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"Adapt or die is the immutable law in both nature and business. ... The future of our industry is completely up for grabs."

David Crane, NRG Energy

Who's got the power? How self-generation could transform the utility sector

> Sparking innovation Utilities need new business models, technology and thinking to unlock future value

> > China's quest for gas Can China pull off its own shale gas boom?





How will utilities adapt if the generation business erodes?



The growth of distributed generation – that is, power being generated where it is used, rather than supplied from a central source – has raised questions about a potential threat to the traditional utility business model. This is forcing serious rethinking of how utilities can adapt if the generation business erodes.

The Edison Electric Institute (EEI), which represents US investor-owned utilities, has even suggested that utilities could be overvalued on the stock market because investors haven't fully understood the impact of decentralized generation.¹

The conservative position – backed by energy source projections from the International Energy Agency (IEA) – is that while the sector can expect disruption, utilities and the grid will remain important for a long time. Until distributed sources compare on cost and are 100% reliable, we will still need utilities to provide power.

"In some advanced markets where distributed sources are viable ... the generation market already looks very different." It may indeed be 20-30 years until the business of generation sees wholesale transformation. But if, for example, solar grid parity becomes a widespread reality and some modern-day Edison invents a low-cost energy storage solution that addresses its intermittency, change could be upon us faster than we can imagine. In some advanced markets where distributed sources are viable, including southern California, the generation market already looks very different.

This is the challenge for utilities: as capital-intensive businesses, they tend to think in long-term cycles and are not known for their ability to shift direction quickly. Can they change this in generations to come?

Alison Kay, EY

Eurelectric's Dr. Susanne Nies stresses the urgent need for utilities to improve their competency and speed in innovation, especially around the business

model, on page 37. As she remarked during our interview, "If Nikola Tesla were alive today, he'd recognize the current power system as pretty much 'his,' familiar, but that won't be the case in a decade or so."

Around half of Germany's generation resource has already passed out of utility hands, thrusting traditionally structured German utilities into the vanguard of change (page 34). Our lead feature (see page 12), which includes interviews with global businesses already generating their own power, explores the impacts and opportunities that could open up for utilities if big businesses eventually "unplug" from the grid *en masse*.

Meanwhile, NRG Energy's CEO David Crane takes the potential for disruption extremely seriously: on page 49 he explores "mortal threats" to the sector and reveals the new technology his company is developing to retain a foothold in generation.

We welcome your views on all the topics covered in this issue; contact details for our authors are listed throughout.

Ak

Alison Kay

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1. "Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business," EEI. January 2013.

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Power & Utilities insights from EY

#UtilitiesUnbundled

monitor

Watching brief on power and utility projects worldwide

UK

Nordics

Financial investors target renewable power

The prospect of stable cash flow at relatively low risk has attracted several financial investors into renewable power in the Nordics. Goldman Sachs plans to buy a 19% stake in Denmark-based Dong Energy, the world's largest operator of offshore wind farms, for US\$1.46b. Danish pension funds PFA and ATP have agreed to acquire 2% and 5% stakes in the utility. German-based Allianz Capital Partners has bought a 72MW wind farm in Sweden. Corporations such as Google, Facebook and IKEA have also purchased stakes in, or signed offtake agreements with, renewable power projects to further their sustainability efforts.

Halfway to 2020 renewables goal

Renewable generation in the UK rose by 56% in the second quarter of 2013 and currently comprises 15.5% of the nation's generation, compared with less than 10% at the same time in 2012. Wind resources account for the majority of renewable gains, with onshore wind farm generation up 70% from 2012 and offshore wind generation increasing by 50%. The largest wind farm in Europe, Gwynt y Môr, off the coast of Wales, is set to come online in 2014. The UK is on track to hit its 2020 goal of 30% generation from renewable sources to meet carbon emission reduction targets.

United States

On-site generation threatens traditional utility model

Spurred by fears of repeated power outages such as those caused by Hurricane Sandy, and by lower prices for natural gas and solar panels, more companies are starting to generate their own power. Less than 5% of US generation is currently produced on-site. But "self-generation" is becoming increasingly mainstream, with companies such as Apple Inc. now producing 16% of its electricity from solar panels and fuel cells. If the trend takes hold it could threaten the utility industry with reduced revenues and impact growth. Edison International, owner of utility Southern California Edison, recently purchased a rooftop solar panel developer and is an investor in a solar finance company.

See Who's got the power? page 12.

Mexico -

Electricity sector opens up to competition

Industrial power costs have more than doubled over the past decade in Mexico, and businesses pay some of the world's highest electricity rates, negating many benefits foreign corporations see in low labor costs and geographic proximity to the US. Hoping to create a more efficient market with lower prices, the Mexican Government is proposing energy reforms to open up the electricity sector by increasing competition and allowing generators to sell directly to energy consumers. Until now, the state-owned Federal Electricity Commission (CFE) has had a monopoly on all aspects of the electricity market: any company generating power could only sell it back to the CFE.



Market monitor is based on news searches conducted in Factiva.com, from Dow Jones and Company.

Argentina

China-led consortium awarded US\$4b hydroelectric dam project

Concerns over a rising energy deficit and growing dependency on LNG and diesel imports have led Argentina's Government to award a multibillion-dollar contract for construction of two dams, as part of a 1,740MW hydroelectric project, to a consortium led by China Gezhouba (Group) Co. Ltd. The winning consortium, which includes Argentine firms Electroingenieria SA and Hidrocuyo SA, will initially finance the entire project. It will commence in December 2013 and is expected to take more than five years to complete.

Germany

Renewables force closure of conventional power plants

Coal- and gas-based capacity is being pushed to the brink of closure with Germany prioritizing renewables through preferential access to the grid and subsidies such as fixed prices, which render conventional power unprofitable. RWE has announced plans to close up to 4.3GW of capacity in Germany and the Netherlands. While wholesale prices have fallen due to the glut of renewable power, consumers carry the cost of the subsidies through continuing increases in retail prices.

See page 34 for further details.

Africa

Chinese investors pour into power

Countries across Africa have received several billion dollars in support from Chinese investors in power projects, which include Nigeria's US\$1.3b Zungeru hydro project, Zimbabwe's 600MW coal-fired plant, Uganda's 600MW and 188MW hydro plants, Tanzania's 600MW coal-fired plant and Ethiopia's 6GW Grand Renaissance dam. Power infrastructure developments in Ghana, Angola and Zambia have also received significant investments from Chinese utilities. Over the past decade, China's investment in the continent has increased dramatically, initially driven by the need for oil. China is now Africa's largest trading partner.

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Japan

Japanese households leave the grid

On the back of constantly rising consumer power prices and a wish to be self-supporting following the Fukushima nuclear disaster, more Japanese homeowners have begun generating their own power from solar panels and hydrogen fuel cells. Major property developers have started incorporating power generation capabilities in their new designs. Government subsidies allow homeowners to recoup their investment after about 10 years. Power technology companies are benefiting from the trend: one of the leading technology companies in Japan reports a 44% jump in sales in its solar division in the latest quarter.

Middle East

Saudi Arabia and Egypt to link grids

Egypt and Saudi Arabia have signed an agreement worth US\$1.6b to link their electricity transmission grids through a 20km undersea cable. Saudi Electricity Co. and Egyptian Electricity Holding Co. will each finance, own and operate parts of the cable in their respective countries. The link is scheduled for completion by 2016 and is expected to allow Saudi Arabia to export up to 3GW of power to Egypt, resulting in a return on investment of 13% for each country. The project, which also involves adding close to 820km of transmission lines in Saudi Arabia and 480km in Egypt, will effectively result in 14 Arab countries linking their power grids.

Australia/New Zealand

Privatizing power utilities

The state of New South Wales (NSW) in Australia is privatizing its largest power producer, Macquarie Generation, in an ongoing privatization program. Earlier in 2013, NSW sold four other coal-fired power stations to raise funds for critical infrastructure projects. Meanwhile, the New Zealand Government launched a US\$4.2b privatization program in an effort to meet its promised budget surplus by June 2015, beginning with the US\$1.4b IPO of Mighty River (49% stake), a power producer, in May 2013. Proceedings for sale of a 49% stake in the country's biggest electricity company, Meridian Energy, are underway through another IPO. This is expected to be followed by a 49% stake sale in Genesis Energy.

India

Smart technology to boost electrification

The India Smart Grid Forum, a consortium of public and private stakeholders, has developed the National Smart Grid Mission (NSGM), with a goal of achieving reliable 24-hour electricity supplies to 100% of the population by 2027. Currently, about one-third of the country has no access to electricity. The NSGM is focused on increasing use of renewable power and distributed generation; reducing lines losses, often a sign of power theft; and enabling better asset management capabilities. Technology trials for the grid are planned for 2015, with urban market rollout by 2020. Smart grid projects in India are estimated to be worth between US\$30b and US\$40b over the next 15-20 years.

DEALS

A busy third quarter included significant transactions across all regions and all segments. Utilities are pursuing mergers and acquisitions (M&A) to optimize portfolios, respond to market reforms and pursue opportunities in emerging markets.

Matt Rennie reports



Matthew Rennie

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Three key trends driving global deals

Around the world, our Power & Utilities (P&U) teams are reporting that transactional momentum is building across all regions and all segments of the market. We believe that this activity is both defined and driven by three key trends.

1 | Global rebalancing

Perhaps the biggest factor driving current M&A activity in the sector is the active rebalancing of portfolios. Amid political intervention, commodity price volatility, high-cost regulatory frameworks and uneven access to capital, utilities are exploring opportunities to consolidate revenue along the breadth of the supply chain.

Much of this rebalancing comes as network utilities transform from asset-based to service-based organizations. As they focus on optimizing organizational design, key decisions are being made about which assets will best drive growth within a new service-based paradigm. We are seeing widespread divestments of non-core activities, including meter reading and ownership, meter data activities and non-core businesses, as well as acquisitions of energy services businesses.

For example, during Q3, GDF Suez acquired Balfour Beatty Workplace for US\$295m (its fourth such acquisition in the past year), and in the largest deal of the quarter France-based Schneider Electric acquired UK-based Invensys Plc for US\$4.6b with a view to expanding energy management solutions and achieving cost and revenue synergies. During the same period, we saw RWE cut capacity while strengthening energy management offerings in a bid to pursue growth amid sluggish demand and low power prices.

2 | Market reforms create opportunities

Market reforms continue to drive transactional activity. Gazprom Energoholding's US\$3.8b purchase of 89% of the Moscow Integrated Power Company OJSC, as part of the Moscow City Government's privatization program, is illustrative of the trend. In Australia, the New South Wales Government began selling off Macquarie Generation and we are expecting more private sector involvement in Australian utilities over the next few years in both the generation and networks sectors.

We expect Japan's proposed deregulation and unbundling of its 10 vertically integrated utility companies to offer excellent opportunities for investors over the next two to three years. These projects are a key focus of our global P&U team, together with our skilled P&U practitioners in Japan.

3 | Emerging markets

on target

Our clients are continuing to review the regional spread of their operations as they find that core geographies are no longer their dominant profit centers. Our recent survey of more than 200 P&U executives indicates that 49% of P&U companies have a greater focus on emerging markets today than they did one year ago.

As higher-growth emerging markets continue to hold investors' interest, Africa is now a key target and focus of investor activity. The continent's growing energy demand, regulatory and social reforms and the need for infrastructure investment have seen it become one of the world's top energy investment destinations. Infrastructure spending in Africa hit US\$700b in 2012, with the power sector accounting for 25%, or US\$176b, of this investment.¹ Opportunities here are huge – the continent needs an additional 250GW of generation capacity by 2030,² which is expected to cost about US\$300b.

