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2015 in review

Claire Volkwyn
Editor
claire@metering.com

As the year draws to a close, it is always a time for reflection and introspection.

As we get ready to put down our pens for a few weeks away from the office, I offer a retrospective on the year and some of the news stories and magazine articles, which to me, illustrate the roller coaster ride that has been 2015. This is a roundup of the alarming, the amusing and the inspiring.

Quarter 1:

- Our online editor, Rose, visits Japan and is inspired by the culture, technology and the ambitious plans to reform the Japanese electricity markets and "install 27 million meters in the Tokyo region by the Olympic Games in 2020."
- In the Middle East, the Dubai Electricity and Water Authority (DEWA) announces T&D losses are down to 3.5%. which is amongst the best in the world, since the installation of smart meters in late 2014.
- Tenaga Nasional Bhd (TNB) of Malaysia announces plans to install 8.5 million residential smart meters within the next 10 years.
- Kamstrup, a supplier of energy and water metering solutions, and Vodafone partner to develop low-cost meter reading technology for water utilities.
- Canadian utility SaskPower completes the recall of 105,000 smart electric meters.

Quarter 2:

- A global report predicts that the smart meter market will be worth $18.2 billion by 2019. This includes smart electric, water and gas. meters for industrial, commercial and residential applications.
- US President, Barak Obama allocates $3.5 billion for grid. modernization in his 2016 budget for initiatives to promote grid modernization and economic competitiveness.
- African Utility Week in Cape Town brings record number of visitors to the city, even as rolling blackouts are implemented across South Africa.
- Sensus launches a low-consumption residential electricity meter that it claims exceeds US safety standards. The Stratus meter incorporates safety features including a redesigned power supply for increased over-voltage protection and better transient performance, isolated components and patented and patent-pending heat identification and protection.

Quarter 3:

- South Africa's city of Tshwane spends more than $80 million on the installation of 14,000 smart prepaid meters and supporting infrastructure, all of which is purported not to work.
- Germany's RWE, trials distributed generation technology in a bid to avoid succumbing to the so called "utility death spiral". The utility eventually splits its renewable energy business form it's traditional base load generation business.
- Israel's Iron Dome missile system will protect the New York smart grid it is reported. A $900,000 grant will help the NY Power Authority and mPrest develop software to detect malfunctioning transformers and avoid an escalation along the grid.
- Dutch utilities Alliander, Stedin, DELTA Netwerkbedrijf and Westland Infra sign deals for 4.6 million smart meters. Iskraemeco enters into agreements to deliver a minimum of 1.6 million smart electricity meters, while Landis+Gyr secures contracts for a total of three million meters.
- Smart Grid GB admits that further delays are expected with the rollout of network operator Data Communications Company (DCC) and the launch is revised to August 2016.
- Smart water meters receive more attention as various areas of the globe experience drought and pressure to manage resources more efficiently. China, India and Indonesia are listed as the hottest prospects for smart water meter vendors. At the same time, installation of water meters in Ireland continue to be met by violence and frustration as consumers protest the move by Irish Water.
- After months of rolling blackouts, South Africa's Eskom turns a corner on maintenance backlogs and normalizes power supply.

Quarter 4:

- Scientists tell the House Science, Space and Technology Committee that the solar system presents a much greater threat to the US electricity grid than cyber security and natural disasters.
- The value of the Internet of Things for energy will reach $22.34 billion, a report predicts.
- Islamic State tries to hack US electric utilities and fails.
- European Utility Week opens in Vienna to a record breaking number of attendees, showcasing the best of Austrian technology and hospitality.
- Enel tells Metering & Smart Energy International that it experiences 100,000 cyber incidents a day. That's 4,166 per hour. Admittedly this is spread across 30 countries and can include anything from a phishing scam to full-scale cyber warfare, but the underlying threat is real.
- Smart Energy GB bids farewell to analogue meters with an innovative campaign in which Royal Philharmonic Orchestra records 'A Requiem for Meters' on custom-made instruments including electric meter violins, cellos made from empty gas meters and a timpani drum constructed from 18 gas meters welded together.
- Metering & Smart Energy International launches new website amid sighs of relief from staff that we didn't break the internet.
- Southern Water announces that advance metering is saving the water distribution company 27 million litres of treated water a day.

As we say goodbye to 2015, I trust that this year is one on which you can reflect with satisfaction and a sense of achievement. While it has not been without its challenges, it has certainly been a year in which the utility world has been able to showcase significant innovation, digitisation and, perhaps most significantly, improved customer satisfaction ratings in many parts of the world.

May we continue to live in interesting times.

Happy holidays

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CURRENTAFFAIRS

GLOBAL SNAPSHOT

UK: Britain and India sign climate change agreement

India and Britain have agreed to collaborate on energy and climate change through a comprehensive package which includes commercial deals worth GBP 3.2 billion. The two nations will engage in joint research programmes and initiatives to share technical, scientific, financial and policy expertise. This will be aimed at encouraging the research, development and eventual deployment of clean technology, renewables, gas and nuclear. Britain has also announced the UK Climate Investments joint venture with the Green Investment Bank. The joint venture between the UK Green Investment Bank plc (GIB) and the Department for Energy and Climate Change was launched as part of the Government of India visit to Britain. This will invest up to GBP 200 million in renewable energy and energy efficiency in India and Africa.

US: The US and Israel announce US$5.1m in funding for smart energy projects

The US Department of Energy and Israel's Ministry of National Infrastructure, Energy and Water Resources have announced US$5.1 million in funding for six clean energy projects, under the Binational Industrial Research and Development Energy (BIRD) programme. BIRD Energy projects focus on commercializing clean energy technologies which stimulate economic competitiveness, lead to job creation and support innovative companies. Projects include initiatives in smart grid solutions for industrial and commercial buildings, aims to improve energy performance through remote metering and efficiency analytics and employment of photovoltaic solar energy systems. US Department of Energy Secretary Ernest Moniz said: "Renewable energy and energy efficiency improvements are essential to shaping our clean energy future. "This partnership with Israel makes possible collaborative investments that move us closer to rigorous technology breakthroughs. These advancements are a key part of modernising our energy infrastructure, enhancing our energy security, and mitigating the risks of global climate change."

South America: Uruguay's generates 95% of its electricity from renewables

Uruguay's head of climate change policy, Ramón Méndez, announced at the United Nations Conference of the Parties (COP21) that the country has in less than 10 years drastically cut down on its carbon footprint – with 95% of its electricity now generated from renewable energy sources. Méndez added that no government subsidies were involved in achieving the amount of clean energy produced, and that in fact; prices are lower now than in the past relative to inflation. The Guardian reports that the country's largest import item is wind turbines. There are also currently large investments being made in biomass and solar power. The World Bank and the Economic Commission for Latin America and the Caribbean, and the WWF last year named Uruguay among its "Green Energy Leaders", stating: "The country is defining global trends in renewable energy investment." Uruguay have pledged an 88% cut in carbon emissions by 2017 compared with the average for 2009-13.

Germany: Musk seeks to compete in German battery storage market

Tesla's CEO Elon Musk targeting Germany as one of his top three markets for his Powerwall battery storage system. Reuters reported that Musk, however, could face stiff competition with established local firms such as SMA solar and Sonnenbatterie. Tesla has formed partnerships with German companies Beegy and LichtBlick in a bid to benefit from local expertise. The company stated that it is working with German and international solar PV (photovoltaic) distributors and installers to offer complete solar PV solutions including PV panels, a solar PV inverter, and installation.

Africa: Nigerian distribution company to install 300,00 smart meters

In Africa, the CEO of Ikeja electricity distribution company in Nigeria, Abiodun Ajifowobaje, said that over 300,000 smart meters would be installed for various customers by the end of 2016. The smart meters, which will be installed at no cost, will ensure transparency in billing, and bring cases of sabotage and vandalism to the company's immediate attention. Ajifowobaje said: "Already between 10,000 and 12,000 meters are being installed monthly in line with this project that reinforces our commitment to exceptional service."

France: Renault-Nissan Alliance provides zero-carbon EV fleet at climate summit

At the 2015 United Nations Conference of the Parties (COP21) held in Paris, the Renault-Nissan Alliance provided 200 electric vehicles to shuttle delegates over for the duration of the summit. The Alliance also installed 90 new charging stations for electric vehicles around the city. The electric vehicle fleet was powered by renewable and low carbon electricity from French electric utility company EDF and will enable the Nissan-Renault EV fleet to cover more than 400,000 km in 14 days. COP21 will mark the first time the United Nations has used a zero-emission electric vehicle fleet for 100% of its passenger-car shuttles at a climate summit.

Central Asia: World Bank provides £25m fund to support climate resilience in Central Asia

The World Bank has committed to support climate resilience in Central Asia with a US$38m fund. The funds will provide financing and technical assistance to rural communities for 'climate-smart' investments in areas considered as priorities. The first phase of the programme will support developments in Tajikistan (US$9 million) and Uzbekistan (US$14 million), and provide US$15 million for regional activities. According to the World Bank, Central Asia is expected to experience more intense global warming than the global average. Saroj Kumar Jha, regional director of the World Bank for Central Asia, said: "Given inherent connections in agriculture, energy, land and water systems as well as similarities in climate change challenges across countries of Central Asia, a co-ordinated and integrated approach toward climate change is key to effectively mitigate risks and to strengthen climate resilience."

Spain: Iberdrola signs Euro 24 million smart meter contract with CG

Spanish utility Iberdrola has chosen Avantha Group Company, Crompton Greaves (CG) to supply it with ZIV single and three phase smart meters. The 24 million Euro contract follows another 17 million Euro order from Gas Natural Fenosa (GNF) for the supply of PLC smart meters. To cater for the growing demand, CG has reportedly expanded its manufacturing plant in Zamudio, Spain and has introduced new, automatic assembly lines that will be able to produce over two million smart meters annually. Spanish utilities are mandated to replace 70% of their an analog meters by 2016 and 100% by 2018. Iberdrola has been implementing advanced grid technologies since 2011, with the first AMI pilot in Castellon, Spain; followed by the Bidelek project in Greater Bilbao in 2012, a large scale smart grid deployment benefiting nearly 500,000 inhabitants.

Thailand: Thailand electricity authority prepares for 2018 smart grid rollout

The Provincial Electricity Authority (PEA) of Thailand has plans to deploy the country's first smart grid project in Pattaya by 2018. PEA is seeking to "embrace internet-connected devices to improve energy efficiency," says the Bangkok Post. The 1 billion baht (US$27,857,950) project will cover the installation of smart meters in 120,000 homes throughout the city. The project also includes the establishment and operation of a data centre to process all forms of communication, especially big data. "The advantages of new advanced information and communication technology (ICT), particularly the Internet of Things (IoT), will help to improve the country's energy management and performance in areas of power generation, transmission and distribution," said Pongsakorn Yuthagovit, PEA's deputy director for system planning. Pongsakorn added that the Authority chose Pattaya due to the fact that it is a high-energy consuming tourist city. Should the rollout in Pattaya go as planned, the smart grid project will be expanded to other major cities including Phuket and Chiang Mai.

Australia: PV customers reject "sun tax" for power grid connection

In Western Australia, solar rooftop owners are rejecting a proposal by state-owned electricity utility Synergy to charge homeowners with photovoltaic systems more to be connected to the grid. According to Synergy's chairman, Lyndon Rowe, these customers aren't paying the fixed cost of being connected to the network. He adds that those without rooftop solar systems and taxpayers are left to cover the deficit. According to local media, there are more than 191,000 solar panel owners in Western Australia – equivalent to 1 in 5 households. Consumer groups have deemed the "sun tax" unfair with rooftop solar PV users being penalised for a "sensible decision to invest in clean, abundant energy," said Solar Citizens consumer campaigner Reece Turner. Premier Colin Barnett has been called upon to immediately rule out the idea of a 'sun tax' as proposed by Synergy. Turner added that the sun tax would also have negative impact on investment in renewable energy.

Jamaica's NWC signs US$7.23m AMI deal with Diehl Metering

The National Water Commission (NWC) of Jamaica has signed a US$7.23 million contract with Germany's Diehl Metering for the purchase of 50,000 solid state water meters for the Kingston Metropolitan Area.

The meters will address several issues including non-revenue water.

Robert Pickersgill, Minister of Water, Land, Environment and Climate Change, said: "The specific objective of the programme is to increase the operational efficiency of the NWC by improving the quality of its services to Kingston and St Andrew as well as reducing related costs.

> *The meters will address several issues including non-revenue water,…"*

"This includes the reduction of operational expenditure by reducing non-revenue water while reducing energy costs."

The Jamaica Observer reported that the Commission would be installing the digital meters over a 12 month period in homes and businesses in the Kingston Metropolitan Area.

Meter deployment

The shipment of the first 8,000 meters was expected by the end of November 2015.

The deployment follows a 2013 pilot project which tested 500 units at the Long Mountain Development housing development in Kingston.

Funding for the project comes under the NWC's KMA Water Supply Improvement Programme, supported by the Inter-American Development Bank (IDB).

President of the NWC, Mark Barnett commented: "Something that our customers are always concerned about is the accuracy of the measurement of the water meter. We do get complaints from time to time and we are always looking for means and ways to ensure that those complaints are reduced as much as possible.

"One of the things that the solid state meters provide is improved accuracy in measurement, both at low flow ... (and high flow). It gives us much better information relating to particular customers. We will be able to detect usage patterns."

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French water distributor selects Sigfox to improve services through IoT

France's fourth largest water distribution company SOGEDO has partnered with Sigfox to provide IoT-enabled services including automatic remote water-meter reading and real-time analysis of usage data for customers.

SOGEDO sought to implement a network designed to use data to become more responsive when managing system operations for local water providers. The distribution company aimed to address some of the issues affecting operations and network efficiency and sustainable use of water resources by users.

The IoT network provided by Sigfox will be used to collect reliable, real-time data from water pipes, water meters and other equipment.

SOGEDO now allows local authorities to monitor their networks in real-time, optimise infrastructure management and respond immediately to emergency situations such as pipeline leaks. Real-time access to usage data will also allow users to manage their water consumption and expenses.

Nicolas Vivian, technical director of SOGEDO, said: "Our partnership with Sigfox enables quick implementation of smart-utility features across our entire system, which will improve performance of water-service providers and make them more efficient and competitive.

"In addition, Sigfox's easily integrated connectivity and excellent performance indoors enable any water meter set to be installed on the water network to transmit its data."

Irish Water weighs up possibility of metering single dwelling homes

Ireland's national water utility Irish Water has started evaluating the possibility of metering apartments for the first time.

The Independent states that the majority of the country's apartments are not metered, "meaning that single people or couples living in a multi-unit development could be paying more for water than a family of five."

The utility has called upon companies to assist with the functionality of water metering technologies for Irish multi-unit dwellings.

Irish Water will use the study to inform a proposal to the Commission of Energy Regulation. Recent census figures showed that there are 150,000 purpose built flats and apartments across the country. Metering these properties would affect 300,000 people.

Under the first phase of the project, which was due to conclude at the end of 2016 with 300,000 meters installed, apartments were considered to be outside the scope of the metering programme because of technical difficulties.

Public consultation

Irish Water has put out a public tender to see if new technology is available to meter any of these properties.

A spokesperson for Irish Water stated: "We expect a large number of these properties will be metered in the longer term as shared service connections are replaced and further options relating to metering apartment blocks are evaluated … the objective is to install meters in the maximum number of these properties".

Southern Water's 5-year smart water rollout saves 27 million litres daily

Water utility company Southern Water serving the UK's South East region, has reported that its five-year scheme to install smart water meters in homes across Kent, Sussex, Hampshire and the Isle of Wight is saving 27 million litres of water daily.

The smart meter scheme began in 2010 and is coming to an end with 450,000 smart water meters installed.

Southern Water announced that on average, 62% of households with a water meter see their bills decrease by GBP162 annually, with customers becoming more conscientious about their water consumption.

Households in Southampton, Hampshire are reported to be saving 5.3 million litres of water every day as a result of the scheme.

Richard Price, director of engineering and construction at Southern Water, said: "Our customers have worked hard to reduce their consumption by 16.5%, against a national average of 10% when having a water meter installed," he said in a statement. "With nearly 90% of all households now metered, our customers must be amongst the most water efficient in the country."

The Netherlands becomes EU's largest gas importer

The Netherlands, once the European Union's largest gas producer, has become its largest importer of gas, according to Bloomberg News.

The country has brought in more fuel than it has exported – with gas imports reaching five billion cubic metres in September.

Bloomberg states that the Netherlands has "capped" gas extraction from Groningen, Europe's largest field, as a result of tremors potentially leading to earthquakes.

The EU member state has turned to other gas producers such as Norway and Russia to generate electricity for heavy industry, as well as household use. Additionally, the import of gas was pertinent to honour contracts to supply customers in Germany, Belgium and France with gas from Groningen.

The nation of almost 17 million has nearly spent the total 265 billion euros (US280 billion) that it earned from gas between 1960 and 2013, on gas imports.

Trevor Sikorski, an analyst at Energy Aspects Ltd. in London, said: "They are going to be buying much more from others than they have been accustomed."

While currently experiencing a gas generation deficit, Sikorski added: "There should be little concern about security of supply" – due to robust connections to the rest of the European region and an underused liquefied natural gas import terminal in Rotterdam.

Czech telecoms firm tests IoT for gas metering

Czech telecommunications company České Radiokomunikace (ČRa) has partnered with Semtech Corporation to test LoRa communications technology for its first IoT pilot programme.

The pilot network developed by ČRa for RWE GasNet and knowledge and content management systems Softlink, uses "pulse sensors on the RWE gas pipeline to capture data that is then sent via the LoRa radio network into the ČRa cloud," reported M2M World News.

The LoRa wireless RF technology was tested under real life conditions for various use cases including indoor, and outdoor with direct visibility through building walls and underground.

Earlier this year, ČRa partnered with RWE GasNet and Softlink to develop a LoRa-based solution that attempted to demonstrate the reach, low power consumption and low operational costs of LoRa technology for smart metering applications.

Vice president of System Business Development for Semtech's Wireless, Sensing and Timing Product Group, Jaap Groot, said that ČRa wants to provide smart city infrastructure for its partners, and found that LoRa technology and LoRaWAN protocol are suitable for its IoT deployments.

The LoRa pilot has been implemented in Prague and surrounding suburbs. ČRa expects to launch the network by the end of 2015.

Electricity Holding Company S.A.O.C

The Electricity Holding Company (www.ehcoman.com) of the Sultanate of Oman, is implementing smart metering in the country. Initially about 10,000 high value customers in all five distribution subsidiaries together will be benefitted. The implementation is through two bids: Bid1: Supply of meters and communication devices; Bid2: System integration.

Bid-1 will be published in December 2015 and Bid-2 in February-March 2016.

For info: ehcprocurement@ehcoman.com

New Portuguese government set sights on green energy

Portugal's Socialist party has established a new minority government which will act upon a provisional government programme outlining planned environmental policy initiatives and review Portugal's hydropower dam-building programme, establish ways of reducing waste and promote efficiency in domestic appliances.

The focus however of the new government is to address transport sector emissions, reinforcing the previous Socialist administration's commitment to electric vehicles.

The Portuguese government also has plans to put an end to public subsidies for conventional power generation, replacing feed-in tariffs with green certificates for renewables and accelerate development in self-generation in public buildings.

President of the Portuguese renewables association (APREN), Antonio Sá da Costa, said that Portugal's prime minister's commitment to the country's renewable energy targets are of utmost importance. The government has set a goal to achieve at least a 40% renewable share of energy demand by 2030.

Costa added: "What replaces feed-in tariffs in Portugal will depend ultimately on decisions made at EU level."

Mexico seeks to open RE with its first electricity auction

Mexico's National Energy Control Centre (CENACE) has announced the first electricity auction in line with the country's energy sector reform, which is primarily focussed on opening the market for solar generators to sell power directly to large customers at utility scale.

The auction will begin in January, where energy certificates will be auctioned off, in addition to energy and capacity.

In the first auction, between four and six million 20-year renewable energy certificates (CELs) will be auctioned off. Fifteen-year contracts for energy and power will also be auctioned off. Mexico has set a goal for 35% clean electricity by 2024 but does not specify concrete goals for technologies.

