent in the next 30 years. This is mainly related to the expected growth of the world population from 7 billion now to a forecasted 9 billion people in 2040. In the next 10 years, China's population is expected to grow by approximately 80 million people and India's by 160 million. Energy consumption is expected to more than double in the next 10 years and both countries will be importing 70-80 percent of their energy needs. Key factors for increased energy demand will be fuel for vehicles and electricity for home use. Growth of international mobility will also lead to an increase of sea-bound and air-bound transportation.

On the supply side, hydrocarbons will definitely continue to be the main source of energy supply for the next 40 years. In the fuel mix we will need to keep all current energy supply options open. Experts predict that renewable energy supply from bio, solar, wind and geothermal will grow fast, and could count in 2050 for more than 35 percent of the total energy supply mix. Prior to the earthquake in Japan, Deloitte member firm nuclear practitioners had anticipated a revival of nuclear power, with over 100 new nuclear plants currently planned, but now the impact of the Fukushima disaster will most likely result in a downward adjustment of this forecast. Due to its abundance, coal will be increasing in importance in combination with carbon capture and storage and also helped by clean coal technologies, coal to liquids, zero emission power plants and the likes. Natural gas is, at the point of consumption, the cleanest hydrocarbon and supply is expected to grow fast as well, mainly due to the abundant unconventional gas resources that have recently become more economically attractive due to new extraction technologies.

This very significant anticipated increase in fuel supply obviously requires massive investments. The International Energy Agency anticipates US\$25 trillion in investments in the energy industry over the next 25 years, or almost US\$1 trillion of investments per year. At a time when natural disaster and fiscal crises have wiped billions of dollars of value off the boards, investors will pay heightened attention to the allocation of risk between the public and private sectors. Governments seeking to mobilize private sector capital will need to carefully consider the relationship between energy policy, fiscal policy and risk allocation on specific projects.

Carbon dioxide and other greenhouse gases are a key factor in investment decisions and it can be expected that there will be continued global focus and media attention for climate change. Sustainable principles will drive the economic and global system more and more and there will be an increased focus on renewable energy. In 2009 in Bali, 2010 in Copenhagen and 2011 in Cancun, world leaders aimed to set global targets for climate management. And although these efforts were not very successful so far, it is clear that emissions certification and trade schemes will increasingly become important in the future.

In this connection, the power and utilities sector faces significant challenges and perhaps the most pressing is reducing greenhouse gas emissions. Carbon capture and storage is one of the many solutions companies are employing to reduce their carbon output. Other power and utilities companies face particular challenges managing their ageing assets, streamlining project management or identifying their highest margin services. Many power companies must also determine how to transfer industry knowledge from an ageing workforce to a new generation of workers.

In the next 10 years, China's population is expected to grow by approximately 80 million people and India's by 160 million.

1. The future of nuclear: The post-Japan path

The earthquake and resulting tsunami in Japan are tragedies of enormous scale. In the days and weeks that have followed, much of the attention is being placed on one power plant, Fukushima and its reactors. The impact of these forces of nature on the nuclear industry will be both profound and long-lasting. This begs two questions: should the world turn its back on electricity powered by nuclear energy, and secondly, how will the global power sector be impacted by these series of events?

The answer to the first question is an emphatic “no”. Nuclear energy still makes up a sizeable portion of many countries’ portfolio mix, including France, Japan, Korea and the U.S., and features prominently in the future energy plans of countries such as China, India and Vietnam, who are embarking on large-scale nuclear new build programs. Many modern nuclear plants have multi-layered safety programs in place that provide a much improved hedge when compared to older plants. Add to the fact that energy produced by nuclear plants is virtually free of greenhouse gas emissions, is constant and provides a mechanism for energy independence, it’s easy to see that nuclear power will be a major source of electricity for decades to come.

To answer the second question, there appears to be little doubt that new challenges will be faced by industry and government alike. These challenges will impact those nuclear plants already in service and those that are planned for construction.

While most countries have announced safety analyses for their nuclear fleets and some have suspended ongoing permitting procedures for new nuclear plants, the most dramatic changes have been in Germany. Recently, thousands of people protested for an immediate shut-down of all nuclear power plants. The governing coalition has reacted by enforcing a temporary downtime of three months for the oldest nuclear plants. However, at least one of those plants has been shut down permanently and the industry is expecting that several more will share this fate.

German operators so far have been very active in the media, essentially repeating the message that German nuclear plants are safe based on local conditions that are not comparable to the seismic and tsunami related conditions of Fukushima. However, they are very careful and taking precautionary measures. E.ON preemptively shut down the plant Isar 1 for a safety analysis based on the lessons learned from Japan.¹

The earthquake and resulting tsunami in Japan are tragedies of enormous scale.

The Fukushima disaster will definitely result in a call for enhanced safety standards, especially in the areas of backup power systems, protection against terrorist attacks and airplane crashes as well as with the primary cooling cycle. These increased requirements could potentially spell the end for the older power plants, as especially the protection against the crash of a large current commercial plane basically means an entirely new concrete mantling of the reactor building, the cost of which is greater than the expected returns of those plants, even in favorable scenarios. There is an expectation for a re-evaluation of the entire risk catalog, as well as an expectation of major changes to policies and procedures regarding incident reporting, crisis handling, both on a voluntary and mandated basis.

The disclosure of information to regulators and the public in terms of operations is already very detailed, while key risks have only been shared with local regulators and costs are generally only disclosed on a much aggregated level, if at all. It is reasonable to expect increased information demand from regulators will result in mandatory reporting requirements for the operators.

¹ Vera Eckert, “E.ON Takes Isar 1 Offline for During Nuclear Talks.” Reuters March 15, 2011. Available at: <http://www.reuters.com/article/2011/03/15/eon-isar-idUSWEA862320110315>

The regulators could also use this opportunity to increase their scope of jurisdiction to other company units that are not currently under their supervision, as they have tried in the past. German nuclear plants have very detailed procedures to follow in case of a crisis, but these and the roles of the operator and government differ between each federal state. At a certain point, the state government takes over making the strategic decisions (e.g. shut down), whereas the operational decisions are always made by the plant leadership.

With the accented emphasis on risk management and regulatory oversight, developers of new build projects will face a different reality of risk and return. The challenges witnessed in recent years around cultivating private sector development of new projects appear set to continue – as highlighted by NRG’s suspension of fresh investment at the South Texas Project. Societies and governments that elect to proceed with nuclear energy may need to re-calibrate the allocation of risk between public and private sector participants.

While the stock prices of many nuclear operators have taken large hits, the ratings have not been changed because of the safety requirements already in place. Thus far, the markets are only reacting to the expected lower earnings due to temporary shutdowns but have not “priced in” a larger safety risk than before the events. Funding might become a little more difficult due to increased public resistance and tighter permitting procedures, but probably not much more difficult than it already is – a notable exception being investor appetite for funding development stage costs – particularly for non-regulated facilities – until greater comfort with development risk is achieved.