In July, President Barack Obama announced that the US would commit US\$7b to strengthening the sub-Saharan electricity network. Renewable energy in the region is a key target and we are seeing both private and foreign players attracted by long-term growth prospects in wind, solar and geothermal. Kenya and Morocco received the second-largest clean energy investments in sub-Saharan Africa – US\$2.9b between them – with South Africa securing US\$5.7b of investment in 2012.³

Local knowledge and partnerships are the key to success in Africa. This was highlighted during Nigeria's recent US\$2.5b privatization process. Local players – in consortia with foreign players including Siemens, Manila Electric, Symbion Power and KEPCO – emerged as winners of most of the projects on offer.⁴ As the country moves to privatize 10 gas-fired power plants, expect to see more involvement from foreign investors on the lookout for M&A opportunities. Our local EY P&U teams in Africa are active in this space and provide a unique portal to inbound investors on the best strategies. "With the conventional drivers for investment starting to return to the market — confidence, opportunity and access to credit — we expect to see a greater number of deals in 2014."

Matt Rennie, EY

What's next?

We see transactional activity centering on global areas where these three trends converge. The focus on electrification and reforms in Africa provide both opportunity and investor confidence to the market, as does the reform process in Japan. We expect to see both of these areas attract considerable attention.

In Europe and North America, the discipline imposed by the last few years has led to utilities examining how best to optimize their portfolios, which, in turn, is driving both divestments of non-core assets as well as investment activity elsewhere in the supply chain. This latter issue is interesting – we are seeing power equipment manufacturers entering into alliances with financial institutions in order to consolidate their positions in projects and secure sales, and the investments noted above by utilities into energy services follow a similar line. Boards are seeking to consolidate and defend their market positions and carefully extend into ancillary areas where they have existing factors of production to deploy.

We are also seeing more positivity and confidence in the market. Our recent survey of 203 global P&U executives revealed that boardroom confidence is at its highest point in two years, with 67% of those surveyed believing the global economy is improving, compared with 47% six months ago. With the conventional drivers for investment starting to return to the market – confidence, opportunity and access to credit – we expect to see a greater number of deals in 2014.

See overleaf for the Big picture on power and utilities M&A in Q3 2013

1. "Africa attractiveness survey 2013, EY, 2013.

 [&]quot;Prospects for the African power sector: scenarios and strategies for Africa project," International Renewable Energy Agency, 2012; "Fact Sheet: Power Africa," The White House, 30 June 2013.

 [&]quot;Global Trends in Renewable Energy Investment," Bloomberg New Energy Finance, 2013, accessed 27 September 2013.
"Nigerian power facilities turn private," *Financial Times*, 30 September 2013; "Korean firm to inject \$30b into Nigerian power sector," *The Nation*, 1 June 2013.

The big picture

Momentum building

Globally, the power and utilities (P&U) transactions market rebounded slightly in Q3 2013 as momentum built amid continued rebalancing of portfolios. While deal value dropped slightly from US\$33b in Q2 to US\$31.6b, volume reached a two-year high, up 25% from the previous quarter and dominated by nine transactions exceeding US\$1b each.

Five of these billion-dollar-plus transactions were in Europe, which contributed more than half of Q3's global deal value, driven by divestments and privatization programs.

In the US, financial buyers are taking advantage of opportunistic power generation assets as utilities review portfolios in light of continued weak wholesale prices.

Asia-Pacific transactional activity cooled slightly to US\$5.9b; however, the region saw some significant deals around China's gas distribution assets and the commencement of privatization activities regarding generation assets in the Australian state of New South Wales. Financial buyers stepped up their activity during the quarter: this category of transactions quadrupled to US\$6.5b, attracted by current valuations and a desire to build portfolios with a view to gas and power price upside.

Focus on energy services

As utilities look for new avenues of growth, we are seeing a focus on expansions into related businesses, with energy services emerging as a key target. Q3 saw a number of European utilities acquire energy services businesses in a bid to add value and support core offerings. Utilities are increasingly scouting for opportunities upstream and downstream in the supply chain to gain competitive advantage, revenue security and yields, which are incremental to, and leverage off, core business. Figure 1. Global P&U M&A deal value Q3 2013



Source: EY analysis

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The capability crunch

Today's skills shortage in the power and utilities sector is unprecedented, says Benoit Laclau, EY's Global Advisory Power & Utilities Leader. Read Benoit's point of view on the "capability crunch" that threatens to increase costs, delay projects and hamper efforts to cut carbon.



Africa's time to shine

Africa is now one of the world's top energy investment destinations, driven by growing demand, market reforms and a huge need for infrastructure. The continent will need 250GW of additional generation capacity by 2030, opening up huge opportunities, particularly in the sub-Sahara.



Take the COO challenge Is the COO role the most challenging in power and utilities? In our experience, outstanding COOs are taking three core actions to ensure their companies are ready for the greatest transformation in the sector's history.



Securing utilities against cyber attacks

Cybersecurity attacks are increasing in number and sophistication every single day. But our latest Global Information Security Survey shows most companies are moving too slowly to improve their defenses. Utilities must act now to improve, expand and innovate their approach to enterprise-wide security risk management.

Who's got the

12

Big industrial energy users are increasingly establishing their own energy supply. How will this influence the future of utilities?

Report by Joseph Fontana, Gil Forer and Charles-Emmanuel Chosson



e are witnessing the beginning of a new age in how electricity is produced and how customers buy it, with the growing deployment of distributed generation (DG) systems including microturbines, combined heat and power (CHP) units, fuel cells, and solar photovoltaics (PV).

Big corporations are investing millions directly into renewable energy projects as part of their overall corporate sustainability moves. A greater number, who can't tie up core capital in projects, are still keen to sign up to long-term power purchase agreements (PPAs) for renewable electricity with on-site or off-site renewable generators.

This partial "unplugging" of big industrial consumers from the grid has raised concerns about the centralized generation business model and potential threats to profitability at traditional utilities. In Europe and the US, recent reports by Eurelectric and the Edison Electric Institute have indicated a looming danger to revenue from DG. But what might the opportunities be?

In this article, Walmart, P&G and AstraZeneca – companies at advanced, intermediate and early stages of the "DG lifecycle" – share their self-generation experiences. On page 19, we take a view of the impacts and new business opportunities for utilities.

A new driving force

Concerns about rising and volatile energy costs, supply security and the shift to a low-carbon economy are creating growing momentum behind DG. Direct investment into generation and long-term procurement – both on- and off-site – have become proven routes for corporations to:

- Achieve long-term cost savings and price security
- Improve energy security through a portfolio of alternative sources
- Increase energy efficiency, using combined heat and power units
- Reduce exposure to carbon price increases
- Enhance reputation and brand by meeting the sustainability expectations of customers and investors

Global companies on this journey include Apple, AstraZeneca, BMW, Google, HSBC, IKEA, Microsoft, Mitsui, Nestle, Nike, P&G, PepsiCo, Renault, Sumitomo, Volkswagen and Walmart.



Walmart: seeking global impact

Walmart is highly ambitious and deeply committed to DG. The US-headquartered multinational has declared a long-term 100% renewable energy target, implementing solar, wind, biodiesel generators and fuel cells across its global operations.

Its stated aim is to globally drive the production or procurement of 7 billion kWh of renewable energy by 31 December 2020, which will equate to approximately 20% of the company's total power consumption.¹ "One potential outcome could be the installation of solar arrays on as many as 1,000 rooftops," says David Ozment, the company's senior director of energy.

Walmart now reportedly draws on 89MW of solar capacity (according to a recent report by the Solar Energy Industries Association),² producing more solar energy today than the entire US did in 1987.³ Ozment explains that Walmart's primary financing tool to date has been "the use of PPAs and operating leases for both on-site projects and large-scale off-take agreements. Examples of the latter have included taking power from windfarms in Texas and Mexico and landfill gas projects.

"PPAs allow our renewable energy partners to do what that they do best – which is own, install and operate systems – and allow Walmart to do what we do best – which is operate stores and procure energy. From a capital allocation perspective, this strategy also allows the company to focus capital on building new stores."

Early challenges were, he says: "finding projects that can actually deliver energy at, or below, utility prices; and negotiating contracts for shorter-term PPAs – 10 to 15 years as compared to the standard 20 to 25 years. Complexity also arises in the US because not all State utility regulatory rules allow PPAs between customers and non-utility third-party suppliers."



David Ozment SR Director, Energy Wal-Mart Stores, Inc.

David joined Walmart in 2003 and leads the company's renewable energy efforts and business relationships with electric and natural gas utilities across the US. Prior to this, he worked in the electric utility industry in management and senior management positions with American Electric Power Company (AEP) and Central & South West (CSW).

^{1. &}quot;Walmart targets 600 per cent increase in renewable energy use by 2020," Business Green website, www.businessgreen. com/bg/news/2261995/walmart-targets-600-per-centincrease-in-renewable-energy-use-by-2020, accessed 18 October 2013.

 [&]quot;Solar Means Business 2013: Top U.S. Commercial Solar Users," SEIA, www.seia.org/research-resources/solar-meansbusiness-2013-top-us-commercial-solar-users – accessed 8 November 2013.

 [&]quot;Wal-Mart Now Draws More Solar Power Than 38 U.S. States," Bloomberg, www.bloomberg.com/news/2013-10-24/ wal-mart-now-has-more-solar-than-38-u-s-states-drink-.html – accessed 8 November 2013.



Steve Skarda

Global Energy/CO2 Leader Procter & Gamble

Steve is responsible for delivering P&G's 2020 sustainability goals on conservation and renewable energy, including reducing greenhouse gas emissions and energy usage by 20% by 2020. He joined P&G in 1996 and has worked in executive Power & Controls roles at the company's plants across the US. Steve powers his home and car with 100% renewable electricity and continuously looks for opportunities to reduce his personal footprint. Complexity multiplied exponentially as Walmart extended its energy strategy internationally, explains Ozment: "Factors such as basic utility infrastructure, net metering/ interconnection rules, ability to use PPAs, Renewable Energy Credit (REC) rules, energy prices, the presence of suppliers and developers, availability of financing, public policy, and utility regulation all vary widely between countries.

"We set up a Global Renewable Energy Committee with representatives from multiple countries or markets where we do business, to share best practices to manage these issues – to bring scale, and ultimately lower prices, to markets when their unique circumstances make it the right time for renewable energy deployment."

For an activity that is non-core, Walmart's investment in learning new competencies is impressive: "We had to understand the technologies – solar, wind, fuel cells, waste to energy. We had to learn to develop and manage PPA contracts and understand the role banks and other financiers play in PPAs. We started to re-evaluate our role in construction oversight and local permitting. We began to assess utility regulation, including net metering and interconnection rules. We've had to develop financial evaluation tools, and measurement and tracking tools for systems we have installed or supply purchase contracts we have entered into."

Energy expense savings are a clear benefit: "Our goal has been to procure renewable energy at, or below, utility prices," Ozment says. "Renewable energy supply contracts can give us price and budget certainty. We can use our scale to drive down the cost of technologies such as solar, making it more affordable for everyone. There are also intangible benefits in terms of public opinion, though that isn't a primary reason for our involvement. Studies have shown



corporations that champion environmental sustainability outperform those that don't on stock prices, and the business case is ultimately what drives these projects."

"Our goal has been to procure renewable energy at, or below, utility prices. Renewable energy supply contracts can give us price and budget certainty."

David Ozment, Walmart

P&G: efficiency ambitions

Global consumer products company P&G has a 30% renewable energy goal by 2020, as part of a long-term vision to power its plants with 100% renewable energy.

Steve Skarda, the company's Energy/CO2 Leader, says: "We are actively purchasing power on- and off-site and expect to implement several new projects in the next two years. Having completed projects including solar PV in the US, Germany and China and a wind turbine in the Netherlands, we are working on expanding our use of bioenergy in the portfolio."

On-site generation at plants is good for finance and efficiency, explains Skarda: "The highest proportion of our energy consumption is thermal. By locating bioenergy projects on-site, we can create additional revenue from heat that is normally lost. We are focused on identifying developers interested in building CHP operations at our plants to



leverage these thermal loads. We also see an advantage in burning raw syngas and biogas directly in our boilers. This offers higher efficiency than electricity generation and far lower capital cost than cleaning those gases to pipeline quality."

