"We're seeing a fundamental change in the global balance of energy markets – both power itself and power as a derivative of commodities."

Christopher Delbrück, E.ON Global Commodities

Nuclear: closing the fuel cycle?
Commercial solutions to nuclear waste disposal are tantalizingly close

Tapping into sustainability
Better collaboration between utilities is vital to meet future needs for water
This is a time of monumental change for the power and utilities (P&U) sector. *Utilities Unbundled* continues to explore what this means at a sector, company and technology level, right through the utility value chain.

In this edition, we report on changes in nuclear generation and energy storage that could be truly transformational in a decade. We’ve been talking to GE Hitachi Nuclear Energy about a new breed of recycling nuclear reactor that could bring near-unlimited and clean nuclear energy to the UK in 2025 (see page 4). The company’s PRISM reactor can use nuclear waste as fuel, potentially closing the fuel cycle. Recycling solutions would appear to be a “no-brainer” for our nuclear future. But first and foremost this technology needs a government sponsor. Will the UK’s Nuclear Decommissioning Authority be the first to be convinced?

Meanwhile, energy storage technology continues to improve, and prices are dropping. Once batteries reach utility scale they could be hugely disruptive: Alistair Parker of Australian utility SP AusNet told us: “The combination of storage and existing solar technology could turn the whole energy sector completely upside down.” See page 9 to read about his innovative storage trial. Batteries could also prompt major change in energy trading, as Christopher Delbrück, CEO of E.ON Global Commodities, recognizes: see page 14 for his assessment of current and future challenges for the trading sector.

Finally, I am delighted to be launching a series of articles addressing the “water-energy nexus” — the interconnected challenges of water use and energy production. On page 24, water expert Tony Conway of United Utilities stresses the need to rethink how water utilities operate, develop new efficient technologies, and foster opportunities for energy and water companies to collaborate. We will continue to explore the nexus with aid agencies and utilities in future editions of our journal.

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

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**Ready for a giant leap**

The next decade could bring revolutions in nuclear energy and storage technology

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**“We need new, efficient technology and better collaboration between utilities to make energy and water production truly sustainable.”**

Alison Kay, EY
Nuclear: closing the fuel cycle?
GE Hitachi Nuclear Energy could be first to market with a commercial solution to nuclear waste disposal

Testing times ahead: a new storage trial by Australia’s SP AusNet signals radical change for network businesses in the next decade

Trading up: utility trading businesses must be more adaptable than ever, says E.ON Global Commodities boss Christopher Delbrück

White hat or black? In the new energy marketplace, consumers pick favorites – but can utilities don the “white hat” of the consumer hero?

Embracing the economics of diversity: a diverse, gender-balanced leadership makes for better business – so why is the utility sector lagging behind?

The water-energy nexus
_Tapping into sustainability:_ innovative technologies offer opportunities for a more integrated and sustainable approach across energy and water, says United Utilities’ Tony Conway
Support for nuclear power as a reliable, low-carbon energy solution has gained momentum in recent years. However, significant challenges remain in effectively managing nuclear waste and improving public acceptance of the industry in the aftermath of the catastrophic failure at Fukushima, which reignited anxiety about meltdowns. New reactors currently being proposed could change that, by extracting more energy from spent nuclear fuel and making the resulting waste products much less radioactive. We have yet to see the first of these new recycling reactors built. But recent developments indicate that the dream of turning dangerous waste products into a safe, clean, low-carbon energy source could be a reality within 10-12 years. Prominent environmentalists including George Monbiot and Mark Lynas are among those who believe in the potential of these new technologies. Plutonium is created as a by-product in most nuclear reactors, leaving operators with a potentially dangerous asset or liability, depending on how you look at it. The UK has the world’s largest stockpile of separated civilian plutonium: 91.2 tonnes, or over a third of the global civilian stockpile. On completion of nuclear fuel reprocessing over the next few years, this is expected to grow to 140 tonnes. It is currently stored at the Sellafield site under strict controls, given its high security risk. Other countries with plutonium stockpiles include the US, Russia, France, South Korea and Japan.

We spoke with David Powell (VP European Sales) and Eric Loewen (Chief Consulting Engineer) of GE Hitachi Nuclear Energy (GEH) about the challenges they face in getting their new PRISM reactor to market, and how this technology could change the energy business.

How PRISM works
PRISM (Power Reactor Inherently Safe Module) is a small modular, sodium-cooled fast reactor that is designed to recycle used nuclear fuel to generate low-carbon electricity. It is an inherently safe design that could help to close the nuclear fuel cycle, decrease the amount of waste and reduce the time that waste has to be stored in a repository to a few hundred years. It is based on proven sodium reactor technology, developed and tested over 30 years in the US.

1. Monbiot and Lynas were among the signatories to an open letter to the UK Prime Minister endorsing PRISM technology in March 2012: www.monbiot.com/2012/03/15/a-letter-to-david-cameron, accessed 1 May 2014.

Eric Loewen explains the system’s efficiency and environmental benefits: “Current fission reactors use just 1% of the energy in uranium. The new PRISM reactor is capable of extracting close to 99%. This could make mining and milling of resources massively more efficient, as well as maximizing the energy potential from spent fuel from existing reactors. Not only that, but the resulting waste is much more robust: after 300 years, the waste from PRISM would be less radioactive than, for example, the uranium ore mines in Australia or Canada.”

On the fuel side, PRISM fuel could be recycled to completely consume and eliminate the plutonium, or it could be disposed of more easily as the spent fuel becomes virtually unusable for weapons proliferation purposes.

PRISM technology is based on a safe design that uses natural circulation from outside air to remove heat from the reactor vessel. In the case of Fukushima, the systems in place to remove heat were dependent on a separate electrical energy source, which was damaged in the event. In contrast, PRISM would permanently remove residual heat after the reactor is turned off.