There have been political shifts in various countries around the world that would not have been thought possible as recently as six months ago.

The political factor will dominate local markets, with some hardly changing at all and others introducing drastic changes. If the regulators demand substantial additional safety measures to mitigate reevaluated risks, counterbalancing measures may be required to bolster the business case for investment. Also, there are a few parties aiming for a European answer to the question what consequences should be drawn from Fukushima. With national interests diverging as far as France (nuclear power house with ~80% nuclear power) to Austria (no nuclear and deep anti-nuclear philosophy) this will be no easy task. Those countries introducing anti-nuclear measures, e.g. speeding up their phase-out process, will likely have to increase funding and subsidies for renewable energy sources and transmission/distribution lines to speed up their developments and meet their CO₂ targets, which will further put pressure on many country’s budget.

To place the events of Japan into perspective, a brief look on selected developed and developing nations’ recent actions on nuclear energy is highlighted opposite.

Americas	Asia/Central Asia	Europe
<p>United States There are controversial discussions about nuclear energy in the U.S. President Obama's plans to support new nuclear build with credit guarantees may not be realized, as there are many voices demanding a stop for new build, at least in the short-term.</p> <p>Chile In Chile, there has been much controversy over the installation of nuclear power plants. The Chilean Government is ready to sign a cooperation agreement with the United States Government on nuclear energy. Chile is a seismically active country like Japan.</p> <p>Venezuela Venezuelan President Hugo Chavez announced a halt to plans on building a nuclear power plant.</p> <p>Brazil According to government officials, Brazil needs to review its nuclear program and better analyse the development of this resource. Construction on Angra III began last year and the government plans to build three more power plants.</p>	<p>China During a News Conference of the Annual Meeting of National People's Congress of China, the Deputy Chief of Environmental Protection Authority of China, Mr Lijun Zhang said: "We are concerned about the damage of the Nuclear Facility of Japan, concerned about the further development of this issue, we will learn from it, and will take it into account when we make strategic planning for the nuclear energy development in the future."</p> <p>India The Prime Minister of India, Dr. Manmohan Singh, has ordered the Nuclear Power Corporation of India Limited to review the safety systems and designs of all the nuclear power reactors. The Government of India is also looking to put in place additional environmental safeguards to ensure safety of newly proposed nuclear reactors.</p> <p>Pakistan The Government of Pakistan has ordered the Pakistan Atomic Energy Commission (PAEC) to check and review the power plants security, system, and designs of all the atomic power reactors in the country. The Pakistan Nuclear Regulatory Authority (PNRA) issued safety guidelines in plants, and ordered to re-evaluate the designs of KANUPP-II and Chashman nuclear power complex in Chashman city.</p> <p>Turkey Turkish Prime Minister Recep Tayyip Erdogan reaffirmed his commitment of building Turkey's first nuclear plant at Akkuyu, Mersin Province, despite huge protest of academia and Turkish people.</p>	<p>European Union In an interview on ORF2, Austrian Environment Minister Nikolaus Berlakovich said that he would enter a request at the environmental meeting in Brussels on 14 March 2011 for a review of reactor safety. He emphasized both coolant and containment and compared these measures to reviews of the financial system after the banking crisis of 2008.</p> <p>France The amount of discussion about nuclear safety is increasing, while the government is convinced about the positive outlook for the nuclear industry after the crisis in Japan has been dealt with. Meanwhile stocks of Areva have been feeling the pressure.</p> <p>Spain Spanish Prime Minister Jose Luis Rodriguez Zapatero Wednesday ordered a review of his country's nuclear power plants.</p> <p>Netherlands The plans for the new build projects and operations of the only nuclear plant have not been impacted so far.</p>

Bottom line

Over the short-term, the debate surrounding the future of nuclear energy will be difficult as each nation's government and population debate the pros and cons, the length of which will depend on how fast the situation at Fukushima I can be brought under control. Countries in close proximity to oceans will give nuclear energy a more extensive and thorough review with an eye towards the safety and strength of their nuclear infrastructure and the potential of damage to the local population and water and food supplies. Longer-term, pro-nuclear nations are expected to unveil additional government review and oversight based on the events in Japan.

2 Richard K. Lester, "Why Fukushima Won't Kill Nuclear Power." Wall Street Journal April 6, 2011 pp. A19

2. Risk management: The new challenge



The utilities industry faces daunting challenges and intense scrutiny from all stakeholders – all the more so at this point in time. The events in Japan have awakened board rooms to the prospect that a single one-off event could drive even the largest of utilities to the brink of bankruptcy. Meanwhile, the about-face in Spanish energy policy has highlighted the interconnectivity between shareholder value and government policy. For economically mature and industrialized nations, concerns surrounding carbon emissions is high while billions must be invested in ageing infrastructure. Some fuel prices are rising forcing utilities to take a second look at operating costs while the workforce is ageing indicating that future productivity could take a hit over the short term. The recent economic downturn and recovery is forcing utilities do deal with more payment defaults while cybersecurity is becoming a major risk in a digitally-driven economy. On the other hand, growing economies such as China and India are beginning to experience their own unique challenges ranging from non-technical loss during transmission to grid connectivity. But one issue they all have in common: how best to mitigate the risks of infrastructure capital projects.

Electric power projects are some of the most complex in the industry. The industry's complexity and continued globalization drives high risk in capital projects and failing to successfully execute these projects can significantly impact shareholder revenue. The trend toward planning, engineering, and construction to completion is increasingly being decentralized across globally distributed partners. To mitigate risks and execute successfully, capital-intensive power projects require clearly defined and auditable business processes and thorough planning upstream which sets the stage for improved construction completion downstream. The business case for improved processes is easy to see: a U.S. National Institute of Standards and Technology (NIST GCR 04-867) report estimates the costs of inadequate interoperability in U.S. general capital projects at US\$15.8 billion a year. What this calls for is interoperability and efficient data management.

The most significant challenge for capital projects is managing and synchronizing the flow of large data sets that must be funneled into a unified and collaborative data warehouse. Regardless of the project – greenfield or refurbishment, partners in geographically dispersed regions around the world generate thousands if not millions of living documents containing multiple iterations and revisions of mission-critical project information such as requirements, contracts, designs, drawing, financial transactions including billing and maintenance instructions. This information should be maintained not only during construction but also for the operational life of the power plant. In most cases, the key question is not whether the information exists, but whether it exists in a format that is easily stored and accessed within the confines of the office but remotely as well. In the case of plants that were built in the pre-personal computer era, most facilities relied on paper drawings and typewritten documents. These documents should be made accessible in a digital format.