Self-generation must align closely with the company's economic models: "We know that sustainability projects are best executed when they can meet the needs of our communities, the environment and our shareholders simultaneously. With that in mind, we are interested in, and capable of, providing long-term creditworthy off-take agreements – but only where they offer a financially attractive proposition for all participants."

Skarda sums up the key challenge today as: "scale and economics, which can work against each other. More than 50% of our energy usage is in our Baby and Family Care business in North America. Low-cost natural gas has been great for our business, but it makes developing competitive renewable projects that address the thermal load much more challenging."

Like Walmart, P&G has had to learn many new competencies fast. "In 2010, we set our '30% by 2020' goal. Since then, we have organized a global renewable energy team with leaders in purchasing, engineering, manufacturing and finance," Skarda says. "On the

"We are working on expanding our use of bioenergy. ... The highest proportion of our energy consumption is thermal. By locating bioenergy projects on-site, we can create additional revenue from heat that is normally lost."

Steve Skarda, P&G



Richard Sturman Global Energy and Climate Change Director AstraZeneca

Richard has more than 30 years' experience in the pharmaceuticals sector and has worked in a variety of operational, project, business change and global roles. He is passionate about addressing the challenges of climate change and improving the environment. technical side, we have proven success at installing solar PV panels, wind turbines and deep geothermal wells at our sites. On the business side, we have executed several renewable energy PPAs. This multi-disciplined, hands-on approach enables us to develop very clear strategies to leverage each of the renewable technologies and business strategies available to us."

AstraZeneca: starting out

Today, about 4% of AstraZeneca's energy comes from renewable sources. The UK-headquartered biopharmaceutical company is targeting a 20% CO₂ reduction in the five years up to 2015 and a 30% reduction in overall energy consumption. Global Energy and Climate Change Director Richard Sturman says: "We're primarily interested in DG for cost reduction, but increasingly carbon reduction is also a key driver. Setting our carbon target for 2015 focused our minds on how and where we get electricity, in the UK and globally.

"In the UK, we've generated electricity using gas CHP units for a number of years and we run limited self-generation in other countries. The business case for future DG would depend on fuel prices and our view of supply security in individual locations. We have considered PPAs for renewable energy supply in the UK and will revisit this in future. Off-site PPAs offer a good way to hedge against price rises and offer a carbon benefit. But they don't tackle the supply security issue. Insufficient gas storage capacity could leave the UK facing an 'energy crunch' in the near future, and we need ways to manage that risk to our business."

Operation of AstraZeneca's UK CHP sites is outsourced to the energy services company Dalkia, and Sturman says these relationships are at the heart of success. "You need strong financial analysis to frame the business case. You need great legal competence to get the contracts right in generation deals with third parties. But most of all, you need the right partner: on any future DG project, we'll be looking for someone we can trust to 'do the right thing' for AstraZeneca."

Sturman believes that business opportunities lie here: "For us, it's cost that matters. Cost is a function of price and volume, and those factors are only going to get more complex. Our ideal



"Our ideal would be to find a partner who could offer a complete 'one-stop shop' to manage energy complexity for us: design, build and operate the technology, and manage our demand and supply. I'm not sure anyone has a good track record of doing all this yet."

Richard Sturman, AstraZeneca





would be to find a partner who could offer a complete 'one-stop shop' to manage energy complexity for us: design, build and operate the technology, and manage our demand and supply.

"I'm not sure anyone has a good track record of doing all this yet. Whether it would be at national or global level, who knows? But if you look at the parallels in facilities management, there are some significant global FM companies now: 10 years ago, we wouldn't have envisioned that at all."

Utility impacts and opportunities

As things stand, today's utilities are still the best providers of safe, reliable and low-cost electricity across the globe. They still produce and deliver the overwhelming majority of the kWh sold, while distributed generation represents a fraction. A key reason for utilities' dominance is their unquestioned ability to deliver power cheaply and reliably. For over a century, this has been accomplished by ever-larger and more efficient generation units producing power in distant locations, which is delivered over tens or hundreds of miles to local distribution systems.

With technological advances in DG pushing lifetime production costs closer to delivered utility costs, generating energy locally becomes a viable option, challenging the traditional utility business model, at least for certain customers. Further technology innovation will increase the pressure on this model.

New business model must coexist with DG

There is no "utility killer" on the horizon – yet – that could cause the sector to go the way of the telephone landline business. But what happens when a 21st-century Thomas Edison invents a generation device no bigger than a family washing machine, capable of producing electricity 24 hours a day from clean natural gas, which is price competitive with current electric bills?

In time, technology will make it cost effective for some customers to leave the utility behind, at least partially. Continuing enhancements in the efficiency of solar panels, batteries to store power, fly wheels to store energy, expanded utilization of energy efficiency and continued Industrial companies are teaching themselves the energy business, but are they necessarily getting the best deal? This is an opportunity that should inspire utilities to use their wealth of knowledge in new ways.

government subsidies will drive down the cost of self-generation, increase reliability and accelerate the number of customers that leave the utility system.

This is the biggest concern for utilities: it is likely that those who leave will include the customers whose energy usage is higher and who help to shoulder the fixed costs of the utility system. In the short to medium term, this will create challenges for both the utility and its remaining customers. With a smaller customer population over which it can spread its fixed costs, utilities will be driven to increase prices. But in regions where a regulator sets utility rates, that regulator may not be willing to allow this – so the earned return of utilities will drop.

A more perplexing question for utility executives will concern the development of new power plants and transmission lines. Utilities typically seek to recover the cost of new plants over a 30- to 40-year time horizon. They will now need to take into account the likelihood of advances in DG that may cut the number of customers remaining on the system in 10, 15 or 20 years. Making this judgment with any certainty could be hard, but a significant improvement in solar panels, fuel cells or some other technology 15 years from now may leave the utility with too few customers to recover the cost of the plant without dramatically increasing pricing.

Utilities therefore need to find new business models that enable a cleaner, smarter grid to coexist and coevolve with DG. To achieve this, they need to be flexible and seek competitive advantage through investment in technology and innovation.

In discussing their experience, our interviewees have repeatedly used terms that should ring bells with utilities looking for new opportunities. Industrial companies are essentially teaching themselves the energy business: managing energy risks, balancing supply and demand, learning energy efficiency, assuming a vast array of other new competencies and managing non-core complexity of all kinds. The growing power of consumers is, of course, not just a matter of action by large industrial corporations: DG and micro-grids will enable individuals, communities and other entities to be more independent in terms of their energy management. But while energy users who are doing everything for themselves may have control, they're not necessarily getting the best deal. If there was ever an invitation for utilities to get inspired to use their wealth of knowledge in new ways, it lies in Richard Sturman's phrase "one-stop shop."

Generation business is adapting now

The generation business is obviously where we would expect the most change, and it is already transforming in some locations – notably Germany (see page 34), where DG is forecast to result in a 20% decline in market share and a US\$3.1b loss in profit for utilities through 2020. Other countries preparing for change include the US and potentially the UK and Italy. Recent moves at big German and US utilities indicate the developing focus on DG and energy services:

- RWE is expanding its concept of a "virtual power plant" with Siemens to integrate distributed energy sources and enable trading of power generated by its customers. It has also announced a strategic shift toward energy services.⁴
- NRG is formulating a new offer of packaged solar PV and natural-gas-fired generation to enable customers to generate their own power. The company plans to launch a "solar pergola" with a battery backup. It is also extending a financing option for homeowners for installing solar panels.⁵
- Duke and Edison International have invested in Clean Power Finance, a leader in the rooftop solar market.⁶

Emphasis is different in emerging markets

In the poorest of countries, the issue is how to unleash the potential of DG for underserved communities. They could leapfrog capital-intensive investment in centralized supply systems and bring energy to local communities through DG and micro-grid solutions.

This represents an exciting opportunity to address energy poverty. However, since commitments are being made now on plants that could operate for the next 40 years, contracts to build long-term assets will need built-in guarantees of repayment if DG significantly impacts their economic viability in the future.

 "NRG Energy looks to change the entire utility business model,"Cleantech Finance website, http://www. cleantechfinance.net/2013/nrg/, accessed 11 October 2013.

6. "Future of electric power: Should utilities reinvent themselves as innovators?," Smart Grid News, http:// www.smartgridnews.com/artman/publish/Business_ Electronomics/Future-of-electric-power-Should-utilitiesreinvent-themselves-as-innovators-4477.html , accessed 18 October 2013.



 [&]quot;Relentless And Disruptive Innovation Will Shortly Affect US Electric Utilities," Forbes website, http://www. forbes.com/sites/peterdetwiler/2013/04/18/relentlessand-disruptive-innovation-will-shortly-affect-us-electricutilities/, accessed 15 October 2013.



Grid needs major investment

The International Energy Agency (IEA) says it still expects conventional generation, including fossil fuel, nuclear power and hydroelectricity, to account for 85% of world electricity production in 2035 (in OECD countries the figure is 79%).⁷

This power will be supplied in a traditional, centralized manner over large transmission and distribution networks. Utility-scale non-hydro renewables, including wind and solar farms, will also require investment in transmission lines and grid infrastructure.

Distribution businesses will need significant increased capital investment to strengthen current systems and enable power to flow from the customer back into the grid. Californian utility Southern California Edison has recently announced a huge investment of US\$1b in its distribution business for exactly this reason.

Right policy is vital

Policymakers need to create the right environment to ensure a smooth transition for utilities. This means introducing incentives that encourage investment in technology and innovation. It means rethinking overgenerous

7. IEA New Policies Scenario, World Energy Outlook 2012. Copyright IEA. subsidies to DG; we need to establish a fair cost structure in which DG customers pay a fair share of the grid services that provide power backup and stability, without overburdening non-DG customers.

Sensible policies are also needed for energy efficiency: utilities need to be compensated for lost revenue from energy sales if they invest in energy efficiency solutions.

From disruption to opportunity

In developed markets, we have already seen leading utilities commit to diversification to provide a cleaner, more sustainable generation mix. The industry's investment in smart metering and grid modernization are further examples of utilities' ability to innovate.

With the right approach, utilities can turn disruptive threats into opportunities, remain relevant to their customers and develop new revenue streams beyond energy supply. There will be winners and losers in this process, but consumers will ultimately emerge with more choices, lower energy costs and more value-added services provided by incumbents and new market entrants.



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In the past decade, renewables have grown from adolescence to adulthood – so what trends can we expect over the next decade?

Report by Ben Warren

ay 2013 marked the 10th anniversary of EY's Renewable Energy Country Attractiveness Index (RECAI). A decade ago, we began charting a fledgling industry; in 2012, annual clean energy investment totaled US\$269b, up fourfold from 2004.

Here are three trends we can expect to shape the renewables industry over the next 10 years.

1 | A subsidy-free world for renewables

We are at a tipping point regarding subsidies. After 25-30 years of government support, subsidies for renewables are toppling like dominoes as governments struggle with debt and technologies mature:

- In the US, the volatile debate over production tax credits for wind has created boom-bust cycles and stalled activity in 2013; the belated one-year extension failed to maintain 2012's momentum.
- In Europe, some countries have slashed feed-in tariffs (FITs) and other subsidies dramatically by 40% or higher since 2008. Spain has replaced its FIT with a "reasonable profitability" guarantee of 7.5%, applied retroactively; Italy has moved to competitive bidding for large-scale projects, while Poland looks set to do the same; and the Czech Government passed a law in September 2013 to eliminate renewables subsidies altogether beginning in 2014.
- China has reduced its solar subsidies and amended its support regime.
- India temporarily revoked incentives for wind in 2012, and the major solar state of Gujarat recently called for retroactive solar tariff reductions.

Although punitive retroactive measures have pushed some industries to the brink, the news is not all bad. It is time the industry was weaned off subsidies – it will unleash great opportunities. In 10 years, subsidies will be gone, and many markets will have renewables projects that are price-competitive with other forms of generation. Already we are seeing unsubsidized solar projects going ahead in Spain and Chile.