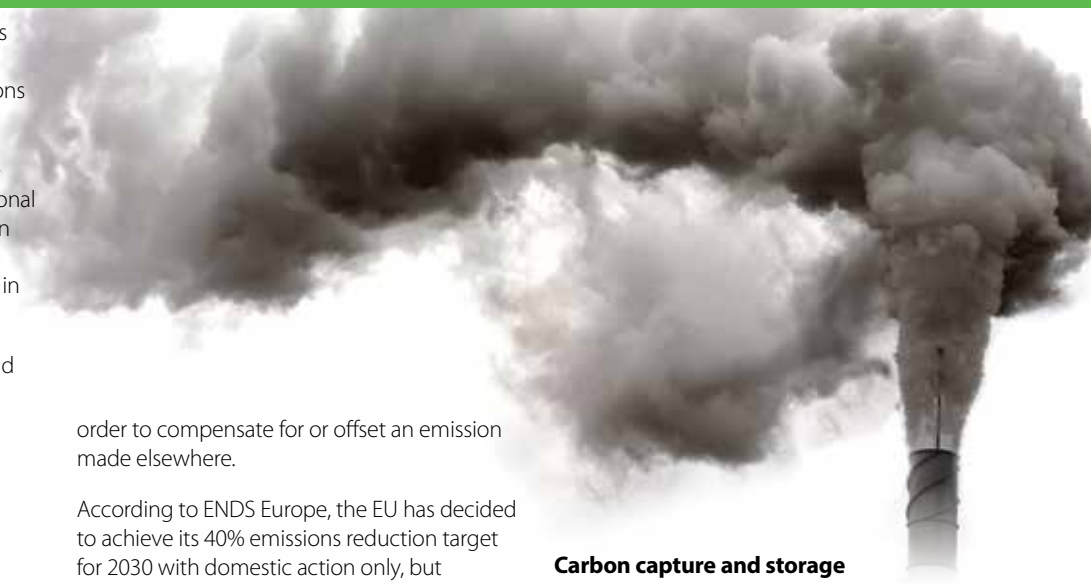
Auction proceedings

Following the release of a provisional timetable for the bidding process, definitive documents are to be published in December 2015, after a process of questions and clarifications. The closing date to register bids will be on January 20, 2016, and the process will be finalised on March 31, 2016.

The only buyer in this first auction will be state electric utility CFE, who is responsible for covering at least 5% of its customers' electricity demand with clean energy in 2018. Other buyers will participate in future auctions.

The Mexican Wind Energy Association (AMDEE) estimates that 50% of the renewable energy certificates will correspond to wind projects in these auctions.

Eurelectric proposes stricter "emissions cap" ahead of Paris climate talks



Power producers' association Eurelectric has said that the European Commission should consider a tighter emissions cap for emissions trading system (ETS) sectors.

EU emissions trading system (EU ETS) is the first – and still by far the biggest – international system for trading greenhouse gas emission allowances. The EU ETS covers more than 11,000 power stations and industrial plants in 31 countries, as well as airlines.

Eurelectric has suggested that the EC should employ stricter measures, with regard to carbon allowances, or strengthen the price signal using the Commission's new Market Stability Reserve – a carbon pricing mechanism to address the problem of excessive greenhouse gas emissions in the atmosphere.

In addition to revaluating the "emissions cap" and adjusting the carbon pricing rate, the electricity industry body noted that carbon offset credits can also be used.

'Carbon offset' is a reduction in emissions of carbon dioxide or greenhouse gases made in order to compensate for or offset an emission made elsewhere.

According to ENDS Europe, the EU has decided to achieve its 40% emissions reduction target for 2030 with domestic action only, but Eurelectric said international credits could be a "viable option to alleviate any risk of price spikes and to increase mitigation ambition".

It added that non-trading emissions sectors such as transport, buildings and agriculture "should also contribute in a balanced manner to any increase in ambition."

Carbon capture and storage

Eurelectric further noted that there is a need to ensure funding for carbon capture and storage (CCS) under the Commission's innovation fund, as energy efficiency and renewable energy projects, which will compete with CCS for funding, already "benefit from a variety of national and European support programmes".

The SGIP wins US$2.1m in NIST federal funding

The Smart Grid Interoperability Panel (SGIP) has won the Smart Grid Interoperability Standards Cooperative Agreement Program federal funding opportunity from the United States Department of Commerce's (DoC) National Institute of Standards and Technology (NIST).

The Program is designed with substantial NIST participation. The initiative supports continuous innovation of the electrical grid through the coordination and acceleration of standards development, harmonisation and advancement of the interoperability and security of smart grid devices and systems. The federal funding award grants the SGIP US$2.1 million in funding during the performance period of January 1, 2016 through December 31, 2018.

Sharon Allan, president and CEO of the Smart Grid Interoperability Panel said: "Winning this award demonstrates SGIP's experience and credentials in executing this strategic initiative.

"We are confident that SGIP has the right expertise including the right team, proven experience, methods and processes, to execute as NIST's chosen partner in driving grid modernisation through collaboration to establish a self-sustaining, ongoing process beyond the funding period."

The organisation's focus is the acceleration of grid modernisation and energy Internet of Things through policy, education and promotion of interoperability and standards to empower customers and enable a sustainable energy future.

EDP Distribuição executive named EE-ISAC chair

The European Energy – Information Sharing & Analysis Centre EE-ISAC has welcomed Aurélio Blanquet (Director, Division of Automation and Telecommunications, EDP Distribuição) as chair of the first European ISAC for the smart energy sector (EE-ISAC). Johan Rambi (Alliander), Robert Redl (EVN Group), Volker Distelrath (Siemens AG) and Chris McIntosh (ViaSat UK) were also elected members of the EE-ISAC Board.

According to an EE-ISAC release, Information Sharing & Analysis Centres are "networks of trust in which both private and public parties share security information either on a human-to-human basis via member meetings, digitally via an information sharing platform or on a machine-to-machine level via situational awareness networks."

The organisation was established to address the need for international collaboration to protect the energy sector from cyber-attacks at European level. The newly-elected EE-ISAC chair stated: "If we want to tackle future issues more effectively, we have to start taking an open approach towards cybersecurity. The only way forward is to share experiences with security incidents, whether they are success stories or not. EE-ISAC offers a platform to share this sensitive information in a secure way."

EE-ISAC is a joint initiative of four major utilities accompanied by technical universities, security technology providers and governmental and non-profit organisations. It is aimed at enabling top utility security experts to learn from their peer's experiences with security incidents, compare and evaluate security solutions (both from a technical and operational viewpoint) and discuss future challenges.

Members benefit from an open dialogue with industry partners and suppliers.

IoT: classic and also quite different

Strictly speaking, the Internet of Things (IoT) is not a new venture for EBV Elektronik. EBV has, for many years, been working on topics which are now specific to IoT or directly associated with it, but which were not classified as IoT before the term was coined. The disciplines of sensor technology, data preparation and data processing, data output, actuator engineering, connectivity and security come together in the Internet of Things – and EBV has been continuously active in all these areas for over a decade. The terms IoT and the very closely related 'Industry 4.0' are now widely recognised and a starting point for further discussions.

One of EBV's main strengths for many years has been its ability to combine these individual areas and from this combination, develop new potential for its clients. For some years, this has found expression in the following segments: on the one hand, the classic market segments including the automotive, consumer, healthcare, high reliability and renewable energies segments and, on the other hand, the technology-driven FPGA, identification, LightSpeed and RF and wireless segments.

Two examples from the healthcare market segment clearly show the extent to which technology is used:

1 **A diabetes management system** essentially consists of a blood glucose meter, an app on a smartphone and a patient database in the Cloud. At intervals throughout the day measurements of the blood sugar level are recorded and transmitted to a smartphone using Bluetooth Low Energy (BLE).The patient can use the associated app to document other things such as food intake. They also receive advice and recommendations via the app about correct diet and fluid intake. The data are bundled together from the app and transmitted in encrypted form to a patient database. Professional medical personnel can then access the data and provide the patient with appropriate advice and notifications, such as the insulin dosage to be given. This system can also be supplemented by an automatic or semi-automatic insulin pump, attached to the patient's body.

2 Another example from the personal health and fitness sector is the **Activity Tracker** or **Activity Monitor**. Numerous

versions of these are now commercially available, from simple step counters to complex sports watches, which measure the user's blood oxygen saturation and heartbeat. There are differences in the features and the precision. Most devices have one thing in common, namely a BLE connection to a smartphone, an associated app and/or an interface to the most popular fitness and running apps. The data are usually sent by the smartphone to the Cloud in unencrypted form. By private arrangement these data can then be seen by friends. In these applications, unlike in the medical application, no great value is placed on data security, since it is up to the users to decide whether or not to share their data publicly.

The industrial area is also supported by applications such as M2M and Industry 4.0. One important area is NFC – dual interface programming of motors (motor control unit) by mobile NFC. Applications of this type are to be found in the Industry 4.0 area, where displays and touchpads on machines are being replaced by tablets.

Also of interest is the networking of electrical energy storage devices and the newly planned business models of the energy suppliers.

For example, one of these business models enables energy storage devices to be charged from various renewable energy sources up to three times a day and for the energy to be accessed at peak times each day. The smart meter gateway and the smart meter are absolute necessities for this. Such a model is particularly appropriate in Germany for owners of solar power systems which have come to the end of their feed-in compensation period, as they will now achieve a faster return on their investment in their energy storage devices with this model. In Germany there are already 60,000 compensation schemes for private homeowners which are due to expire in 2018.

Since these installations are all still functioning well and generate electricity at the cost of their upkeep (ca. €0.02) it is advantageous to install a storage device.

Communication between machines (M2M, machine-to-machine) has been an important area for decades. However, the Internet, with its infrastructure and the increasing spread of products such as PCs, tablets, smartphones and new semiconductor products, has not only shaken up the market completely but also permitted totally new approaches to solutions in areas which were not previously relevant at all.

One good example of how interdisciplinary thinking with networked solutions is being driven is showcased in the science magazine 'The Quintessence', where new ways of using these technologies has been showcased. The articles always look at the bigger picture in order to generate inspiration for new products by interlinking different categories of items and talking about work that crosses various areas.

The most recent issues, for example, have looked at sensor technology, the Internet of Things, cyber security, Cloud technology and Industry 4.0, while the next issue will be devoted to smart systems.

It is important to make developers and decision makers clearly aware of the importance of the IoT in their own professional (and also private) environments, so that they can leverage its growing potential in the best way possible. Thus, a single fundamental question to be asked is: How can we help our customers to develop a solution that is smart, has a data connection with the outside world and enables secure communication? In short: it is about being smart, secure and connected everywhere.

IoT solutions for traditional customers

With its market matrix technology, EBV Elektronik already has a very good initial approach to determining which technology can provide what added value to the corresponding application, in order to achieve a competitively viable product.

With the IoT, however, the challenges facing clients also change when, for example, an existing autonomous device needs to be connected to the Internet or to a Cloud solution. This connection also brings with it new requirements. For example, a wireless module in combination with the corresponding software solution may provide the desired connectivity, while an appropriate security solution may provide the corresponding data security for authentication and data exchange.

... IoT provides clever start-ups with a very good chance of realising their ideas"

Customers know their core products inside out – these are often autonomous devices – and the customers are often world leaders or hidden champions in their sector. However, as far as RF technology and security are concerned, in many cases these companies have had little or no involvement until now, so in many instances they do not have enough of the appropriate resources in-house to meet the challenges of IoT. This is where a specialist provider comes in, as it has a particular strength in its ability to assist these customers with appropriate resources and specific know-how, in bringing their new product to market as soon as possible. Specialist providers can explicitly address the security risks which arise with data transmission, for at the end of the day an appropriate security solution can always be found using suitable semiconductor components and appropriate software.

Support for newcomers to electronics

In principle the IoT connects different markets which have existed until now as essentially isolated solutions. This has blurred the lines that used to separate many applications from each other. Good examples of this include sportswear that can now contain sensors, or pieces of furniture with built-in recharging units for wireless charging of mobile devices. Typically, the sportswear or furniture manufacturers were previously not electronics specialists, so they require suitable partners to implement the electronics functionality for them while taking into account characteristics of the corresponding solution from all possible angles. EBV shows these companies the possibilities offered by the technologies and provides introductions to suitable partners who are able to address the individual requirements of the corresponding area of business or solution in an appropriate way. For example, the company helped a major sportswear manufacturer to incorporate a pulse rate sensor in outerwear and pressure sensors in running shoes.

Similarly, there are watch manufacturers with a very long tradition and an excellent name in the market who are now beginning to market a smartwatch, in order to prevent classic electronics suppliers such as Apple or Samsung from taking away their livelihood and in order to secure their place in this future market segment. In these cases, EBV becomes involved in what is akin to matchmaking by introducing these new customers to other customers who have the expertise to help them with the implementation of the application.

Support for start-ups

Start-ups also have very clever ideas but often the hardware for these businesses is a standard product; primarily distinguished by their software and services, by the connection to the Cloud and/or by underlying data processing. EBV Elektronik has already helped various start-ups to bring their products to market – sometimes even brokering a contact with a potential financial backer or investor, or with an appropriate manufacturing partner. Again, EBV can often provide start-ups with vital logistical support, such as for the organisation of software updates or for the outsourcing of gateway, server and/or Cloud services.

Sensor technology and low power

Sensors constitute an important element of the Internet of Things. By being able to have access to a wide range of sensors, intelligent pre-processing of the sensor data directly at the sensor permits a significant reduction in the data volumes transmitted over the RF interface. This reduces the workload of the frequency band used while reducing the power needed for transmission.

It is precisely in such cases – where sensor data are to be captured in the field, possibly pre-processed and then transmitted onwards – that low power design is often a very important topic. One good example of this is a battery-operated temperature sensor which transmits its data over an RF connection to a computer. The smaller the energy requirement for the switching, the longer the sensor system is able to operate without a battery recharge and the lower the maintenance cost will be. Above all, the low power microcontrollers produced by Atmel, Freescale, NXP and STMicroelectronics, which contain an ultra-low power processor core from ARM, now enable astonishingly long battery lifetimes.

Semiconductors (also) for niche markets

Sometimes there are no appropriate semiconductors for the particular market or the desired design. One reason for this might be the fact that this market moves or changes too quickly; however, it might also be that the classic semiconductor manufacturers feel that a market or a field of application is not attractive. Under its EBVchips programme, the company is able to create a solution relatively quickly for applications that were previously not covered. Two of the products which come under EBVchips are not pure semiconductors but wireless modules, known as Vesta and Maia, for special applications. Vesta and Maia provide developers with a platform that they can use to bring a software-configurable product with Internet connection to the market relatively quickly. While Vesta is a sub-GHz module for IP500 mesh networks, Maia is a sub-GHz module which is delivered with approved stacks for M-Bus and OMS.

Actuators

The data processing is followed by actuator control, so EBV's programme includes a wide range of motor drivers for the regulation and control of motors. EBV also offers many possible solutions for smart lighting. Smart lighting involves intelligent lighting solutions – including the control of brightness and colour temperature.

Industry 4.0

The catchword 'Industry 4.0' refers to a high level of networking in the manufacturing area. One relatively new aspect in this area is predictive maintenance. Here, sensors identify potential wear and tear and alert operators in good time, before

a breakdown, that maintenance and/or a replacement of parts is required.

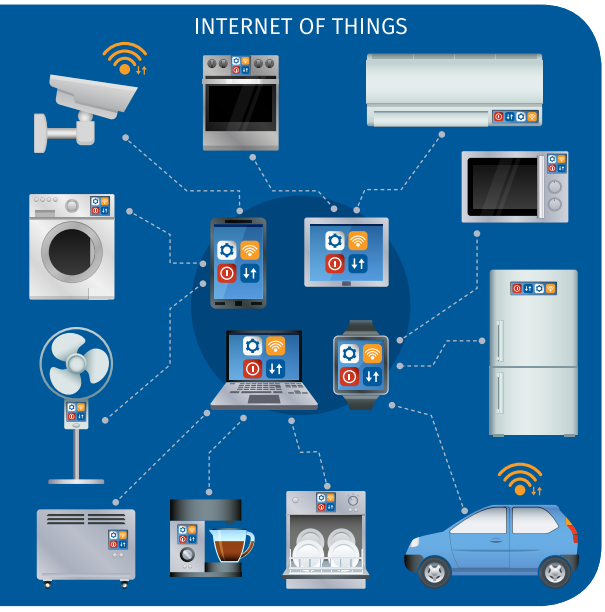
Involvement with Industry 4.0 is no longer limited to purely technological implementation, but extends to answering questions such as 'How do I work with that? What does it mean? Who are the players? What are the repercussions?' Consequently, the challenge is to bring discussions to a higher level and to help customers adapt their processes, supplementing product-related advice with the business element.

New applications

New possibilities are also arising in the areas of home automation and the connected car. In a house, for example, most light switches could be dispensed with if sensors were able to detect where people were. These sensors also provide valuable input for the efficient control of heating. At the same time, German car manufacturers are assuming that by the year 2020 at least every second new vehicle will be a connected car, i.e. a vehicle with a permanent Internet connection.

In the medical area the IoT allows new forms of patient monitoring. The appropriate sensors on the patient's body and a smartphone in their pocket can continuously monitor certain vital parameters in everyday life, without them needing to be in hospital or visit a doctor daily. In such applications the IoT not only provides for a much higher quality of life but also reduces the treatment costs at the same time, so that the improvement in the quality of life is also of interest from the purely financial point of view. This type of patient monitoring system primarily uses BLE and Wi-Fi for data transmission.

> *"The level of demand for security and identification products is currently accelerating massively"*



IoT @ EBV

While EBV Elektronik provides its customers with the necessary technical support in connection with the IoT, the support also extends far beyond purely technical aspects. It begins with information about the possibilities offered by the IoT, continues with technical seminars with specific manufacturers on applications and/or vertical markets and extends to consultancy services which can sometimes even lead to a radical review of the business model. For example, one customer previously developed and manufactured compressors but now sells compressed air as a service: instead of selling its customers a machine, it now provides them with air with a well-defined, permanently available quality and specification. Making use of the previously mentioned predictive maintenance in the framework of the IoT and the resulting reliability, by virtue of offering a service, this customer is now able to create much more value. Of course the customers themselves determine their business models, but with the right questions interesting discussions about relevant points can be triggered.

Although the company's core business is very clearly semiconductor distribution, the company has also been investing in software support for some time. This means investigating and qualifying the software of potential and existing partners, so EBV is able to involve qualified third-party suppliers in order to facilitate the fastest possible implementation of the customer's solution. As a result, 20 companies whose software is specially tailored to IoT applications have already been certified. The spectrum ranges from engineering services and software houses to Cloud partners.

Security

Data security is a sensitive but extremely important topic. It is vital to increase a customer's awareness of this topic by asking questions like 'Have your products already been copied?'

During an analysis of competitors, one customer discovered that a certain device, albeit with an outwardly different appearance, was an exact copy of its own product.

How high is the risk that people will access the data, manipulate them or pass themselves off as authorised to access the data and tap into them?

The level of demand for security and identification products is currently accelerating massively: up to a year ago there were only three or four queries per year about ID and security solutions; this has risen to between 15 and 20 queries per month.

As far as the topic of identification and security is concerned EBV has all the market leaders on its product line card, including the manufacturers Atmel, Infineon, NXP and ST. Depending on the application, even a small crypto-component can have a large effect, and sometimes complete security solutions with key management are also required. In this area EBV works with corresponding partners such as the Fraunhofer Institute for Applied and Integrated Security near Munich. EBV's FAEs are specially trained in security and help developers to recognise the potential dangers and work through the corresponding issues. Since very few medium-sized companies have the resources to create their own secure server infrastructure, collaboration with the appropriate specialists in the field is an absolute must in this area in order to ensure the long-term success and the survival of the business. MI

INTERNET OF THINGS

SPECIAL REPORT

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Demystifying IoT: Navigating the trillion dollar industry

The utility industry has spent US$67.7 million on Internet of Things (IoT) technology in 2015, according to Tata Consulting Services. Duke Energy, PG&E, ComEd in the US and Enel and Endesa in Europe are just a few examples of electric power companies adopting smart devices to add digital processing, data analysis and communications capabilities to an aging analog infrastructure.

Customer demand for rich information through, access to smarter, digital utility services is not the only catalyst driving IoT. Larger factors such as climate change are boosting city and community initiatives considering similar modernization. Today smart cities are leveraging IoT to gather multitudes of data which can be used as distributed intelligence, across most, if not all verticals – energy, water and transportation.

Over the past several months, there have been an overwhelming number of reports that point to IoT transformational impact in the utilities industry.

A BI Intelligence report states that the global smart meter installed base of 400 million devices in 2014 is expected to more than double to 925 million by 2020. Revenues for smart grid sensors, notes IHS, will hit US$350 million in 2021. From a regional smart grid perspective, by the end of 2015, annual smart grid spending in China could total US$20 billion, with smart meters driving US$2 billion of that total. Moreover, with Internet of Things (IoT) architectures rapidly driving smart lighting technology, Gartner forecasts that the smart lighting installed based, estimated at 46 million units in 2015, is projected to grow to 2.54 billion units by 2020. Finally, the global number of connected devices managed by utilities is expected to grow to 1.53 billion in 2020, according to Ericsson.