Beyond managing the challenges of large capital projects, investors, boards and senior management of power and utilities may wish to update their systems and processes for assessing, monitoring and managing risk across their businesses. At a project level, this may feature a more critical approach to modelling of shareholder value under alternative scenarios. Host governments seeking to attract private sector capital to their projects will need to understand the evolving perspective of investors on risk management.

Bottom line

For investors, now is a time to dust off risk registers, carefully vet investment decisions, and bolster the quality of data management on large projects. For governments, now is a time to reconsider the interconnection between energy policy and project level risk allocation – or risk watching capital flow elsewhere.

3. M&A: Is it time to buy or sell?

As companies in some markets look to renew growth in an anemic economic recovery, many power and utilities executives are being called upon to facilitate M&A driven growth strategies. With over a trillion dollars of cash on corporate balance sheets in the United States alone, and improving capital markets around the world, many companies are seizing the moment to become strategic buyers while others divest non-core assets. By and large, utility mergers are being driven by the challenge of finding growth opportunities within existing utility service territories due to reduced customer demand and associated reduced opportunity for power generation or electric transmission investments.

2010 was characterized by a lack of mega deals but several were prominent. According to Dealogic, the largest deal by value was the US\$21.5 billion merger between GDF Suez and the UK's International Power Plc. The combined business creates an independent power generation group with over 66GW of gross capacity in operation and committed projects expected to deliver 22GW of gross capacity by 2013.³ Williams Pipeline Partners LP and Williams Partners LP was the second largest deal of 2010 at US\$13.2 billion. This deal forms one of the largest natural gas partnerships in the U.S. Coming in at third was EdF Energy's sale of its UK electricity distribution networks to Hong Kong-based Cheung Kong Infrastructure Holdings Ltd for US\$9 billion. More recently, Cheung Kong, controlled by billionaire Li Ka-Shing, agreed to acquire 75 percent of a Canadian power plant for C\$91.4 million (€68 million, US\$93 million).⁴ These two deals will help propel the company's acquisition momentum into 2011. Another U.S. – focused deal involved FirstEnergy's bid for rival electric company Allegheny Energy. The deal had been subject to a number of regulatory formalities at public utilities commissions in several states before being given their formal approval. The planned merger between FirstEnergy and Allegheny Energy cleared its final hurdle on February 24 after the Pennsylvania Public Utility Commission gave its blessing to the deal in a 3-2 vote.⁵ Together the companies would include 10 electric distribution companies in seven states serving six million customers. The combined company would have about 24,000 MW of generation, US\$48 billion in assets and US\$16 billion in annual revenue.⁶ Rounding out the top 5 largest deals announced during 2010 was PPL Corp's US\$5.6 billion deal for Central Networks from E.ON which will nearly double the size of PPL's global customer base to 10.2 million and expand its geographic reach.⁷

2010 was characterized by a lack of mega deals but several were prominent.

This deal follows the completion of PPL's US\$7.6 billion purchase of two Kentucky utilities in 2010. This appears to be a trend being used by other utilities of investing in government-regulated businesses which provide a more stable revenue source for energy companies compared with the volatile, unregulated electricity sales that have slumped since the recent recession.

Several other M&A trends will continue to evolve during 2011:

New regulatory hurdles to cross. Previous M&A deals were subject to the "cause no harm" edict where the proposed deal would cause no harm to consumers. This is now being replaced with a "net benefit to the public" edict where future M&A deals are likely to be judged on the benefits they bring to the consumer. As part of this new operating model, the net benefit will also help localities meet their new goals of reliance on renewable energy and by cutting greenhouse gas emissions.

Going for scale. In fragmented electricity markets, reaching a certain scale will allow merged entities to provide more service offerings and to spread new technologies such as smart grids and pass cost savings on to a larger base of consumers. Merged utilities can install systems that shut down home air conditioners when the system is under strain – or switch two-way water heaters between gas and electric. A case in point is the current situation in Ontario, Canada.

The city currently has 90 local electric utilities, mostly owned by municipalities.⁸ Further, 30 of them have less than 10,000 customers each and will likely have to look at a certain degree of collaboration or through consolidation activities to get scale. But they'll need financing for the capital costs, and sometimes size matters.

3 "GDF Suez, International Power: Closing Of the Combination." <http://www.foxbusiness.com/markets/2011/02/03/gdf-suez-international-power-closing-combination/#>

4 "Cheung Kong in C\$91 million Canadian Power Deal." Infrastructure Investor February 28, 2011

5 "FirstEnergy, Allegheny Deal Clears Final Hurdle with Conditioned OK from Pennsylvania PUC." Platt's Global Power Report March 3, 2011

6 Ibid

7 "PPL to Buy UK Power Grid for \$5.6 billion." The Allentown Morning Call March 4, 2011

8 "Local Utilities Told to Consider Mergers to Help Drive Investment: Size Will Help Providers Raise Capital for Growth." Toronto Star February 16, 2011

9 "Renewed Renewables." Financial Times March 17, 2011



A renewed interest in renewable energy. The political unrest in the Middle East and North Africa combined with the tragedy in Japan point to a predicted increase in interest in renewable energy. The WilderHill Clean Energy Index, which had previously underperformed the Standard & Poor's 500 by nearly 9 percent from the beginning of the year until the day of the earthquake, has more recently, out-performed the market by more than 4 percent.⁹ However, some countries have begun to pull-back their subsidies on renewable energy – potentially leading to M&A activity as incumbents seek to reposition their portfolios. Germany recently cut certain industry payments by about 15 percent. During 2010, it had spent 18 percent on renewable energy subsidies.¹⁰

Political uncertainty over the renewal of federal tax credits for renewable energy production and slumping electricity prices saw wind power installation in the U.S. fall 71 percent in the first half of 2010 versus the previous year. The most severe reversal came from Spain. Since the beginning of 2002, the Spanish government spent €23 billion into solar but recent subsidy cuts will likely threaten the very existence of some developers. But with the nuclear industry firmly at center stage of the naysayers, renewables may find that private equity firms have an increased appetite for investment.

Bottom line

Over the short term, the power sector will continue to witness increased industry consolidation as many markets remain fragmented. Regulations on coal-fired generation are expected to increase, steering buyers toward cleaner baseload generation. Chinese power companies are only just now getting started in mergers and acquisitions; China's giant utility State Grid Corporation spent nearly US\$1 billion to buy seven Brazilian power transmission companies, the latest in a series of big bets by Chinese corporations in Latin America. Outbound China M&A will definitely continue to display rapid growth.

¹⁰ Ibid

4. An energy resource dilemma: Is natural gas the clear winner?

Today's power companies have the ability to produce electricity from various sources: renewable resources, nuclear, coal-based and natural gas/unconventional gas. Each has their pros and cons. Renewable energy typically requires subsidies, production tax credits and other forms of government incentives. The energy produced is clean but can be expensive and, in some cases, intermittent. Nuclear energy, virtually carbon free, is faced with new challenges following the tragedy in Japan. Coal, on the other hand, appears likely to be the dominant fuel source for electricity to be produced over the next several decades. It continues to be abundant and accessible to producing countries but clean coal technologies will likely require several more advancements before reaching commercial operation. What does this portend about the future of natural gas?

