METERING.COM

METERING & SMART ENERGY INTERNATIONAL

ISSUE 3 | 2018

ELECTRIFY EUROPE

FOCUS ON BLOCKCHAIN

THE EVOLUTION OF SMART METERS

VITZROCELL,
the leader in portable power solutions

Vitzrocell is the only company in the world developing and manufacturing Primary Batteries and EDLC at the same time for AMR purpose.

550 Million VITZROCELL has been manufacturing and delivering more than 550 Million batteries to our valuable customers in the world wide markets so far.

50 Countries VITZROCELL is well recognized in more than 50 countries expanding markets with our customer oriented power solutions.

150 Customers VITZROCELL has more than 150 customers based on the strategic partnership.

31 Years VITZROCELL is one of the most reliable manufacturers of lithium primary batteries for 31 years since 1987.

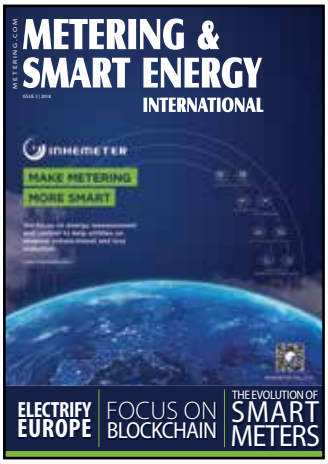
"VITZRO" Lighting up the World and Shining More

VITZRO CELL

Sales office VITZROCELL B/D 25Gil-10 Neungdong-ro, Gwangjin-Gu, Seoul 143-837, Korea Tel : 82-2-2024-3222/3235/3296 Fax : 82-2-499-2756
Factory Chusa-ro 235-35 Sinam-myun, Yesan-gun, Chungcheongnam-do 340-860, Korea Tel : 82-41-332-8642 Fax : 82-41-332-8646
E-mail overseas@vitzrocell.com

In this edition

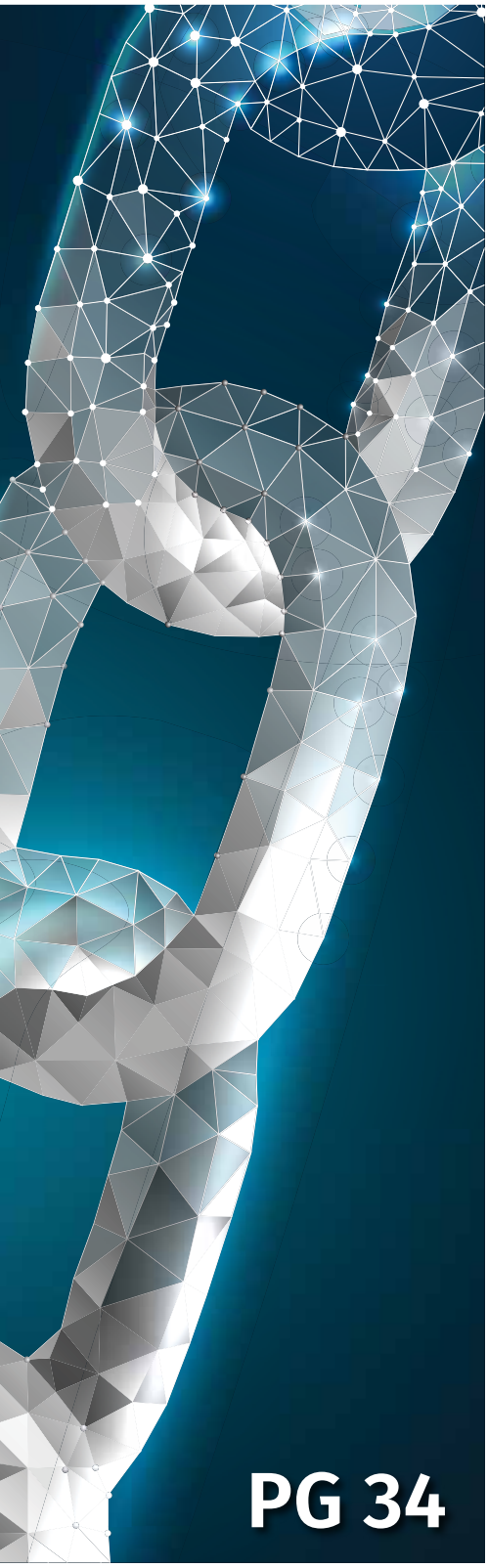
PG 24



Grid operations

Grid intelligence

In this edition



Business and strategy

Special report: Blockchain

Regular features

Event news

CHANGING TIMES

Claire Volkwyn
Editor
claire@metering.com

Change seems to be the most appropriate word to describe our sector – our world – at this time. And our editorial this edition reflects much of that change on both a global and a nano-scale.