PRISM is also designed to avoid seismic damage during earthquakes. Below-ground installation will lower radiation hazards and limit access points for increased security. As with other Small Modular Reactors (SMRs), PRISM’s smaller and simpler design provides cost efficiencies unavailable to most large reactors.

Current development and next milestones

With the reactor having undergone extensive design work since 1981 and the potential for deploying the first plant in the UK by 2025, the prospect of near-unlimited and clean nuclear energy resources is tantalizingly close.

The technology has recently embarked on another phase of assessment with the UK’s Nuclear Decommissioning Authority. A forthcoming hurdle is to get a green light from the UK Government to start the licensing process, after which the project can go forward through detailed design, construction and operation. Based on past projects, estimates on timings include up to six years for licensing and around three to four years for construction.3

“We’ll be working closely with the Nuclear Decommissioning Authority (NDA) over the next 12-24 months to help them understand our technology, and why we believe it is safer and better for this particular application than any other option, so they can make a choice,” says David Powell.
Stability in the policy framework will be a key factor in getting PRISM to take hold in any market. Loewen is confident that the UK offers the required policy stability to introduce nuclear technology.

Overcoming barriers to commercialization
Loewen explains that in a PRISM reactor, the cladding around the fuel and the core structure is made from a ferritic stainless steel called HT-9. Though used in the past, this type of steel is not currently available, so GEH would need to find a supplier willing to start manufacturing HT-9 again.

“The good news is that this presents a unique business opportunity for the UK to become the supply chain for ferritic stainless steel to other countries that are building fast reactors right now, such as India, China and possibly South Korea,” says Loewen. “So while this is a supply risk for us, it also represents an opportunity for someone else.”

Unlike many in its field, GEH has been building reactors continuously for the past 50 years, so Loewen is confident that its plant experience is current and risks are consequently low. Technical risks are well known and planned for: “PRISM’s design incorporates the knowledge gained from 22 previous sodium-cooled reactors operating worldwide.”

When asked about political risks, Powell says that there is strong cross-party support for nuclear in the UK, including support for dealing with plutonium, but adds that they will be keeping an eye on the UK’s May 2015 general election. Loewen and Powell believe the PRISM project has the balance of environmental benefits, engineering quality and sound economics to survive a change of government.

Market potential for PRISM
While the UK decision is awaited, Asia clearly has interest in recycling technologies, for example in South Korea. India also has plans to deploy sodium reactors: “They are proud of their indigenous program for sodium-cooled reactors, and where India wants to take its technology is not unlike the PRISM approach,” comments Loewen.

Meanwhile, Japan continues to revamp safety measures and is set to restart some of its idled nuclear plants in mid-2014. “The country needs to stabilize post-Fukushima,” says Loewen. “But historically Japan’s been at the forefront of sodium-cooled reactor technologies. It also has a history with nuclear fuel reprocessing. I see them coming back as a big player.”

The US remains committed to disposing of, or reprocessing, its excess military plutonium, estimated at 61.5 tons. But there is no regulatory environment at present to support a recycling solution in the US. The U.S. Department of Energy recently made a decision to shelve plans for a MOX recycling plant. “What happens now is unclear,” says Powell.

For the present, the issue of what to do with the waste in the US is unresolved. The Yucca Mountain repository site in Nevada has yet to receive clearance, as the Environmental Protection Agency (EPA) has set a requirement for a 1 million-year safe engineering design.

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5. HT-9 was used in experimental Breeder Reactor #2 and is proven.


8. US Department of Energy (DOE) funding for research into plutonium reprocessing was withdrawn in mid-March 2014, due to concerns about cost overruns for the MOX fuel. The DOE’s multibillion-dollar MOX Fuel Fabrication Facility, on the Savannah River near Aiken, South Carolina, is now on “cold standby” as the DOE seeks other disposal or reprocessing solutions for its excess stocks of weapons-grade plutonium.
Impact on the nuclear industry

Nuclear fission has been part of the energy landscape for some 60 years. Through that time it has evolved rapidly, contributed significantly to global low-carbon electricity supply and created and sustained a high-tech industry. But the sector has also had to face a number of challenges, primarily focused on costs and safety.

Today’s priorities for nuclear power are threefold:
• Control costs
• Mitigate the types of risk seen at Fukushima
• Do far more to minimize and resolve the legacy of waste that arises

SMRs, and PRISM in particular, show that the nuclear industry has had these priorities in mind for more than a generation. The technology is neither revolutionary nor unproven. What really marks PRISM out from other modular reactors is its ability to address the security challenges posed by growing stockpiles of plutonium.

If successfully deployed, PRISM potentially offers a new market for separating plutonium from spent fuel at existing nuclear plants. This could potentially reduce the ongoing costs of nuclear waste disposal. However, in the UK, we can’t expect to see this feed through into reduced energy prices: nuclear will remain a relatively small part of the UK energy mix for decades to come.
Given the development, licensing and construction costs involved in delivering the first of any commercial-scale reactor design, PRISM crucially needs a lead sponsor – whether that is a utility looking for a reactor more suited to a geographically dispersed electricity system, or a country willing to commit to dealing with its plutonium and waste stockpile in a way that creates value rather than simply being a cost of historic programs.

Meanwhile, the tendency is to “kick the can down the road” – the costs of storage remain lower than building new permanent solutions. The UK will be considering this issue in the next few years and other countries will observe with interest.

Recycling solutions appear to be a “no-brainer” for the nuclear sector, promising an effective method of dealing with waste and a commercial upside. The long-term goal is to put more spent fuel into the recycling loop – rather than taking it from the reactor to storage, which is how most of the world’s nuclear waste is currently managed.

Figure 2. PRISM complements a “closed” nuclear fuel cycle.