Brazil is a great example of competitive bidding enabling wind to be cheaper than other energy sources, including natural gas, while a new Australian wind farm is now cheaper than a new coal or gas plant.

"It is time the renewables industry was weaned off subsidies — it will unleash great opportunities."

Ben Warren, EY

2 | "Asset-light" utilities The capital model for utilities will evolve. Although there is a historical and emotional attachment to utilities owning and operating their assets, it no longer makes economic sense.

Tremendous amounts of capital are needed for upgrades to infrastructure and new projects, but project finance is tight, and utilities have constrained balance sheets. Whereas most carried an A+ credit rating a decade ago, today only one of Europe's top utilities is A+. A shift from asset owner (where the generation assets sit on the balance sheet) to asset operator (where assets are owned by investors but operated by utilities) would free up much-needed capital for utilities.

l often hear the argument "our shareholders don't want it." But shareholders want derisked balance sheets; what's more, shareholders are likely to be the very investors that become owners – pension funds and insurance companies – and are better placed to finance ownership. In 10 years, you can expect the sales of non-core generation assets to have succeeded in Europe and to have moved onto generation assets globally.

3 | Companies producing and procuring their own

renewable energy Whether spurred on by high energy costs, unstable energy supplies or protecting their brand, the number of companies producing their own green energy or buying it directly from renewable

generators will skyrocket. Google led the way in 2007 by installing a 1.7MW solar farm at one of its sites. Other companies such as IKEA, Nike, HSBC, Volkswagen, PepsiCo, Renault and Walmart are following suit. Apple produces 16% of its electricity from solar panels and fuel cells.

Though the vanguard is in consumer goods, retail, finance, technology/ telecoms and pharmaceutical industries (see *Who's got the power?*, page 12), in 10 years' time this will be a mainstream trend.

Renewable Energy Country Attractiveness Index (RECAI) – November 2013

Delayed decisions, inconsistent messaging and policy overhauls are keeping renewables in the dark in some markets, while others have their sights firmly set on large-scale deployment. A wave of IPOs, the awakening of a new investor class and changing EU-China dynamics are also signalling interesting times ahead for the renewables sector. To read the latest edition, go to www.ey.com/RECAI

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Nuclear goes Juliar

After major setbacks following the 2011 Fukushima disaster, the nuclear industry is making a comeback. Will the smaller, cheaper, safer design of small modular reactors (SMRs) win over critics?

Report by Brad Hartnett

s governments and utilities search for low-carbon generation, the benefits of SMRs look compelling:

- 1. Cheaper: SMRs require less up-front capital than large-scale plants, and the modular design allows units to be deployed incrementally, so cash generated from the electricity sales of the first operational units can offset the negative cash flows of subsequent unit construction.
- 2. Less construction risk: building standardized units in a factory that can be shipped to site fully assembled reduces project construction risks, a key consideration as delays and cost overruns have damaged the credibility of larger projects.
- 3. Safe: smaller means less fuel and fewer radiation hazards, and some designs can be placed below ground level, providing additional radiation shielding and security benefits.
- 4. Clean and reliable: as more renewable energy is added to the grid, inherent problems with intermittency create real challenges for reliable dispatch. SMRs provide a reliable base load supply, free of carbon emissions.

Multiple designs but LWRs lead the pack

SMRs include a diverse range of technologies and reactor designs with unit capacities below 300 megawatt electric (MWe), including light water reactors (LWRs), heavy water reactors (HWRs), breeder reactors, and gas-cooled or pebble-bed fast reactors (see Figure 1).

LWR designs are the most commercially promising in the near term, given their low technological risk. "Ninety percent of the design is well proven; it's in operation today in many power and naval reactors," says lan Hore-Lacy, Senior Research Analyst with the World Nuclear Association (WNA). "The main change is the integral reactors: on many, the steam generators actually sit inside the pressure vessel."

Because LWRs use ordinary water for cooling and, primarily, low-enriched uranium fuel, Hore-Lacy says they "face the fewest regulatory hurdles of any SMRs."

Developers of LWR SMR designs include familiar names such as Westinghouse and Babcock & Wilcox (whose SMR design was previously profiled in *Utilities Unbundled*). Newer names include NuScale Power in Oregon and SMR, LLC, a Holtec International subsidiary based in Florida. "... we see a real market for smaller, safe, incrementally scalable nuclear power plants."

NuScale, established in 2000, was one of the first companies to focus exclusively on SMR development. "In 2009, a lot of people still thought we were nuts," says Mike McGough, Chief Commercial Officer for NuScale. "Now there are other suppliers, and we see a real market for smaller, safe, incrementally scalable nuclear power plants."

Challenges in commercializing SMRs

In the US, the top challenges are seen as the regulatory process, financing, the supply chain and public acceptance.

"We began our engagement with the Nuclear Regulatory Commission (NRC) in April 2008," says McGough. "With a design certification application running to nearly 10,000 pages, and 39 months for the NRC to review a new design, regulatory uncertainty can be a key challenge."

Mike McGough, NuScale

Building up a supply chain is also an issue, McGough says. "Our reactor works by convection, conduction and gravity. But we still have components that have to be built, including the turbine and a purpose-built factory to manufacture the power modules. These take time and investment."

Although public acceptance remains a challenge, perceptions of nuclear energy are becoming more positive globally. "I've long said that smaller nuclear reactors would ease public acceptance considerably," says Hore-Lacy. "The International Energy Agency (IEA) recently announced data¹ showing rising public acceptance of nuclear power in most countries. Acceptance in the US was about 35% higher in 2013 than in April 2011; even Germany was 10% higher."

1. "Tracking Clean Energy Progress 2013," Figure 1.13. International Energy Agency. 2013.



Mike McGough Chief Commercial Officer NuScale Power

Mike McGough oversees NuScale's worldwide commercialization efforts. He is a 34-year veteran of the commercial nuclear industry and has held a variety of executive and leadership roles for companies including Westinghouse, NAC International, Duratek, Energy Solutions, and PCI Energy Services. McGough has written, published, or presented over 80 papers and has worked on numerous projects, including new plant development, decommissioning, defueling, spent fuel dry cask storage and steam generator replacement.

Figure 1. SMRs in operation, under construction and in well-advanced development

An innovative industry

Other designs and approaches will reach the market in the future. GE Hitachi has developed a small modular, sodium-cooled fast reactor, PRISM (to be covered in the next issue of *Utilities Unbundled*), that recycles used nuclear fuel to generate low-carbon electricity. It can also function as a plutonium burner and thus may be able to reuse the UK's plutonium stockpiles. PRISM is an inherently safe design that could help close the nuclear fuel cycle, reduce the amount of waste and reduce the time it has to be stored in a repository to a few hundred years.

Name	Capacity	Туре	Developer
Small (25 MWe up) reactors operating			
CNP-300	300 MWe	LWR	CNNC, operational in Pakistan
PHWR-220	220 MWe	HWR	NPCIL, India
Small (25 MWe up) reactor designs under construction			
KLT-40S	35 MWe	LWR	OKBM, Russia
CAREM	27 MWe	LWR	CNEA & INVAP, Argentina
HTR-PM	2x105 MWe	Heat Transfer Reactor	INET & Huaneng, China
Small (25 MWe up) reactors for near-term deployment – development well advanced			
VBER-300	300 MWe	LWR	OKBM, Russia
Westinghouse SMR	200 MWe	LWR	Westinghouse, US
mPower	150-180 MWe	LWR	Babcock & Wilcox and Bechtel, US
SMR-160	160 MWe	LWR	Holtec, USA
ACP100	100 MWe	LWR	CNNC and Guodian, China
SMART	100 MWe	LWR	KAERI, South Korea
NuScale	45-540 MWe	LWR	NuScale Power and Fluor, US
PBMR	165 MWe	Pebble-bed HTR	PBMR, South Africa; NPMC, US
PRISM	311 MWe	Fast Neutron Reactor	GE-Hitachi, US
BREST	300 MWe	FNR	RDIPE, Russia
SVBR-100	100 MWe	FNR	AKME-engineering, Russia

Source: World Nuclear Association, 2013

Figure 2. Smaller footprint – a 540 MWe NuScale project requires only 44 acres of land.



Source: NuScale Power

Getting the message out regarding safety is central to NuScale's approach. "Our design is immune to a Fukushima-like station blackout, as in these circumstances our plant would safely shut itself down and cool itself off indefinitely with no operator action, no additional water other than what we have in the plant and, most importantly, no power: no AC power, no DC power, no emergency diesel generators, and no backup batteries," says McGough.

Looking ahead: the best markets for SMRs

Globally, Hore-Lacy sees Southeast Asia, the US, the Middle East and Africa as the most promising markets. "Indonesia is replacing its planned six 1,000MW-class plants with SMRs in a different part of the country," he says. "The US is also a favorable market. And the potential of SMRs for both power and desalination makes them attractive to the Middle East and North Africa."

NuScale has its sights firmly trained on the US as well as on the UK, China and other emerging markets. "We think the early markets for our design will include the US. Prospective customers are likely to be heavy on carbon-emitting generation and concerned about global equilibrium of natural gas prices," says McGough.



Ian Hore-Lacy

Senior Research Analyst World Nuclear Association (WNA)

Ian Hore-Lacy edits and updates information on all aspects of nuclear power for WNA at www.world-nuclear.org/ Information-Library. He is also the author of *Nuclear Electricity*, the 10th edition of which was published in the UK in 2012 and in China in 2013 as *Nuclear Energy* in the *21st Century*. Hore-Lacy has consulted to the Australian Uranium Association, whose predecessor he headed from 1995.

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AGI reinvents the rate case

Rate cases are one of the most unpredictable aspects of an industry that strives for predictability. But AGL Resources, the gas giant, has found a way to improve the traditional structure.

Report by Roy Ellis

ne of the most challenging tasks in any rate-regulated utility business is making a rate case to the state utility regulators. The ability to recoup years of investment may rest entirely on whether the commission accepts the utility's rationale and timing for a rate hike.

But over the past decade and a half, AGL Resources, the largest gas-only distribution company in the US, has developed a new financing model that AGL executives say reduces the risks to the utility, gives the commission a more powerful regulatory role, increases transparency of the utility planning process, and encourages steady, more cost-efficient infrastructure maintenance and extension of facilities to accommodate growth.

Conceptually, AGL's model is simple: whenever it wants to make a significant investment to improve the quality of its 150,000 miles of pipeline or upgrade other infrastructure to serve its 4.5 million customers better, it doesn't just start digging. Instead of installing pipeline first, then asking for a rate increase, AGL asks regulators to approve the replacement approach and provide a funding mechanism that balances the needs of customers and of the utility. Once these approvals and provisions are in place, AGL begins the replacement project.

Advantages of asking first

Asking for the appropriate framework up front has a number of advantages, says Shannon Pierce, Managing Director, Regulatory Affairs and Marketer Services at AGL Resources. First, it encourages a more proactive approach to infrastructure maintenance, an approach that goes beyond projects that might increase customer count. "We think that a program that encourages new investment and replacing aging infrastructure is better if it encourages proactive replacement on a long-term schedule, not in response to an emergency," she says.

The process is also shorter and simpler – addressing 2 or 3 issues instead of 200, and lasting only three to six months instead of up to a year. "It gives us time to plan and collaborate and compromise, have some give and take, and get suggestions and feedback from the regulators," Pierce adds.



Shannon Pierce

Managing Director, Regulatory Affairs and Marketer Services – Southern Operations AGL Resources Inc.

Shannon Pierce was appointed to her current role in February 2013, having previously served as senior counsel for AGL Resources. Prior to joining AGL, Pierce worked as an energy and utilities associate for McGuireWoods LLP. The ability to receive feedback is a key advantage over the traditional approach. "In a rate case, you really don't get that opportunity because once you've spent the money, you file the rate case and then you start getting numerous data requests," she says, "whereas in this framework, you're able to get that feedback, have that back and forth and likely come to a compromise among the parties. If the commission says no, the utility can simply go back to the drawing board with no harm to customers or investors."