Our special supplement is focussed on a current buzzword and potentially industry changing concept – namely blockchain. Blockchain has the ability to provide intermediary free interactions between stakeholders on the network, effectively rendering the utility's role in energy trading or sharing obsolete. What this means for utilities is still to be determined and it may well be true, as one of our contributors says, that "blockchain technology can barely justify the current hype around it." Yet, what is clear is that things are changing...

This is further demonstrated in our articles on the evolution of smart metering (page 16) and the increased use of SaaS in smart metering (page 42).

My editor's note is complemented by a message from our Publishing Director, Ross Hastie, who joined the company in October 2017. He shares some of the changes reflected within our business and that of our parent company, Clarion, in his message.

Continuing with the concept of change, it gives me great pleasure to welcome back to the Metering & Smart Energy International sales team, an old friend, Errol Bryce, who has joined the team and will be reaching out to renew contacts and forming new relationships. He is taking over from Graham Emeric, who sadly, will be exploring a new direction in his life and will be leaving us to pursue other opportunities.

I invite you to share your change journeys with us, and your stories of how things are still the same, by contacting me at claire@metering.com

Until next time!

Claire

Ross Hastie
Publishing director

Smart energy is already profoundly changing people's lives and the rate of change in this industry never ceases to increase. The next revolution to impact global society is well underway. Change brings innovation, inspiration and improvement.

Yet we all know the old adage, "the more things change, the more they stay the same." We are about the change, but our commitment to keeping you informed is unwavering.

This publication, once known as *Metering International*, has been a trusted partner and voice in the smart energy industry for 21 years. As the industry transformed and remodelled itself, so did we, when our name became *Metering & Smart Energy international* in 2014.

And now it's time for the next evolution.

From Issue 4, due for release in August, this magazine will be known as ***Smart Energy International***, reflecting how our content has evolved along with the major players and innovations in the smart energy space. Online, this brand refinement will happen in July.

Metering always has been, and will remain, one of the core pillars of our content. But since we have been covering so many other sectors of the smart energy industry for years already, we feel it's time for the brand's name to reflect that evolution.

All this is happening in the context of our parent company's significant expansion. On page 12 you can find out how the reach and scope of our publication has been given a massive boost as we increase our portfolio of media partnerships with some key power and energy events, especially in the US, thanks to Clarion Events' acquisition of the PennWell Corporation.

Exciting times lie ahead; we look forward to you joining us in the next chapter of this evolving story.

Metering.com | LinkedIn: Metering & Smart Energy International | Twitter: @Metering | Facebook: Metering.International

Managing director:
David Ashdown

Publishing director:
Ross Hastie

Deputy publishing director:
Bernice Bredenkamp

Sales manager:
Graham Emeric

Sales executives:
Alick Lee
Philip Gordon

Editor:
Claire Volkwyn

Senior production coordinator:
Blossom Ngesi

Design/Layout:
Cathy van Dyk

Staff writers:
Ashley Theron-Ord
Nicholas Nhede
Pamela Largue

Head Office:
2nd floor, North Wing, Great Westerford, 240 Main Road, Rondebosch, 7700
P O box 321, Steenberg 7947, South Africa
Phone: +27 21 700 3500, Fax: +27 21 700 3501,
E-mail: info@spintelligent.com, www.spintelligent.com

Production:
Reproduction by Spintelligent and printing by Tandym Print.
Subscription: $40 / Euro35, for 6 editions.

ISSN 1025-8248

KG Technologies™

World Class Switching Solutions for Energy Management

Latching Relays

Customized IEC Compliant Solutions To Meet Your Needs

SHORT CIRCUIT PER IEC 62055-31 UC2 COMPLIANT

SHORT CIRCUIT PER IEC 62055-31 UC3 COMPLIANT

FULLY UC3 COMPLIANT AT RATED AT 277 VAC

EXCEEDS ALL SAFETY STANDARDS

AVAILABLE WITH AUXILIARY CONTACTS TO DETECT STATE OF RELAY

How Long Do You Want Your Latching Relay To Last?