But what does this mean for the utility? How do they monetize this opportunity?

US-based IoT analyst firm Machina Research has released a report, prepared for Redknee, which estimates that the successful monetization of IoT could realise revenues of US$1.3 trillion. The report looks at global forecast through the "prism" of monetization and found that a growing proportion of revenue associated with IoT is related to sophisticated monetization opportunities. It identifies seven capabilities needed by a monetization platform, which includes the following qualities: "scalable, open, real-time, flexible, transparent and secure, agile, and built with the diverse requirements of the IoT in mind."

One of the key points related to "sophisticated monetization opportunities" in IoT, is the change in the positioning of selling IoT-based business models – that is, offering products as a service, rather than a piece of hardware. Sokwoo Rhee, Associate Director of Cyber-Physical Systems Program at National Institute of Standards and Technology (NIST), expands on the importance of a move toward service based IoT models.

MI: What value can IoT bring to the utility industry? How do businesses capitalise on this trillion dollar opportunity?

SR: The Internet of Things is an enabler that can help utility companies and businesses in other industries alike grow beyond what has or what could have been imagined initially. At the core of IoT is connectivity. However, in order to drive value for the business and its customers, adopters of IoT need to create new, innovative services to attract and retain clientele. Having a network of purely connected devices is of no worth; companies need to develop digital services that are enabled through communication technology.

There is a common misunderstanding that IoT solely encompasses "connectivity". IoT includes the services that are built "on top" of that connectivity. Businesses will have to evolve and develop a service orientated, IoT-as-a-service approach in order to differentiate themselves.

IoT has four layers – the bottom layer encompasses the hardware (chips, sensors, actuators etc). The second layer is the connectivity layer; the third layer is the software and data analytics layer; and finally the fourth is the service layer from which data is gathered and decisions are made to provide end-users with valuable, actionable information – also referred to as "closing the loop."

MI: What are the major factors driving IoT and what are the primary factors accelerating its adoption by energy providers?

SR: 1. The emergence of new data science: This involves big data, fast processors, analytics cloud technology and combining data sets.

One great example is the thermostat. Conventional thermostats provide basic functions of displaying and controlling temperatures with setpoints. With the emergence of additional processing power, low power wireless capabilities and cloud technology, now the thermostats can analyse the history of the temperature and control the HVAC system to optimize energy profile for maximum savings and comfort.

2. Rapid improvement of the performance and the reduction of cost of the critical electronics components for IoT (CPU, radio, sensors, etc): eg. air quality monitoring through amalgamating data sets "data fusion" to create efficiencies across several different platforms/devices , for example, smart home.

Additionally, there has been a change in mindset, especially in the last five years, in terms of what is possible with data gathered from sensor technology. More and more, industry is seeing the value of data in improving operational efficiencies, creating new services, performing risk analysis, creating new revenue streams, gaining enterprise-wide insights and more.

> *Forward thinking energy companies are ones that involve their customers prior to product and service development."*

MI: To what extent will change management be required when implementing IoT? What does this process look like? How does a utility and its staff prepare for that?

SR: A utility company or any business considering IoT, should have a full understanding of its different elements, including the hardware and software requirements, how to combine different domains, a roadmap/strategy, and a team with the necessary expertise who have a holistic understanding of what their role is in the transition toward a more integrated business model. In many IoT applications, a new business model will emerge when the existing business is properly combined with the IoT concept. So it is critical that the team have both expertise in the business and IoT technology side by side. Employing IoT could be a potentially difficult task if silos remain. Businesses need to break down these silos to create efficiencies and drive down costs.

MI: What are the major factors hindering IoT uptake?

SR: A lack of identified and proven business cases, which could lead to challenges in acquiring financing. Also, cybersecurity at policy level – considering not only the physical security of assets but also taking into account, risk management, safety management and so on. Again, there is a lack of application examples to create practical discussions around trustworthiness.

Finally, with the volume of technology and varied connectivity protocols, standardisation also poses a challenge to uptake.

MI: How do you think IoT has impacted on a business's relationship with their customers? What do you think this will look like in 5-10 years' time?

SR: Due to the fact that the energy landscape is changing, customers perceptions have also changed. Utilities will find it difficult to innovate through the traditional model of creating a new product/service, marketing the product/service and selling it – "push" strategy.

Forward thinking energy companies are ones that involve their customers prior to product and service development. They engage their customers to decipher their needs and create an ecosystem, where the utility has established interest and a community of customers that are ready to buy its new offerings, prior to marketing and selling them. We will also continue to see the development of platforms to manage IoT devices and services – Google and Apple are two examples of this.

MI: What do you see as being the next big wave in IoT?

SR: The next big trend in IoT will appear in the public and industrial sector, with the emergence of smart cities and the integration of different city verticals – energy, water, transportation. There will also be an increase in IoT in the manufacturing sector with hardware costs decreasing. MI

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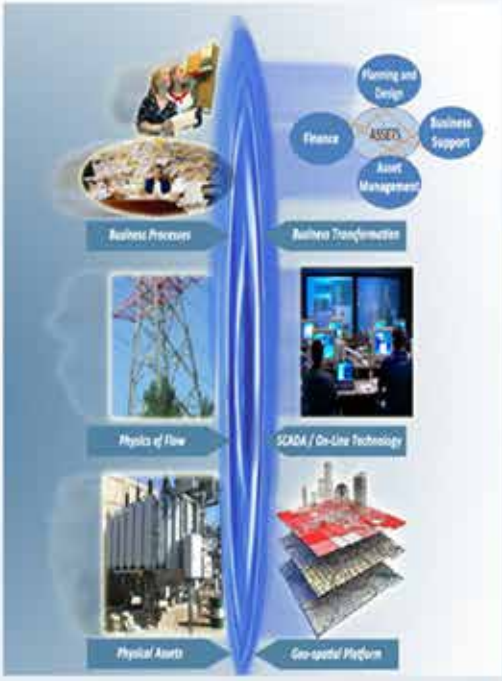
THE DIGITAL UTILITY TRANSFORMATION



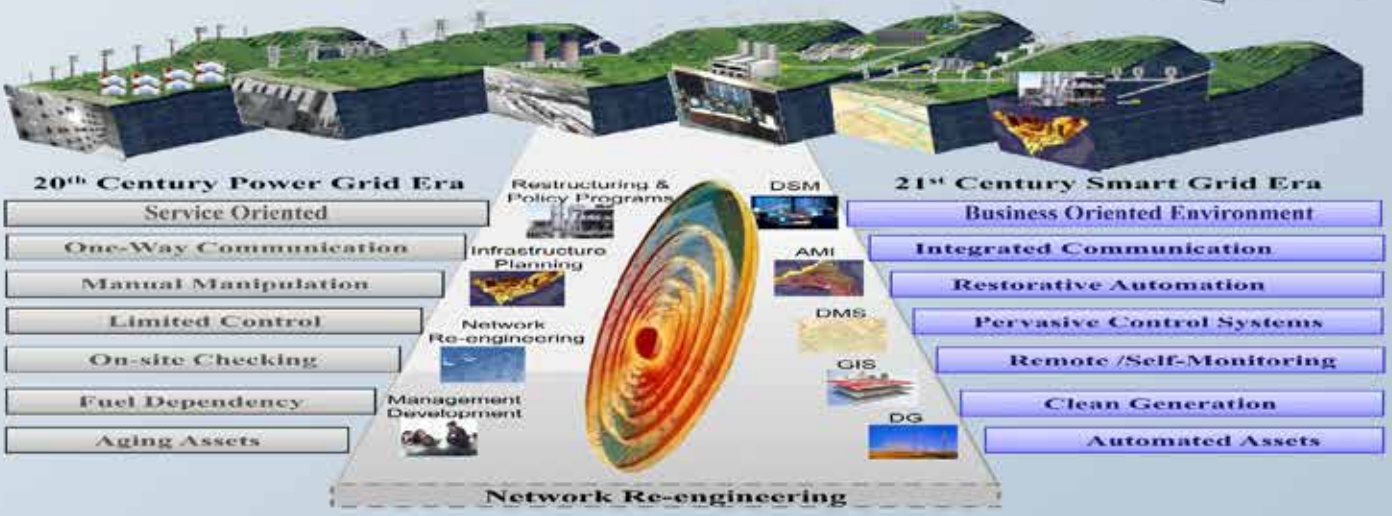
COMMITMENT TO LEAD THE DIGITAL TRANSFORMATION OF UTILITY BUSINESS IN THE 21ST CENTURY TOWARDS OVERALL BUSINESS SUSTAINABLE ENVIRONMENT WITH ULTIMATE PROFESSIONAL INTEGRITY

- GEOGRAPHIC INFORMATION SYSTEM
- DISTRIBUTION MANAGEMENT SYSTEM
- ADVANCED METERING INFRASTRUCTURE
- DEMAND SIDE MANAGEMENT
- INVESTMENT PROGRAMS
- POLICY / RESTRUCTURING PROGRAMS
- LEADERSHIP IN SPECIALIZED PROGRAMS

15 YEARS OF SERVICES:

ADVISORY
CONSULTING
ENGINEERING
MANAGEMENT

BUILDING THE SMART GRID



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LPWA: Disruptive new networks for IoT

Machina Research has for a long time identified the emergence of **Low Power Wide Area** (LPWA) networks as one of the most far-reaching trends in **M2M** and **IoT**, and in the course of 2015 these technologies have truly come of age. At the moment, practically every technology supplier, service provider, and enterprise that can be regarded as the cutting edge of **IoT** is trying to understand how **LPWA** will enable, or impact, its business.

The technologies that enable LPWA networks are far from identical. These technologies can be categorised under six main groups: LoRa, UNB, random phase multiple access (RPMA), cellular, weightless, and solution-centric LPWA.

These networks meet both of the following criteria:

- **Low Power:** The technology is capable of delivering multiple years of device operation on a single AA battery, assuming hourly application readings and factoring in the effects of battery self-discharge and degradation.
- **Wide Area:** The technology is capable of delivering at least 500 meters of signal range from the gateway device directly to the endpoint, assuming challenging deployment conditions – such as urban and underground environments.

Apart from these criteria, there are other characteristics that can be seen as typical of LPWA. These include advantages that are of a secondary (increased network capacity) or non-technical (reduced costs) nature, as well as technical trade-offs that are a consequence of being able to meet the two defining criteria:

- **High Endpoint Density**
- **Reduced Hardware Costs**
- **Reduced Connectivity Costs**
- **Low Data Rate**
- **Constrained Latency**
- **Limited Mobility.**

Importantly, LPWA is technology-agnostic, meaning that it applies both to new networking technologies that have been specifically designed to deliver LPWA-style performance and to incumbent ones that are adopted to do so, on an iterative basis.

Several market issues remain open

A number of market issues will define the LPWA industry's future direction, including the relationship between LPWA technologies and radio spectrum; the commercial models that are used to the deploy LPWA networks; the role of battery life as an application requirement; as well as the role of downlink communication as an application requirement.

- **Spectrum use:** LPWA networks can be rolled out in both licensed and unlicensed radio spectrum, depending on technology. Each approach comes with its own pros and cons, as summarized in **Figure 1**.

LICENSED SPECTRUM FOR LPWA	UNLICENSED SPECTRUM FOR LPWA
Pros • Freedom of network usage • Potential to use existing cell sites • Fast start-to-blanket coverage	**Pros** • Fast time-to-market • Enablement of new providers • Viable BYO option
Cons • Reliance on spectrum holders • Uncertain service propositions • Spectrum overheads	**Cons** • Limited security • Lack of multinational players • QoS and capacity issues

Figure 1: Licensed and unlicensed spectrum use in LPWA *[Source: Machina Research, 2015]*

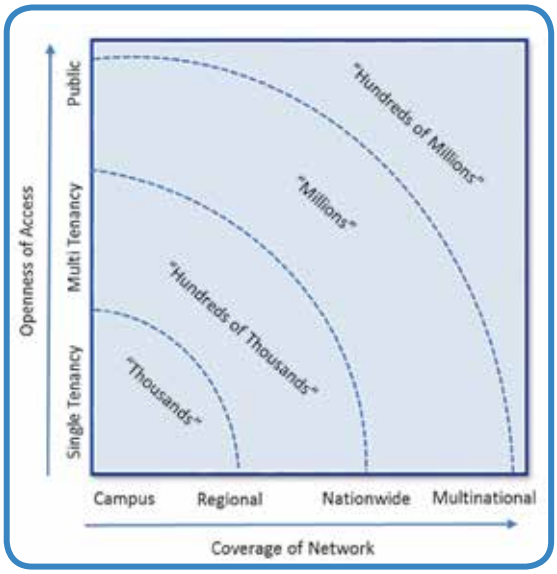

Figure 2: Deployment Commercial models for LPWA network deployments

[Source: Machina Research, 2015]

- **Deployment model:** There is no uniform model for deploying LPWA. Different models can be broken down along two dimensions, according to who is permitted to access the network and what level of territory is covered. These are illustrated in Figure 2.

- **Battery life:** Arguably the most opaque parameter related to LPWA technologies is battery life. On this front, as in most other technical aspects, it is advised that all enterprises test and trial LPWA more carefully than their other connectivity options. In addition, enterprises should consider proactively employing a "minimum viable lifespan" approach to their applications, instead of trying to squeeze as much battery life out of the devices as possible.

- **Downlink capability:** Another very significant parameter in the LPWA market is downlink capability, as the range of IoT applications that require only uplink communications from the endpoint to the gateway is likely to be limited. Besides the technical characteristics of the networks, the use of spectrum plays a large role in determining downlink flexibility. All in all, downlink capabilities can be expected to become a key selling point for LPWA alternatives, as well as a premium feature for the network providers that are able to offer it to their customers.

LPWA for utilities - transformative potential

For utilities, LPWA has undeniable potential to drive technological transformation. This is especially the case in water, gas and municipal heating, which are all areas where smart metering remains a remarkably nascent concept, due to the lack of adequate connectivity options.

The worldwide availability of new networks that are able to cost-effectively serve large numbers of battery-operated meters in underground or otherwise difficult locations will be a definite business enabler for firms operating in the said sectors.

In addition to connecting metering devices, LPWA can bring further operational gains by allowing water, gas and heating utilities to employ sensor-based condition monitoring throughout their distribution infrastructure. In these markets we are talking about deployments that would not be feasible in the first place without LPWA.

IoT and electricity infrastructure

In electricity, the picture is more complex. Electricity meters do not need to rely on batteries, and the economics for getting them connected to begin with are clearer than in water for example, so there are already a variety of connectivity solutions enabling smart metering. The likes of powerline, ZigBee, as well as the traditional cellular (2G/3G/4G) networks have all been used widely in metering rollouts to date, albeit with somewhat mixed success in terms of technical robustness and cost effectiveness.

In the meantime, at grid level, electricity utilities need to address a different set of pain points. While the objective in metering, in principle, is to maximise the number of connected endpoints and minimise the overheads of doing so, the issues in grid infrastructure have to do more with coping with the vast volumes of data that is being generated in substations and other distributed "islands" of big electricity data, often beyond the reach of the fibre-optic backhaul.

This is an area where the evolution towards 5G holds a lot of promise, but overall, all the real game-changers can be found outside of the connectivity layer. Smart grid is one of the most compelling verticals for edge intelligence and fog computing – two intertwined concepts that refer to the processing and filtering of data at or close to its source, instead of transmitting all the way to the enterprise level for backend analytics.

Towards virtual power plants – connecting homes and buildings

A virtual power plant (VPP) – controlled over abstracted software tools and systems – can provide much more targeted and sophisticated load-balancing and demand-response measures across the electricity networks. Besides the "smarts" added to the meters, grid elements, and the enterprise backend, the end-devices that consume the supplied energy are a critical part of the VPP concept. In this context, the utility sector's fortunes will largely depend on how the presently confusing landscape for in-building connectivity will ultimately play out.

The recently released Thread protocol warrants extra attention in both residential and business settings, standing a good chance to muscle ZigBee and Z-Wave out of the market. Meanwhile, the upcoming iterations of Bluetooth (mesh networking) and Wi-Fi (sub-GHz spectrum) may also prove major enablers for in-building connectivity and thereby energy management.

Furthermore, this is another domain where LPWA is expected to find significant adoption. For example, if an appliance manufacturer – in a close partnership with electricity utilities – wants to implement a solid demand-response capability for every device of its product model then it will essentially have to invest in a wireless WAN technology, because there will be no single short-range option it could rely on for universal connectivity.

All in all, the outlook on IoT connectivity varies according to which part of the value chain one decides to look at. LPWA will never be able to address all connectivity needs that a utility company may have, but that does not change the fact that as a whole these networks are a very exciting addition to the technology toolkit. MI

ABOUT THE AUTHOR:

Aapo Markkanen is a principal analyst at Machina Research, where he focuses on access technologies and the role they will play in the evolution of M2M connectivity. He has a particular research interest in Low Power Wide Area (LPWA) networks and competing short-range alternatives.

IT/OT CONVERGENCE:

what does this look like for the modern day utility?

By Adarsh Krishnan and Eugenio Pasqua, ABI Research

IT/OT Convergence indicates the integration of information technology systems used to manage business operations and information i.e. ERP (Enterprise Resource Planning), CRM (Customer Relationship Management), SCM (Supply Chain Management), or EAM (Enterprise Asset Management) with the operational technology used to perform actual operations and support physical value creation. A typical example of OT are SCADA systems used to monitor industrial plants and/or electrical distribution systems.

Traditionally these two domains do not overlap and have been managed as separate entities. The IT systems used to manage the high-level business operations and the OT systems the production domain. Due to the use of non-interoperable technologies and standards, the data they produced remained confined inside closed organisational silos and could not easily be shared with each other, unless an expensive customisation process to integrate them was performed.

IT/OT convergence basically means solving these interoperability issues by providing a common technological ground over which the two domains can effortlessly exchange data and work together.

The IoT as a concept envisions the use of open and interoperable standards to facilitate the exchange of data both "horizontally" (between machines and devices – even from different vendors and technologies) and "vertically" (from machines to high level management systems and vice versa). This translates into the creation of a single unified network infrastructure based on open communication protocols and standard data models so that the machine-generated data can be liberated from

"With a full IT/OT integration, industrial organisations have the means to have a complete view of what's happening..."

these silos and shared with the higher-level management systems.

The benefits can be seen on three levels:

Cost Benefits: The use of open and interoperable standard technologies – as opposed to vendor-specific, proprietary technologies – reduces the Total Cost of Ownership (TCO). Traditional solutions based on vendor-specific and proprietary technologies often limit the selection of the hardware and software required by monitoring, control, and automation solutions to a restricted group of manufacturers, and concentrates more on their degree of compatibility with each other rather than the best quality-price ratio. In addition, these solutions often involve an expensive customisation process to integrate the different components (both hardware and software). On the other hand, through the use of open and interoperable standards the development and implementation of industrial solutions becomes faster and easier, widening the range of selectable vendors and reducing the overall costs of the solution.

Operational benefits: By facilitating the access to production and equipment status data at the higher management levels, industrial organisations can use this information to improve the performance and the productivity of their assets (both in terms of machines and personnel) while making a more efficient use of resources and thus cutting down energy consumption and waste. In addition, by using the equipment more efficiently, its life duration can be increased while reducing the risk of failures. Also, maintenance can be further improved thanks to faster responsiveness to failures and even by planning maintenance and corrective actions before a failure may take place.

Strategic benefits: With a full IT/OT integration, industrial organisations have the means to have a complete view of what's happening on the factory floor in real time, and this allows for a number of strategic benefits. In a fully integrated industrial infrastructure, the information is managed in such a way that the right information is delivered to the right person at the right time and in the right format, enabling a better and more informed decision making. This wealth of information and higher insight on the organisational processes enables better collaboration between the different levels of the organisation and an optimisation of the management of the whole supply chain, from product design and engineering to the after sales services.

Modernisation of legacy infrastructure: The first and probably the major challenge that industrial operators and organisations have to face in the process of modernisation of their industrial facilities is how to take advantage of the emerging technologies while protecting the considerable investments they have already made in their existing infrastructures. Industrial facilities are populated with legacy

"IT/OT convergence basically means solving these interoperability issues by providing a common technological ground over which the two domains can effortlessly exchange data and work together"

equipment and networking cabling that does not support Ethernet and IP-based networking, and any approach based on a wholesale replacement of these old legacy assets can't be expected to be welcomed by the industry as it would require extensive capital investments in the new infrastructure while at the same time abandoning the old infrastructure in which investments had already been made. Secondly, an extended downtime due to the shutdown of the machine during the replacing operations would mean a consistent loss of revenue; in addition to the high technical risks associated with the execution of the project as well as the changes in policies and procedures, which would require additional training of the workforce.