Since 2006, Dr. Loewen has guided GEH’s technical efforts for deployment of the PRISM integral fast reactor. His U.S. Navy service included Instructor at Nuclear Power School, and Quality Control Officer and Senior Reactor Operator in USS Long Beach (CGN-9). As Science and Technology Advisor to the Congress and aide to then-Senator Chuck Hagel, he integrated nuclear power into the U.S. Energy Policy Act 2005. From June 2011 to June 2012, Eric served as President of the American Nuclear Society (ANS).

The NDA has already been persuaded that PRISM offers a credible alternative to the continued risk of the status quo. Over the next couple of years, the energy industry will be closely watching the NDA’s decision-making process for managing plutonium stockpiles and its potential implications for PRISM licensing discussions.
Over the next two years, Australian utility SP AusNet will be undertaking field trials on energy storage technology that could radically transform its electricity network business.

Over the past two years, the company’s Asset Management Division has increasingly focused attention on demand management and alternatives to tried and tested network solutions, including deployable distributed generation (DG), smart demand management and active demand-side management contracts.

From late 2014, the company will test a new hybrid battery and diesel energy storage system known as GESS (Grid Energy Storage and Diesel Generation System). This is the first system of its kind to be used for distribution network support in Australia. Leaders at SP AusNet are already excited about the technology’s potential to change how networks are managed in the future. EY spoke recently with SP AusNet’s Alistair Parker (General Manager, Asset Management Division) and John Theunissen (Manager Network Modernisation).

Parker believes the trial could become a springboard for broader transformation of the business, as multiple technologies start to converge: “This is potentially a hugely disruptive technology – the combination of storage and existing solar technology could turn the whole energy sector completely upside down. For us, this isn’t just about testing 1MW of storage and understanding how it works functionally and technically: it’s about understanding future directions of the sector and how our business model will change.”

Theunissen explains: “Our primary goal is to test GESS’ effectiveness in demand management during peak times. We’ll also test a variety of other uses, including ‘islanding’ and power quality stabilization where it is affected by renewable generation.”

However, Parker and Theunissen are already considering the broader implications of batteries being installed on a widespread basis in homes and businesses. “This will affect us,” says Theunissen, “although it may not be in our immediate realm of business as a network operator. The question is, what are the most attractive commercial propositions for storage when so many different parties – technology service companies, retailers and consumers – are potentially involved?”

Report by Stuart Hartley.

1. i.e., consistency of voltage and frequency.
with customers. Challenging weather conditions (Victoria faced a record heat wave last summer) have increased SP AusNet’s willingness to embrace new technology alongside more traditional engineering solutions, to safeguard reliable supply.

Energy storage has become particularly interesting because of the exceptionally fast adoption of solar photovoltaic (PV) generation in SP AusNet’s service territory. From next to none in 2008, the company now has over 60,000 solar PV customers – more than 10% of total residential customers – and the number still growing. SP AusNet has already seen increased strain on the network, in the form of voltage fluctuations and load imbalances, as a direct result. To date, batteries have been too expensive and fragile for practical use in supporting networks across the board. The only application for which they have been economically viable is frequency regulation. Other applications, including demand response and peak shaving, are expected to remain unprofitable for utilities for some years yet.2

However, with many of the world’s leading battery manufacturers based in the Asia-Pacific region, SP AusNet has been tracking the technology’s progress for some time. “We noted some of their claims about improved battery capabilities, and this led us to set up the trial,” says Theunissen.

Delivering on commercial potential
Carrying out a trial that makes commercial sense today has been extremely important to Parker and Theunissen. The GESS solution combines a 1MW/1MWh lithium Ion (Li-ion) battery with a diesel generator. This decision to deploy hybrid technology was made primarily on cost grounds. In effect, it allows the company to simulate the operation of storage capacity two to three times the actual 1MW size and test out the use case of a larger system – which would not have been feasible given the current cost of battery technology. In fact, the trial may yet show that this hybrid approach will be the most cost-effective route to deploying storage technology in the medium term.

As it is, deployment of the GESS solution has only been made possible by funding from the Australian energy regulator,3 which covers more than half of the project costs. SP AusNet sees this as a powerful example of regulatory support encouraging innovation by utilities in a commercial context.

Theunissen comments: “Thanks to funding support and the hybrid technology we are using, this trial has a positive business case. The test period will give us a sense of how quickly storage could actually become commercial without support – whether in three, five or 10 years. We know roughly how far battery costs would need to fall to make this a commercial proposition in other specific network locations.”

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2. Under Australia’s Demand Management Incentive scheme.
Advanced battery technology is set to play an increasingly important role in grid management in the next decade:

- Sales of advanced batteries for utility-scale storage are expected to grow from US$220m in 2014 to US$17.8b in 2023.
- Prices for advanced batteries continue to fall. The cheapest by 2020 will be large-format Li-ion batteries, expected to drop from US$550 per kWh in 2014 to US$200 in 2020.
- Asia-Pacific is likely to see the highest volume of advanced battery sales in the next decade. North America and Europe will also see significant activity in utility-scale applications.
- Li-ion batteries are the current market front-runner, with more than 80% of the grid storage market (as of 2013). Other technologies include sodium-based, advanced lead-acid and flow batteries.

Multiple benefits across the value chain

SP AusNet’s initial goal for the GESS trial is to prove the major use case, which relates to demand management and reducing peak flows across specific parts of the network. “Spot” reinforcement of network bandwidth, through adding storage capabilities at particular points, should allow the company to defer expensive upgrades to existing wires and substations. Overall, SP AusNet expects to deliver multiple benefits relating to code compliance: energy storage promises to be a valuable part of the company’s armory in responding to load pressures and power quality issues.