In a perfect world, meters would only need to handle resistive loads. However, in today's grid, meters are subjected to high inductive loads as well. Thankfully, KG Technologies' customers rest assured knowing that our latching relays have been tested and certified to meet both resistive and inductive loads at rated currents specified by IEC 62055-31.

In addition, with our K125 relay, you have the added protection that your meter will remain operational under the most extreme conditions. Beyond exceeding all electrical endurance safety requirements of IEC62055-31:UC3, our K125 relays remain functional even after a 7kA short circuit. For relays that meet ALL of the UC3 requirements—*Pass UC3 with KG.*

We Give You the Power To Make Your Supply Chain Leaner

Decades of engineering and close collaboration with our customers give us the insight to design innovative solutions that help our customers successfully achieve project outcomes. With our UC2 compliant K119, UC3 compliant products, and fully UC3 compliant K125 rated at 277Vac, we provide a range of customized solutions to meet your needs.

Most notably, our K125 allows meter manufacturers to produce smaller meters with no decrease in performance at an advantageous price point.

KG Technologies Delivers

As the world switches to a greener and smarter tomorrow, KG Technologies is raising the bar for quality, value, and service. We welcome the challenge of delivering high quality IEC compliant solutions customized for your energy management needs.

We work with you so that our products work for you!

KG Technologies™

Toll Free: +1.888.513.1874
www.kgtechnologies.net

Switch to a greener tomorrow with KG Technologies today!

CURRENT AFFAIRS

ELECTRICITY

Energy management certification programme secures DoE validation

A certification programme for energy management professionals (EMPs) offered by the US Energy Management Association (EMA) has been endorsed by the US Department of Energy (DoE) and the American National Standards Association (ANSI).

The DoE accredited the programme through its Better Buildings Workforce Guidelines initiative.

Robert Knoedler, president at EMA, said: "This is an important milestone for the EMP credential. Recognition by ANSI and DoE demonstrates their acknowledgement that EMPs are professionals with the specialised knowledge, skills and experience to provide a variety of energy-related services to building owners, institutions, corporate and utility administrators, and various federal, state and local agencies.

"The Better Buildings Workforce Guidelines programme requires that recognised certification programmes first attain ANSI accreditation, which involves a rigorous process of demonstrating compliance with the International Standard ANSI/ISO/IEC 17024.

"Once accomplished, the certifying body applies for formal Better Buildings Workforce Guidelines recognition — a designation that demonstrates the programme is "high quality, industry endorsed, and nationally recognised by DoE."

Outdoor lighting market through to 2025

ON World forecasts number of installed outdoor lighting to reach nearly half a billion by 2025.

The research firm, ON World, has found that over 50% of the installed outdoor smart lighting units are by companies from the IT/Telecom industry, followed by advanced metering infrastructure (AMI) vendors and then lighting manufacturers.

Current trends in the smart lighting systems market include:

- Intelligent lighting has become the foundation for smart cities
- Competition continues to grow for smart lighting technologies
- The smart city market will present a multi-billion opportunity for smart lighting systems vendors
- Mergers and acquisitions amongst big companies, eg Verizon acquired Sensity Systems, Itron bought Silver Spring Networks
- Wireless mesh networks are being used in mass scale-lighting rollouts. Florida Light & Power deployed 500,000 units using Silver Spring's platform
- Adoption of low power wide area networks such as Sigfox, LoRa, NB-IoT and RPMA continue to increase.

Mareca Hatler, research director at ON World, said: "Offering a fast ROI and ongoing operational benefits, there are few major cities today that are not considering a smart lighting system.

"Adoption accelerators include the rapid migration to LED lighting, low-cost, low-power wireless sensor network technologies and maturing cloud IoT frameworks."

The US dominated the outdoor lighting market in 2017. The majority of outdoor lights installed were smart streetlights, ahead of installations in campuses, car dealer lots, parking garages and shopping malls.

Global standard for prepaid meters updated

The International Electrotechnical Commission (IEC) has updated the Standard Transfer Specification (STS) IEC 62055-41, a global open standard for prepaid metering systems for gas, water and electricity.