"We believe regulators are receptive to this modern approach because typically, a program lasts for a particular period and the funding period also has specific start and end dates," Pierce adds. "I think the wonderful thing about these infrastructure programs is that there's transparency on the utility's part to provide the planning and the modeling analysis to the regulators before the investment," she says. "And that's really important: with proper planning and appropriate transparency, I think that we have seen the regulatory process become less adversarial and more of a partnership with the regulators. I like to think of this as a win-win-win: a collaboration that really balances the interests of customers, utilities, regulators and the state."

A new collaboration

AGL's approach grew out of a collaborative effort that began in 1998 between Atlanta Gas Light Company and the Georgia Public Service Commission. Atlanta Gas Light wanted to find a more efficient approach to funding its investments than a rate case, and the commission wanted to make sure AGL upgraded its infrastructure. "This framework was the first of its kind. The Georgia commission recognized a problem, both with our system and with the traditional cost recovery model. They challenged Atlanta Gas Light to come up





with a structure, and we have worked collaboratively over the past 15 years to fine-tune it," Pierce says.

Thanks to the success of those first initiatives, Atlanta Gas Light has been able to invest more than US\$2b in Georgia alone, including replacing more than 2,700 miles of aging cast iron and bare steel pipes. Next, AGL plans to replace 756 miles of vintage plastic pipes and extend new gas lines to rural areas that were not previously connected to the gas network. Another dividend to the ask-first approach is cost efficiency: "Although we invested US\$2b, our rates to customers have actually trended below the rate of inflation," Pierce notes.

Since then, AGL has taken the model to its other subsidiaries, including the Illinois-based Nicor Gas. In Illinois, utilities, commissioners and legislators even reached a consensus to address long-term infrastructure needs through new legislation, according to Pierce.

The idea has caught on beyond the company as well. More than 40 utilities in over 28 states have now developed similar programs, says Pierce. But although the process is more efficient than a rate case, it still requires painstaking planning.

"What I have learned is that you have to make sure all your internal stakeholders are appropriately engaged and are a part of the planning and evaluation process," Pierce says. "That means making sure rates and regulatory, construction and engineering, legal, and corporate communications are all involved in the planning and execution process to make sure that our program is the most effective program for customers."

Pierce adds, "You also must engage external stakeholders early and often – your commission and, in some cases, legislators, customers and consumer advocates, and economic development organizations. Broad collaboration is critical to success." "I like to think of this as a win-win-win-win: a collaboration that really balances the interests of customers, utilities, regulators and the state."

> Shannon Pierce, AGL Resources

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Bigsolar

Solar-to-steam plants, such as BrightSource's new facility in Ivanpah, California, have features that give them some unique advantages over other renewables, executive Joe Desmond tells EY's Brad Hartnett.

he Ivanpah Solar Generating System, which recently started its first power production and is scheduled for completion by the end of 2013, will be the world's largest concentrating solar power (CSP) facility. At 377MW, Ivanpah will provide enough electricity for 140,000 US homes.

Developed by BrightSource Energy of Oakland, California, in partnership with NRG Solar and Google, Ivanpah uses more than 173,500 individually-controlled heliostats, each consisting of two mirrors, to track the sun throughout the day and reflect sunlight onto boilers that sit atop three 459-foot-tall towers. When the concentrated sunlight strikes the boilers' tubes, it heats the water to create superheated steam – solar steam – which is used to power a turbine, creating electricity just like conventional generation. But in a world where photovoltaic (PV) cell prices have dropped precipitously and continue to fall, will there still be a role for utility-scale solar projects like this US\$2.2b plant?

Joe Desmond, BrightSource's Senior Vice President of Marketing and Government Affairs, believes so. "Concentrating solar thermal power has key advantages that will continue to make it attractive to grid operators and to utilities around the globe," Desmond says. "It is able to ride through changes in weather patterns much more smoothly due to thermal inertia and provide voltage support. But more importantly, CSP, combined with thermal energy storage, transforms a variable resource into a flexible, dispatchable generator," meaning the power is available as needed.

As CSP is itself becoming better understood, utilities are starting to recognize the attributes of CSP that continue to make it attractive – in some cases even more so, as the intermittency of PV and wind at scale is becoming a larger issue. In situations where PV and wind represent less than 10% of generated power, integrating them typically can be handled by existing grid constructs. However, as penetration levels increase, the intermittency presents challenges.

"Short-term variability increases the need for frequency regulation," says Desmond, "and increased variability requires greater flexibility and operating reserves, with more ramping capability to meet output changes."

The net result, as witnessed by countries such as Germany, with its high penetration of both wind and PV, is that the overall cost of managing the grid can increase. Because CSP with thermal storage allows CSP plants to be dispatchable, overall higher levels of other variable renewables such as wind and PV are also possible.

Further, CSP technology provides "solar steam," which can be hybridized (or combined) with existing or new gas- or coal-fired plants as a way to reduce carbon intensity or "boost" efficiency during certain times of the day.

An evolving market

Early CSP systems mainly consisted of parabolic trough collectors involving solar concentrators (mirrors), heat receivers and support structures. Most of these systems used synthetic oils, heated to around 360°C to 400°C, as the heat-transfer fluid. This more mature technology still has the largest market share (about 95% of facilities in operation at the end of 2011). And some newer trough plant designs are using molten salt, either for heat transfer or as a thermal storage medium.

Increasingly, however, plants under development are turning to newer solar power tower technology, like that used at Ivanpah. In fact, this technology represented 18% of CSP plants under construction by year-end 2012. Solar towers can achieve higher temperatures than parabolic trough systems because more sunlight can be concentrated on a single receiver and the heat losses are minimized. This allows for the use of higher-efficiency steam turbines as well as higher-capacity factors, which can lower the cost of both generating electricity and storing thermal energy.

"We calibrate and control each heliostat to ensure a specific amount of flux on the receiver, making it possible to maintain steam at a steady pressure and temperature throughout the day," Desmond explains. "And BrightSource works with utilities in order to design optimal solutions that meet a utility's specific load profile and requirements."

The CSP market continued to grow in 2012, with total global capacity up more than 60% to about 2,550MW. The market doubled relative to 2011, with Spain accounting for most of the 970MW brought into operation.

Another characteristic of CSP is that it is relatively easy to integrate with fossil-fired power plants. The "solar-augmentation" of an existing fossil power plant can offer a lower cost and lower risk alternative to stand-alone solar plant construction.

In addition to generating electricity, concentrating solar technology enables a much larger value chain. Other applications of CSP include desalination, mining and other industrial processes that require constant-pressure, constanttemperature steam. In 2009, BrightSource worked with oil major Chevron to build the world's largest solar thermal enhanced oil recovery demonstration facility. The 29MW thermal solar-to-steam facility supports enhanced oil recovery efforts at Chevron's oil field in Coalinga, California. The project demonstrated BrightSource technology's ability to reliably and cleanly reduce the carbon intensity of enhanced oil recovery efforts.

"CSP, combined with thermal energy storage, transforms a variable resource into a flexible, dispatchable generator."

Joe Desmond, BrightSource Energy



Joe Desmond Senior Vice President, Marketing and Government Affairs BrightSource Energy

Joe Desmond brings more than two decades of private and public energy sector experience to his role at BrightSource Energy, where he oversees communications, marketing, and government and regulatory affairs. Prior to BrightSource, Desmond served in numerous executive roles under California Governor Arnold Schwarzenegger, including Chairman of the California Energy Commission. He also served as Senior Vice President of External Affairs at NorthernStar Natural Gas.

A long road

As the largest power tower project deployed at this scale, Ivanpah's development faced challenges similar to those any large infrastructure project faces, including permitting, financing and engineering. "It had been almost 20 years since the California Energy Commission had permitted a solar thermal plant and so, with new technology and new questions, it took quite a bit longer than it otherwise would," said Desmond of Ivanpah's permitting.

According to Desmond, the project was incorporated as Solar Partners, a limited liability partnership and a legal entity separate from BrightSource, and financed in part by a US\$1.6b U.S. Department of Energy loan guarantee.

"DOE's loan guarantee was instrumental in attracting the capital necessary to finance this innovative project at commercial scale," says Desmond.

Power produced at Ivanpah will be sold to PG&E and to Southern California Edison under 20- and 25-year PPAs.

Ivanpah's developers also worked to allay a number of species and land impact concerns. One chief concern was the impact on the desert tortoise, a threatened species under the Endangered Species Act. The company spent US\$22m on care for adult tortoises and juvenile tortoises found on or near the site, including the development of a "head-start" nursery for young tortoises, which the company will maintain until they are large enough to resist ravens, coyotes, drought and disease.

Desmond also notes that the acreage of the site is far closer to civilization than some media accounts suggest: "Ivanpah is located adjacent to a 36-hole golf course in Primm, Nevada, and not far from three casinos, a rollercoaster and a discount shopping mall."





At BrightSource's new Ivanpah plant in California, vast arrays of mirrors will superheat enough steam to generate 377 MW of electricity.

Significant role for CSP

Looking ahead, Desmond sees largely blue skies for CSP. Beyond the US, BrightSource has operations in China, Europe, Israel and South Africa and sees good potential for both large-scale CSP deployment and industrial applications at a smaller, modular scale. Utilities have begun to establish specific targets for CSP procurement, while governments have taken notice of CSP's potential for localization.

"Knowing how important affordability is for consumers, the industry is working hard to reduce costs across the board. We're on the cusp of a major market transformation, and it'll be interesting to see how that plays out. But, in the end, we're quite positive that there's a significant role for CSP," he concludes.

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DISTRIBUTED GENERATION hits the Black NUMBERS

With distributed generation firmly embedded in Germany, how is life changing for utilities?

Report by Helmut Edelmann



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ith the energy revolution well underway, Germany's core energy markets continue to change quickly. Power generation is ever more decentralized: 48% (86GW) of the country's total installed capacity is now distributed generation.¹ Forty-seven percent of energy-related industries in Germany produce electricity themselves and another guarter are planning such a commitment over the next few years, according to 2013 research by EY.²

 According to preliminary figures from the German energy association BDEW published in *BDEW Stromzahlen 2013*. This figure includes industrial autoproduction as well as renewable energy installations. Germany's tradition of industrial self-generation stretches back several decades, so utilities are already well-adjusted to the concept. Utilizing heat and steam from industrial processes for generating electricity within combined heat and power plants has a long tradition. In the chemical industry, for example, companies like Bayer have run their own power plants for years either in cooperation with big utilities or independently. The German operation of auto company VW currently produces 60% of its own energy.

But the German Renewable Energy Act,³ which subsidizes domestic users and farmers to produce their own electricity from renewable energy sources and feed it into the grid, has intensified commercial pressures by cutting the overall price of energy and reducing revenues from centralized power plants.

Combined heat and power units, micro-combined heat and power units and photovoltaic (PV) systems continue to gain ground. For example, the installed capacity of PV systems shot up from 1GW to 32GW between 2004

Coopetition: neue Geschäftsfelder in der Energiewende erfolgreich erschließen, EY 2013.

^{3.} Originally introduced in 2000.

and 2012. Further significant rises are expected: the total target PV generation funded by the act is 52GW.⁴ A considerable increase in smaller micro-combined heat and power generation units is also expected, prompting Lichtblick and VW to join forces to install up to 100,000 "homebased power plants." This target may seem highly ambitious, but it clearly shows the potential growth in decentralized generation that many market players believe is out there.

Nevertheless, the market has not yet reached what we would term an advanced stage of development. EY research with companies that are already, or plan to be, active in this field indicates that only 18% believe the decentralized generation market is well or very well developed, while 32% believe that the market in Germany is hardly developed, if at all.⁵

New partnerships key to success

The country's energy transformation will rely heavily on decentralized plants,⁶ and there is plenty of potential for development. New market players are emerging in these fields in the shape of partners, service providers and competitors for energy suppliers and municipal plants. To be successful in the long term, the energy sector needs to enter into more new partnerships – both within the sector and with companies from other areas.