Even though coal is likely to remain the dominant fuel source in the power sector for years to come, gas-fired generation continues on a solid growth trajectory through 2035 although the growth is somewhat slower than the rapid market expansion since the early 1990s. Increased gas use in the power sector is sensitive to several market fundamentals including the depth and longevity of the current shale gas boom and its impact on prices, the aggressiveness of, and pace of governmental policy actions to reduce carbon emissions and the rate of market penetration by renewable energy. For countries looking to move to a low carbon future, gas will play an exceedingly important role: it emits roughly half the CO₂ per unit of electricity produced when compared to coal and can be dispatched to meet rapid increases in demand. The acceptance of shale gas risks to water resources, however, continues to be debated in some societies. Meanwhile, whether shale gas is a greenhouse gas winner or loser remains an open question – owing to the methane released in production. How these questions play out could influence the position of shale gas relative to coal and other energy sources.

According to the International Energy Agency, on a worldwide basis, there is a conservative estimate of over 400 GW of operational coal-, gas- and oil-fired capacity that is more than 40 years old. An additional 585 GW is between 30 to 40 years old precipitating the need for a massive and lengthy infrastructure re-building process. This means that about one-third of the fossil-fuel generating capacity is inching towards the end of its product life-cycle within the next decade.

Further, the age distribution of power plants by region is becoming more important. Power plants in the non-industrialized nations are relatively young having come online within the last several decades. The most significant ageing will come from power plants within the industrialized economies.

Japan

The tragedy in Japan has forced much of the nation's power generation to turn from nuclear to LNG. Prior to the disaster, nuclear power provided roughly a quarter of the nation's electricity and the country has shut down 11 nuclear reactors which represent 9.7 gigawatts of generating capacity.¹¹ Japan is already the world's largest buyer of LNG and since the tragedy LNG imports have further increased. Although today's situation is extreme, during an earlier shutdown in 2007 of the Kashiwazaki-Kariwa nuclear plant, approximately 40 percent of the power shortfall was met with gas-fired power generation. By applying the same template to the current situation, some analysts predict that 800 million cubic feet of incremental demand for LNG is well possible.¹²

China

Electricity demand in China closely mirrors that of its economic growth. By some estimates, electricity demand in China rises at an annual rate of 7.7 percent through 2015¹³ while economic growth is predicted at 8.4 percent for 2011.¹⁴ Over a longer period of time, the share of reduced carbon emission generation from nuclear, carbon capture and storage fitted plants, hydro and other forms of renewables doubles to 2035. Perhaps the greatest challenge China faces in electricity generation is the sheer size of what's required. Up to 2035, China is likely to add installed capacity equivalent to what the United States currently has today. Recent determinations that shale gas reserves concentrated in the country's western Sichuan province may be as high as 35 trillion cubic feet point to a potential shift in China's traditional reliance on coal fired power.

11 Guy Chazan and Liam Plevin, "Crisis Pressures LNG Shipments." *Wall Street Journal* March 17, 2011, pp. C11

12 "Japan's LNG Thirst." *Financial Times* March 15, 2011, pp. 14

13 International Energy Agency, *World Energy Outlook 2010*, pp. 232

14 *The Economist*, "The World in 2011," pp. 118



Russia

Gas-fired generation from Russia will likely rise over the next decade. Gas-fired electricity accounted for close to half of total generation as recently as 2008.

Low-carbon generation from nuclear, hydro and wind will enter the nation's energy mix by 2035 and these sources will combine to reach the other 50 percent of electricity generation. The investment required to bring these additional sources of generation online amounts to US\$400 billion with one third going to renewable energy, 28 percent to nuclear and 23 percent to gas.¹⁵

Middle East

The Middle East weathered the recent economic crisis and along with a growing population, will require additional infrastructure development and generating capacity. For this reason, gas is projected to remain the dominant fuel of choice for the power sector over the next two decades. At the same time, high oil prices will likely be detrimental to oil-fired generation: the share of oil-fired generation in the electricity mix is projected to decline from 36 percent in 2008 to 13 percent by 2035.¹⁶

European Union

Within the European Union (EU), gas-fired generation will continue to maintain a steady share of roughly 25 percent of the total generation portfolio mix over the foreseeable future. With a higher price for CO₂ than in other OECD countries – US\$38 per tonne by 2020 and US\$50 per tonne by 2035, this creates an opportunity for increase use of renewable electricity generation. Increasing generation from renewables in the EU will see this class of electricity to double to roughly 20 percent to in 2011 to 40 percent by 2035.

Bottom line

Gas is the winner as a fuel source based on its availability and low prices in some markets. The outlook for natural gas and its many variants – including unconventional and LNG – looks bright. Some of this outlook is based on new discoveries and enhanced drilling techniques which leads to new supply.

¹⁵ International Energy Agency, "World Energy Outlook 2010," pp. 236

¹⁶ Ibid

5. Driving performance in ‘smart’ utilities: Data analytics to the rescue

Across the globe, smart grids and smart metering are quickly moving from fiction to fact. Over the next five years, the U.S. will likely dominate global capital expenditure (capex), as government stimulus funding drives a mass-market roll-out of advanced metering infrastructure. By 2030, the U.S. will spend US\$60 billion on intelligent smart grid infrastructure.¹⁷ This includes grid automation, communications infrastructure, IT systems and hardware, systems integration, and home area network equipment, in addition to smart meters. Ultimately perhaps, the top-spending market will likely be China, where annual smart grid capex will overtake the U.S. by around 2016. China’s plans for wide-scale smart meter deployment will see it install close to 360 million smart meters by 2030.¹⁸ Two other major emerging market forces, India and Brazil, also make the top ten countries for smart grid investment, ranking third and sixth respectively. Both of these nations have announced massive smart meter projects. Rounding out the top ten are France, Germany, Spain and the UK in Europe, while Japan and South Korea make up the last two entries. All of these smart meter/smart grid implementations will share one common trait: the need for extensive use of data analytics.

In terms of smart grids and smart meters, large data volumes are commonly identified as one of the key issues facing utilities over the next 3 to 5 years. According to some estimates, smart meters and smart grids will likely have utilities companies capturing metered data every 10 to 15 minutes, every hour of every day which will dramatically increase data management processing needs. Further, the yearly data storage requirements for 500,000 meters reading every 10 to 15 minutes are estimated to be 200 terabytes, placing severe constraints on many utility IT departments.¹⁹ Utilities should consider looking to data analytics to exploit raw data to drive insight and extend foresight into business performance and decision making.