Parker explains that the physical characteristics of SP AusNet’s service territory network may offer customers strong benefits from energy storage: “As a rural distributor, we have some long lines to maintain in remote locations that need a robust, reliable supply. Parts of our network are prone to bushfire risk and are costly to service. In future, we might serve isolated communities with a small load more effectively and economically through a market grid arrangement, combining DG and storage. We could keep them connected to the network, but make them self-sufficient during periods of high network or environmental risk.”

Source: SP AusNet

Figure 1. The proposed GESS layout, which connects to SP AusNet’s 22KV network in suburban Melbourne. The trial runs from 2014 to 2016.

The global grid energy storage market could reach US$10.4b by 2017, boosted by improving system economics and market changes that reward storage. How will life change for network businesses?

Better “business as usual”
- More flexibility – e.g., peak shaving
- Better integration of renewables into the grid to balance fluctuating loads and voltages
- Improved supply security/emergency cover for remote locations
- Savings on asset maintenance – e.g., reducing the need to upgrade substations

New business opportunities around the growing market for storage
- Integrated demand-side response to balance load
- Ancillary network services provided by consumers

But:
While energy storage may promise new tools for network design, management and operation, it could also add to complexity for network businesses. The combination of solar and storage technologies could also threaten traditional utility business models. If volumes carried over energy networks fall, this will put upward pressure on per unit transport costs. Traditional revenue generation mechanisms may need to be reappraised.

At a time of great public concern in Australia over rising prices, the possibility of cheaper alternatives to traditional network solutions is very attractive. But SP AusNet also wants to use the trial to understand the wider range of possibilities that storage might offer for the industry. Theunissen adds: “Network service providers can see the cost benefits of storage by using it for demand management, to ease network pressures and stabilize networks heavily impacted by distributed energy resources – essentially, these are prudent ‘code compliance’ issues that a regulator can support. But given the range of other possible uses for the technology, from a strategic point of view we want to explore where storage is best positioned to maximize the value of the overall investment. Is it better to keep storage at a grid scale, or more effective to locate it nearer the fringes of networks? When do you reach the tipping point which supports a more generalized use of the technology?”

Batteries go domestic
SP AusNet is already starting to revise its thinking around energy storage, which originally envisaged storage capacity installed primarily at a grid level. Once battery costs come down to a suitable price, storage capacity could be deployed more at the fringe of the network – working with individual customers. “There’s a strong value proposition for individual customer storage,” says Theunissen, “in particular related to

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energy arbitrage, when there are large differences between off-peak and peak pricing. Solar energy users often cannot use all the electricity generated in the daytime, but a domestic-sized battery could change that.”

Parker agrees: “The take-up of solar panels shows how customer demand can push a technology because it makes them feel empowered. We could see the same momentum in domestic energy storage.”

If so, partnering is likely to play a critical role in delivering success, as Theunissen explains: “You have battery vendors, who specialize in batteries and battery management systems; power conversion equipment companies providing the interface between the battery and the grid; and service providers framing up the overall solution for the customer. We wanted to deal with just one party for the GESS, so we structured our procurement process accordingly.”

If storage is widely taken up at grid — and microgrid — level in the future, Theunissen could foresee a situation where the multiple parties combine in a one-stop shop: “The smart grid has shown us how players can start to integrate in a new environment. I can see a need for network service providers, energy retailers and technology service providers to collaborate in a commercially attractive way.”

Anticipating disruption
With all its thinking around energy storage, SP AusNet is keeping an eye firmly on the future.

“Promoting storage might look cannibalistic, given the traditional, asset-based utility model,” says Theunissen. “But we have a real appetite for change. We are entering an age when digital technology and rich data will enable us to integrate capabilities across different technologies. Along with batteries, this could release a quantum scale of benefits which will transform energy supply.”

Parker reinforces this sense of SP AusNet being at the cutting edge of radical changes that could have a lasting impact on the utilities sector – and wanting to lead rather than be engulfed: “We’re keen to get in there and be amongst the first – not just the first thinkers, but the people who actually know how these things work, both functionally and technically.”

Alistair Parker
General Manager
Asset Management Division, SP AusNet

Alistair leads a team of 160 engineers, planners and regulatory experts who support SP AusNet’s gas and electricity distribution and transmission networks. He spent the first 15 years of his career with National Grid in the UK, initially as an engineer and then in commercial roles, before joining a Big Four management consultancy practice.

John Theunissen
Manager Network Modernisation, SP AusNet

John runs SP AusNet’s network modernization team, which is currently conducting a range of trials focused on creating a “smart network.” These include a residential energy storage pilot, distributed generation for network support, a commercial and industrial demand response portfolio as well as a range of “big data” analytics applications developed in conjunction with a smart meter rollout program. John previously worked as a corporate consultant for Eskom in South Africa.

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6. Following a tendering process, service provider ABB was contracted to deliver the overall solution.
Utility trading businesses must be more adaptable than ever to deal with tougher international competition, financing constraints and heavier regulation. Christopher Delbrück, CEO of E.ON’s trading business, presents his view of recent changes and opportunities.

Report by Metin Fidan.

International trading in energy and commodities has become a central part of strategy for utilities, which trade to lock in prices and assist with their management of physical supplies. But trading has become vastly more complex and challenging in recent years, with big utilities and oil and gas companies in fierce competition with independent traders.

German utility E.ON re-launched its trading arm a year ago as E.ON Global Commodities (EGC, see inset box opposite). EGC runs one of Europe’s broadest power and gas portfolios and wants to expand its global presence across North America and Asia to diversify risk and drive growth in an increasingly tough market. CEO Christopher Delbrück talked to us recently about transformations in trading and his ambitions for EGC.

“We’re seeing a fundamental change in the global balance of energy markets – both power itself, and power as a derivative of commodities,” says Delbrück. “The US shale gas boom, a European demand glut and the rise of significant energy demand in Asia have created a paradigm shift in price formation and the flow of natural gas around the world.