Clearly this is seriously disruptive change – placing German utilities at the hard edge, looking for the right opportunities and new business models. They face a major challenge of the imagination to stay relevant to changing customer needs, revise strategies to counter declining sales volumes and create new revenue streams. The speed of advances in self-generation in Germany – and the impact on utility revenues and customers – could presage the future for utilities around the world.

RWE on the front line of change

Professor Dr. Hanns-Ferdinand Müller discusses the key impacts of major-scale market change at RWE.

Self-generation by Germany's industrial, agricultural and domestic energy consumers naturally impacts RWE's commercial position. The company forecasts declining electric sales, indicating for example that peak demand will decline by around 20% from 24GW to 19GW through to 2035.⁷

"We can't prevent the loss of electricity sales due to consumers providing their own energy," says Professor Dr. Hanns-Ferdinand Müller, CEO/CFO of RWE Vertrieb AG. "But if we simply resign ourselves to this and don't innovate in the value chain, our traditional business will be cannibalized. If we don't take up the business opportunities, others will. RWE has established a dedicated company that pools new energy-related services and will generate revenue of €0.5b (US\$0.68b). Shifting half a billion from traditional business into new business segments is pretty remarkable."

"RWE has established a dedicated company that pools new energy-related services and will generate revenue of €0.5b. Shifting half a billion from traditional into new business segments is pretty remarkable."

> Professor Dr. Hanns-Ferdinand Müller RWE Vertrieb AG

Partnerships offer a "win-win"

The self-generation trend clearly demands innovation, not just creating new products and services and learning new skills but also finding ways of cooperating with other businesses in the energy value chain. RWE is extending its concept of a "virtual power plant" in partnership with Siemens to integrate distributed energy sources and enable trading of power generated by customers.

Müller clearly believes success will be decided at local level: "RWE has the energy industry expertise and scale to develop new products and services that will enable us to meet the challenges of the energy transformation," he says. "For example, many German municipal utilities enjoy high customer loyalty, providing them with the opportunity to market new products. But they are often not in a position to develop the products themselves. Forming partnerships with them at distributed generation and municipality level creates a win-win situation.

"Partnerships of this kind are nothing new: they have shaped RWE for more than a century and are characteristic of us. One very clear example of this is marketing of energy volumes generated with renewables. In Germany, we lead the field with our

^{4. &}quot;Photovoltaic systems: data messages and EEG feed-in tariffs" (in German), Bundesnetzagentur, www.bundesnetzagentur.de/cln_1912/DE/Sachgebiete/ ElektrizitaetundGas/Unternehmen_Institutionen/ ErneuerbareEnergien/Photovoltaik/DatenMeldgn_EEG-VergSaetze/DatenMeldgn_EEG-VergSaetze_node.html accessed 25 October 2013

S. Coopetition: neue Geschäftsfelder in der Energiewende erfolgreich erschließen, EY. p.10, 2013

erfolgreich erschließen, EY. p.10, 2013 6. Ibid: 77% of respondents to the EY survey believe that decentralized generation plants are indispensable for the energy revolution to succeed.

 [&]quot;Relentless And Disruptive Innovation Will Shortly Affect US Electric Utilities," Forbes, www.forbes.com/ sites/peterdetwiler/2013/04/18/relentless-and-disruptive-innovation-will-shortly-affect-us-electric-utilities, 18 April 2013.



virtual power plant, enabling municipal utilities to bring countercyclical energy volumes to market - benefiting the environment and delivering a financial return for both parties.

"There is actually no conflict between earning money and entering into partnerships. Take the example of the co-generation plant in the municipality of Schmalkalden in which the local authority, a private investor and RWE each hold equal shares. The way I see it, it's better to get a third of the cake than nothing at all. What's more, we are currently discussing distributed generation offerings with local authorities and private housing companies."

Looking to the future

In terms of how the self-generation trend will change the overall business model, it is unclear whether the major German utilities will all follow a similar path in the future. Müller says the models that develop "depend on the extent to which companies can offer the expertise required to manage complex portfolios and associated services. Moreover, this process is a nonstarter without a correspondingly large customer base and good customer relationship management."

Clearly, Germany is way ahead at present, so how does Müller see the trend impacting other countries? "In Germany, this development is a conscious political decision and is subsidized accordingly. In neighboring markets, however, it is far less pronounced - partly because there is often no money available for such intensive subsidization. Distributed generation is not an absolute imperative in the power sector."

Others may follow Germany's lead

The success of distributed generation in Germany undoubtedly depends on subsidies – but also on the distinct characteristics of the German market and culture. The federal structure of the market and the political system encourages decentralized solutions, and we see a strong trend toward independence and self-production. Many people – both private households and entrepreneurs – want to actively shape their own energy future. And if Germany goes this way successfully, other countries will definitely follow.



Professor Dr. Hanns-Ferdinand Müller

CEO/CFO RWE Vertrieb AG

Hanns-Ferdinand Müller joined the RWE Group in 2001. He was appointed to his current CEO and CFO role at RWE Vertrieb in January 2011. From 2004, he served as a member of the board responsible for sales at the regional company RWE Westfalen-Weser-Ems AG. He then served simultaneously as group-authorized representative for the local authorities division and managing director of RWE Effizienz GmbH. Prior to joining RWE, Professor Müller worked in logistics, banking and management consultancy.



Utilities know they must innovate to drive new growth. But which technologies, business models and new ways of thinking are needed to unlock future value? Eurelectric's Dr. Susanne Nies presents a personal view. tilities have not been challenged at any time as much as they are challenged today. Addressing these challenges – including decarbonization, decentralization and smart grids – will depend heavily on innovation.

Eurelectric's recent report *Utilities:* powerhouses of innovation, concludes it is "imperative" for both the sector and the EU economy. Our report has found that faster innovation by utilities could be worth \notin 70b (US\$93.9b) to the EU economy in 2030.¹

Policy backflips kill innovation

The energy industry's historically slow pace of innovation is due partly to its regulated nature, but current uncertainty surrounding energy policy is also a factor and has Eurelectric extremely worried.

The energy transition is a particular challenge. For example, already 15 EU member states have shifted their renewable support schemes. They had no choice – generous subsidies were too costly to sustain – but this has created huge political uncertainty, which is absolutely negative for innovation.

A bit of stress is good. But we believe that if governments are changing policy every day, and utilities are subject to these policy changes, you cannot expect them to be innovative. You can expect them to wait for more changes or go outside to invest somewhere else – in Brazil or Turkey, for example.

But utilities cannot completely blame external factors for a lack of innovation. They must do more to move from a traditionally male-dominated engineering focus and think differently. They must get into the impatient Zuckerberg/Google kind of mindset and consider different solutions: what have they not done before? Currently, Google does more research and development than all US utilities combined.²

Think beyond technology

A common pitfall is to consider innovation as just technology, when processes and business models must also be assessed. In fact, I would rank business model innovation as the single most important challenge to utilities today. We need to get away from the old model, where utilities sell just megawatt hours, to one where they also sell a much more differentiated set of products – for example, energy services, e-mobility and generation capacities, as well as megawatt hours.

Opportunities lie in the "new downstream," where technologies around energy efficiency, decentralized generation and the electrification of transport and heating/cooling are on the brink of mass-market take-up.

Energy efficiency has totally untapped potential. For example, Germany can only reach its target of generating 80% of its energy via renewables by 2050 by improving energy efficiency, regardless of all the system issues.

Consumers are at the heart of these changes, and utilities must get closer to them. They need to engage with the customer in a different way: as a "prosumer," an empowered participant in the system.

Today, utilities have contact with their customers for not more than 10 minutes a year, and this contact is usually limited to sending a bill. This is not sustainable. Customers want and need more, and this is driving changes to technology, business models and process innovation.

The way forward

For many utilities, partnering with other organizations, including IT and even the car industry, may be a smart way to fast-track innovation. We could see some mergers and acquisitions with smaller players. E.ON's purchase of UK energy efficiency company Matrix highlights the trend for utilities to gain experience via M&A, because it would take too long to get this experience in an organic way. I believe innovation will be the critical enabler that unlocks new sources of value in the decades to come, allowing utilities to thrive, improve their offerings

Dr. Susanne Nies

Head of Energy Policy and Generation ^{Eurelectric}

Susanne Nies coordinates industry positions for Eurelectric – the Union of the Electricity Industry – which is an association representing the common interests of the electricity industry at a pan-European level. She works closely with Eurelectric's Board to formulate high-level strategy on energy policy and power generation.



and better serve increasingly engaged customers. Policymakers, too, must keep innovation, including process innovation, "top of mind" if they are to achieve decarbonization and energy security objectives in a cost-effective way. And what are the next changes to

come? While Europe is, in many senses,

^{1. &}quot;Utilities: Powerhouses of innovation," Eurelectric, 2013.

"Faster innovation by utilities could be worth €70b to the EU economy in 2030."

Dr. Susanne Nies, Eurelectric

the avant-garde for the power sector's innovation – European utilities have done more in terms of R&D than their counterparts in the US or Japan, for example – there are shortfalls in the European approach, including the belief that the energy transition is equal to renewables deployment. In reality, the transition is about the complexities of managing the 2.0 version of an IT-based power system, which will include megawatts, negawatts, interconnections, big data, the new downstream – and things coming up in the future we have not even thought of. There needs to be a place for uncertainty and surprise, and the market will ultimately figure it out. Utilities will, however, need to be more sensitive to changes. While some lessons have been learned, companies must learn to adapt if they are to be truly innovative.

Winning the war for the ball of the war for the war fo

True leadership will be needed to steer the industry through its unprecedented challenges – with both men and women at the helm.

Interview with Alison Kay

here is an acknowledged shortage of talent in the power and utilities (P&U) industry. Yet one pool of talent remains largely untapped: women.

Research shows that the best decision making comes from groups that represent diverse backgrounds and opinions, with gender balance playing a key role in that diversity. Companies with women on their boards and in top management are also better performing.¹ Yet women are under-represented in the boardroom and senior management ranks.

This gap is increasingly recognized by governments and businesses – but progress in narrowing the gap is slow. For example, in the UK women made up 19% of board members of FTSE100 companies in 2013. Though up from 12.5% in 2010, FTSE100 companies would need to appoint 66 female directors in the next two years to meet the target of 25% by 2015.²

Changing the face of tomorrow's leaders

"We are committed to changing the face of tomorrow's P&U leaders by actively supporting women as they rise to the top, and not just in non-executive positions," says Alison Kay, EY's new Global Sector Leader for Power & Utilities. "I've seen great women in senior roles in the P&U industry who have found it difficult to break into the C-suite. We can change that."

Kay will lead Changing the face of tomorrow's *leaders*, a global program to identify and nurture future women leaders in P&U to become senior leaders and board members in the industry. "Creating a better gender balance is not something that will happen overnight," explains Kay. "This is a ten-year program focused on action, not passive conversations."

The EY program launches in spring 2014 with the "Women in P&U Index," which will map diversity across the leadership teams of the top 100 power and utility companies, local government and regulatory bodies. "The index will give us an important baseline. I hope the number of women in P&U leadership roles is about 10%, but I suspect the index may reveal it's closer to 5%," says Kay. "In any case, the index will provide real clarity on the size of the challenge we face."

1. "Women Matter," McKinsey & Company, 2007. 2. "Women on Boards stats promising". UK Government, www.gov.uk/ government/news/cable-women-on-boards-stats-promising, 7 October 2013.

Other elements of the EY program include rewarding excellence and leadership through annual awards; promoting debate through global research into what can be done to increase female leaders in P&U; and establishing a mentoring program.

"With the right mentoring, coaching and sponsorship, I hope to see more women pursuing their ambitions rather than dropping out at the senior manager level," says Kay. "I want to see the next generation of leaders – both male and female - working together to tackle the tremendous business challenges facing P&U."