Security issues: Apart from the involved costs, among the main reasons industrial organisations are skeptical about opening their industrial networks are security and privacy issues. With the ever-growing treat of security breaches, industrial organisations need to make sure their industrial plants are inviolable, since the consequences of any failure could be severe. Having industrial equipment somehow accessible from the Internet poses a high security risk, and the security mechanisms of current technologies don't yet inspire the trust necessary to enable a wide adoption of these new technologies. In addition, industrial organisations have always been kind of jealous of their data, and they are not really comfortable with the idea that their data could be accessed by malicious users. Proper security mechanisms thus must be provided and proven to allow quicker adoption of the IIoT concept.

Lack of the necessary interoperability: Industrial environments are populated by a heterogeneous number of devices and communication protocols, whose diversity either prevents or limits their ability to connect and interoperate. Although there are some methods available to facilitate this interoperability, such as the use of protocol translating gateways or the Open Platform Communications (OPC) standard, these are often limited and expensive, and do not often provide high flexibility. The industry still lacks a common framework or platform based on flexible and open communication protocols and data models on which any industrial device and network should be built in order to provide the truly universal interoperability that is envisioned by the IIoT concept, along with the requisite security and reliability. Recently a number of initiatives like the Open Interconnect Consortium (OIC) and Industrial Internet Consortium (IIC) have been formed to work toward that objective, but they are still at an early phase and as such it is difficult to predict if and when such a framework would become a reality.

> *Clear understanding of the long term value, integrating legacy systems, and slow return on ROI are some of the key concerns for utilities*

Cultural difference between IT and OT groups: One aspect that is often not taken into consideration lies in the functional and operational differences between the existing IT and OT groups that could potentially complicate the IT-OT convergence process. IT and OT organisations within an enterprise have a different cultural basis, and the way each group perceives a project or a solution is strictly dependent on its background. The IT-OT convergence at the base of the IIoT must then take into account these differences and plan a reorganisation of the IT and OT units under a common structure.

Utility-specific considerations

The challenges mentioned above are also applicable to utilities but in addition, the process of integrating existing IT systems such as billing management, CRM or ERP with utility OT systems can be time and labour intensive. Clear understanding of the long term value, integrating legacy systems, and slow return on ROI are some of the key concerns for utilities that implement such programmes.

It's important for utilities to clearly define the short, medium and long-term goals of its grid modernisation plans and subsequently have a plan for phased implementation over time. This has multiple advantages as it not only minimises disruption but also facilitates sufficient time to implement the change management programmes for seamless transition.

Energy utilities are still in the initial stages of a grid modernisation that started with the deployment of smart meters. The integration of the different IT and OT components will be a continuous process as utilities expand their capabilities to include applications such as demand response, battery energy storage systems (BESS), distributed energy resource systems and electric vehicle charging systems. MI

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Utilities in the AGE of the

In 2008, the number of "things" connected to the Internet surpassed the number of people on our planet. By 2020, the number of Internet-connected things is estimated to reach 50 billion. In this age of the Internet of Things (IoT), what role do utilities play? Smart meters and smart grid technology are among these connected devices and are integral to making the IoT possible in the utility sector.

Creating an Active Grid for IoT

By Roberto Aiello, Itron

These technologies are already delivering tangible benefits to both utilities and consumers; however, while smart grid networks and devices do a fine job of moving data around today, will simply connecting devices be enough to enable the IoT tomorrow? With increasing demands on the grid, including electric vehicles, renewable energy and distributed generation, we are moving away from a centralized generation and delivery model to a dynamic, distributed collection of "micro-grids" that will need to be synchronized, monitored and maintained in real time.

Enter the active grid. Beyond being smart, the modernized grid needs to be active, meaning it also needs to have the inherent capability to respond in real time. Today, metering and grid systems collect reams of data and make sense of it in the utility's back office. The active grid leverages data to make real-time changes in the field. The active grid harnesses the power of the IoT to improve efficiencies and create value for both utilities and communities.

With this approach to the grid, utilities can capitalize on the potential of these connected devices that have the computing power to not only measure and communicate, but solve problems on the grid in real time. Imagine data analysis and decisions taking place where it makes the most sense – at the edge of the network rather than only in the utility back office. Imagine using devices that dynamically detect theft situations or transformer overload before it happens – improving safety, reliability and ultimately, profitability. This is true distributed intelligence.

Key Attributes of Distributed Intelligence

As a result of advancements in software-defined networks and communications, and the affordability of increased computing power, it is now possible to deploy a much more robust smart grid technology platform. More importantly, for the first time, this technology enables coordinated analysis and action among diverse grid devices that wasn't previously practical or cost-effective to solve key operational challenges. To make this vision a reality, four key technology attributes are required.

In-field Processing Power

Thanks to Moore's Law, which holds that computing power doubles every 18 months, it is now possible to embed the computing equivalent of a smart phone into smart meters and grid devices at a comparable price point to current single-use smart meter technologies. This enables advanced communications, high-resolution data processing and analysis in the edge device – at several hundred times the data resolution compared with five-minute interval data.

Adaptive Communications Capabilities

Robust processing power in the endpoint combined with advancements in software-defined communications have also paved the way to solve critical connectivity and communication performance challenges that have long frustrated utilities deploying single-communications networks. Communication modules now combine RF mesh, Power Line Carrier (PLC) and Wi-Fi communications on the same chip set. This enables dynamic and continuous selection of the optimal communications path and the most appropriate frequency modulation based on network operating conditions, data attributes and application requirements. This new platform also provides peer-to-peer and local broadcast communications capabilities, so that edge devices can talk to each other individually or communicate with select groups of devices simultaneously to support new distributed analytics use cases.

Locational Awareness

Historically, the inability of smart meters to know exactly where they are on the distribution network has been the greatest obstacle to leveraging smart meter data and communication capabilities for real-time grid operations. Now, for the first time, smart meters are intuitively and continuously aware of where they are in relation to other grid assets (e.g. feeders, circuits, phases, transformers, distributed generation, other meters). This awareness is enabled by continuous monitoring and algorithmic interpretation of electrical characteristics relative to various grid devices within the network. This continuous self-awareness opens up an entirely new approach to smart

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grid applications that were simply beyond reach before without a reliable, continually-updated connectivity model.

Multilingual Abilities
Robust processing power and memory also allow smart meters and grid sensors to provide a unified software and computing platform that simultaneously supports multiple communication and application protocols. Smart meters or grid devices can "speak the language" of not only smart metering, but distribution automation (DNP3 or IEC 61850), load control/ demand response (OpenADR) and home area network (SEP 1.X and 2.0, Homeplug). This communication fluency enables localized communication and coordinated action among diverse grid devices to respond to changing conditions at the edge of the network.

Leveraging Distributed Intelligence

The ability for edge devices to know exactly where they are, process and analyze data independently and communicate with other types of devices creates many new possibilities for improving the accuracy, resolution and timeliness of analytic applications. When combined, the aforementioned technology attributes open up an array of new possibilities that provides more efficient, practical and cost-effective solutions to grid operation challenges, including real-time diversion detection, outage detection and analysis, identification of high-impedance connections and transformer load management.

Real-time Diversion Detection
Diversion detection can be based on real-time, continuous and localized analysis of changes in electricity current flows and voltage levels in the distribution network to distinguish legitimate metered loads from theft.

Outage Detection and Analysis
By combining locational awareness on the grid with peer-to-peer communications at the edge of the network, meters can systematically and continuously evaluate the status of nearby meters and devices to quickly model and localize outage events and report reliable and actionable information back to the utility in near real time.

Identification of High-impedance Connections
High-impedance connections (HIC) or "hot spots" on the low-voltage distribution system represent a safety risk and can cause customer voltage problems and utility energy losses. By continuously calculating and monitoring impedance throughout the lower voltage system, distributed intelligence changes the game for HIC detection. It provides a practical and cost-effective solution for utilities to identify these losses, voltage anomalies and potential safety issues before they become a safety hazard or a costly liability.

Transformer Load Management
Overloading of distribution transformers is an increasingly common problem caused by growing loads and the emergence of distributed generation, which can overload transformers in the reverse direction. Distributed intelligence allows the load on individual distribution transformers to be analyzed continuously and managed locally in real time.

Globally, many utilities are in a position to leverage these capabilities and the significant advancements in distributed intelligence and analytics as they implement their grid modernization strategies and connect to broader opportunities beyond operational efficiency to smart cities and IoT.

In the age of IoT, we must keep up with the latest technology trends and enable new IoT applications that reach beyond connections and truly bring the power of action and intelligence to field-level devices. The convergence of smart with the emerging smart cities and IoT markets is helping accelerate this trend. Nevertheless, thresholds of innovation are reached that warrant a shift in thinking about how to approach and solve problems. For tomorrow's grid, that time is now. MI

ABOUT ROBERTO AIELLO

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THE ENERGY

Enabling Energy Industry Transformation through Big Data, Analytics and the IoT

By Dr. Amit Narayan, CEO, AutoGrid Systems

The US$6 trillion dollar global energy market[i] is undergoing a major transformation. The world is moving away from the use of fossil fuels and towards the use of renewable energy resources. In addition, retail electricity markets around the world are increasingly being deregulated, with established industry leaders facing new competition. These changes are proving to be difficult for utilities and other energy service providers who need to find ways to integrate more intermittent renewable energy resources into their generation portfolios and find new ways to engage with their customers and increase revenues.

To address these challenges, energy service providers are moving away from focusing on ownership of energy generation assets towards a new role in which they balance energy supply and consumption through intelligent management of flexible distributed energy resources. Yet moving away from centralised delivery of electrons to forecasting, optimisation and control of flexible distributed energy resources, on both the supply and demand side, requires a high level of real-time insight on and control over the grid and these resources – levels of insight and control that energy service providers do not currently possess.

In their new role as managers of flexible distributed energy resources, big data, predictive analytics and the Internet of Things (IoT) will be essential. With these technologies, energy service providers can create an Energy Internet of Things (EIoT) that not only provides them with a living portrait of the grid, but also with the ability to manage a vast array of flexible distributed energy resources, ranging from solar power systems and energy storage systems to smart thermostats and Electric Vehicle (EV) chargers. With big data, predictive analytics and machine to machine (M2M) communications, energy service providers can collect and process petabytes of data streaming from millions of IoT connected assets across the entire energy supply chain, providing them with the intelligence and control they need to forecast and optimise electricity supply and demand across the grid, in real-time and at scale.

Increase Customer Engagement

By embracing big data, predictive analytics, IoT and other EIoT technologies, energy service providers will also increase engagement with and deliver significant benefits to their customers. These EIoT technologies will help customers with solar power, Combined Heat and Power (CHP) plants, and other on-site energy generation resources sell the electricity generated by these resources to energy services providers, increasing the value of these assets.

They will make it easier for customers to use their energy storage systems to predict (and reduce) demand charges or earn revenue through participation in energy markets or other grid flexibility programmes. EIoT technologies will also help energy service providers automate and expand demand response programmes to more IoT devices; providing customers with greater choice over the types of IoT devices they use for these programmes, while also increasing the amount of money these programmes save them in energy costs. By engaging customers as active participants in the energy value chain, rather than as passive price-takers, energy service providers can use EIoT technologies to provide their customers with significant benefits, while also strengthening their customer relationships.

Enabling Management of Flexible Energy Resources

How are energy service providers using big data, predictive analytics and the IoT to forecast, optimise and control flexible distributed energy resources today? One way is through using these technologies to implement more effective Demand Side Management (DSM) programmes for their residential, commercial and industrial customers. These DSM programs include:

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- Behavioral Demand Response (BDR) and dynamic pricing programs that use Advanced Metering Infrastructure (AMI) to make these types of programs a reliable, cost-effective energy resource.
- Bring Your Own Things (BYOT) initiatives that allow customers to choose which IoT devices they want to enroll in demand response programs that reduce peak demand.
- Fast responding, fully automated commercial and industrial 24x7x365 demand response that allows energy service providers to balance out intermittent renewable generation.
- EV charging demand response programs that enable customers to lower the cost of EV ownership by choosing to slow or suspend charging of their EVs during demand response events. As EV ownership increases, these types of programs will grow in importance.

Controlling Flexible Resources with a Software-Defined Power Plant

For a specific example, we can look to Northern Europe. Here a utility is using big data, predictive analytics and IoT technologies to add more renewable energy to its generation portfolio and reduce grid imbalance charges. The utility is using these technologies to implement a software-defined power plant that integrates customer-owned Combined Heat and Power (CHP) units in greenhouses, industrial demand response, and other flexible distributed energy resources into a single, reliable resource. The utility can use this software defined power plant to forecast, optimise and control this network of flexible distributed energy resources in real-time and at scale. With this dispatch-grade resource, the utility can react in real-time to market signals from wholesale electricity markets and trade in these markets 24 hours a day, seven days a week, 365 days a year.

Using Internet-connected EV Chargers to Reduce Peak Demand

Another example can be found in the United States, where a utility is using big data, predictive analytics and IoT technologies to build an EIoT solution that allows it to study how EV owners respond to different pricing incentives at their homes and at the workplace, providing them with insight into how they can use EV charging demand response programmes to reduce peak load demand and improve customer engagement. EV owners participating in the study can charge their vehicles at prices lower than normal if they agree to slow or suspend charging during a utility scheduled peak load event. After opting into the programme no action by the customer is necessary – the EIoT solution connects to the customer's EV charger to slow or suspend charging when a peak load event occurs. The EIoT solution can also be used to forecast expected EV customer response to demand response events, to communicate with customers' EV chargers, and to perform post-event measurement and verification. With the EIoT solution, the utility is securing valuable knowledge on how its customers respond to incentives for charging electric vehicles at home and at the workplace, helping them ensure that they design these programs so that they both reduce the utility's peak load and increase customer satisfaction by helping EV owners reduce their EV charging expenses.

Overcoming Technology Challenges

In the past, many of the big data, predictive analytics, IoT and other EIoT technologies required to implement the projects described above were difficult for energy service providers to deploy. They required investment in on-premise computer hardware and software. The M2M communications needed to connect to IoT devices were still being developed. The computer power and big data and predictive analytics software needed to process the massive amount of energy data required to implement these projects was expensive or did not exist. Yet today, cloud computing and Software as a Service (SaaS) have made on-premise solutions unnecessary. Robust M2M communications standards, such as OpenADR and SEP 2.0, have been developed that enable energy service providers to connect with and control CHP power plants, energy storage systems, smart thermostats and IoT devices. Cheap computing power and sophisticated, scalable energy-specific big data and predictive analytics software can now accurately forecast the power consumption of over one million endpoints simultaneously every 10 minutes on a medium-size cluster running on commodity hardware servers. In addition, fog computing now enables much of the analytics for these tasks to be moved to the grid edge, further supporting the implementation of forecasting and optimisation programs in real-time and at scale.

A Cleaner, More Affordable, More Reliable Energy Future

Distributed energy resources, such as renewable energy and energy storage, and new types of demand management and grid-flexibility programmes provide hope that we can move away from our dependence on fossil-fuel energy resources. However, without big data, predictive analytics, IoT and other EIoT technologies to provide intelligence and control over these resources, they cannot be forecast and optimised, and their adoption will be slow and expensive. With these technologies, energy service providers can accurately forecast how much energy these resources will be able to provide in the future and also control how these resources are used. These EIoT technologies are accelerating energy service providers' transformation into managers of flexible energy resources, allowing them to address the challenge of developing a new energy supply system that is clean, affordable and reliable.

Dr. Amit Narayan is the CEO of AutoGrid Systems,a leader in big data analytics and control software for the electricity and energy industry. MI

[i] http://www.undp.org/content/dam/aplaws/publication/en/publications/environment-energy/www-ee-library/sustainable-energy/world-energy-assessment-energy-and-the-challenge-of-sustainability/World%20Energy%20Assessment-2000.pdf

Analytics is advancing faster than you think...

Metering & Smart Energy International had the opportunity to speak with **Julien Groues, Senior Vice President, EMEA** for **C3 Energy** at the recent European Utility Week. Here he shares some thoughts on the direction the utility business is moving in, where opportunities lie for utilities utilizing analytics and the value they can derive.

MI: Where is the utility sector going?

Electricity systems have largely been physical systems in the past, consisting of wires and other equipment. However, in the last few years this environment has become significantly more IT enabled and is being transformed into a communication rich environment through the addition of sensors on the network and sensors at customer premises.

Several things have happened over the past couple of years to drive this transformation: firstly, the cost of sensors has decreased dramatically and at the same time the cost of communication has decreased, which means that sensoring the network – putting sensors into homes or putting a sensor on a transformer or on a piece of generation equipment – is becoming much cheaper.

Secondly, the flow of energy has always been uni-directional and that is now changing through the addition of distributed energy onto the grid.

At any point on the grid, whether it's at a customer's premises or on the transmission or distribution network, we now see generation equipment, be it a wind turbine or PV or geothermal. This is changing the dynamics of the system.

The need for much better controls for balancing the grid and for managing the entire relationship across this value chain is critical.

We now have access to information on specific components of the grid, which, combined with what has been happening in the information technology world – lower costs of processing power and storage through cloud computing – creates an enormous amount of processing power to apply to grid data at a fairly low cost.

There have been advances in analytics, especially machine learning, which improves the predictions that can be made based on artificial intelligence using real-world data.

When all of these things are combined, namely the information from the sensors along with the information from the existing operational systems, we get an unprecedented opportunity to provide enormous value to the utility sector.

For example, by implementing energy efficiency programmes or by improving the performance of a piece of generation equipment, we can improve the efficiency, reliability and security of the grid.

MI: So what can analytics provide to utility companies?

We have done a lot of analysis with McKinsey and found that across the entire value chain from generation all the way down to the customer, there is approximately $300 of value per meter that can be captured through analytics.

That is $300 per meter of recurring value *annually*.

McKinsey determined that the economic value is shared between the consumer and the utility company. Value is demonstrated, for example, through money saved, efficiency gains, decreased power loss or by shifting planned maintenance work to become more predictive.

The $300 per meter value is real. There are large scale deployments that prove this. You don't need to wait for your entire network to be sensored, or for your entire customer base to have smart meters before you can start to derive benefits. These types of projects can be deployed very fast – most of them are deployed within six months – so utilities can start deriving value very quickly and achieve a return on investment in less than a year.

Performing analytics is not as difficult as one might think. I don't mean to imply that it is not a complex problem but analytics companies have invested hundreds of millions of dollars in creating excellent technical platforms that make analytics a far less complex problem for a utility to manage.

For example, through analytics utilities can predict asset failure and modify their asset replacement strategies. Instead of saying, "This year I'm going to change all of my transformers that are 25 years or older," a utility would say, "This year I am going to replace all of my transformers that are at risk of failure." In this way, utilities are completely changing the way they do things.

This has both operational and capital expense implications. Many utilities are benefiting tremendously from doing things in an analytical manner and the big difference in the last few years is that, while a number of people have been talking about analytics, we are now starting to see full-scale deployments

of analytic systems across a number of utilities.

One of the things that this industry needs is visionaries. The reality is that utilities cannot afford to take undue risks – the power needs to stay on and consumers need to continue to receive the electricity that they expect. A lot of things depend on utilities operating the way they are meant to – hospitals, food production, water treatment, banking – and if it doesn't work, we have a problem. So while it is true that the utility sector is traditionally very conservative, there are still things that can be done to improve the efficiency and reliability of supply through innovation.

Some utilities have taken a profound leadership position in terms of technological innovation and are reaping the rewards.

We have worked extensively with Enel and Engie in Europe. Both of these companies have focused extensively on what it means to be a digital organisation. Engie is a large and extremely diverse utility across many different aspects of the power value chain, including transmission, generation from traditional sources such as nuclear and coal as well as renewable energy, to electricity retail. They are making a significant investment in their digital transformation and the work that we have done together in terms of customer engagement has been very interesting, specifically how to better manage relationships between utilities and their customers through the application of analytic software.

Utilities have sometimes been challenged by customer engagement. What is it that you are bringing to the table that is going to change the way they interact going forward? How are you presenting the information that you now have available in a way that the utilities can utilise on behalf of the customers?

Utilities have been in a challenging position traditionally, because people expect to go home, turn on the lights, and things just work. The electricity system is expected to work all the time and when it doesn't, typically consumers get upset.

Many utilities across the world have done a phenomenal job in terms of improving their customer relationships, both in deregulated markets or even in captive, regulated markets, and are now ready for the next step.

"One of the things that this industry needs is visionaries"

We are able to help utilities improve their customer engagement and satisfaction through providing portals for the customer whether it be online or on a mobile device. This gives people access to the information they need when they need it; they can be alerted to changes in the system, such as outages, or notified about the possibility of a high bill, for example.