Utilities that are able to effectively employ data analytics will likely be more successful at addressing their critical business challenges. Here are some functional areas where data analytics can provide bottom-line solutions:

Revenue management. Analytics can leverage integrated meter reading, meter inventory, and customer billing data to improve revenue management. Proactive adjustment of billing schedules to match chronically delinquent customers’ pay cycles could reduce the number of outstanding receivables and collection expenses. Internally, analytics capabilities include business performance management using scorecards and dashboards, and financial performance management through better budgeting, forecasting, and probability analysis. Pre-pay and customer visibility into consumption may allow utilities to better manage consumption, thereby reducing accounts receivable.

Fraud and loss prevention (theft analytics). An analytic process to identify suspicious patterns in consumption, billing, and payments can lead to more targeted investigations for the revenue assurance department. Often resource-constrained, this team is better able to minimize energy theft and fraud when its time is used more effectively. Monitoring usage at premises without accounts limits unbilled revenue. Spikes in usage and comparisons to historical consumption patterns at the premise can identify changes in behaviors and thus activity at the premise.

Demand forecasting and load management. Customer segmentation performed on the basis of interval usage data can lead to more homogenous clustering, and consequently, lower variance between forecasted load and actual usage. Subsequent analysis, along with targeted communication and interaction with customers, can help inform, educate, and motivate changes to customer usage patterns. The generation of individual demand forecasts and bottom-up aggregation of load forecasts within each customer segment can be facilitated by such analytic solutions. Such a solution can help minimize costly spot-market purchases of power.

17 GTM Research, U.S. Smart Grid Market Forecast, 2010-2015, September 2010.

18 “Ten countries will account for 80% of global smart grid investment by 2030.” PRWeb, <http://www.prweb.com/releases/2011/02/prweb5058704.htm>

19 Andres Carvallo, Austin Energy “Energy IT Sees Smart-Grid Boon for Data Storage.” May 1, 2009/ SearchStorageChannel.com



Asset management. Analysis of meter flags, as well as maintenance parameters for transformers and other field equipment, can lead to better management of maintenance schedules. Simply put, device maintenance need not be done on a standard schedule, but based on one or more actual device characteristics – such as temperature, voltage, current, or cumulative power transmitted since the last maintenance, etc. Intelligent devices that collect and report on such characteristics in near-real time can help maintenance operations make informed decisions. Extending the life of a transformer by even a few months can lead to greater preparedness for its eventual replacement. All of these are drivers for quicker outage resolution and greater customer satisfaction.

Outage impact. A solution to compute and analyze the magnitude and nature of electricity consumption in distribution networks that underlie specific assets in the device hierarchy (e.g., substations, feeders, and transformers), can facilitate the analysis of the potential effect of outages both financially and in terms of customer satisfaction. When coupled with asset management systems, this type of a solution may prevent costly outages by proactively assisting the utility in maintaining a device ahead of a disruption, or perhaps even extend its service life.

Compliance. A constant set of analysis rules and reliable reporting infrastructure can greatly enhance the credibility of utilities' periodic reports to regulatory agencies. The timely and accurate submission of reports on customer service, electric reliability, and the impact of smart grid initiatives can help the case of regulatory relations departments.

Customer service. Analytics can help improve customer interactions and drive the development of new incentives and pricing plans configured to customer needs. For customer service representatives, having a complete view of all interactions with the customer on the phone as well as intelligent information that may be pertinent to addressing his or her concerns can result in a satisfied rather than a frustrated customer.

Sales and marketing. With highly targeted customer information and analytics-based interpretation of customer data, utilities can better target customers with more effective sales, marketing and educational programs.

Bottom line

By slicing, dicing, and manipulating data in new ways to create scenarios and answer complex questions, analytics can move informed decisions into the future, giving utility companies the ability to move from asking such basic questions as "How many meters do we have installed", "How many reads were collected?", and "How many customers do we have?", to more effective questions like: "Why is this happening?", "What if this trend continues?", "What is likely to happen next?", "How do we best prepare?", and "What is the best outcome?" In this way, data analytics identifies events that may have the most effect on the business as a whole so that appropriate action can be taken as early as possible.

6. Clean technologies: Which ones are leading?

As renewable and clean energy technologies continue to penetrate the market for power generation, several trends are beginning to emerge using recently released investment, research and development (R&D) and patents data.

Venture investment by technology sector

By many accounts, investments in renewable energy and clean technologies rebounded in 1Q 2011 as many investors focused on larger and later-stage deals. Measured by dollars invested, cleantech venture investment was up by 52 percent compared to the previous quarter (US\$1.69 billion) and was also 31 percent higher than the same period a year ago (US\$2.28 billion).²⁰ Conversely, the number of deals recorded in 1Q was 159, a total which is likely to be the lowest quarterly count since mid-2009.²¹ The most attractive locations for investments during 1Q 2011 in energy efficiency, bio-energy, solar, wind, water and geothermal were the U.S. with 96 deals, 29 deals in the UK, 20 deals in China and in Germany with 18 deals.²²

Solar

The leading sector in the quarter by amount invested was solar at US\$641 million²³ and according to investment data from *Envirotech & Clean Energy Investor*, a monthly periodical tracking publicly announced deals involving venture capital investments, private equity transactions, flotations, refinancing, rights issues, mergers, acquisition, project financings and major contracts, solar was the most attractive investment technology specifically in the U.S. (35 deals), China (11 deals) and in Germany (10 deals).²⁴ In general, solar continues to gain traction in many parts of the world thanks to generous government subsidies and falling solar panel prices. Look for this trend to continue throughout 2011.

Wind

The most attractive investment locations in wind energy during 1Q 2011 were found in Denmark, U.S. and Spain with 10, 9 and 7 deals respectively. Subsidies for wind power were the main reason why wind continues to be an attractive investment. Wind power – the largest and most mature of the emerging renewable energy technologies – still requires generous government subsidies and legislative mandates.

Energy efficiency

Investments in energy efficiency are likely to remain a trend for the foreseeable future in OECD nations such as the U.S. and the UK. During 1Q 2011, the U.S. led with 35 deals and the UK with 14 deals. Energy efficiency measures appear to provide an upside potential in non-transportation uses of energy by generating savings in energy consumption and abatement of greenhouse gas emissions.

The R&D factor

Renewable energy companies continue to spend heavily on research & development (R&D) in attempts to improve current technology and lower production costs. For example, even though Singapore may not be the first location that comes to mind when talking about wind power, Spanish wind company Gamesa is the latest to set up an R&D laboratory in the country. The company recently signed a memorandum of understanding with Nanyang Technological University, National University of Singapore and the Agency for Science, Technology and Research to develop research into wind turbine blade coatings to withstand extreme weather conditions and in using smart sensors to monitor the performance of materials used in wind turbines.²⁵ Gamesa has so far pledged US\$1 million.