Alison Kay

Global Sector Leader Power & Utilities FΥ

Alison became EY's Global Sector Leader for Power & Utilities on 1 July 2013. In this role, she is committed to promoting diversity and improving the gender balance of P&U leaders by actively nurturing and supporting more women as they rise to the top.

Alison's career has been built on a well-rounded knowledge of the sector from the ground up. She joined United Utilities as a graduate in 1994, where she spent time in business operations and customer service. She gained client experience working for Accenture from 1998 to 2007 on projects across the sector – from generation to transmission to retail.

She joined EY in 2007 to lead the development of the Advisory Power & Utilities sector for UK and Ireland, growing it from a start-up business to an established practice. And from 2010, she led the transformation of the Risk practice, building it year-on-year through an enhanced market focus and new services.

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Alison Kay



The dilemma of **FULL**

Many countries in Central and Eastern Europe will face economic difficulties if forced to meet European Union (EU) energy targets. Former European Commissioner Günter Verheugen discusses the challenges of the EU-11 with EY's Piotr Piela.

o one expects the road toward 2050 to be easy. EU ambitions to increase energy generation from renewable sources are a challenge for all of Europe, as countries juggle competing priorities of carbon, costs and the underlying need to "keep the lights on." But for the EU-11 - Bulgaria, Croatia, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Romania, Slovenia and the Slovak Republic – this journey is considerably more arduous.

A new report – Analysis of Central Europe's Energy Sector – produced by EY on behalf of the Central Europe Energy Partners (CEEP) argues that attempting to meet far-reaching EU targets would be economically disastrous for these countries unless urgent changes are made to consider their circumstances.

"Inevitable" trade-off between goals

The CEEP report considers the EU-11's ability to meet 2050 renewable energy targets within the framework of the three

main energy policy goals that define long-term energy sector efficiency:

- 1. Stable economic growth
- 2. Security of supply
- 3. Environmental protection

These goals create an energy policy mix where achievement of one goal can be traded off for another. For example, one trade-off may see environmental regulations loosened to increase security of supply based on indigenous fossil fuel while also achieving low energy prices.

Generally it is assumed that all of the goals can be achieved with little or no trade-off effect between them. However, former German politician and European Commissioner Günter Verheugen questions this, pointing to issues raised in the CEEP/EY report. "The report finds that some trade-off between the goals in the EU-11 region may be inevitable unless new financing mechanisms for the development of the region's energy sectors are introduced," he stresses. Verheugen says that the countries

of the EU-11 are at a "completely different starting point" in terms of facing energy sector challenges than the EU-15 countries.

"The last decade has seen some convergence between the EU-11 and EU-15 economies – the EU-11 has had higher GDP growth rates than the EU-15. However, the EU-11 is substantially lagging behind and will be catching up for a long time." He cites several notable differences between the energy sectors of the two regions:

- The need for large-scale modernization of energy infrastructure in most EU-11 countries
- The EU-11's low levels of energy efficiency, compared with the EU-15
- The relatively higher energy prices of the EU11, which already burden households and businesses while hampering competitiveness
- Ongoing issues regarding the energy security and stability of supply in many EU-11 countries: some countries remain dependent on one energy supplier
- The bigger role of coal in the energy mix of many EU-11 countries

Overly ambitious targets

Verheugen says that one of the biggest challenges surrounding this issue is the lack of awareness regarding the EU-11's energy dilemma. "We must raise the profile of these concerns and take them much more seriously than in the past. These countries should not be regarded as troublemakers when they are being confronted with overly ambitious targets," he says.

Solving the problem will require the EU-11 to, as Verheugen says, "square the circle" between improving their competitiveness and following a responsible climate change and energy policy: "In short, this means that a one-size-fits-all approach will definitely not be an appropriate answer." He believes that financing the modernization of the energy sector of the EU-11 countries is a priority and could be tackled via several approaches.

"One possibility would be a more rigid prioritization of the EU structural funds, while another would be to issue project Eurobonds, guaranteed by the community budget. In any event I believe that successful public-private partnerships will have to be established to ensure the huge financing requirements."

"These countries should not be regarded as troublemakers when they are being confronted with overly ambitious targets."

> **Günter Verheugen** European University Viadrina Frankfurt (Oder)

"Become more open-minded"

Developing a solution, or a range of solutions, to the EU-11 dilemma will require more analysis about their specific challenges before the EU establishes its energy policy framework for 2030 and beyond. Verheugen emphasizes the importance of keeping an open mind when considering a way forward: "By 2050, one or two EU-11 countries may have a very high share of renewables in their energy mix. Others, however, will still need coal or wish to explore their indigenous resources. We should assist such countries in doing so and help them in meeting environmental challenges."

He says the challenges facing the EU-11 demand a closer look at shale gas extraction, pointing out the US shale gas revolution has already had a huge impact on the global energy scene and the competitiveness of the sector in Europe. "The potential benefits of unconventional hydrocarbons, mainly shale gas, are clear. It is time for an in-depth evaluation of the feasibility of shale gas extraction across the whole EU, particularly in the relevant EU-11 countries."

Working together

While the EU-11 countries are diverse, Verheugen says that their shared "bitter heritage" of the COMECON (a Soviet-era economic organization) ties them together.¹

"While they are now working to build vibrant economies, catching up will take a long time," he says. "Their common energy concerns, including higher demand, higher prices, huge investment needs and security of supply mean the EU-11 would do well to stand together to make their case known to all EU countries, and those in Brussels."

Verheugen says that it is time for Europe to realistically review its long-term energy and climate strategy and "fix its position" in preparation for the UN's COP21 conference on climate change to be held in 2015. He believes CEEP has a big role to play here, "drawing upon its contacts with governments and EU institutions to focus efforts on reassessing the competitiveness of current energy policy."

Competitiveness must be the priority

The CEEP/EY report has already sparked discussions within Brussels but many believe these findings must be translated into policies. Next March, the EU Summit will discuss Europe's longer-term energy strategy, and Verheugen says this is an important opportunity to plan a way forward.

"The present crisis will not be tackled if we cannot achieve a much better performance of the real economy. A number of good plans have been adopted: however, we still lack a coherent policy approach.

"I hope that these findings and next year's summit result in a pragmatic and flexible approach, which helps improve the competitiveness of Europe more generally and of the EU-11 in particular."



The executive summary of the CEEP report, which was prepared by EY's Power & Utilities team in Poland, can be downloaded here http://www.ey.com/

Publication/vwLUAssets/EY_Raport_ CEEP_2013/\$FILE/CEEP_raport_2013.pdf



Günter Verheugen

Honorary Professor European University Viadrina Frankfurt (Oder)

Günter Verheugen was European Commissioner for Enlargement from 1999 to 2004 and Vice-President and European Commissioner for Enterprise and Industry from 2004 to 2010. He was also responsible for the commission's relationships with the US. Prior to joining the commission, he held senior roles within Chancellor Gerhard Schröder's Cabinet. He is now honorary professor at the European University Viadrina Frankfurt (Oder).

Piotr Piela

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^{1.} Comecon – the Council for Mutual Economic Assistance – was an association of Soviet-oriented Communist nations founded in 1949 to coordinate economic development.

Service excellence?

Delivering excellent service is about getting back to basics, according to Fernando Arias of British Gas. In the UK's energy utility market, constantly improving service is a vital survival factor because it is simple to switch your energy supplier. UK utility companies have to deliver great service to make customers stick with us, and this will become more important as we fight for a presence in the increasing technology and serviceoriented world.

For British Gas, service reputation is and will be critically important to underpin our business evolution from a traditional utility to one offering a range of energy and home services.

Customer service entails a big investment for utilities around the world, and this is likely to escalate as customer expectations continue to increase. But it is just one of many significant financial demands facing energy companies: others include keeping costs under strict control to offset higher commodity prices, securing gas supplies from abroad (the UK currently imports more than 50% of its gas needs), and investing in meeting the decarbonization targets set by the EU.

The key is to ensure that we deliver the *right* service, the first time round, because this will a) keep customers happy and b) always work out better than rectifying mistakes. But to succeed in this, we need to refocus on what really matters to customers and change if we are not organized to deliver it.

Focus on being the best at what *customers* value

To excel in any field, you have to choose what you want to be best at. And if delivering excellent service within your means is the goal, applying the following principles will help.

1. Measure and incentivize customer outcomes, not "silo" performance Big companies are great at measurement. We set up many key performance indicators (KPIs) and want to excel at all of them. But the desire to be the best at everything – especially if it involves incentivizing individual parts of the business to deliver their optimal outcome in isolation from the rest, or in isolation from the customer – can increase your costs and obstruct excellent service.

At British Gas, we looked at how to control cost across the whole end-to-end service chain, rather than cutting costs in individual silos (billing, payments and so on). If that meant spending more money in service delivery activities (e.g., metering) to save more in service recovery activities

2. Simplify operations

Unnecessary complexity interferes with service levels and increases costs, so where possible we have to eliminate it, both internally and in customer-facing processes.

Tariffs and billing are a good example. In the past, energy utilities in the UK have not made it easy for customers to understand what they are paying for. In 2012, the UK-based online switching site WHICH? reported that it had found energy customers with more than 1,400 different tariffs across the industry. Rather than adding value, this level of choice was impossible for customers to comprehend. British Gas

"I believe all utilities can benefit from jettisoning counterproductive KPIs and taking a holistic approach to service."

(e.g., call center costs) overall, we did it. And rather than measuring whether each internal process hit "traditional" benchmarks, we realigned the incentives and now measure whether the overall function supports great customer service.

We measure whether customers receive accurate bills on time - not whether we clear an exception in 5 days as opposed to 10. When a distressed customer calls about their payment arrears, we incentivize our agents to focus on solving their problem and measure whether that customer is still with us in three or six months' time. In this instance, we don't need to have the best average call-handling time; we need to be the best at finding that customer a sustainable resolution to keep him or her out of debt. That way, we have a happy customer while optimizing our resources. Happy customers also make our people more engaged, as using customer metrics is much more inspirational than using bone-dry KPIs.

Fernando Arias, British Gas

now offers just four tariffs, and we have simplified the bill so that it's much easier to understand. Customers are much clearer about charges and options, so they have a better experience and don't need to contact us for an explanation, and internally our billing operation is simpler and more efficient to operate.

3. Normalize excellence

All utilities have "service heroes" – experienced, super-competent employees with a natural talent for dealing with people and troubleshooting. But it is a mistake to rely on them, rather than creating systems and processes that enable *everyone* in your team to deliver outstanding service. We can take the lead from the top retailers in doing this – especially the way they insulate customers from complexities they don't need to witness.

Fernando Arias

Finance Director for Customer Operations British Gas

Fernando Arias joined British Gas in 2009 and has held several senior finance roles in metering, playing a leading role on the company's smart metering strategy. He took up his current Customer Operations FD role in 2012. Before joining British Gas, Fernando gained broad international experience in private equity and corporate finance with Citigroup and PwC throughout the Americas.

Matching the best

British Gas is a leader in service excellence within the UK energy sector, but we're determined to continue to improve, and our goal is to match the best in class in the country: the top three are all retailers, and we can learn much from them. Meanwhile, the service excellence being driven by competitive pressure in the UK could provide useful lessons for utilities all around the world. In search of that excellence, I believe all utilities can benefit from jettisoning counterproductive KPIs and taking a holistic approach to service. With the openness to keep listening and a clear view of what matters to customers, utilities can excel at service and reap so many benefits.

Back to basics on service excellence

1 | Measure and incentivize holistically, not in silos

It's the customer outcome that should dictate your KPIs, not the reverse. Focus on what you *really* need to excel at to deliver great customer experiences.

2 | Reduce operational complexity

Complexity is the greatest threat to large corporations. It interferes with great service and increases cost. Keep streamlining and offer choice only where it adds value.

3 Normalize excellence and make everyone a service hero Design systems and processes to make it easy for all employees – not just the best – to deliver outstanding service every day.