One of the biggest challenges utilities face is that their customers are never totally sure how much electricity they are consuming until they get the bill. Through analytics and better information sharing, utilities can identify when a customer's consumption is higher than normal, or how much they're spending on heating or lighting or appliances. Today, utilities are taking customers on a journey, making sure they understand how much energy they are consuming and what it costs; how they compare to other customers within the same area, with the same type of house or the same number of people in the household.

Our information empowers utilities make recommendations about ways that customers can save on energy bills, such as changing light bulbs or installing an efficient thermostat. The advice will, of course, be determined by each customer's unique set of circumstances. The last thing a utility wants to do is recommend that somebody install a more efficient air conditioning unit when they don't even have one.

This is how a utility can improve the customer journey; by segmenting their customers, disseminating the right information at the right time, monitoring campaigns and adjusting messaging to improve program results, utilities can ensure that they continue to drive customer satisfaction and reduce churn.

These analytics offerings are both gas and electricity utilities. A lot of our customers are actually dual-fuel utilities who offer both gas and electricity services. Of course, some of the challenges that gas and electricity providers face are a little bit different, but the way they can utilise data to improve efficiency and make predictions is very similar.

What would you say is the biggest challenge for utilities at the moment, in terms of adopting analytics and getting into an analytic mind frame?

Many utilities are focused on technology deployments, and are asking themselves how best to get their smart meters deployed, how to sensor the grid or what customer engagement strategy they should deploy.

Because a lot of the deployments are still in the early stages of this cycle and because utilities are very much in the wires business as opposed to the analytics business, development is progressing slowly.

We are still very much in the "let's deploy some of the technologies out there" stage, rather then asking "what do I have available today?" A lot of people think that in order to implement an analytics project, they need more data. However, many utilities already have a lot of data available and they don't necessarily need to add sensors to the grid to start unlocking value from the data. Obviously, the more sensors you have, the more information you have, and the better your predictions will become, but most utilities are already able to make very good predictions across most aspects of the utility value chain based on the current available data, which will improve over time as more sensors are placed into the network.

The first challenge is really one of timing – when do you start? Considering where we are right now, the earlier you start, the earlier you will start seeing the benefits.

The second challenge is that a lot of the existing systems do not communicate with one another, so they tend to have a large number of siloed systems. Whether it's due to different systems, different integrators or even just different technologies, utilities can end up with a very diverse environment of systems.

Another challenge is that a lot of the systems are getting old and people are having difficulty extracting data from older systems. This is where analytics companies are able to help – by extracting the data from the various systems and consolidating it into a single system, utilities are able to apply analytics on one federated system. MI

By: Livio Gallo, Head of Global Infrastructure and Networks, ENEL

Internet of Things: Between convergence and active energy demand

We are living in an era characterised by extremely rapid technological change bringing about new economic, environmental and social challenges. Among the main megatrends having a deep impact on infrastructure are urbanisation, environmental sustainability and digitalisation.

By 2050, more than 70% of the world's population will live in cities, with a huge number of these people living in mega-cities that will span hundreds of kilometres and house hundreds of millions of people. As a result of this urbanisation, new disciplines like urban ecology have been created in order to face new challenges, and the ecological footprint of human activity has been placed under the microscope.

A second megatrend that is affecting modern society is environmental sustainability, which is driving a raft of policy decisions in western countries, with the European Commission for example pushing towards a green, decarbonised economy by 2050. In the energy sector, the growth rate of renewable power generation sources that, in Italy, are already able to fulfil half of peak demand, is mirroring this trend.

Finally, there is digitalisation. We are living in exponential times: ever since

We are bearing witness to a huge convergence between operational technologies (OT) and information technologies (IT)."

Intel co-founder Gordon Moore said that information and communication technologies (ICT) double their capabilities every two years, ICT has followed this trend and it is expected that by 2020 trillions of smart devices will be available to billions of people, with an average number of 1,000 smart devices per person.

In this scenario, an essential element which will drive future developments of infrastructures is convergence. We are bearing witness to a huge convergence between operational technologies (OT) and information technologies (IT). As a consequence, network operators are increasingly driving the creation of new customer services, empowering customers and giving them an active role in the energy market.

Accordingly, network operators are working to facilitate the convergence of energy, transportation and telecom infrastructures. In this rapidly changing environment, the operations of infrastructures have to be re-thought in order to make the most of the opportunities provided by these trends and the Internet of Things (IoT) plays a key role in this scenario.

Enel IoT ecosystem

At Enel the Internet of Things is already a reality at grid level: we have millions of sensors and actuators in our power grids that constantly communicate with our IT and OT systems. Enel is a recognised pioneer in the utility sector, as it started moving towards the Internet of Things back in 2001 with the introduction of the world's first smart metering system.

That year, Enel started the five-year Telegestore Project in Italy, in which it invested 2.1 billion euros in installing smart meters across its customer base of 32 million household and business delivery points. More than 7,000 people were involved in the production and installation of the meters, with more than 30,000 meters installed on average every day, ensuring the highest level of quality and performance. The implementation of Enel's AMM (Automated Meter Management) system, the largest ever, was completed in 2006, with all the 32 million meters remotely managed and controlled. Currently, this system collects more than 400 million monthly readings and performs more than 10 million remote operations,

This has also led to Enel reducing its operational expenditure by 450 million euros per year, savings that are reflected in the final customer's bills. The system also enables the possibility of involving the final customer, increasing its awareness of energy consumption and enabling advanced services that target energy efficiency. In order to exploit these new opportunities Enel developed the Smart Info device that gives the customer easy and secure access to metering data. This device is connected to a power socket in the customer's home, collects real-time metering data from the smart meter and makes it available to the customer through a standard interface that implements an open protocol.

Replicable smart meter model

Following the extremely positive experience in Italy, Enel has developed a new generation of AMM solutions that adopt the innovative communication Meters and More protocol, an open technology available to anyone that wants to use it. Since the launch of the smart meter project in June 2010, the Enel Group's Spanish subsidiary Endesa, has successfully installed and managed nearly seven million smart meters, with the aim of reaching 13 million meters by 2018. Currently, Enel's smart metering has been implemented in many other countries around the world, as well as in pilot projects prior to massive deployments carried out successfully in more than 20 different utilities worldwide.

Another huge step in the implementation of the Internet of Things was the launch of the Remote Control and Automation project in Italy, which late last decade aimed to improve quality of service. The implementation of innovative techniques enabled real-time monitoring and remote control of the distribution network's most important nodes, alongside solutions that automatically isolate faulty sections and resupply healthy ones. The project is one of the world's largest of its type; it involves 2,500 HV/MV primary substations and 110,000 MV/LV secondary substations (out of about 425,000), all remote controlled by 28 control centres, as well as the 50,000 MV fault detectors installed in the substations.

Remote control combined with automation has led to automatic local fault detection and self-fixing of those faults, have significantly improved the average time needed to perform the first fault selection and isolation attempt, supported by field crews, cutting it down from 50 minutes to less than four minutes. As a result of these innovative solutions, the System Average Interruption Duration Index (SAIDI) between 2001 and 2012 improved by 68%, while the distribution tariff paid by the final customer was reduced by more than 30% in nominal terms.

Following the extremely positive experience in Italy, Enel has developed a new generation of AMM solutions ..."

The final goal of this energy management system (EMS) is to perform smart monitoring of field actuators, increasing the flexibility of the grid – which is key to optimising grid efficiency, maximising the integration of renewables and fulfilling customer needs."

Trailblazer in EV technology

In addition, Enel is a trailblazer in the deployment of technology necessary for smart electric vehicle (EV) charging infrastructure, particularly in order to minimise electricity grid investments, by allowing EV customers access to demand response programmes for EV charging. Enel's charging stations are additional smart devices that are remotely managed and controlled in real-time, which also enables advanced smart charging and vehicle-to-grid solutions.

Due to white certificate incentives and corporate tax discounts related to the purchase of EVs, the EV fleet market can be expected to dominate electric mobility in Europe (the fleet market currently accounts for more than 30% of Italian EV sales) and a realistic time to market for such demand response programmes for EV charging exists for fleet operators as service customers. This means that corporate fleets are suitable for these applications, as fleet operators can take advantage of a load modulation scheme controlled by precise boundary conditions in order to reduce the running operational cost of the EV fleet.

A final step forward in the digitalisation of Enel's assets has been the development of the Archilede Active Control System, a new platform for the remote control and management of street lighting infrastructure that turns street lights into smart components within the Internet of Things. This new solution, in addition to increased efficiency in energy consumption, enables support of smart city services through the integration of smart sensors or devices installed in streetlights that provide advanced services to local authorities, like pollution and noise monitoring, provision of useful information or CCTV monitoring.

Taking advantage of its role as Smart Energy Partner at Expo Milano 2015, Enel implemented all of these innovative grid solutions at the Expo, developing an innovative platform designed to collect all data provided by those field devices and then convey all that information. The final goal of this energy management system (EMS) is to perform smart monitoring of field actuators, increasing the flexibility of the grid – which is key to the optimising grid efficiency, maximising the integration of renewables and fulfilling customer needs. EMS is also suitable for management of microgrids, which enables the implementation of all the functionalities and services provided by a smart grid also in areas not yet reached by such a grid.

Customer engagement

The implementation of all these IoT solutions offers obvious benefits to customers, such as increased awareness of their energy consumption, supporting dynamic load management and finally promoting a more active role for the customer. Within new smart grid solutions, consumers' demand becomes "active", as it can be managed in line with network conditions, making it a viable option for addressing electricity system challenges such as improving efficiency and reliability, increasing penetration of renewable energy, infrastructure planning and the deferring of investments.

"EMM supplies a range of value-added services, including charging point location and booking, billing, consumption monitoring, network planning and asset management"

Many concrete examples of the customer's new active role are already in field. Enel's smart meters have been designed to allow end users to have real-time access to certified information on electricity data, which can be displayed on different visualisation interfaces (in home displays, PC, smartphones, etc.) One of the main features of the e-mobility recharging infrastructure developed by Enel is smart charging, which allows recharging processes to be flexible according to customer needs, offers real-time grid status updates and both current and forecasted renewable energy production.

Given that a new generation of affordable, high-performance and long-range electric cars is coming, new technologies will help further spread the use of electric vehicles, leading to a significant reduction in emissions and an improved quality of life, especially in urban environments. For this reason, the Enel Group is constantly working on the creation of innovative e-mobility solutions.

Enel has developed and installed an innovative smart recharging infrastructure which has been in part enabled by the smart metering infrastructure created by Enel, used by millions of customers in Europe. Apart from providing the basic end-user services related to the EV charging process, Enel's charging points also provide additional features through online smart management ensured by the Electric Mobility Management system (EMM). EMM supplies a range of value-added services, including charging point location and booking, billing, consumption monitoring, network planning and asset management. MI

Establishing a cybersecurity roadmap *in the digital age*

The 2015 (ISC)2 Global Information Security Workforce Study survey conducted by Frost and Sullivan revealed that there will be a shortage of 1.5 million professionals in the cybersecurity sector. Very simply, there is a major skills shortage and lack of experienced, qualified cybersecurity personnel. Training and education of staff should be a top priority for all critical enterprises developing or implementing a ICT strategy. Cybersecurity is no longer just about cyber technology defences; it is about the processes implemented and the training given to staff to manage cyber threats.

This is a sentiment shared by Nadya Bartol, Vice President of Industry Affairs and Cybersecurity Strategist at the Utilities Telecom Council (UTC), who shared some of the key security concerns as well as best practice in formulating a strategy to minimise the risks faced by utility companies today.

What are the major security concerns around IoT deployments, what is the potential impact of these risks and what are the measures that can be put in place to manage/minimize the risk of cyber-threats?

Utilities have been running the Industrial Internet of Things (IIoT) since they began implementing intelligent devices. In my observation, they don't use the phrase Internet of Things. They don't think of themselves running IoT, but that digitisation has been a natural progression as technology has evolved (eg. sensors) and has enabled the efficient operation of the grid, pipelines and administration of water supply and so on. They're all intelligent. The problem is not with digital or IIoT, but more

so the security in running these networks that run all these very important functions that impact our daily lives.

The change comes as these networks are exposed to an increasing number of technologies coming online, where in most cases sensory technology has been confined meters, cameras, mobile devices used to run SCADA monitoring, for example.

So it's the same security issues, but there are more points of compromised potential entry due to the fact that manufacturing base that produces all these devices is not necessarily uniformly educated about how build and design secure.

The manufacturers of devices and sensors that haven't had to be on the internet in the utility space are a lot more recent to the table. The knowledge about how to design secure is not everywhere, it is not necessarily taught in schools, so people come out and go into these companies and they don't quite understand how to do this.

> *"The knowledge about how to design secure is not everywhere, it is not necessarily taught in schools, so people come out and go into these companies and they don't quite understand how to do this."*

People who work in the IT space don't understand how to write efficient design hardware and software for geographically distributed environments. So when a utility has sensors in multiple places in a geographically distributed network, it is interesting to hear their concerns about the efficiencies associated with it, such as, I have this much security built on my network, on my communications network or on, then my SCADA may not run at the speed that is necessary.

It is a security design issue. How do I acquire a solution that will not impede on my primary purpose? Then there are the considerations that networks/devices can be hacked and customer data can be stolen leading to malicious activities causing service disruption or possible explosion.

So security concerns are all the same, but they are on steroids because today, there are so many more devices that are connected to the grid

When considering the measures or controls put in place to secure networks, there is a workforce crisis. There are several measures, however, there are not enough people who understand and know how to implement them. As these technologies are rolled out, they need to be designed securely, thought about through the lens of security, and architected securely.

Establishing minimum security requirements is tricky due to the fact that when someone is designing a device for the future, the tendency is to incorporate all kinds of features in case those features will be used. However, these features can be misused and misconfigured too.

The designer needs to take into account what a device is supposed to do as well as what it is not supposed to do.

What has been some of your experiences with working with utilities? Do they fully understand how manage cyber risks associated with digital technology integration?

Utilities know that they have a cybersecurity challenge. They know they need to build reliable, dependable and safe networks that will run whatever function they are putting in place. They know they have a challenge and they are working on this challenge and trying to design and operate networks the way they are supposed to be. When there aren't enough people, it is not necessarily going to get done. There are simply not enough people to do this. While utilities may understands that they have a cybersecurity challenge, I don't think anybody fully understand how to **manage** evolving cybersecurity risks. There are however, ways to organise the work, govern the work, design networks, implement protective controls to respond to and minimise the impact should a breach occur.

Utilities that have these innovations – a set of agile, reputable processes that need to be governed appropriately and governed in a way that processes are collaborative throughout the organisation – are better off from a security point of view, than those who do not.

Protective controls include authentication for access. This could be a password, badge, pin, token, or thumbprint. Security training, managing identities is very important. Who has access to what device? When can they have access? Why do they have access? What can they do with this access? Minimising what people can do within certain systems is also a method of control.

Ownership and responsibility: Who is responsible for securing customer data. What is the utility's role and what is the customer's role?

This is tricky; I think that it depends on the jurisdiction that the utility is in.

When the utility collects billing data, which closely resembles personal data, it is the utility's responsibility to protect, when it resides on their systems. But if the customer is careless with their own data, the utility cannot be responsible for that.

> *"I don't see an IoT security strategy any different from a security strategy because these are the networks and systems of the future."*

When it comes to energy consumption data, both the utility and the customers have a responsibility to protect data. However, I think this relationship is still evolving.

In terms of whether the customer will play an increasing role in protecting their data, – will depend on the level on customer sophistication – which can vary greatly. There is a lot of education needed to help customers understand what all this data means for them.

How do utilities go about putting in place a strategy for IoT security?

I don't see an IoT security strategy any different from a security strategy because these are the networks and systems of the future. A cybersecurity strategy today needs to be agile and focus on reliability and safety business objectives and should always reflect the purpose of the business.

A strategy needs to have a policy which is a set of general statements and associated processes that implement the controls that minimise risk. For example: access authentications, training, awareness of individual users, secure design principles, secure architecture.

This includes measures that will kick in when a security breach happens:

- How quickly are you going to respond?
- What are you going to disconnect?
- What are the rules for disconnection? And what are the rules for reconnection?
- How are you going to get the system back online?
- External consequences: How are you going to interact with the press and authorities?

Utilities need to minimise the risk at the front end and the backend, managing risk in the most organised way possible to protect the utility and its customers.

When it comes to purchasing software and hardware, the dialogue and relationship developed with suppliers is critical when implementing their digital and social security strategy. What is key, is to establish a set of security control requirements that utilities want their suppliers to comply to – to ensure deliverance as well as setting up a set of processes should a breach happen:

- How are you going to communicate irregularities with your supplier?
- Who is your point of contact?
- Whose responsibility it is to fix or mediate the situation?
- How does everything go back online?

A utility can stipulate whether it would like certain functions activated or closed when acquiring hardware, and can choose not to have open functionality or may choose to minimise functionality.

The utility can also request hardware as products of secure coding practice, as people who are trained in secure coding practice understand how to write code that is less vulnerable and that others would not necessarily know how to do. They will avoid common "constructs" in the code – avoiding exploitable vulnerabilities.

Utilities can also mandate encryption but these measures again depend on what the device does.

What role does staff training play? Is there a need to train staff around cybersecurity?

Yes, definitely, there is role-based training and education. This means educating people whose job is to secure the network or design the network. These include engineers, operations personnel, software developers and people who participate in implementation of design and implementation of ICT.

And then there is the general user awareness – making individuals in the utility aware of the impact of their actions (from utility executives to customer service personnel) and of the utility's ability to deliver reliable and dependable services.

What, in your opinion, is not being said enough about security at the moment?

It will never end, it has become a way of life and we need more educated people.

What are your top tips for utilities in securing their systems?

- Know your assets to know how you can secure them; understanding your asset base is critical
- Invest in training for utility staff
- Hire trainable people
- Suppliers are critical – ask questions, negotiate with your providers
- And invest in awareness training for end-users MI

ERDF ON THE DIGITISATION TRAIL

During the recent European Utility Week, Metering & Smart Energy International had the opportunity to speak with **Christian Buchel**, deputy CEO of **ERDF**, and **Olivier Chatillon**, director of **ERDF**'s Brussels office and director of European Affairs.

As deputy CEO and chief digital and international officer, Buchel and his team are responsible for accelerating and identifying opportunities for digital integration, to improve services and service quality for ERDF customers.

Buchel plays a dual role in the industry as he is also vice chairman of the association, *European Distribution System Operators for Smart Grid* (EDSO for Smart Grid). The association was created in 2010 and the purpose was to bring the concept of smart grids to reality. Together with his colleagues from all over Europe DSOs are combining their expertise as distribution operators in order to forward proposals to the European Commission to accelerate the transformation of the sector.

"We believe that the industry can bring huge positive advantage to Europe as we have incredible skills in Europe, very good technical skills and we believe that this revolution – the digital revolution – is an opportunity for Europe," Buchel says.

Olivier Chatillon is responsible for European affairs and for the ERDF Brussels office.

When asked about his role in the company, Chatillon says: "I see myself as being the ambassador for ERDF in Brussels and I am responsible for liaising with the European Commission and being involved in consultation with Brussels on behalf of ERDF."

ERDF is very active in the DSO sector Buchel explains, elaborating that the DSO is able to combine proximity and capacity to innovate, and pursue research and development opportunities, giving them a unique position in the sector. This is part of the reason for opening an office in Brussels, as it gives the ERDF leadership an opportunity to interact with the European Union and utilise their expertise across various demonstration projects.

Says Buchel: "we are currently part of 18 different demonstration projects in which we are testing how solar can be integrated into the grid or how consumers can be more active and empowered by the data which is delivered to them."

"We are working on other demonstration projects for solar or wind power, or to explore how to combine flexibility and storage; and we bring this expertise to a European level by participating in a number of European projects."

EFDF is a member of the Grid4EU project, one of the biggest European smart grid projects, operating across a number of different countries including Germany and France. ERDF is the technical coordinator for this project.

ERDF has also been involved in a project which started in January 2015, called the *Flexiciency* project. "The name is a contraction between flexibility and efficiency, hence 'flexiciency,' Buchel explains.

The strategic objective of the project is to build a data platform by which the market players can access data and develop new services. The project is being undertaken in conjunction with ENEL and Austrian service provider VERBUND Solutions; and with IT support provided by SAP.

Chatillon continues: "These projects are part of the European Union Horizon 2020 programme. Grid4EU is ending this year and we have been working with several countries to test renewable integration into the grid; how this can be done in a smart way using flexibility from the customer side, utilising storage and different means to optimise the grid."

As more smart meters are installed across Europe, there will be huge amounts of data collected by utilities. ERDF believe that could amount to many thousands of terabytes of data which will be coming into the utility every year and which will need to be managed in a confidential and secure way. They will need to ensure that this information is aggregated and made available to the market players in such a way that the DSO platform and the market platforms operate together to enable the market facilitator.