“Cheap shale gas has pushed coal out of the US, creating significant oversupply elsewhere and sending coal prices extremely low. Coupled with the rapid expansion of subsidized renewables, European power prices have plummeted to pre-2008 levels. Volatility has disappeared, at least from the forward markets. All these trends are causing big shifts in how utilities run and optimize power stations.”

The other significant transformative influence is European policy and regulation, says Delbrück. A series of regulatory interventions such as EMIR, REMIT and MiFID II will all impose new constraints on trading, and new capital adequacy requirements could place heavier burdens on the sector.

Current opportunities for EGC

Delbrück views developments in the flow of natural gas as favorable for the new global EGC business: “The European gas market and the global LNG market will become more closely linked, and that provides opportunities if you play on both sides.”
Meanwhile, with banks in the US leaving the trading sector, there is an opening for companies like EGC to fill their shoes – another strong motivation for EGC to expand into the US power and gas business, says Delbrück.

He also sees niche opportunities in power trading, with different national regulations creating opportunities for more structured transactions. In coal, freight and iron ore trading, increased global flows between different sources and users provide more opportunities to trade and deliver in Europe, the US, Latin America and Asia. “We see liquidity pushing up and a desire for increased use of financial instruments to hedge exposures,” he says. “Deal-makers are getting smarter, and there’s a lot of opportunity for established players like E.ON, with the credibility of an energy company, to help customers manage their risks.”

“There’s a fundamental change in the global balance of energy markets … a paradigm shift in price formation and the flow of natural gas around the world, causing big shifts in how utilities run and optimize power stations.”

Christopher Delbrück, EGC

Going global

Active on 30 exchanges and in more than 40 countries, E.ON Global Commodities (EGC) trades a wide range of standard and exotic products covering electricity, natural gas, oil, coal, freight and emissions. Launched May 2013, EGC merged the midstream operations of E.ON RuhrGas with E.ON Energy Trading. The new business combines commercial trading capabilities with gas supply expertise, enabling E.ON to better adapt to fundamental changes in the wholesale gas markets.

See our EET interview in Utilities Unbundled, Issue 6, June 2009.
Reinventing the business
Integrating two former E.ON businesses to create EGC has been demanding, says Delbrück. The company is now undergoing further restructuring under its new management team. “As a predominantly Europe-based company, we had to reinvigorate ourselves to become global in our culture and practices.

“Cultural change is always the biggest challenge: traditional midstream companies have a distinctly different mentality to trading businesses. Meanwhile, the whole midstream business environment is itself transforming. The old model, where midstream companies only had volume risks, while the price risks were taken by upstream producers, is dissolving. We are transitioning to a different kind of working partnership with upstream partners, with a whole new risk/reward balance.

“Internally, former EET and Ruhrgas teams have been working together to understand how they can make more from what we have – they’re collaborating on our portfolio and our business issues, and learning from each other. We’re making good progress, but this isn’t something you can do in a matter of months, by running a couple of change management workshops.”

Continued focus on innovation
In terms of where EGC needs to be most innovative over the next 5-10 years, Delbrück says one aspect is developing products and services for the power market to protect and generate value in the short term – week-ahead, day-ahead and intra-day business. “There is also an opportunity to provide third-party services where other players are not willing to live with short-term volatility, and opportunities to help customers manage their asset portfolios, especially on the wind side.

“On the longer-term horizon, as liquidity has dropped, origination will play a much stronger role in future. Customers are becoming more sophisticated in the way they manage risk and we need to find products that meet their long-term needs. We’ll see growth in structured transactions and different indexations, possibly tied to the end-product.

“In gas, the biggest innovation will be looking at structuring products to help customers meet these needs.”

Delbrück believes energy storage will become a key transforming factor. “The shape of power markets could be completely transformed once cost-efficient batteries become available,” he says. “That would eliminate a lot of the need for flexibility in matching supply and demand. Around the mid-2020s, we might see a significant impact on trading as a result.”

Asset-backed trading a foundation for growth
EGC will focus on creating value for clients through asset-backed trading. “We understand assets and their need to be managed and optimized in a market,” says Delbrück. “Our first move into the US involved supporting colleagues in E.ON’s wind business to get the best value from their 2.5 GW wind capacity. We’ll expand from there, helping E.ON entities or external clients with supply and management of their energy and commodity needs. We know that power producers in Asian regions are increasingly looking for international partners to manage their excess capacity. We have a couple of long-term relationships in Asia already, which we hope to build on.”

The challenge is gaining trust in new markets: “The E.ON name is obviously known, but to convince counterparties to deal with us and build our reputation requires a lot of senior, physical presence in these new locations.”

On a personal note, as Delbrück drives future transformation, what will he enjoy most? “The most exciting thing for me is always in bringing energy to markets that need it. It is an essential part of society, and sometimes we’re painfully reminded of risks to security of supply. I enjoy the intellectual stimulation and challenge in understanding and managing these risks.

“There is so much change in the energy sector today. You can help transform companies several times in your career. Shaping EGC’s business at a time when the whole sector is changing is something I find a great challenge, and highly rewarding.”

Christopher Delbrück
CEO
E.ON Global Commodities (EGC)

With more than 18 years of experience in the energy sector, Christopher has held a number of senior management positions across E.ON and The Boston Consulting Group. He was CFO of E.ON Energy Trading from 2010 and took up his current CEO role at EGC in October 2013.
In old cowboy movies, it was always easy to tell the good guys from the bad guys. The good guys wore the white hats. The bad guys wore the black hats.