Farther north in China, the State Grid Corporation recently launched a national power generation R&D experiment center in Nanjiang city, Jiangsu province. The center will focus on research of solar power generation technology, photovoltaic system grid-connected experiment testing and mobile testing of grid-connected photovoltaic power station to solve key technological problems in massive application of solar voltaic power generation.²⁶

An R&D investment boom is emerging in Australia, with much of the research dollars going to the creation of low-emission technologies, with carbon capture and storage (CCS) technology being potentially one of the most beneficial. The 2008 review performed by Ross Garnaut said that CCS technology would be crucial to Australia achieving its emission reduction targets.²⁷ While solar and wind remain in fashion, CCS technology should be considered a viable technology by the Australian government. Once a price on carbon has been established along with an emissions trading scheme, industries should consider utilizing the new technology.

²⁰ Press release, Cleantech Group LLC. "Global Clean Technology Venture Investment Rises in 1Q 2011As Investors Focus on Larger Late-stage Deals." April 5, 2011

²¹ Ibid

²² *Envirotech & Clean Energy Investor*, January, February, March 2011; Deal Tracker section

²³ Ibid

²⁴ *Envirotech & Clean Energy Investor*, January, February, March 2011; Deal Tracker section

²⁵ Jessica Cheam, "Spanish Wind Giant Gamesa Sets Up Research Lab in Singapore." *Straits Times* April 8, 2011

²⁶ "State Grid Corporation Debuts Solar Power Generation R&D Center." *Sinocast Energy Beat* March 17, 2011

²⁷ Alan Mitchell, "Gluttons at R&D Feast." *Australian Financial Review* April 6, 2011

Patent activity

It is often said that today's patents offer insight into tomorrow's products and this appears to be true when viewing recent patent activity in energy-related market sectors.

According to the Canadian Patent Office, Canadian patent 2,643,380 was issued on March 22, 2011 for a method to store variable wind and solar power as heat in heavy oil formations, including oil sands and oil shale, and assigned to PyroPhase Inc.²⁸ Presently, wind and solar power amount to less than 2 percent of U.S. total electric generation because they require costly backup plants to supply wind and solar when both are not available. This new method can use variable and off-peak power because it stores radio-frequency energy as heat in North America's multi-trillion barrel heavy oil formations. It converts this resource to fuel for refineries in amounts 5 times the electric energy input while virtually eliminating CO₂. Because this new method uses power whenever it is available, and is instantly interruptible, it stabilizes the electric grid. It compensates for fluctuations in wind and solar power input and also in users' demand. This in turn reduces the need for spinning reserves, i.e. power plants that run all the time to meet sudden load changes, and thus wastes fuel.

A recent study from the European Patent Office (EPO) indicates that six countries dominate sustainable energy patent applications.²⁹ According to the study, almost 80 percent of all clean energy technology (CET) patent applications are filed in Japan, the U.S., Germany, South Korea, France and the UK. The study examined close to 400,000 international patents from an international pool of 60 million. Key technologies analyzed include photovoltaics (PV), geothermal, wind and carbon capture and storage (CCS). The study appears to indicate a surge in CET patenting application activity following the adoption of the Kyoto Protocol. On average, CET patents increased by 20 percent since 1997 with the most explosive growth in the fields of solar PV, wind, CCS, hydro and marine, and biofuels. For specific technologies, South Korea leads in PV while Brazil and Mexico share the top two positions for hydro and marine.



Bottom line

Clean energy technologies continue to receive the most venture capital investment, research and development funds and patent activity. These technologies hold great value for the renewable energy industry that will provide many countries with barriers to entry and strong competitive advantages in the marketplace. Given the recent surge in oil prices worldwide, the demand and opportunity for commercially available clean energy is positive.

²⁸ Canadian Newswire Ltd.
"Patents Issued on
Massive Wind Energy
Storage." April 7, 2011

²⁹ "Six Countries Dominate
Sustainable Energy
Patents." *Europolitics
Environment*
October 14, 2010

7. Reversing course in LNG: From west to east

Review the current headlines of major energy publications and readers will likely witness a growing trend: more and more LNG is on its way to Asia, reversing a trend of only a few years ago when most of the LNG was being imported by the west. This is not just happenstance but rather a direct result of increasing demand in Asia and growing gas supplies in the U.S. and Australia. According to some estimates, Asia-Pacific makes up almost two-thirds of world LNG demand, making it a major site of global LNG trade.³⁰ Since 1990, world gas usage has increased by 50 percent: in Asia-Pacific, consumption has tripled.³¹ This surge in Asian demand is impacting the natural gas resources base of several countries including Canada, Australia and the U.S.

The rush to export Canada's natural gas to Asian markets continues to draw new players to the northwestern shores of British Columbia. Following the application for the first domestic natural gas export license by major western companies, a partnership has asked Canada's National Energy Board for approval to build a second export terminal in Kitimat, B.C.³² Asian buyers are increasingly seeing LNG as a plentiful source of clean energy – and an emerging alternative to nuclear energy. Given the over-supply of current and future gas development in North America, prices are likely to remain depressed for some time and growing higher in Asia. The math appears to bear this out. In late March 2011, western Canadian gas was being sold at approximately \$3.65 per million Btu. Some companies were estimating that gas could be piped to the coast for 75 cents, liquefied for \$3.00 and shipped across the Pacific for \$1.00 or less.³³ Once these costs are added together, gas could be delivered for less than \$8.50 to Asia – where in late March 2011 gas was being sold for roughly \$11.00. The spread could potentially be increased as Asian demand creates a tighter LNG market.

With 11 major LNG projects in the west and 4 in the east, Australia has been thrown into the limelight among major gas producing countries.

Australia has entered an intriguing phase of its evolution as a preferred location for domestic gas and LNG development. With 11 major LNG projects in the west and 4 in the east, Australia has been thrown into the limelight among major gas producing countries. These projects mean increased level of supplies of natural gas for geographically close customers that see Australia as a reliable partner. But several emerging issues continue to challenge and constrain industry development including the expensive nature of the projects, slow bureaucracy and difficult environmental conditions.

Over the last several years, the U.S. has been the largest beneficiary of new supplies of unconventional gas. But with U.S. demand for LNG expected to remain low, U.S. LNG terminals are using only a small percentage of their total send out capacity for LNG imports which increases the opportunity for the U.S. to become an LNG exporter. One way for the U.S. to reach exporter status is to install LNG liquefaction facilities at existing import terminals and utilize dock and storage and other equipment already in place. Even before the tragic March 11th earthquake and tsunami, Japan was projected to be the world's largest importer of LNG over the next five years.³⁴

Bottom line

The great LNG continental shift continues to move supplies from west to east. With excess gas and weak demand in North America and explosive growth in demand in Asia, Canada, Australia and the U.S. are likely to improve their status as gas exporters over the foreseeable future. The LNG continental shift shows no signs of slowing down any time soon.