> *"As more smart meters are installed across Europe, there will be huge amounts of data collected by utilities"*

About Flexiciency

The four-year project, launched in early 2015, is part-funded by the European Commission's Horizon 2020 research programme, with the aim of addressing flexibility and efficiency within the European energy market, putting focus on consumers and making use of data from smart metering. More specifically, the project's mission is to create new opportunities for energy business and expand the DSO's market facilitator role for new services. As neutral players in the market, they can support the creation of new business opportunities and innovative services for end users, based on consumer data collected by smart meters. The initiative marks an important step towards the achievements of 2020 energy consumption and CO_2 emissions targets through the development of advanced energy services and the implementation of new policies and market regulations that promote the creation of smart grids, in the process boosting jobs and growth in Europe.

The Flexiciency consortium is composed of 18 partners from 10 different European countries and covers key competencies from across the electricity value chain of the electricity retail markets to successfully design and implement the demos and develop the different platforms.

Five large-scale demonstrations show that the deployment of efficient novel services in the electricity retail markets (ranging from advanced monitoring to local energy control, and flexibility services can be accelerated thanks to an open European market place based on standardised interactions among electricity stakeholders, opening up the energy market also to new players at EU level.

"The data we are collecting from the customers should give possibilities across the platforms for the market players to produce new offers – developed demand response for instance, or develop more flexibility in the system," he says.

According to Buchel, bringing consumption data to consumers is a way of helping them manage their own consumption. The added value that this data will provide to help new services or aggregators or new offers from the market will be vital. Buchel is, however, very clear that individual protection and privacy considerations are a priority for ERDF.

"I see our role as a DSO is being that of 'making things possible,'. That means to make energy transition possible, to make innovation possible and to be an enabler for consumers, local authorities, the market etcetera and bring new services to our clients in order to address climate change," he says.

"Reducing consumption and increasing energy efficiency will be driven by data and it is a natural service for a DSO to provide, so we are working hard to develop suitable

skills with data scientists and analysts within ERDF".

When considering the challenges faced by the sector, Buchel believes that there are legacy challenges which will be true for tomorrow, just as they are today. This is particularly the challenge of quality.

"While we are integrating renewables, flexibility and storage into the grid we have to continue ensuring that the quality we deliver everyday, every minute remains the same," he believes. "We would not be happy to say "because we have to integrate renewables, I am happy to go without power for an hour every day." This obviously is not acceptable, so the challenge is keeping quality at the current level with all the new technology being added on to the grid."

"We have a number of new challenges too; we have to integrate renewables and flexibility, which are strategic goals for managing climate change and this is a big challenge.

"Another big change, is the question of innovation – we have too integrate the huge opportunities of the world around us – for instance big data, the Internet of Things, social networks and customer experience, while taking worldwide trends into account.

"Our challenge is to integrate these global trends, to transform our utilities and have better services, better quality and acceptable pricing for the consumer.

He concludes that this is not just a technical challenge but a cultural challenge too, to move from a traditionally vertically structured organisation, into one that is more horizontally structured.

Addressing the challenges

About four years ago ERDF launched a demonstration project, along with a number of start-ups, SMEs, universities and other academics. This was the first step the company took to building up knowledge through demonstration projects. By working with a number of partners they have been able to share experiences and utilise each other's unique capabilities.

"We launched our digital transformation project 14 months ago, which is a completely horizontal project across all elements of the business, all activities of ERDF through which we are able to test global trends, customer experience, big data and the Internet of things," Buchel states.

The four elements driving transformation within ERDF are defined as follows:

1. **Using existing trends and technology to operate the grid more efficiently.**

   For example, ERDF is testing how big data can enable predictive maintenance of assets and potentially even identify failures before they occur.

2. **Identifying how these trends can drive more efficient relationships with customers, generators and other stakeholders**

   Buchel explains: "In France we now have over 3400 generators on the grid – five years ago we had only a couple of hundred. These generators are obviously made up of photovoltaics on roofs, by which our customers are now also generators. We are trying to make the dialogue with local authorities, customers, generators, suppliers and all the users of the grid more efficient."

3. **Driving innovation, particularly in mobility, for both customers and workforce**

   ERDF actively participates in all the innovation ecosystems in their region, such as the government-led FrenchTech, a technology hub consisting of SMEs, start-ups, universities etc, all with the purpose of developing French technology and encouraging sharing of skills and knowledge across the various players.

> *"Our challenge is to integrate these global trends, to transform our utilities and have better services, better quality and acceptable pricing for the consumer"*

> *"Innovation is leading ERDF to develop applications for their customers which alerts the customer or home owner of a power outage"*

Innovation is leading ERDF to develop applications for their customers which alerts the customer or home owner of a power outage, along with information of when the power is likely to be restored and helps determine if the problem is localised to a particular home or if it is wider grid issue.

The applications allow owners to monitor power at locations across the country, which is particularly useful for people with holiday homes, or with aged parents.

"This is part of how we are improving the customer relationship that we have," Buchel enthuses.

"Mobility is a critically important part of our business as almost half of our workforce spends the day is out of the office in the field. We've developed internal applications in order to enable staff to do their jobs better when they are out of the office. To this end we have rolled out 10,000 smart phone and iPad devices to our staff who have operational responsibilities, in order to make it easier for them

to do their job 'in the field'. This is one of the ways that we are bringing worldwide trends into the company, not just for the customer but also for the staff."

4 Enabling data driven action

Buchel believes that by handling data better, they will be able to transform the data into actionable information and for this purpose they are working with a group of data scientists to enable this transformation of the data into tangible information.


Christian Buchel

ERDF may be the first DSO in Europe that has developed an open data website, which provides aggregated data, by for example providing information about the amount of renewable energy connected to the grid or the amount of generation available at a particular time – providing complete transparency across the business. This kind of information has helped the DSO determine how load is used, and will provide important information for future load prediction and management.

While customer relationship management is an important consideration for ERDF, Buchel believes this needs to be driven by a cultural change within the DSO. He explains it by saying: "As an example, the development of applications is something we would never have pursued previously. Before the development of these kinds of applications customers would have had to try to determine for themselves if an outage was within their home or if it was part of a wider area outage.

"Of course Linky, which is our smart meter, provides access to data consumption for customers via our website and enables us to send alerts to our customers if we see that their consumption is higher than normal, thereby enabling the customer to make an adjustment to their usage – or not – depending on what suits their lifestyle. The customer can of course choose not to follow the advice but because our job is to be an enabler, the alerts provide our customers with choices." MI


Olivier Chatillon

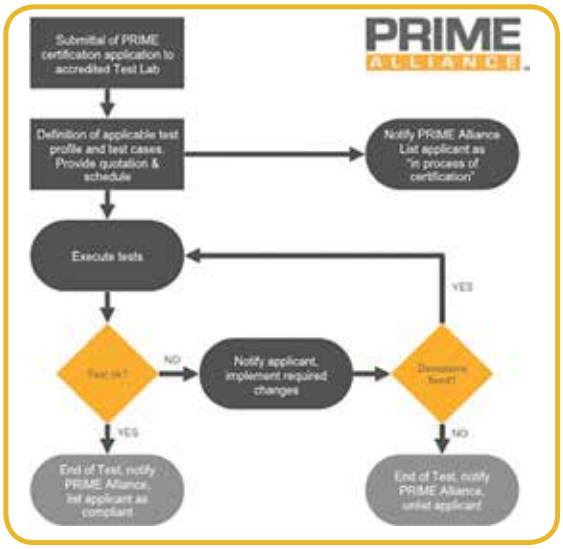
PRIME v1.4

CERTIFICATION PROCESS

PRIME Alliance has implemented, since 2010, certification processes for service nodes and base nodes with the help of its laboratory partners DNV GL, ITE and Tecnalia. Laboratories perform a series of tests based on test cases, defined, provided and maintained by the **PRIME Alliance TWG**, and thus they assess product compliance according to test results and evaluation criteria.

Seamless, trouble-free interoperability among certified products is perceived as one of the key advantages of PRIME. This process has been running quite successfully since 2011. As of November/2015, 17 technology platforms, 31 smart meters and nine data concentrators have achieved PRIME certification and thus the right to carry the PRIME brand.

The PRIME certification process allows for different profiles to be certified: chipsets or platforms, meters or data concentrators. Additionally, if the end products implement pre-certified platforms, the certification process is simplified, allowing faster time to market.



The PRIME certification process

Products of PRIME Alliance members that have successfully passed all tests and fulfilled the requirements of the PRIME certification process are listed in the PRIME Alliance website. This is an added value of the certification process and Alliance membership. The manufacturer, product reference, certified profile, certification date and certification lab are mentioned

PRIME v1.4

PRIME v1.4 is the new version of the specification of the PRIME standard. PRIME v1.4 adds a set of new communication modes called 'robust modes' (as an example within CENELEC-A band, the addition of robust modes provides more reliable communications up to 14.5 dB gain compared to PRIME v1.3.6 but lower data rates with 5kbps and 10kbps) and will extend the frequency coverage up to 500 kHz to achieve higher data rates in environments where such extended frequencies can be used. The two new transmission modes are Robust DBPSK and Robust DQPSK, which add four OFDM symbol repetitions after the already existing PRIME v1.3.6 convolutional encoder. These robust modes enable communication in low signal to noise ratio environments, improving the excellent results obtained in PRIME deployments all over the world. One of the unique features of the PRIME robust modes is that the repetition is done at the OFDM symbol level instead of the bit level, so more time domain diversity can be achieved. Bandwidth extension to 500 kHz is intended to provide higher data rates up to 1Mbps for those applications and areas where other frequency bands are applicable (America and Asia, other applications such as automotive communications).

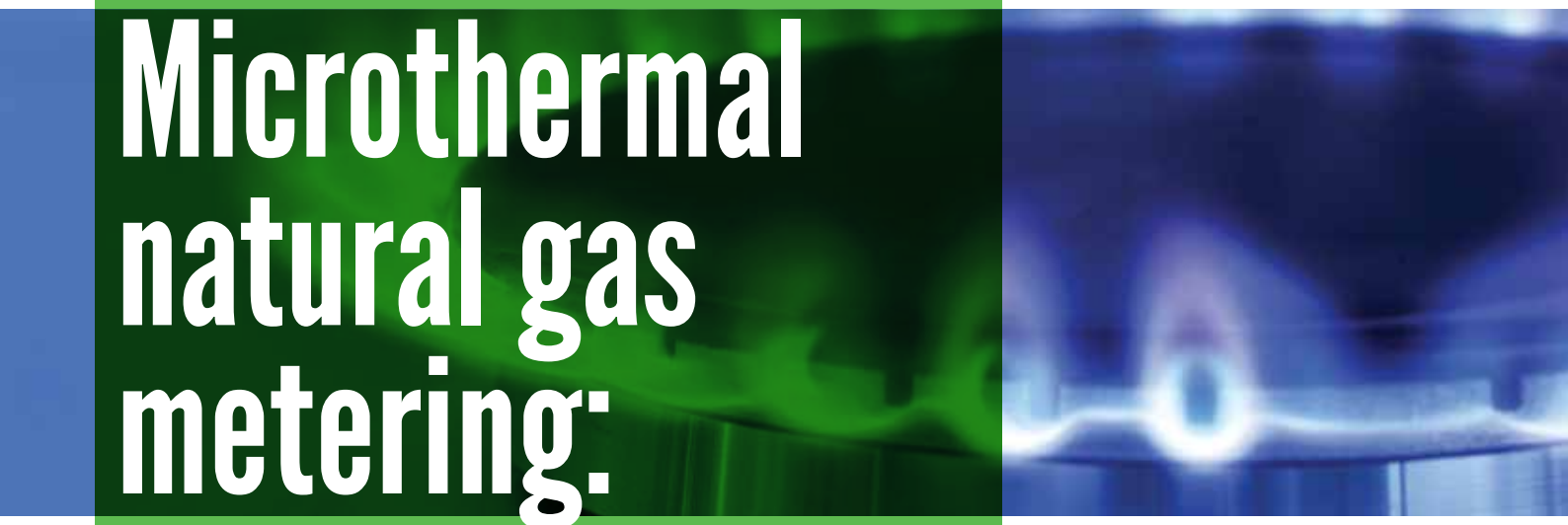
Apart from those features derived from the new physical layer (PHY) requirements, main new features of the MAC layer in PRIME specification v1.4 are oriented to reduce the overhead of the channel by means of increasing the size and flexibility of the frame, and reducing the number of control packets. For example, data packets and ALIVE packets are used to inform about the quality of each link, and decisions about the modulation scheme are taken considering this information.

PRIME certification according to PRIME v1.4

Upon finalization of the PRIME v1.4 specification, the PRIME Alliance Certification Task Force began in 2013 the work to implement a certification process for the new specification. The work has been focused on two main areas:

- Definition of the new v1.4 test cases for each of the sub-layers and use cases, and device roles (base nodes, service nodes). This work has been tackled by PRIME Alliance experts and was finished in mid-2015.
- Definition of the toolchain required to implement the certification process in partner laboratories. This has allowed the PRIME Alliance to issue an RFI and RFQ to its members for the implementation of this toolchain according to the aforementioned definition document. After this process PRIME Alliance has contracted the work to the consortium DNV/ Neuron for the implementation of the toolchain. This work is currently in its final stages and approaching completion.

PRIME certification process for base nodes (concentrators) and service nodes (meters) will be fully operational in independent certification labs during Q1 of 2016 and first v1.4 certified products will arrive in the market at the end of Q1. As a result of this, 2016 will see the massive deployment of PRIME v1.4 products in the field taking advantage of the new features such as robust modes, 500KHz band extension and improved performance. MI



Microthermal natural gas metering:

Creating value through novel types of data

By Dr. Aleksandar Petrović, Sensirion

In addition to basic flow values, static gas meters (and these include microthermal meters) are particularly useful for supplying unique pieces of information, such as the heat capacity of gas. This article examines the benefits of merging this additional information with the data typically available to gas utilities, such as the location of gas meters or gas composition. The merging of data, which is peculiar to static metering technologies, could be used to generate intrinsically new information about the meter and its environment. Today, the remote monitoring of meter health using off-the-shelf technology is a realistic proposition; and the term 'smart meter' could well come to stand for one that not only communicates but also cooperates.

New demands on gas metering

The monitoring, measurement and billing of natural gas consumption is changing worldwide. Legislation has been passed, primarily in Europe, which requires traditional non-communicating meters to be replaced or upgraded. The ultimate aim is to allow more efficient (remote) data collection, greater consumption transparency, fairer billing and increased user engagement. Together, these factors could well result in raised energy consumption awareness.

Generating new data assets

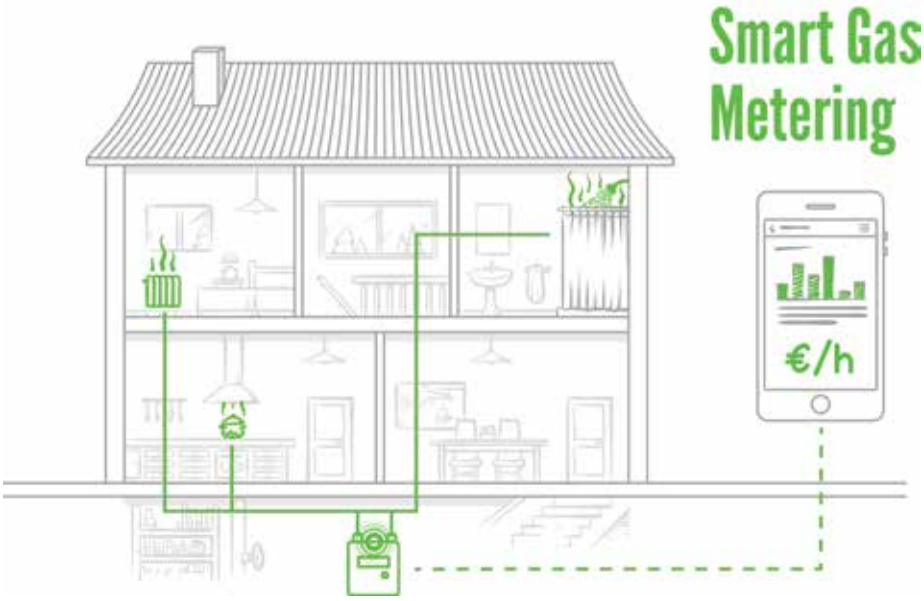
The transition from 'traditional' to 'smart' has brought about many changes. For one, new gas metering technologies, such as microthermal and ultrasonic, have moved from research laboratories into the mainstream. Second, smart meters, in other words meters that communicate, now generate large data sets that have become important assets in their own right. And, third, gas meters become smart not only by virtue of being able to communicate but also because the on-board sensors can generate new, valuable pieces of information about the meter's immediate environment. Some advanced gas meters can sense temperature changes, potential gas leakage or even earthquakes, and take appropriate action. Certain ultrasonic gas meters are able to carry out 'self-diagnosis' and report potential malfunctions.

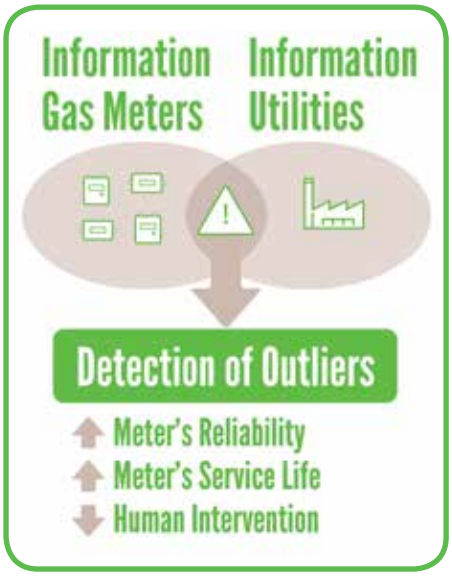
Sub-meters for gas metering

Ongoing developments in measurement technology have led to a revival of interest in other natural gas metering and monitoring applications. These include sub-metering for small apartments. Natural gas sub-meters, such as those typically installed in condominiums or large apartment buildings, combine decreased size with increasingly diverse functionality, making them ever more suitable for direct integration into gas stoves and gas boilers. This means that in future, information about gas consumption in the home could be collected at several different places, providing very tight monitoring and a clear idea of energy consumption.

Safety and reliability can profit from big data

By their nature, smart gas meters are exposed to a higher risk of tampering. This is due to the presence of various types of software, their communicating capabilities and, in general, the increased complexity of their design. Although we need to address these weak spots from various angles, some





help could come from the data that smart meters generate. We need to find ways to make full use of the data assets generated by gas meters.

Some static metering technologies appear able to offer unique, exciting signals that could lead to the increased safety and reliability of gas meters to the ultimate benefit of the end user.

Microthermal gas flow measurement technology is playing an increasingly important role in natural gas metering (residential, commercial and industrial). Microthermal and ultrasonic gas meters are gradually replacing the older, diaphragm-type systems. Gas utilities and gas distributors, as well as smart home and smart energy businesses, are interested in improving metering technology with a view to making it more accurate, secure and reliable.

How can we profit from the by-product signals generated by microthermal gas meters?

Unlike diaphragm- or turbine-based systems, static gas meters do not have moving parts, a feature that should result in increased service life without compromising performance. Furthermore, microthermal gas flow measurement technology provides not only the gas flow-related parameters, such as the standard volume and flow, but also additional parameters associated with the intrinsic physical properties of measured natural gas or its immediate environment. These additional parameters can be amalgamated with the information available to utilities, such as the geographical distribution of gas meters or the geographical distribution of distributed natural gas types, which can result in added value.

What unique data can microthermal gas meters generate?

Microthermal natural gas metering devices, such as meters and sub-meters, provide a wealth of information, collected locally, about the flow, composition and physical properties of gas (Category 1 data). The data may include standard volume, flow, temperature, thermal conductivity and heat capacity, as well as parameters determined by the microthermal measurement method, such as the temperature gradient over the sensing element. Importantly, all of these signals are (or can be) generated – but at the moment not necessarily transmitted to the meter manufacturer – by a single sensor embedded on, say, a CMOS chip.

Gas utilities and/or gas distributors, on the other hand, typically have access to additional information relating to the exact geographical/physical location of the gas meter, the gas type/composition available in a particular region, and gas consumption profiles at specific locations (Category 2 data).

merged datasets could be remotely analysed for outliers across a certain geographical region of interest. For example, the heat capacity of gas should be very similar within regions that use natural gas of the same type and quality. Instead of heat capacity, any of the parameters from Category 1 or a suitable mathematical relation between them can be used. The detection of an outlier should prompt further investigation, because it might indicate any of the following:

- Tampering with the gas meter,
- Logging malfunction,
- Transmission malfunction,
- Gas meter core measurement unit malfunction,
- Gas leakage,
- Changed gas parameters,
- Changed measurement conditions.