Power generation has been a bit like that for the past few decades, with utilities always cast as the black-hatted villains. As Steve Westly, a Silicon Valley venture capitalist who focuses on clean energy, commented at the recent CS Week conference in San Antonio: “Most people view utilities as large, distant companies. Their primary interaction is that utilities send them bills that go up every year. When they do think about utilities, customers mostly have a negative image of companies responsible for air and water pollution.”

But now utilities have a chance to wear white hats. The rapidly declining cost of solar power, the growing sophistication of power conservation technologies, and rising customer expectations for better service are beginning to shake things up in the industry, creating an unprecedented opportunity.

Just as telecommunications has evolved into a complex branded service over the past 25 years, electrical utilities will have to start thinking and acting much more like other retail businesses. As Westly puts it, utilities have a chance now — but only a chance — to trade in their old black hat for a white one.

Forward-thinking companies such as E.ON in Europe, and NRG Energy in the US, are already trying to reinvent themselves for this new era, but most others have yet to catch this wave.

Reasons for resistance
A number of factors may be holding utilities back. One is that successful companies often miss major shifts in technology. Sun Microsystems did not see the shift to distributed computing. Kodak invented digital photography but was still unable to adapt itself to a film-less world. Blockbuster went bust for failing to imagine a world without video stores.

The regulated nature of energy companies may have intensified this blinkered worldview: in most places, electricity and natural gas providers were monopolies, and customer choice did not extend much beyond on or off.

Another factor slowing their transition now is past experience. Many of today’s power executives have tried to innovate before, only to be caught short when the business cycle turned and they were left holding, say, a portfolio of imploding dot-coms. It therefore seems reasonable that some utilities are hesitant to invest in technologies like data analytics, even as new competitors like Google seem willing to lead the way in leveraging “big data” to improve customer products and services.

Finally, most utilities are not paid to take risks. Investors typically look for stability in utilities — something that is hard to achieve when experimenting with
new technologies and business models. This results in a Catch-22: utilities don’t really have the mandate from investors or regulators to be especially innovative, but have to innovate to stay relevant.

However, standing by while the transformation continues is not an option. As Westly asserts, “Change is always hard – but the alternative is doing nothing while your business continues to shrink.”

“In the end, adapting to this new world demands not just swapping out coal plants for wind farms but reimagining the entire company,” says Westly. “Customers don’t just want a company they can trust to keep the lights on but a partner able to provide them with a range of services that go far beyond the traditional power network.”

“New possibilities
Innovation and new business models are taking hold across commercial, industrial and residential retail segments. Some of the best opportunities, in our view, are to:

- **Build stronger customer connections and unlock new opportunities through customer information and billing transformation.** The market for customer information systems is expected to grow from around US$3b today to US$5.5b worldwide by 2020.1 This represents a platform upon which utilities can develop two-way communication and enhance customer engagement.

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communications to deliver new products and services and help customers manage energy consumption.

- **Encourage energy conservation through new partnerships.** A number of companies have already partnered with utilities to provide energy efficiency and demand response (DR) solutions, which provide incentives to cut or shift energy use.
  - Opower works with utilities to promote energy efficiency through customer analytics and now has 93 utility partners reaching 32 million households and businesses across eight countries.¹
  - Nest (recently acquired by Google for US$3.2b) is a smart thermostat company that enables utilities to collect consumption data and offer DR services. SCE, National Grid, ComEd and Austin Energy are among the utilities that have already partnered with Nest.
  - Simple Energy is a gamification company that enables utilities to help their customers save energy and increase customer engagement. They serve six utilities in the US, Canada and Europe.
  - Entelios, a European smart grid solutions provider (recently acquired by US-based EnerNOC), has partnered with E.ON to develop DR products for German industrial and commercial customers.
  - **Redefine the company as a power facilitator and innovative financier, not just the power distributor.** One of the big lessons of the internet is that a well-designed distributed system can trump even the best centralized design.
    - A number of startups, including SunRun, Mosaic and SolarCity, are creating long-term relationships by extending financing and providing support to help homeowners install solar panels.
    - Companies such as Lunera Lighting (LED lights), Enlightened (lighting control), View (smart windows) and SCienergy (energy management software) present opportunities for utilities to help finance and mass-deploy these technologies and develop partnerships for the proliferation of lighting and room comfort as a service.
    - The growth in microgrids and distributed generation (DG) also presents opportunities for electricity distributors to operate clusters of DG installations as virtual power plants (VPPs), efficiently balancing supply and demand services in real time. Global VPP capacity is expected to grow from almost 4 GW in 2013 to over 19 GW by 2020.³
  - **Support the growth of electric vehicles (EVs)**
    - Creating the charging and billing infrastructure to support EV deployment could be a huge opportunity. Westly, an early investor in Tesla Motors, says EVs are significantly more efficient than internal combustion engines – the current Tesla model gets the equivalent of as much as 95 miles per gallon – and as its price goes down, demand is likely to surge.
    - The power two-wheeler (PTW) vehicle industry is also expected to experience significant growth in coming years. Established PTW players such as Brammo in North America and GOVECS in Germany can expect competition to increase from traditional automotive manufacturers, including BMW, Honda, Peugeot and Smart/Daimler.

Identifying the right offering from all these possibilities won’t be easy, and power companies will have to live in a world with more risk than they had to cope with in the past. Any utility that wants to join the white-hatted posse must accept that uncertainty. As John Wayne once said, “Courage is being scared to death — and saddling up anyway.”

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¹ Opower website, accessed 21 May 2014.
² “Virtual Power Plants,” Navigant Research, 1Q 2013.
Power and utilities is a sector in transformation. Beset by change from all sides, companies need to embrace diverse thinking, experience and talent to meet the challenges they are facing, writes EY’s Alison Kay.
Energy and water are fundamental to our lives – they reside at the place where society, politics and economics collide. But power and utilities (P&U) is a sector in transformation. How energy is produced, who generates it, how it is bought, sold and distributed is all changing and all at the same time.