30 "Watching the world: LNG Booms in Asia-Pacific." *Oil & Gas Journal* March 7, 2011 pp. 109

31 Ibid

32 Nathan Vanderklippe, "New Venture Enters Race to Transport B.C. Gas to Asia." *The Globe and Mail* March 25, 2011 pp. B1

33 Ibid

34 "Growing Trend: U.S. LNG Terminals That Export Domestic Shale Gas." *Foster Natural Gas Report* April 1, 2011 pp. 17

8. Trends in carbon: What utilities can do now

The carbon market endured its most challenging period during the economic recession from mid-2008 through 2009. As global gross domestic product (GDP) fell, so too, did the demand for carbon assets indicating a symbiotic relationship between carbon markets and economic growth. The recession also impacted the capital inflows into developing markets; clean project developers found it virtually impossible to lock in finance.

During the 2009-2010 period, the driving force behind the growth of the carbon market was the European Union Emissions Trading Scheme (EU-ETS). According to the World Bank, a total of US\$119 billion (€89 billion) worth of carbon allowances and derivatives were traded. The majority of the trades were futures trades which garnered a 73 percent share, while spot market volumes grew to 1.4 billion tons.

The carbon market in the U.S. also witnessed growth, specifically from the Regional Greenhouse Gas Initiative (RGGI) which grew almost 10-fold to US\$2.2 billion (€1.6 billion) in expectation of federal carbon legislation. With a focus on economic stimulus and more recently, political tensions in the Middle East and North Africa gaining media attention, it now appears unlikely that U.S. government legislation on carbon will come anytime soon. How can utilities deal with this uncertainty?

One new theory which has been offered has utilities considering moving ahead on capital generation projects as best they can and embracing energy efficiency measures to delay expensive build decisions.³⁹ The longer these decisions can be delayed through energy efficiency, conservation and demand management programs, the better off utilities are likely to be until there is certainty in the rules.⁴⁰ What are some of the other available options?

Understanding carbon exposure. While a global scheme is still in flux, businesses can use the lead time to understand their carbon footprint and identify points (both in core operations and throughout the supply chain) of particular carbon intensity, with an eye toward making reductions. Many companies are already doing so under national, regional, state or provincial schemes. In fact, some observers predict that continuing delays in implementing a global scheme indicates that national schemes will rise in prominence over the next few years; multinational companies should strive to understand where in particular their carbon impact is concentrated.⁴¹

Use scenario analysis to understand the viability of the business model under a variety of carbon price scenarios. Similar to the intensified stress-tests now being employed by financial services firms, companies should assess how their strategy and operations would have to change under a variety of potential carbon prices (including both high and low extremes). Scenarios employed should also include the possibility of both low and high carbon prices within the span of a few years. Given the oscillations in supply and regulatory driven demand in emissions-reduction projects this is certainly within the realm of possibilities.⁴²

Be prepared to provide more detailed disclosure on the company's carbon impact to a host of parties from both the public and private sector. Even as a global carbon price remains murky, carbon information itself carries an increasing premium. Whether driven by investor requests, (for example the Carbon Disclosure Project), or by securities regulators (including for example the United States Securities and Exchange Commission), companies are being asked to provide more information on climate change risks and opportunities. Movement towards integrated reporting – with increased emphasis on sustainability reporting, including implications of climate change and carbon regulation – only intensifies this trend.⁴³

Bottom line

Until such time as carbon pricing certainty begins to emerge or there are government policy decisions on what the rules will be regarding carbon reductions, power and utilities companies need to be proactive in managing their carbon exposure. Energy efficiency combined with conservation is one way while modeling carbon pricing under a number of scenarios is another. Given the increased regulatory presence in utilities markets around the world, companies should be prepared to provide additional disclosure on their carbon impact.

35 Central Intelligence Agency – The World Factbook 2010 <https://www.cia.gov/library/publications/the-world-factbook/geos/xx.html>

36 Ibid

37 International Monetary Fund, 2010, World Economic Outlook (April)

38 Ibid

39 Catherine Cash, "Take Safe Steps Like Efficiency While Policy Remains Uncertain." Electric Utility Week October 11, 2010

40 Ibid

41 Deloitte Global Services Limited. "Getting in Tune? COP16 and the Cancun Agreements." https://www.deloitte.com/assets/Dcom-Global/Local%20Assets/Documents/Sustainability%20and%20Climate%20Change/dttl_scc_COP16_wrapup_211210.pdf

42 Ibid

43 Ibid

9. Renewable energy: Key trends and outlook

Since the end of the global economic recession, growth in the renewable energy continues to gain momentum according to a number of recent studies. These studies indicate that while solar and wind energies remain the leading growth industries, hydropower projects and geothermal are making a comeback in Europe and along the Ring of Fire. Perhaps just as important is an emerging new link between natural gas and intermittent wind and solar power.

According to research firm Clean Edge, the global renewable energy market is expected to hit US\$349.2 billion (€246 billion) in the next ten years based on projections that the renewable energy market – including solar, wind, geothermal and biomass – grew 35.2 percent during 2010 to US\$188.1 billion.⁴⁴ Their research found that the solar photovoltaics (PV) market rose from US\$2.5 billion in 2000 to US\$71.2 billion. in 2010⁴⁵ The PV market is forecasted to reach US\$113.6 billion by 2020.⁴⁶

While solar has seen significant growth, so too has the global wind power market. Clean Edge has forecasted a growth in wind from US\$2.5 billion in 2000 to slightly over US\$60 billion through 2010.⁴⁷ China increased its wind capacity for the third straight year reaching 16 GW while new installations in the U.S. dropped. China outpaced the U.S. as a leader in total wind power capacity, with a capacity of 42 GW.

According to BP's Energy Outlook, renewable energy resources, not including hydropower will continue to take market share away from fossil fuels albeit at a slower pace than previously forecast. The report projects renewable energy as the fastest-growing source of energy over the next several decades with use of coal and oil forecasted to slightly drop, and natural gas becoming the energy sector with the fastest-growing fossil fuel. This shift in increased use of renewable energy is a result of continuing overall growth in energy consumption being led by developing countries.