One means of increasing meter service life would be to use redundant signals to carry out self-diagnosis.

Furthermore, proposed data collection, fusion and analysis from microthermal gas meters open doors to 'cloud based' solutions that

> *"Merging these two datasets can generate interesting new insights..."*

Added value for all

Merging these two datasets can generate interesting new insights on at least two levels. Maps showing how Category 1 flow, composition and physical properties are distributed within a neighbourhood, city or region can provide or corroborate insights into how certain factors vary from one point of measurement to another. These factors include the thermal conductivity and/or temperature and/or heat capacity of natural gas, as well any other microthermal gas meter-specific parameters or combination thereof.

Merging and processing the two types of data can also have other benefits. These include: the detection of outliers (see below), improved supply quality control, an increase in the meter's service life and a reduction in the amount of human intervention necessary in the field.

In the case of outlier detection, Category 1 data could be measured or calculated at the point of interest (at the installation point of the microthermal natural gas meter). The

enable meters themselves to profit from each other's signals, measurements and failures. A smart meter might well come to mean a meter that not only communicates but also cooperates with other smart devices.

Summary

By carrying out self-diagnosis or being sensitive to changes in the environment, new gas metering technologies will increase meter reliability and versatility. This is a trend providers of gas metering technologies as well as gas utilities will need to bear in mind and comply with.

Static gas meters, such as microthermal gas meters, are particularly well suited to providing unique pieces of information in addition to basic flow values. This additional information can be combined with data typically available to gas utilities, such as the location of gas meters or gas composition, to generate intrinsically new information about the meter and its environment. The remote meter 'health check', for instance, is already viable today with technology that is available off-the-shelf. MI

Empowered customers in smart cities – A PERSPECTIVE

Paul Budde, Executive Director, Smart Grid Australia

Customers are now becoming active participants in all aspects of society and the economy. This is forcing massive transformations of the parties involved.

Key sectors leading this transformation are energy, telecoms, transport and IT. Together these will be the key infrastructure facilitators for the development of smart cities, smart buildings, smart communities, and indeed smart countries.

New infrastructure systems are emerging, driven by a combination of pull factors – technological change, price, regulatory changes and increased knowledge – as well as push factors, with both empowered people as well as new entrants with different business models entering the market.

Central in all of this are smart people. The customer has become the disrupter, facilitated by new technologies, and the customer side is now the focus of change.

This has an effect on government and businesses alike. Customers want to deal with smart cities and smart companies. Energy and sustainability play a key role in this, but they are no longer stand-alone items – they need to be integrated with communications and IT developments.

Cities, companies, society and economy at large will need to transform and show leadership, cut through their silos, create open systems and mould their systems, products and offerings to meet customer needs.

While city, state and federal government need to show leadership, it is in the industry's interest to build a platform to develop the smart projects that will allow all of the various customer and industry elements to connect and engage in multiparty activities. Making the customer central to these developments means providing them with the tools and services they are looking for, enabling choice, affordability, simplicity and reliability.

An open and interconnected environment will facilitate growth opportunities for existing and new entrants to drive innovative technologies and business models. It will allow the annual global spend of over US$2 trillion in electricity, communications and IT and other infrastructure to be leveraged for the benefit of all stakeholders.

Apart from telecommunications developments like smartphones, home electronics, apps and the internet, we are seeing an explosion in photovoltaics (PV) and storage, including new advances in battery technology, which will accelerate this disruption by allowing a truly two-sided market. To gain the most from these developments, the industry needs a holistic platform that can incorporate transactive energy, virtual power plants, microgrids, EVs, communications developments such as Internet of Things (IoT) and machine-to-machine (M2M) interactions, as well as the all-important data analytics.

There are already a few electricity companies that are progressing on this process of transformation.

Change agent Alliander

Smart City Amsterdam is an initiative of the City of Amsterdam with two key partners – KPN, the Dutch national telecoms company, and the energy company Alliander.

Alliander N.V. is the holding company of several subsidiaries and group companies, including the regional network operators

in the Netherlands, Liander and Endinet. Liandon is Alliander's knowledge centre and it is largely responsible for the technical innovations around the transportation and distribution of electricity and gas. Alliander's shareholders are Dutch provinces and municipalities. The largest shareholders are the provinces of Gelderland, Friesland, Noord-Holland and the municipality of Amsterdam.

The regional distribution of energy in the Netherlands is the exclusive responsibility of network operators. This is laid down in the Dutch Electricity Act and the Gas Act. Network management is the most important activity within Alliander. About 90% of the revenue comes from connections, meters and the distribution of energy by Liander and Endinet. The other 10% comes from activities involving the construction and maintenance of complex infrastructures by Liandon as well as other activities.

Smart City Amsterdam is an initiative of the City of Amsterdam with two key partners..."

Alliander operates energy networks which distribute gas and electricity to large parts of the Netherlands. With their work they facilitate businesses, homes, transport and recreation.

So far, nothing unusual.

However, they also want to strengthen and empower society by providing free access to the energy infrastructure and giving customers more insight into their energy consumption. Responding to the rapidly changing energy landscape they are working to build a future-proof and open network that can accommodate multiple energy providers. To obtain insight into society's energy ambitions at all levels, they consult with provinces, municipalities and other customers. They help them to resolve their energy issues and develop complex energy infrastructures.

Here lies the link with smart cities, and in order to be able to provide future energy they rely heavily on communications, and in particular on IoT and M2M. Because of their close link to their customers they also become involved in a range of city-based and community-based projects which include free (renewable) energy, micro-grids, transport solutions and so on. By being actively involved in those broader smart city projects they are on the road to understanding where the future business opportunities are; and the further they move towards this future the more the company will rely on totally different business models.

This already has resulted in stopping several investment projects based on the old grid principle, as Alliander has learned that the smart way to undertake these projects is through collaboration and sharing, rather than through building more and new traditional grids. By taking a leadership role in developing smart cities they are gaining valuable information on what the future will hold.

Change agent Tenaga

According to Malaysia's main energy provider, Tenaga National Behad (TNB), the topic of smart grid has well and truly moved in the direction of smart cities. To this end the company has positioned itself as a key infrastructure provider in the smart city developments of that country. Energy will be a key element in this development but in order to become an important player in the smart city market TNB understands it will have to broaden its approach towards energy, and offer a more complete set of smart city products and services.

It has also researched the key sectors in the smart city such as healthcare, transportation, culture and entertainment, telecommunications, security, building management, etc, and has come to the conclusion that specific services will have to be developed for each of those sectors.

This will necessitate the company making some fundamental changes to the organisation and the way it operates, and this certainly will not be an easy task. But, as is happening elsewhere, TNB is facing reduction in traditional power supply and it will have to make a choice – whether to remain the largest player in a shrinking market or move into new services. Obviously it will need to be realistic about this and concentrate on areas that lie within its competence. One of the areas it is looking at is whether its smart meters can be used for other applications, and if it can collaborate with partners to broaden their use

It is looking at different business models. They have developed three main models, simply operate on a project basis for third parties, a build operate and transfer (BOT) model and a build-operate and manage (BOM) solutions.

So looking at these last two examples, there will clearly be a place for the grid operators in new energy market – people will continue to need safe and reliable power, and an interconnection to keep the various hubs together. However, those operating the grid will have to start having very different conversations. It has to become bi-directional, a network of all sorts of energy interchanges. But perhaps most importantly, from now on, future energy developments will be driven by the customers, people who want to live in smart homes, smart communities and smart cities. MI

ABOUT THE AUTHOR:

Paul Budde is the Managing Director of BuddeComm, a global research and consultancy company covering telecommunication, the digital and sharing economy, smart grids, smart cities, e-health and e-education. He is also the Founder and Executive Director of Smart Grid Australia, co-founder of the Global Smart Grid Federation and co-initiator of the UN Broadband Commission for Digital Development.

SMART ENERGY *for* SMART CITIES

It is well-known that one of the major challenges facing cities today is the increase in worldwide urban population and the inevitable strain this puts on city systems and resources. According to the United Nations, in 2014 54% of the world's population lived in urban areas, and this figure will increase to 66% by 2050.

By Roz Euan-Smith and Jacob Perreira, IHS

The need to manage cities more efficiently is driving interest in innovative solutions and as technology hardware costs have dropped and connectivity has become more commonplace, opportunities to collect and analyse real-time data to manage cities better are being realised. This can be thought of as the implementation of the 'Internet of Things' (IoT) in the city context.

Global analyst firm IHS is currently tracking the progress of approximately 400 smart city projects around the world. All these projects use integrated information and communications technology (ICT) systems to improve efficiency, manage complexity and enhance citizen quality of life, leading to sustainable improvement in city operations.

Out of the projects being tracked, approximately 27% are focused on mobility and transport solutions, 26% on physical infrastructure (which includes street lighting and waste management), 25% on energy and resource efficiency, 11% on governance, 8% on safety and security, and 3% on healthcare. 40% of the projects are based in Europe, 31% in Asia Pacific, 25% in the Americas and 4% in the Middle East and Africa.

Most projects are either trials or in the early stage of implementation, and could take years before they are fully functioning. Despite this, many governments have unveiled investment schemes to accelerate smart city and IoT development, including the United States, United Kingdom, Singapore, India and China.

Energy and resource efficiency is a key area for smart city projects around the world, as cities want to become less dependent on carbon and provide a better environment for their citizens. In Europe, EU energy efficiency targets are driving investment in smart city solutions, and 51 of the region's 157 smart city projects focus on energy and resource efficiency.

A number of countries in Europe have started trialling smart grid technology as part of smart city developments. One example is the work in Aspern, where a sustainable smart city is being developed on the site of a former airfield just outside Vienna.

The Aspern smart city project is backed by a €40 million joint venture between the City of Vienna, the city's utility companies (Wien Energie and Wiener Netze), and Siemens. By 2028, the area is scheduled to have around 8,500 apartments, 20,000 jobs, and a commercial campus. The development is being used to test energy-efficient technologies, such as smart grid and smart building solutions, which will not only be used in Aspern but also rolled out to other cities.

Similar to Europe, several countries in Asia have either started trialling or have announced investment packages for smart city development where improving energy and resource efficiency is a key goal. Most notable among them are China, Japan and South Korea.

Japan and South Korea both lack domestic energy resources so have historically been dependent on energy imports. Japan had been pursuing a strategy of investing in nuclear power, until the Tohoku earthquake

> *"In many cases the sums that governments are committing will not be enough on their own."*

and nuclear disaster in 2011. Since then Japan has been looking at renewable energy sources and smart grid technology as an alternative.

In addition to the need to find a safe and reliable energy supply, Japan is interested in smart grid technology to protect cities from the mass power outages and rolling blackouts that affected Tokyo and many other parts of the country in the aftermath of the 2011 earthquake. Japan has been developing smart city test beds for several years now, with an emphasis on energy management – not only to reduce emissions but also to improve the cities' ability to respond to catastrophes.

China has also announced investment packages for smart city development, and is currently involved in a knowledge exchange exercise with the European Union. 15 Chinese cities have been paired with 15 cities in Europe, to share knowledge and technical capabilities in smart city solutions and promote the development of global smart cities. Many of these projects prioritise improving energy efficiency and environmental factors, such as air quality.

In the Americas the United States is leading the way in terms of number of projects. In September the White House announced the Envision America programme, which will significantly contribute to growth in the number of smart city projects in the United States. The US$160 million funding package will be used in a broad range of smart city projects, including traffic and mobility, physical infrastructure, safety and security, as well as energy and resource management. As of November 2015, funding recipients are yet to be announced, but corporate partners engaged in the programme include Itron, GE, Landis+Gyr, Qualcomm and Microsoft.

However, despite this recent increase in activity, smart city projects face a number of challenges before they can deliver their full value potential. A common stumbling block is the fact that many cities have little flexibility in their annual budgets to allow them to invest in large-scale rollouts of new technology and infrastructure. Although a number of national governments have made commitments to invest in smart city technology, these are large-scale, long-term projects which will require sustained investment for implementation and maintenance in order to deliver their full potential value. In many cases the sums that governments are committing will not be enough on their own. MI

ABOUT THE AUTHORS:

Roz Euan-Smith is a senior analyst within IHS Technology, whose research focuses on Smart Homes and Smart Cities. Recent projects include a worldwide study of the smart home energy management devices market and analysis of the potential of residential demand response.

Jacob Pereira is an IHS analyst specializing in utility meters, grid infrastructure, distribution automation and smart communications. He is a member of the IHS Power & Energy team which has published syndicated, primary research reports across the utilities vertical for more than fifteen years.

E-meter: Soldier for the war on blackout

The technical parameters for e-meters are defined by totally outdated standards today. These standards do not reflect the current state of knowledge and real state of the power supply system. European bureaucrats introduce savings based on smart meter rollouts, but they do not quite take into account the way of connection to the end user's distribution. Under pressure of sanctions for not fulfilling the bold plans of Brussel's directive 2020, plenty of utilities began to rollout suggested standardized interoperable systems (PRIME, G3-PLC).

While this solution perhaps can replace the need for manual meter reading, it will not solve the real needs of utilities.

Utilities have to face the following challenges:

- Within the power network, there are massive installations of appliances generating a high spectrum of voltage and current harmonics
- The influence of stochastic production is increasing as a result of the high penetration of renewable generation
- Penetration of production into the field of distribution leads to growth in power flows
- Installation of large capacity renewable sources against an insufficiently built transmission system.

The above mentioned points are the biggest threat and cause of blackouts. Obviously, the question is not whether they will occur, but when, and whether we are able to fight against this phenomenon and its impacts.

It is clear that both consumed and produced energy is a complex system. It is therefore essential, so that measuring of delivery and consumption is realized. The measurement of basic harmonics will not therefore be sufficient.

It is necessary to equip all e-meters with disconnectors. The aim is not to disconnect the customer totally (even if it were possible), but to regulate (limit) consumption, especially in crisis periods, when there is a lack of power supply. That is why, in order to minimize the impacts of blackouts, establishing an island regime is required.

If the e-meter is controlled remotely and is equipped with a high-powered element (disconnector), it is crucial to secure communications from cyber intrusion or interference. The power supply system, with its vital functionality for society is one of the most vulnerable to cyber attacks.

An e-meter with disconnector is very strong tool for preventing blackouts, if it is combined with a frequency relay. This relay monitors changes in power energy frequency in real time (in milliseconds), and can react promptly to changes. Frequency is the main indicator of an emergency state. Load disconnection, or connection in a crisis situation, can to stop a massive blackout, or decrease its impacts, respectively.

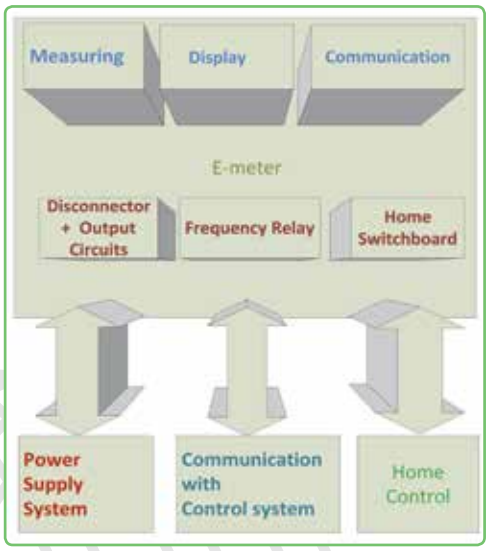


Figure 1: Functionalities of the new e-meters.

Via the monitoring of the direction of power flow (together with voltage increase), we are able to regulate the customer (with possible disconnection) in order not to unnecessarily burden the stability of power supply system. We thus get the tool that can very effectively help with electricity network stabilization.

There is no doubt we have to think about the customer as an inseparable part of power supply system. Every household is a potential partner from the immediate consumption point of view, and, more importantly, with the accumulation possibility.

At this point, the e-meter should begin to operate as a home switchboard that is able to manage home accumulation in an optimal way.

Last but not least, it is necessary to have home switchboards if the household is equipped with photovoltaic power. This functionality aims to optimize energy flow at the customer's premises and is perfectly suitable for implementation into the e-meter. All necessary elements (measuring, load control, communication, display, etc.) are already realized in e-meter.

Data exchange between the e-meter and outer world is vital. It is, thus also necessary to concentrate on efficiency in data transmission.

Although the current standardized interoperable e-meters are not able to ensure the functionality of the home switchboard (and not at all to contribute to the power supply system stabilization), there are already new solutions emerging today, where described characteristics are not only in sexy PowerPoint presentation form. We can say that these functionalities are realized in physical form, even though in the form of single devices (in case of frequency relay also in legislation form). Integration into the one platform (into the one e-meter) also exists, there is only one limiting factor for extension: higher price. However, if utilities fully realize all positive impacts of installation of these e-meters, the price will not be the obstacle in future. MI

ABOUT THE COMPANY:

Based in the Czech Republic, ModemTec is a leading R&D company within the smart metering/smart grid sector. ModemTec is a well-known producer of products based on reliable PLC Communication and develops multiutility solutions and implements security standards.

www.modemtec.com

A TECHNOLOGY MILESTONE AT EUROPEAN UTILITY WEEK

"It's all about putting intelligence where it makes sense to solve the problem"

In an industry first, Itron demonstrates how the distributed intelligence of OpenWay Riva™ technology changes the game in grid operations

By Tim Wolf, Itron.

When it comes to paradigm shifts, the event itself doesn't always appear that eventful. In a conference room tucked away above the main show floor at European Utility Week (EUW) in Vienna in November, a delegate from a European utility dutifully volunteered to connect two jumper wires, effectively creating a meter bypass – a very common form of energy theft. A few seconds later, an event alarm event was sent from the meter, over an IPv6 network, to the system operator alerting him that energy theft was taking place.

Wait a minute – smart meters already detect theft and they have done so for years, haven't they? But this was different. Instead of relying on mechanical tamper alerts and time-consuming analysis of customer billing records and consumption patterns to find energy theft, this meter bypass was detected by real-time and localized analysis of current flows on the low-voltage network.

Here is how it works: whenever current is drawn from the network, there is *always* a corresponding drop in voltage, even if it's miniscule, at other meters on the same transformer. Now, if meters are smart enough to know exactly where they are located on the low-voltage network; if they have the computing power to analyze high-frequency, high-resolution data at the edge of the network; and if they are articulate enough to talk "peer-to-peer" with nearby meters, the diversion detection process is transformed. In effect, the meters ask each other, "Did you see that small voltage drop, and if so, was it associated with metered consumption or was it unaccounted?"

If the latter, someone is stealing energy.

Welcome to the world of OpenWay Riva™ technology, where Itron is applying the capabilities of distributed intelligence to create entirely new and much more effective approaches to solving key problems and creating new opportunities in the era of smart grid, smart cities and the Internet of Things.

Energy theft is a global problem that costs utilities and their customers nearly $90 billion per year, according to a 2014 study by the Northeast Group. Yet, if utilities could more efficiently detect, investigate and collect lost revenues, it flows straight to the bottom line. The challenge is that addressing energy theft is a labor-intensive endeavor that has limited return due to the imprecision of current approaches. Of the thousands of tamper alerts received from current generation smart meters, only a handful, upon field investigation, turn out to be actual cases of energy theft.

Instead of delivering a haystack of possible energy theft data based on "circumstantial evidence," each of which requires further investigation and correlation with other data sources to find the needle, OpenWay Riva technology approaches the problem differently. It not only detects that energy theft is taking place, it also tells the utility exactly where it's taking place, how much electricity is being stolen and the likely modus operandi. In this case it was a meter bypass.

"This was a first for the industry – using distributed intelligence in smart meters and other grid devices to solve problems where they are taking place on the low-voltage network," said Tim Driscoll, Itron's director of emerging products and technologies, who led the demonstrations of several new distributed analytics applications at EUW. "By applying distributed intelligence to the energy theft problem, we increase the accuracy and timeliness of diversion detection by 300% or more, which makes those losses much more recoverable. And the same technology allows us to achieve comparable improvements in other use cases, including transformer load management, outage detection and analysis, and even detection of unsafe grid conditions. It's all about putting intelligence where it makes sense to solve the problem."

Take, for example, detection of high-impedance connections, another distributed analytic that Driscoll and his team demonstrated for the first time in Vienna. These 'hot spots,' as they are often referred to by grid operators, involve bad wiring or connections on the low-voltage network that cause voltage drops and heating. They represent not only a source of technical loss, but also a potential safety problem and liability risk for the utility.

Over time, these bad connections build up heat, which causes them to degrade further and faster, often resulting in

customer complaints about flickering lights. Undetected, they can sometimes lead to fires and even fatalities. Despite being a safety concern for utilities throughout the world, they have had no cost-effective or practical way to proactively detect these potential safety problems on the low-voltage network. That changed in Vienna.