This transformation is pushing the traditional utility business model – which assumes stable, predictable cash flows within a familiar regulatory framework – beyond its comfort zone and could ultimately redefine what it means to be a P&U business. What’s needed is new thinking.

Change in the sector is outpacing change in the boardroom

Although the demands of the changes facing the sector are well accepted, what is less understood is how to navigate the challenges they present. While P&U companies have become masters of continuous, incremental change, current business models are not fit for purpose. They will not deliver the transformation that is required. Financial performance is a bellweather that underlines the fact that the time to act is now – the sector has significantly underperformed the broader markets; P&U companies have lagged behind the global equity markets on price by almost two-thirds over the last five years.

Utilities need to embrace a culture of innovation and entrepreneurship with a willingness to embrace the best ideas – wherever they come from. We need diverse thinking in and out of the boardroom. To succeed, we need to bring in and develop new skills and approaches. And one pool of talent that is currently untapped is women.

While many factors influence performance, there is no doubt that diversity creates competitive advantage – by encouraging businesses to challenge current approaches, consider alternatives and think the unthinkable. There is an overwhelming amount of evidence that diversity is not just a gender issue, it is a business issue, and companies that embrace diversity outperform their competitors.

EY’s recently released report Talent at the table: index of women in power and utilities confirms that there is a correlation between the number of women on boards and business performance. According to the findings, 85% of companies believe that there is a link between diversity and improved reputational and financial performance. Furthermore, the average return on equity for P&U companies with high diversity scores is 7.7%, compared with only 4.5% for those with lower scores. But diversity delivers more than just financial benefits; organizations with more women in senior positions score highly on a range of factors including leadership, accountability and innovation. So how well is the sector performing in terms of gender diversity?

Index of women in power and utilities underlines the scale of the problem

EY was interested to understand the answer to this question, and commissioned independent research. The resulting index analyzes the world’s top 100 P&U companies by revenue and ranks them by the number of women on the Board of the headquartered company and on the senior management team. The findings, while disappointing, are unsurprising. In the sample, women account for just 4% of board executives and 12% of senior management teams. This simply isn’t good enough – just 4%? You can’t hear 4% - they have no voice.

Starting the journey to diversity

The purpose of our index is to shine a light on the current state of gender diversity and to track progress. But that alone will not bring about change. Fresh thinking, at a global, industry-wide level is essential if we are to rise to the demands of transformation in the sector. At the end of the day, diversity is not merely about equality; it’s about sound economic fundamentals.

EY is committed to exploring this issue with the P&U sector, in depth and over a number of years. This is the beginning of a long journey on the path to better gender equality. I welcome your thoughts and encourage you to contact us with your comments and suggestions. Please provide your feedback on www.ey.com/womeninutilities or via Twitter @AlisonKayEY.

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Read more in EY’s report Talent at the table: Index of women in power and utilities, available now at www.ey.com/womeninutilities
Rising demands on global water and energy infrastructure are creating a growing sense of urgency – from the UN, governments and the private sector – to act today to put water infrastructure in place for the future.

Some countries in water-stressed areas are already feeling the strain, with growing acceptance that water may well be the source of future conflicts. The World Economic Forum’s January 2013 report listed water supply crises as one of the highest risks in terms of both their likelihood and impact.

In other areas, population growth and other factors (see inset box, Pressure on the water-energy nexus) are raising awareness of the scale of the problem, which has been compounded by a lack of investment. According to McKinsey & Company, spending on global infrastructure currently totals US$2.7t a year (about 4% of global output) – but it should be closer to US$3.7t.

Water and energy are intricately linked: the water industry is hugely energy-intensive, and the power and utility sector is equally dependent on water.

### Did you know?

The global energy industry uses 15% of the world’s total freshwater withdrawal.1

So are there opportunities for a more integrated and sustainable approach across energy and water? This is a challenge the water industry has taken on, searching out ways to foster innovation and use the latest technology to improve efficiency.

In this and future issues of Utilities Unbundled, we will be examining responses from the water and P&U sectors, as well as international aid agencies, to address this issue. First to comment (see overleaf) is water expert Tony Conway, whose role at United Utilities is to identify world-leading water utility innovation, visit innovation hubs around the globe and introduce the best approaches into his company.

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1. International Energy Agency World Energy Outlook 2012, © IEA. Global water withdrawals for energy production in 2010 were estimated at 583 billion cubic meters (bcm), or some 15% of the world’s total water withdrawals. In the IEA New Policies Scenario, withdrawals increase by about 20% between 2010 and 2035.


Water is essential to life. It is also a critical resource for the power and utilities (P&U) sector. But innovation is the only way to meet the demands of the future, says Tony Conway, Strategic Programs Director at United Utilities.

Rethinking how a water utility operates

The water and P&U sectors are similar in that both tend to be inward looking and to lack commerciality; services to customers are provided via thousands of assets, and the rate of change can be slow.

When United Utilities decided to reassess what a water company should look like, we recognized that all our assets are part of an end-to-end system that can be optimized for great customer service. We adopted the best thinking from manufacturing on how to do this and restructured into three production lines: 1) water; 2) wastewater (which we call water recycling); and 3) energy. We are introducing production-line performance monitoring in real time and using analytics to identify improvement opportunities.

We are now two years into a five-year program and have already seen gains in customer service and efficiency. We’ve also learned there is no shortage of available innovation around the globe.
“There is no shortage of available innovation around the globe: treatment technology, smart networks, data and information, customer engagement and so on. The trick is finding the right innovation quickly, assessing it quickly and implementing it quickly.”

Tony Conway, United Utilities

The trick is finding the innovation quickly, assessing it quickly and implementing it quickly. United Utilities is developing and piloting specific ways of bringing this about.