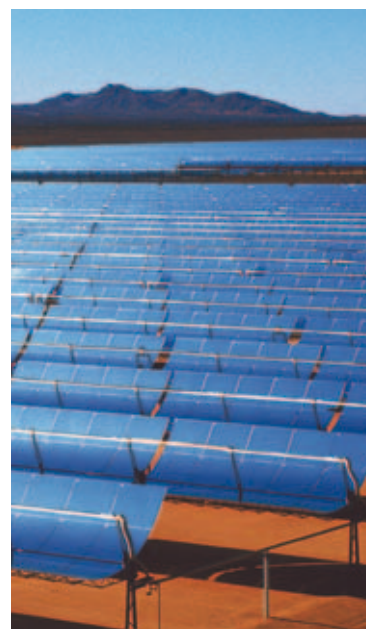
A report from Industrial Info Resources projects that the European hydropower market may not be growing as quickly as wind and solar but is still a critical resource in the region. The company recently reported that there are close to 200 European hydropower projects currently under development with an estimated investment value of €35.1 billion (US\$45.7 billion).⁴⁸ Within the next 12 months, the research company estimates €9.5 billion (US\$13.5 billion) worth of hydropower projects are forecasted to begin.⁴⁹

Geothermal energy has been enjoying a revival in the western U.S. where utility demand for this base load form of renewable energy, combined with federal and state level incentives, are encouraging developers to embark on new drilling programs. Meanwhile, in Indonesia, government agencies and developers are looking to significantly ramp up the country's installed capacity. Home to 40% of the world's geothermal resource, over 95% of Indonesia's geothermal energy remains untapped – opening significant opportunities for investment.

Does natural gas have a role to play in clean energy policymaking? Many industry followers believe so basing their prediction that natural gas can be paired with both solar and wind allowing for around-the-clock electricity. One example is the world's first solar-thermal plant that was recently brought online in Egypt. In Kuraymat, roughly 100 kilometers south of Cairo, a major solar-thermal power plant is going into operation for the first time in Egypt. The solar field consists of parabolic trough collectors with an overall surface area of 130,000 m² and is part of a hybrid power plant that will use both solar power and natural gas to generate electricity.⁵⁰ Moreover, integrated solar combined cycle (ISCC) plants, which increase steam generation by adding solar heat to gas-turbine waste heat, are another example of the pairing of solar and gas. Ain-Ben-Mathar, in Morocco, recently became home to the world's first operating ISCC plant with its 470 MW project (20 MW from solar).⁵¹

Bottom line

Even though global economic growth has been somewhat slow since the official end of the global recession, renewable energy is projected to play an important role over both the short- and long-term. As country's reassess the path forward for nuclear energy, renewable energy may be able to fill some of the short-term gap. Between 2010-2030, the contribution to energy growth of renewables is seen to increase from 5 percent to 18 percent.⁵²



44 Clean Edge. Clean Energy Trends 2011. March 2011

45 Ibid

46 Ibid

47 Ibid

48 Industrial Info Resources via Market Wire. Power Trends: European Hydropower Projects Top 35 Billion Euros. March 30, 2011

49 Ibid

50 <http://www.solarthermalmagazine.com/2011/01/02/egypt%E2%80%99s-first-solar-thermal-plant-goes-into-operation-in-kuraymat/>

51 Clean Edge. Clean Energy Trends 2011. March 2011

52 Greenwire News Agency. Renewable Energy Will Soon Out-strip Demand for Oil, BP Forecasts. January 20, 2011

10. Energy efficiency and demand side management: Status and outlook

Utilities have four primary objectives: increase power availability by minimizing interruptions in power delivery; accommodate renewable energy by preventing congestion; preparing for growing power load; and improve energy efficiency by reducing waste in power delivery and energy losses. In essence, utilities are being challenged to both curtail demand and to find ways to meet new demand requirements. This begs the question: is building more generation capacity the answer or are there other options available to utilities?

First to be considered is the amount of investment needed to replace obsolete capacity and to meet projected demand growth. From 2009 to 2035, the amount of electricity needed amounts to close to 5,900 GW on a global basis.⁵³ Cumulative global investment required in the power sector is US\$16.6 trillion.⁵⁴ US\$9.6 trillion of the total or almost 60 percent is needed to build new generating plants.⁵⁵ Improvements and expansion of electricity networks accounts for the remainder, with cumulative investment in transmission and distribution totalling US\$2.2 trillion and US\$4.8 trillion respectively. While these estimates may well turn out to be accurate, other more short-term options involve energy efficiency and demand side management.

Energy-saving programs that are administered by electric utilities are a rapidly growing sector of the demand-side management industry. Energy efficiency funding remains robust and continues to increase substantially in both the U.S. and Canada. The combined total of energy efficiency program budgets for ratepayer funded electric and gas programs reached nearly US\$6.1 billion in 2009, up from US\$4.5 billion in 2008.⁵⁶ These energy efficiency programs appear to have led to substantial reductions in both energy usage and carbon emissions. In addition, the savings include reductions of close to 105,000 GWh of electricity and 367 million therms of gas.⁵⁷ The avoided cost benefits of these programs were approximately 61 million metric tons of CO₂ and ratepayer savings of more than US\$9.7 billion in electric and gas costs.⁵⁸ Based on this scenario, utilities win by decreasing the baseload of electricity required to meet demand and in the amount of CO₂ released. And consumers save on their electricity bills.

The primary goal of demand side management is to reduce electricity consumption during periods of peak demand.

Through an innovative use of technology, demand side management (DSM) holds the promise of significant economic, environmental and social benefits. Most importantly, DSM helps utilities avoid the high capital costs of building peaking power plants. Instead, utilities can implement DSM networks at a fraction of the cost. To make DSM a viable option, utilities will need to consider the following:

Dynamic pricing without enabling technology. This pricing mechanism provides the advance notice that the price rate for electricity will be lower during certain periods of the day, and subsequent manual adjustment of power usage.

Dynamic pricing *with* enabling technology. This method could involve a smart thermostat, or a programmable switch that is connected to many home appliances such as an air conditioner, heater, etc., that is programmed to automatically lesson power use based on information received directly from the utility company detailing peak and off-peak power prices.

Direct load control. Direct load control is the ability, or perhaps more importantly, the permission given by the consumer to the utility to cycle home appliances off and on for brief periods of time during peak usage times. In return, consumers obtain lower utility bills.

Bottom line

To meet increasing demand for electricity utilities can elect to build more generation capacity or can elect to implement energy efficiency measures or demand side management programs. Throughout 2011 and into 2012, utilities will likely find it necessary to engage in building more capacity to meet forecasted demand and use both efficiency and demand side management.

⁵³ International Energy Agency, *World Energy Outlook 2010*, pp. 217

⁵⁴ Ibid

⁵⁵ Ibid

⁵⁶ Association of Energy Services Professionals. *Demand-Side Energy Management Programs are a Growing Segment of the Energy Industry and the National Economy*. PR Newswire January 18, 2011

⁵⁷ Ibid

⁵⁸ Ibid

What's ahead for 2012?

In tracing the top ten trends in this year's power and utilities report, it is clear that each issue will affect each company differently, depending on both their business model and on the jurisdictions in which they operate. The earthquake and resulting tsunami in Japan will have repercussions across the entire spectrum of power and utilities resources during 2011 and beyond. If there is one important take away from this year's report, it is infrastructure risk management. Whether power and utilities companies use natural gas, coal, nuclear or renewable energy, they will all place new emphasis on infrastructure safety.

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