Using a load box to simulate load on the customer side of the meter and a variable resistor to crank up impedance on the line side, Driscoll and his team simulated a high-impedance connection. Almost immediately one of the OpenWay Riva-powered meters began detecting the change. Over the course of a few seconds, the meter calculated the resulting increase in impedance while simultaneously comparing itself and other meters under the same transformer to thresholds programmed into the system by the operator and to recent impedance data for that same line stored locally in that meter. The application also has the intelligence to differentiate between high-impedance due to faulty wiring versus an intentional meter bypass.

Following this analysis at the edge, the OpenWay Riva-powered meter dispatched a priority message about the hot spot, including its location, to the utility, enabling the utility to repair the issue before it could become a customer complaint or – even worse – a fire and a potential liability for the utility. Up to this point, utilities have not had a good answer to this problem, which in the end is about safety.

"We can make some economic calculations about safety, such as insurance premiums, certification processes and the cost of safety equipment," said Driscoll, "but the real value of safety is protecting people – whether utility employees or customers – from harm. You really can't put a number on it; you just do it."

Ever since the big conversation toward the smart grid began a decade or so ago, one key part of the story had yet to materialize. In order for the smart grid to actually be 'smart' and deliver on many of its promises, it's been clear that a diverse group of devices, including meters, sensors, switches, inverters, EV chargers and thermostats, are going to need to communicate and collaborate with each other in real time at the edge of the network to solve problems without necessarily waiting for operator intervention to take action.

At EUW, the Itron team demonstrated how OpenWay Riva technology approaches what it calls "Direct Load Management," a broader term developed for managing new load and resource challenges in the age of two-way power flows, widespread distributed energy resources and Level 2 electric vehicle charging.

By adding robust computing power to the edge device, OpenWay Riva technology not only provides the ability to crunch high-resolution data, the device also becomes a computing platform. OpenWay Riva-powered meters and devices not only have the computing power of a late model smart phone or desktop computer, they also have a Linux operating system with an open application environment giving them the ability to run a broad array of applications, whether from Itron or third-party app developers. This means that OpenWay Riva-powered meters can support multiple application and communication protocols, meaning meters can communicate fluently in the language of distribution automation (DNP 3), load control (OpenADR) and home energy management (SEP 2.0), to name a few. In other words, the smart meter is no longer a meter; it is a computing device upon which smart metering is a key application. "Think about that distinction," Driscoll told his audience.

In the ensuing demonstration, the OpenWay Riva-powered meters maintained peer-to-peer communication with each other to accurately calculate total load on their transformer and determine the direction of net power flow. Utilizing their up-to-date knowledge of both the transformer load rating and the controllable loads and distributed generation assets available behind the transformer, the OpenWay Riva-powered meters initiated action to reduce overall load to within allowable limits based on an average per meter for the hypothetical transformer. And the system did this without intervention from grid operators, but kept them informed of what was going on along the way.

"Instead of trying to manage large volumes of devices centrally, OpenWay Riva technology distributes the management of the load control process locally to meters on each transformer," said Driscoll. "As a result, we're seeing much higher reliability and lower latencies, which means devices can run much closer to tolerances knowing that response to control commands will be much more immediate and precise. This allows more effective control actions and load reductions with lesser noticeable impact on consumers and their daily lives."

So what's the value add of OpenWay Riva and distributed intelligence from a financial standpoint? That depends on the market, the utility and the use case drivers, says Driscoll. But based on Itron's initial business case modeling, the company is confident that the initial suite of distributed analytics will increase benefits to the utility by up to 50 percent compared to current smart meter offerings in the marketplace. Additional future applications mean added value. Beyond utility benefits, OpenWay Riva technology also provides a platform to broaden and extend the value stream to include broader consumer and societal benefits, including energy efficiency, reduced carbon emissions and ancillary services.

"We spend a lot of time evaluating smart grid technology and calculating the potential value to our utility clients," said Robbert Kremers, senior manager, Accenture EALA Smart Grid Services Group, who also attended the OpenWay Riva demonstration at EUW. "What we saw with OpenWay Riva in Vienna is a paradigm shift in terms of smart grid business case and technology investment."

"The initial applications we demonstrated in Vienna at European Utility Week are just a beachhead for our OpenWay Riva platform," said Driscoll. "Itron is taking a standards-based ecosystem approach to OpenWay Riva to expand choice for our customers and drive innovation in the marketplace. This is taking the smart grid to what we call the active grid. Judging by our customers' reactions thus far, we're on to something." MI

ABOUT TIM WOLF
Tim Wolf is the director for marketing at Itron Inc., where he is responsible for marketing and communications for Itron's global electricity and smart grid businesses. He is a regular presenter at industry conferences and writer in the industry trade press. He can be contacted at tim.wolf@itron.com.

ABOUT ITRON
Itron is a world-leading technology and services company dedicated to the resourceful use of energy and water. We provide comprehensive solutions that measure, manage and analyze energy and water. Our broad product portfolio includes electricity, gas, water and thermal energy measurement devices and control technology; communications systems; software; as well as managed and consulting services.

Increasing customer satisfaction and revenue enhancement in utility companies

Nowadays, the concept of 'e' services like e-government, e-hospital or e-shopping has become very popular and when we hear about 'e' services, our understanding is a quicker process, convenience for customers and more business opportunities for service or product providers.

Today penetration of the 'e' concept across different elements of our lives is more visible than ever before and service providers like utility companies cannot remain an exception to that evolution. Most utilities directly or indirectly follow this concept (i.e. through smart metering projects, for instance) to provide better service to customers and improve their income. Achieving this concept needs some consideration because technology itself (i.e. smart meters) cannot guarantee improved customer service or improved revenue and utilities may have to underwrite significant costs, such as integration costs, due to smart meters producing huge amounts of information that needs to be processed and categorized. Selection of an IT system for this purpose is therefore critical.

Inhemeter's electric Utility Solution (eUtility) is a full IT System, which has been designed based on the requirements of utility companies in order to integrate business processes in an automated and auditable manner. This solution empowers the utility to deliver better services to customers, manage resources better, speed up processes, etc. with an open and standard interface. The eUtility solution will additionally mitigate any future integration cost for the utility.

Inhemeter's eUtility solution is composed of different standalone modules and has been designed based on the SOA (Service Oriented Architecture) concept with all modules in eUtility working seamlessly as one system. Based on individual requirements, different modules can be selected. For example, if African utilities are interested in prepayment solutions, the utility modules related to prepayment will be selected. All modules have been designed based on the latest technology and they are highly flexible and adaptable, depending on the different utility requirements. All software modules are integrated onto an open platform (such as CIM or CIS systems) to fulfil current and future utility requirements.

Inhemeter's eUtility solution targets:

- Improved utility revenue and customer satisfaction
- Provision of an auditable, transparent and automated management platform
- Improved lifestyle for the utility customers
- Fair distribution of electricity
- More efficient electricity billing cycles and customer service
- Effective asset management
- Improved investment into the utility industry
- Improved quality of supply and access to electricity
- Elimination of future cost for integration
- Effective management of natural resources; decreasing CO_2 emissions.

> *"Inhemeter's eUtility solution is composed of different standalone systems"*

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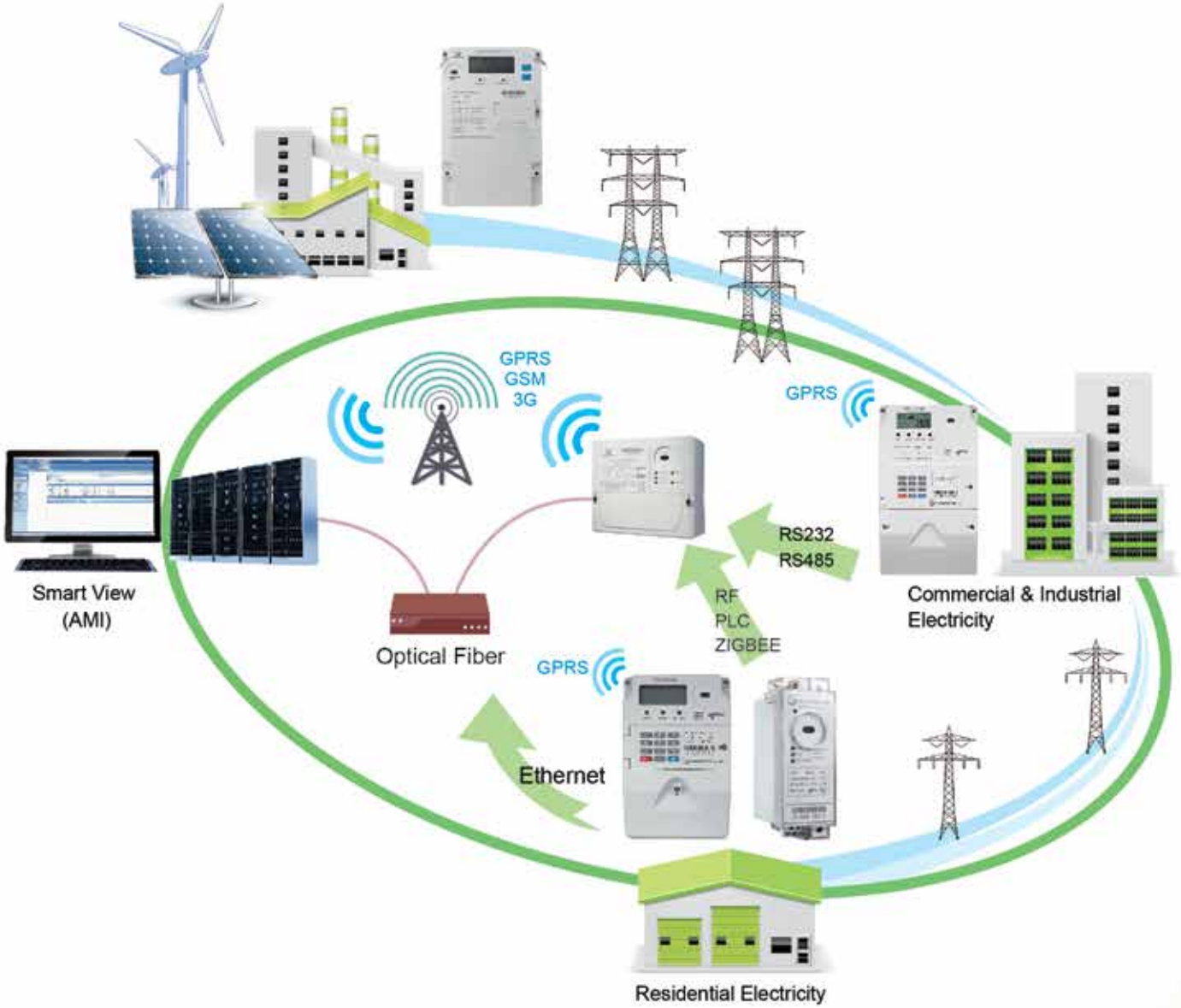

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Figure 1. The conceptual architecture of the eUtility Solution

Inhemeter's eUtility solution can be composed of some or all of following systems:

Prepayment system: This solution is used for prepayment customers and supports STS compatible meters, regardless of the meter provider. The vending system can also work with non-STS meters.

Smart metering system: The AMI system is the core of the smart grid used for energy efficiency, demand response, operational efficiency, customer satisfaction and revenue protection. AMI systems provide two-way communication from master station to smart meters to accomplish remote processing of business processes. The first effect of deploying a smart metering system is the generation of huge amounts of data and the flow of the data to utilities. The proper management of such large quantities of data creates big challenges for utilities. The MDM system provides a common information infrastructure for receiving meter reads from different kinds of meters and AMI systems, processing the reads to produce billing data, storing and managing data and providing access interfaces to that data to interested parties.

Field device management system: Accomplishment of utility business processes in the field (like meter reading, meter installation, meter replacement, connect and disconnect, etc.) using the traditional manual method creates a lot of challenges for the utility, because the traditional way of doing things is not very efficient and can be compromised by human error. The smart utility field device management system is designed to overcome the above mentioned challenges and automate utility field business processes. It can also be seamlessly integrated into the utility's existing system to improve management efficiency.

Payment platform: After the development of the prepayment solution in most utilities around the world, the purchase of electricity by customers through a highly available and easy-to-use vending medium is another challenge. New players such as third parties and retail companies have appeared in this market to simplify and secure utility revenue collection. The payment solution provides a secure, fast and easy-to-use vending medium by which utilities and third party vendors are able to provide consumers with convenient access to prepaid electricity, water and gas STS tokens.

Billing and CRM system: The billing/CRM system delivers real-time data processing, dynamic tariff management and close customer interaction capabilities for smart grid infrastructure. Real-time consumption control and transparency ensures the utility can offer customers the right choices. The system provides billing services for energy consumption across various types of customers.

Cell phone solution: Smart phones are a popular communication medium and most applications are migrating from desktop platforms to smart phone platforms; and electricity vending and metering systems will be no exception. The Smart Electric Assistance application was designed to move electricity vending points and metering business from normal desktop PCs to smart phone applications. The software caters for a retailer to vend prepaid products, pay bills and run reports – all via a secure and convenient environment. This technology increases the footprint the utility can utilise to sell electricity and provide more options for the purchasing of electricity by customers.

For normal cell phones, the system can also provide a secure, fast and easy-to-use vending medium. This method is developed based on a very simple concept of SMS or USSD that is supported by all telecom service providers and cell phone devices. This method improves utility services to customers and provides more options for customers to purchase electricity

Distribution automation: The distribution automation system (DA) represents the next evolutionary step in smart grid development. DA empowered distribution optimization and distribution automation further modernizes the grid. DA is designed based on advanced digital measurement technology to measure and monitor real time parameters and the operating status of destruction networks and components. The system collects data, analyses power quality, outage management and abnormal events; providing utilities with access to critical distribution optimization information from within the heart of the grid to improve grid efficiencies. MI

ABOUT THE AUTHOR:

As software group general manager, **Huang Qing** has nearly 10 years' experience in software design and development. He is in charge of research on the E-utility system solution, such as registration management system, vending system, AMR systems etc. He is fully conversant with IEC standards, STS standards for vending energy, DLMS standards, etc.

ABOUT THE COMPANY:

Shenzhen Inhemeter is a international high-tech company consisting of a team of professional elites with years of experience in the metering industry with 'make metering smarter' and 'excellent enterprise in global metering industry' as its permanent goals.

Connie Durcsak: A legacy defined

On 14 November 2015, the utilities telecommunications sector lost a champion of ICT solutions, collaboration and advocacy for utilities, with the passing of Connie Durcsak, CEO of the Utilities Telecom Council (UTC). Durcsak's passing will leave an undeniable hole in the organization, but it is the work she did within the sector and the impact she had on its people that defines her legacy.

Ron Beck, past chairman of the Utilities Telecom Council (UTC) board, says of Durcsak: "It was her understanding of the technical issues and the telecommunications industry that really helped her understand the issues facing our members as she went out to meet with them."

Durcsak started working with the UTC in July 2011, coming from the Personal Communications Industry Association (PCIA) where she served as senior director of industry services.

It was at this time that the Grid Investment Grant programmes were being awarded by the Department of Energy, and Durcsak, through UTC, provided a forum for members to share successes, challenges and failures in this area.

Michael Quinn, vice president strategy and chief technology officer, Oncor, believes that the best way to describe Durcsak is through an anecdote which illustrates her vision and leadership. "Early on in her career she identified that security and communications (voice or data) would be inexplicably linked. This is common knowledge now, but when she proposed the idea, it was met with some resistance. She fostered the idea and recruited top talent into UTC because of her fervent belief in the connection. Now UTC has a seat at the table in both communications discussions as well as cyber discussions. The adjacent links were natural extensions for her to explore."

Advancing international links

"When I first met her in my role as vice chairman and board member of EUTC [European Utilities Telecom Council], UTC was a US association which had some additional business in Canada, Latin America and Europe," says Andreas Breur, head of new technologies/projects, RWE Germany.

"Right from the beginning Connie was very engaged with EUTC in order to help the organization to gain profile. She supported this with huge effort and constantly attended our board meetings and conferences with the aim to bring UTC and EUTC closely together."

Many of her colleagues have commented on her energy and the work she put into engaging and bringing international partners on board. The formation of both the Latin American and African branches of UTC was driven by her desire to 'educate and engage.'

Says Quinn: "As she took the reins, UTC had European and Canadian affiliates that essentially operated independently but shared some administrative elements. This grew into Latin and South African contingence but the true transition is into having an integrated international trade association that is operated and governed as such."

Visionary leader

Roxanne Fong, business development manager at Pacific Gas & Electric tells of Durcsak's focus on improving the utility and technology convergence for the better, "with a gift of innovative thinking, a visionary spirit, and the tenacious patience

> *"Connie understood that people can accomplish remarkable things when they work together. She marshaled the energies and expertise of UTC members to chart the association's strategic direction. Connie's belief in inclusiveness and collaboration made her the consummate leader and senior executive."*
>
> Paul Fagan, Senior Vice President, Sales and Marketing, Fujitsu Network Communications, Inc.

required to successfully lead meaningful change."

Matt Schnell, ITT telecoms manager at Nebraska Public Power District, echoes the sentiment. He continues that she "provided us a vision of the new UTC to meet our members' future needs, embedded that vision deep into her staff and the UTC leadership, and set the vision on course. The restructuring is well underway and UTC will be a better organization for our members due to her great vision and leadership of."

"Her desire to involve more stakeholders in numerous key committees as well as her efforts to establish the Young Professionals Committee represent just a few components of the innumerable contributions she has made," says Dave Woronuk, President and CEO of MegaSys.

Under Durcsak's leadership, UTC put RF spectrum acquisition for utility smart grid applications at or near the top of her priority list; driven by her awareness that dedicated spectrum to build private wireless networks was an essential element of a safe, reliable electric distribution system going into the future.

Role model

"In an industry filled with men, I particularly looked up to Connie as a mentor and leader and have especially enjoyed working with her over the years," Kathy Nelson, principal telecommunications engineer at Great River Energy says of Durcsak.

"She was a great friend and mentor," says Mike Lowe, communications manager, Blue Ridge EMC. "She mentored me by helping me find strengths and weaknesses in the people I supervise and the teams I work with.

"She was a very caring and warm person but had the strength and leadership skills needed for a growing business like UTC. She will be greatly missed."

The woman behind the CEO

When asked about the woman behind the role of CEO, Beck describes Durcsak as deliberate and tactful, classy and factual.

He continues: "While I am sure that she had an impact on any number of people, I can tell you that she really influenced my youngest daughter. Katlyn accompanied my wife Elaine and I to Madrid for a European Utilities Telecom Council (EUTC) meeting. Connie was as classy as they come and really understood the nuance of leadership. My daughter, then 16 years old, saw a thought leader and a manager that lived by a couple of core principals. Work hard. Know your people. Be true to yourself. Do the right thing.

"In the world that is Washington DC, this ran contrary to what my daughter thought you needed to do to be successful. Katlyn turned 21 recently and still considers Connie to have been a positive and influential factor in her outlook of her own future."

"I enjoyed working with Connie," Breur says. "Privately I would say that we were friends – both addicted to "Kitchen Aid Mixers". We exchanged experiences and recipes. Talking about the latest dishes we made with the help of our mixers was always fun.

"I will miss her! She was a very inspiring person in a male dominated business and I always was thankful to be working with her in order to make UTC and EUTC ready for the future of our business."

Fong comments that even though Durcsak was devoted to her work, she always found time for her colleagues, friends, and family. "Although much too short, Connie's was a life well lived! She was a determined, visionary, collaborative, goal-oriented, caring person who loved life and all that it offered."

Nelson concludes: "Our loss is overshadowed by the premature loss of a mother to two young daughters and the loss of a wife and daughter. Connie spoke of her daughters often and we frequently talked about work and travel challenges associated with being working moms. It's hard to believe that her smile, charm, and charisma will not be there waiting for us at the next UTC event." MI

"Connie and I shared many adventures while we were setting up the Africa UTC. We went on a game drive in the Kruger National Park, and on a subsequent trip, even managed to find our way (after a rather long, bumpy, muddy detour) to the southern most tip of Africa at Cape Agulhas.

I read the draft of this tribute in Cape Town before travelling home after the launch of AUTC. Connie and Maura Dunphy from UTC had planned to be on this trip for the week. Maura and I decided to continue with our visit and we have a good time talking over past times with Connie.

Connie was a colleague and a friend and she will be greatly missed."

Peter Moray, Director Global Development UTC

"Connie was more than just a role model for women. I would step up a level and say she was a role model of a modern executive of an industry association to serve a widely varying constituency during a time of widely disruptive change and cloudy prospects for the future. I would say that she would be a role model for any executive. I wouldn't limit that by gender in any way."

Rick Geiger, Cisco

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