Innovation for more efficient water use

Part of my role is to look for the best ideas around the world. I am heartened by the amount of innovation out there, which is enabling water companies, energy utilities, local governments and businesses to use water more efficiently.

One area of huge potential is in wastewater. Historically, wastewater has been seen as a cost — something needing treatment in order to protect public health. But new technology is changing this paradigm, and wastewater is increasingly seen as a valuable resource.

It can be used to generate electricity, displace the demand for drinking water by reusing treated “gray” water, and also serve as a source for recovery of resources.

These are not necessarily expensive technologies. For example, new energy-efficient pumps or aeration systems for wastewater can repay their investment in as little as five years and reduce operating costs by between 20% and 50%.

New wastewater treatment technology, like the additions to United Utilities’ Dayhulme Wastewater Treatment Plant, are being built to enable energy-neutral facilities.

Increasingly, water companies are focusing on energy control and optimization, monitoring energy usage in real time and comparing it with energy forecast models. And with real-time control of wastewater networks, incoming rainfall can be tracked by radar, with active digital control managing flow to optimize customer service, environmental impact and energy use.

Improved operating technology, analytics used in combination with “big data” and visually intelligent ways of distributing situational awareness information around an organization are all improving performance and enabling better decision-making. Other developments include:

• Acoustic technologies that improve our understanding of the condition of infrastructure networks; combined with risk assessment tools, they can anticipate service failures before they occur.
• A more integrated and holistic approach to water management and urban design that means communities are better able to manage flooding and water pollution and to provide local sources of water.

Digital water

Developing countries have an advantage over those with existing infrastructure: they don’t have the burden of upgrading aging infrastructure. There is an opportunity, in developing countries, to put in the newest, most efficient technologies and use real-time data to make better decisions; we call it “digital water.”

In many ways, developing countries are in a better place because they can adopt new systems more quickly than developed countries. This is also due in part to mindset: customers in developed countries tend to take water for granted (much like electricity), and do not see the need for serious or disruptive change.

The water-energy nexus means that developing countries need to approach both water and energy generation in a staged, symbiotic way — both are essential to improving economies and lives. These challenges can’t be solved separately.

Becoming more water and energy aware

The energy and water sectors have much to learn from each other — the more we understand our connections and how we impact each other, the greater efficiencies we’ll be able to achieve.

Utilities can be transformational for developing economies, and there is a global opportunity for growth. We need to overcome barriers to long-term thinking and be innovative in the way we do business from this point forward.

Tony Conway
Strategic Programs Director
United Utilities PLC

Tony Conway is an Executive Director of United Utilities, a water and wastewater utility company serving 7 million customers in England. Over the last 30 years, he has led asset management, operations and engineering functions, as well as business change, transformation and regulatory programs. In December 2012, he became Strategic Programs Director, with the informal title of Director of Curiosity.

6. The Dayhulme Wastewater Treatment Plant will treat about 91,000 tons of wastewater sludge and generate its own power.
Power transactions and trends report Q1 2014

EY's quarterly Power transactions and trends report analyzes mergers and acquisitions (M&A) and key market trends in the global power and utilities sector. After a transformative 2013, when global utilities rebalanced asset portfolios and business models toward new growth areas, Q1 2014 kicked off on a promising note.

ey.com/PTT

Performance journal: A new way of working at Australia's Western Power

Western Power transmits and distributes electricity to a large section of Western Australia. Since Paul Italiano was appointed CEO in February 2012, he's overseen extensive changes in the organization's values. performance.

ey.com/wp-content/plugins/download-monitor/download.php?id=771

Capital Confidence Barometer: Power & Utilities, April – October 2014

The Global Capital Confidence Barometer is a unique biannual study of corporate and boardroom confidence, conducted for EY by the Economist Intelligence Unit (EIU). The latest report explores how increased economic optimism and credit availability, as well as a dual focus on growth and portfolio optimization, will spur merger and acquisition (M&A) activity across emerging and mature markets.

ey.com/powerandutilities/CCB

Ready for takeoff? Overcoming the challenges of big data

Based on points of view from EY's global analytics leaders and sector experts, this report focuses on how companies can generate value from data.

www.ey.com/readyfortakeoff

From defense to offense: the challenge of distributed energy

For decades, the electric power sector – whether regulated or deregulated, wholesale or retail – operated on a simple premise: we have the power, and when our customers need it, we will provide it. All that is changing. This new EY report explores how conventional centralized, dispatchable, fossil- or nuclear-based generation will be impacted as customers adopt distributed energy resources (DER).

ey.com/der

Hidden value: finding the X-Factor in capex allocation

Energy utilities are facing significant capital demands at a time when capital is hard to come by. A new “5 Series” article, Hidden value: Finding the X-Factor in capex allocation, explores how utilities can get as much value as possible from every dollar invested to meet their capital needs.

ey.com/GL/en/Services/Advisory/Hidden-value-of-capital-allocation
Renewable Energy Country Attractiveness Index
Established in 2003, our global quarterly publication ranks 40 countries on the attractiveness of their renewable energy investment and deployment opportunities, based on a number of macro, energy market and technology-specific indicators.
ey.com/recai

Getting ready for UK shale gas
This report details the supply chain and skills needed to develop shale gas reserves in the UK. This study was commissioned by UKOOG to identify supply chain or skills blockages that will prevent the UK from realizing the economic potential of shale gas.

Reporting
In the latest issue, learn why investors are placing increasing importance on non-financial indicators, how big data can improve business performance and more.
ey.com/reportingmagazine
The most important part of a conversation is listening.

Talking at customers is over. The new customer relationship is about dialogue. As the utility landscape transforms, you’ll need to consider changes to your business that align with what your customers are saying. EY can help you develop and execute a transformation roadmap that doesn’t just deliver a system — it starts a conversation.

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