The IEC says revision to the specification enhances the security and functionality of prepaid metering systems, especially in developing countries.

Don Taylor, director of the STS Association, said: "We wanted to improve drastically the encryption algorithms and make them state-of-the-art secure. The idea is for the encryption level to be valid for the next 30 years."

The specification was initially developed in South Africa by the IEC Technical Committee 13 in 1993, with the aim to help state utility Eskom connect 10 million households to the main grid, simplify consumer energy bill payments as well as help improve revenue collection.

"Most people living in developing countries find it very difficult to predict how much money they will have left at the end of the month.

"Wages are often paid weekly and a monthly electricity bill, similar to what exists in Europe or the US, would be totally impractical," added Taylor.

The IEC shifted the focus of its prepayment standard to helping utilities across the globe to reduce carbon emissions; mitigate climate change by enabling interoperability of metering infrastructure; and use related technologies from different manufacturers to help utilities expand distributed renewables.

Zigbee opens certification programme for UK energy market

The Zigbee Alliance has announced the launch of its new certification programme Smart Energy 1.4.

The Alliance has updated its certification programme to endorse smart energy products and services in the UK energy market.

The revised standard addresses technology functionality requirements rising from the UK's efforts to deploy 26 million smart meters by 2020.

For instance, smart meter communications technologies endorsed by the new standards will possess dual-band frequency capabilities enabling smart meters and energy management devices to operate at farther distances and through more RF-challenging building materials.

The Zigbee Alliance claims its certification programme will help increase consumer awareness and confidence in smart meters and their benefits (billing accuracy, optimisation of consumer energy use, carbon emission reductions).

EDMI's Communications Hub is the first UK product to receive certification from the new programme.

The Zigbee Alliance has certified over 700 smart energy products globally.

New study reviews emerging technologies and environmental impact

A study conducted by the Environmental Defence Fund to understand the role of seven emerging technologies in helping top companies drive profits and environmental performance, found that 70% of company executives have their businesses and environmental goals more closely aligned than they were five years ago, owing the use of advanced technologies.

Seven out of ten executives say their companies are actively investing in new technologies including blockchain, sensors, data analytics, mobile ubiquity, dematerialisation, automation and sharing technologies.

78% say despite external pressure (regulatory, consumer and investor), new technologies will force businesses to improve their environmental impact. 75% consider the environmental impact of these technologies before deployment whilst 80% said consumers will in future hold businesses more accountable for the effects of the solutions.

The study also revealed that data analytics is the most implemented innovation and has the greatest impact on organisations' brand reputation. Blockchain and de-materialisation are expected to have the highest growth potential and are foreign to 35% of business leaders.

Tom Murray, VP at EDF+Business, said: "Fourth Wave innovations can supercharge sustainability efforts by surfacing valuable data that was previously invisible, improving resiliency across global supply chains, and enabling powerful collaborations between industry, advocacy groups and communities."

The study was conducted in partnership with KRC Research on some 500 executives from companies with revenues ranging from $500 million to $5 billion in the retail, manufacturing, energy, technology, and finance industries.

Open Charge Alliance enhances security of EV charging transactions in new specification

The Open Charge Alliance has introduced new security, smart charging and smart transaction handling features to its existing specification for electric vehicle (EV) charging infrastructure and technologies.

The Netherlands-based consortium updated its Open Charge Point Protocol (OCCP) by adding secure firmware updates, security logging and event notification, security profiles for authentication, as well as secure communication in a bid to improve the security of charging station transactions.

The updated OCCP helps grid operators sustain reliability of grid networks by enabling interoperability of energy management systems, local grid control technologies, smart EV charging and EV charging station management systems.

The new features included in the standard were developed in October 2015 during specification review sessions which included OCCP users and more than 100 participants from 27 countries which belong to the Open Charge Alliance.

The updates are ideal for charging station operators managing complex multi-vendor (DC fast) charging stations. They are available on the consortium's website for free.

> *"The updated OCCP helps grid operators sustain reliability of grid networks by enabling interoperability of energy management systems"*

WATER

Brazil develops its own smart water solution

Some seven municipalities in Brazil have reduced water loss in distribution networks using a new technology co-developed by the Sao Paulo Research Foundation (FAPESP) and IoT start-up I.Systems.