China's quest for 25

Despite a wealth of shale gas reserves in China, extracting it economically is proving difficult.

hina's abundant shale gas reserves have attracted worldwide attention, with the country's Ministry of Land and Resources (MLR) estimating a recoverable resource of 25,000 billion cubic meters (m³). An independent assessment made by the US Energy Information Administration indicated a geological resource of as large as 100,000 billion m³ and a recoverable resource of 36,000 billion m³.

In 2010, the Chinese Government ambitiously targeted domestic shale gas output by 2015 of 6.5 billion m³ in its "2011-2015 Shale Gas Development Planning" document, kickstarting three years of drilling and exploration.

Investment boom in shale gas

Investments to develop shale gas resources are rising rapidly. Determined to reduce dependence on coal and inspired by the "shale gas revolution" in the US, China hopes to increase its natural gas self-sufficiency by accelerating the development of shale gas.

To achieve this, the MLR completed the first round of the China Shale Gas Resource Potential Assessment in 2011. During the same period, various new regulations were issued, intended to challenge the shale gas resource oligopoly held by the four largest domestic oil companies (PetroChina, Sinopec, CNOOC and Shaanxi Yanchang Petroleum) and boost investments by the private sector.

The most important of these listed shale gas as an independent mineral resource, which allowed the private sector to engage in shale gas exploration and initiated open bids for exploration rights.

The restructuring appears to have been successful. In the second round of bidding for exploration rights, in September 2012, non-state-owned enterprises comprised one-third of the 83 participants (versus none in the first round in 2011). These enterprises came from sectors ranging from coal mining and utilities to real estate and finance.

By mid-2013, the number of wells drilled by the MLR and by independent oil and gas companies stood at 129, up from 36 in 2011. And by 2012, shale gas production output had risen sharply since its earliest development stages to 25 million m³, albeit constituting only 0.02% of the country's total natural gas output.

Financial and technical challenges

Despite the investment boom and the enthusiasm of investors, the sector still faces several obstacles.

The most significant obstacles are the large amounts of start-up capital required and the long payback period involved. Drilling a single well may cost up to RMB100m (US\$16m), and profitability is conditional on the discovery of shale gas resources. In addition, most shale gas developers do not benefit from the present government subsidy of RMB0.4 (US\$0.065) per m³, as this only applies after production begins.

The sector also must contend with underdeveloped technology. "Due to the differences between the geological conditions of China and US, the exploration and downhole technologies imported from the US cannot be directly applied here. And the uneven shale gas resource distribution in China has also increased difficulties," says Professor Dujie Hou of China University of Geosciences. "More work needs be done to develop a mature technology, based on exploration experience in China and parameters that are consistent with our own geological conditions."

Professor Dujie Hou, China University of Geosciences

These difficulties put pressure on gas developers, as the technology is immature and exploration results highly uncertain. Professor Hou indicates that investors are concerned about their commercial reputations as well as returns, and he argues that a more stable and sustainable development model is needed: "China must first and foremost increase its investment in technology to improve success rates for drilling, rather than continue its investments in exploration."

Investment expected to slow

Although the four largest domestic oil companies are thought to possess rich gas resources and ample financial reserves, all seem reluctant to expand their shale gas exploration in China. This is mainly due to the high development of risk involved, the unstable production output and the unclear (and partly unreliable) block exploration results from the MLR. Other concerns include vaguely defined exploration rights, late-running construction of gas transmission pipelines, an uncompetitive shale gas pricing mechanism and water shortages.

As a result, Professor Hou says, "Investment is showing signs of cooling down. Investors are becoming more cautious. We see domestic exploration and production (E&P) players adjusting their strategic positioning of shale gas: the overly optimistic ones are becoming more cautious while the pessimists are showing more interest. This is a positive trend for the long-term development of the sector." Many industry experts believe the time frame for commercialization of shale gas is still unclear, but as it will take at least 10 years for China to set up large-scale exploration, the government's planned production target for 2015 looks unachievable.

Professor Hou adds, "Potential environmental damage should also be a concern for the government. We should advance our development steadily but not act with undue haste; the accumulation of experience is of utmost importance. Damage done to the underground environment is irreversible, and we should try our best to prevent this from happening."

New technology may help

Recently, research by Yantai Jereh Oilfield Services (a domestic company providing integrated oilfield equipment and service solutions) led to several technological breakthroughs involving fracturing equipment in shale gas exploration. The company's new technology is expected to reduce current labor costs by up to 40%, land area for operation by 50%, and consumption of diesel and water by more than 50%.

However, Professor Hou argues, "The most important factor is not drilling but successfully locating the gas-bearing shale layers after the well has been drilled. Many improvements are required and more work need to be done to develop a mature technology, based on exploration experience in China and parameters that are consistent with our own geological conditions."

Opportunities for foreign E&P players

Despite the operational challenges, Professor Hou says China is optimistic about the future of shale gas while acknowledging there is a long way to go. He sees good opportunities for foreign E&P companies. "In general, China is supportive regarding cooperation and joint ventures. Cooperation between PetroChina and Shell is good news for the sector."

In March 2012, PetroChina and Shell signed a cooperation agreement for the joint development of shale gas resources in the Sichuan province. A year later, the Government approved the production sharing agreement between the two parties. The first approved Sino-international joint venture involving shale gas development invites global E&P players to leverage their technological and equipment expertise to access China's shale gas resources. Furthermore, SinoPec has begun talks with BP, Chevron, Total, Shell and ConocoPhillips on joint research projects concerning domestic shale gas development.

The PetroChina-Shell project gained initial success in exploration of shale gas resources very recently. However, PetroChina has not released information to the public regarding exploration results and progress, and details of the project and technology are confidential; therefore, it is difficult to determine how successful the venture has been.

According to data from the MLR, none of the 84 wells drilled in 2012 have proved themselves capable of producing shale gas economically, which casts doubt over whether subsequent investments should be made.

However, Professor Hou argues that despite the failure of test wells to produce gas to date, "it is still too early to state definitively that no shale gas exists in the block. It would be unwise to come to such a conclusion based on our limited exploration experience. It is too soon to tell whether the joint ventures have been 'successful,' as the profitability of such projects can only be realized over the very long term."



Professor Dujie Hou

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Professor Hou is primarily involved in research for oil and gas migration and accumulation, natural gas formation and distribution, and unconventional oil and gas resources, characteristics and distribution. His research projects include National Programs for Science and Technology Development, projects supported by National Natural Science Foundation of China and other international cooperation projects.

From The second second

Will homegrown power doom traditional power companies? NRG's David Crane thinks utilities face a mortal threat.



hen people ask me how I expect utilities to survive and thrive in the future, I tell them that I don't expect them to thrive. Indeed, channelling my inner Goldfinger, I tell them that "I expect them to die." Of course, I am speaking half in jest, but only half ...

Over the next decade, I believe three external trends will doom the rate-based regulated power industry as we know it:

- Cheap solar panels installed beyond the meter (distributed generation). Solar panels are dirt cheap ... and they continue to get better and cheaper. People and businesses will generate their own power or, in real estate terms, "monetize the solar resource of their personal property." The volume of electrons flowing over the wires will be dramatically reduced.
- Automated conservation. As a parent who cannot get my own children to turn off the lights, I always have been extremely skeptical that anybody could get people to stop wasting electricity. Estimates of electricity wasted in the US vary from 20% or 30% (the equivalent of 10-15 years of natural demand growth). But once conservation behavior is fully automated through the deployment of technology such as motion-sensitive thermostats, electricity demand will fall ... and keep falling.
- Extreme weather. Let's face it our wood-pole-based, above-ground electric distribution network is simply not up to the challenge of 21st century weather. Storms as serious as Sandy are expected to become more the norm, not the exception. And customers will cease to tolerate it. "Grid independence," "grid autonomy" or "grid resilience" – whatever it ends up being called – is coming. If you are a rate-based utility, this is not a good thing.

The parallels between where our industry is today and where the telephone industry was in the mid-1980s are uncanny. The then-incumbent US telephone monopoly faced real competition for the first time in its most consistently profitable business area, and it moved forcefully to face the perceived threat. But AT&T misunderstood the real threat, which came not from MCI and Sprint, but from the disruptive technology of cell phones. By the time AT&T woke up to the true nature of the existential threat, it was too late.

I'm not the only one thinking these thoughts. In January, Peter Kind was commissioned by the EEI to produce a paper, in which he evaluated in stark terms the threat that distributed power poses to our basic business model (I say "our" because, while NRG is not remotely a rate-based utility, our current business model is equally reliant on people consuming electricity transported across the grid). What shocked me about Peter's article wasn't the Cassandra-esque nature However, we already have a viable partner for solar power in the distributed generation-dominated future. A Trojan horse to the future primacy of the electric grid lies in the unheralded natural gas distribution system. It reaches 34 million homes in the US alone and, unlike electric wires, underground gas pipes are relatively impervious to the extreme weather events that have plagued the East and Gulf coastal regions over the past decade.

So why and how does the gas distribution system supplant and replace the electric distribution system? All you'd need is one device in your home that will reliably, economically and cleanly convert gas to electricity. It could be a fuel cell, a micro-CHP or another type of energy conversion appliance. When that happens, for the first time in 100 years, customers

"Over the next decade... three trends will doom the rate-based regulated power industry as we know it."

of his warnings (which I totally agreed with), but the fact that his paper was published by EEI, historically the great bastion of our industry's status quo.

I do not mean to imply that utility CEOs do not see the same threat as I do. Forward-looking executives such as Jim Rogers, the outgoing CEO of Duke Energy, have spoken publicly about the threat, although most still believe that the fundamental centrality of "the grid" will persist.

As more utilities recognize the existential threat caused by distributed technologies, a further layer of complexity resides in determining where the beyond-the-meter threat originates from. Solar may become dirt cheap, but nothing is going to change its fundamental intermittency. Off-grid solar needs a reliability partner if it is going to be part of a grid-independent solution for energy consumers.

How about batteries? Our industry's holy grail always has been long-term storage, but I'm less optimistic about battery technology than others.

David Crane, NRG

will be able to go to the local electricity monopoly and say: "Disconnect that wire into my house. I am sick of lighting candles every time a tree comes down. And I am sick of those ugly wires and poles!"

This isn't science fiction. I predict that within the next year or two a wave of distributed generation technologies will be in the market with the express goal of displacing grid-based power. One of the most promising of these gas conversion appliances is a machine we're working on with Segway inventor Dean Kamen. Based on the principles of the Stirling engine, Dean's gas conversion machine - the Beacon 10 - operates like a refrigerator compressor running backwards. Heat goes into the compressor and out comes 10 kilowatts of electricity to power your home. And because the Beacon 10 throws off an enormous amount of heat as a byproduct, its functionality will replace or supplement your hot water heater, pool heater and possibly your home heating system.

Prepare to be disintermediated

For the traditional utility CEO, the question becomes, "Where does my utility fit in this world where most people are supplying most of their own electricity with store-bought appliances?" Clearly there is a role for utilities and the grid as a backup system – much like the US Postal Service is now a de facto backup to FedEx when it comes to high-value mail. But after dominating the electric supply business for so long, many utilities will resist rather than embrace the future. That will be a mistake. Of course, a few utilities will embrace the future and will seek to lead this new energy paradigm. Certainly, NRG hopes to be one of the leaders in creating and serving this distributed energy future.

Will we succeed? I don't know, but what choice do we have? Adapt or die is the immutable law in both nature and business. Where will the dominant electricity providers of the future come from, and what part of the value chain will they claim in order to achieve that dominance? It could be a startup or a big energy company. It might be Comcast or IBM. The future of our industry is completely up for grabs.

Today, I think it's very much a jump ball – anything can happen. In my mind, the only thing I am sure will not happen is that our sector will continue to be dominated by traditional utilities that keep thinking and acting like traditional utilities.



David Crane President and Chief Executive Officer NRG Energy

Prior to joining NRG in 2003, David Crane was CEO of International Power PLC, a UK-based wholesale power generation company. He also worked for Lehman Brothers and ABB Energy Ventures, where he was responsible for developing and financing independent power generation plants and transmission facilities in the Asia-Pacific region.

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