Developed under FAPESP's *Innovative Research in Small Businesses* programme, the technology 'Leaf' has to date helped reduce average water flow by 5.8% and decrease minimum night time flow by 15% in networks operated by Prolagos.

Leaf is artificial intelligence-based and makes use of time, weather and consumer historical usage data to adjust water pressure in line with demand.

The water networks deploying the solution serves the Araruama, Armação dos Búzios, Arraial do Cabo, Cabo Frio, Iguaba Grande, São Pedro da Aldeia and Saquarema municipalities.

In addition, some 35 companies have also adopted the technology. Coca-Cola claims it has reduced water waste due to leakage by 2% at its soft drink bottling plant in Femsa.

UK's 2018-2027 market for smart water infrastructure

The 12 largest water utilities in the UK are expected to invest over $1.2 billion in smart water infrastructure between 2018 and 2027.

The investments will be directed towards smart water metering, analytics and smart networks under efforts to address very high rates of non-revenue water and to improve management of water resources, distribution systems and consumer usage behaviours, according to a study conducted by Northeast Group.

The market intelligence firm found that more than 50% of residential consumers do not have a meter on their premises.

Regulatory support and utilities efforts to combat projected severe water shortages by 2040, will drive increased investments in the market during the forecast period.

Ben Gardner, president of Northeast Group, said: "The UK market has a water metering penetration of just 48%...

"We project that this penetration will rise to 61% by 2027 with significant investment in smart water metering. In addition, smart water networking at the district metering level will also take place over the forecast period, as will investment in software and analytics."

The 12 large water utilities including Thames Water, Severn Trent Water and Anglian Water have already drawn up metering investment plans through to 2030.

California: Utilities' smart infrastructure investments in 2017

The largest regulated water utilities in California invested more than $645 million to modernise water infrastructure in 2017, says the California Water Association (CWA).

An analysis conducted to investigate investments made by CWA's 100 members found that the association's largest eight invested $645 million in upgrading existing water assets and in new and innovative technologies and infrastructure.

The eight companies are California American Water, California Water Service Company, Golden State Water Company, Great Oaks Water Company, Liberty Utilities, San Gabriel Valley Water Company, San Jose Water Company and Suburban Water Systems.

Great Oaks Water Company commissioned a water system control and data acquisition technology whilst the Golden State Water Company directed $110 million towards modernising water distribution pipes and installation of smart water meters.

Investments made are expected to help the utilities to improve services they offer and management of water resources which are currently under depletion due to droughts and water losses.

Approximately 2 million gallons of water is lost to leaks resulting from some 240,000 water mains breaks reported in the US every year, according to the American Society of Civil Engineers.

The American Water Works Association says $1 trillion is required towards improving water infrastructure to meet growing water demands in the US over the next 25 years.

Water tariffs, utility awards and Sustainable Development Goals

Water market research company Global Water Intelligence says utilities need to increase tariffs by 5.9% a year to achieve the Sustainable Development Goal on water and sanitation by 2030.

The 5.9% annual increase would raise the global average combined tariff from $2.08/m^3 to $4.38/m^3 in 2030 and will enable the generation of $449 billion of annual investments required to meet the 2030 goals.

Southern Asia will need to increase tariffs by 15.2% per annum to raise enough funds to develop new, and modernise existing, water resources as well as optimise their management. To date the region has average water and wastewater tariffs of $0.14/m^3.

SDG6 goals include improving global consumer access to fresh, clean and affordable water. According to the UN, more than 2 billion people are living in countries with excessive water stress, with Northern Africa and Central Asia experiencing water stress levels of above 60%.

Rapid increases in population, climate change and ageing infrastructure are some of the factors stressing the water industry.

Unavailability of funding by utilities to address such challenges is one area the GWI is confident will be solved by increasing the tariffs. The annual increases would reduce utilities' reliance on government grants from 31% to 18% of annual investment needs.

The private sector is expected to cover 7% of the global infrastructure investment needs by 2030 owing to increases in implementation of regulation encouraging private financing of water projects.

Christopher Gasson, publisher at GWI, said: "We are at an inflection point in the way water is financed. For the past two decades there hasn't been much change in the way utility assets are paid for. Going forward, there will be..."

Utilities awards

Following the launch of GWI's *Financing Water to 2030 report*, during the Global Water Summit held in Paris mid-April, the research firm named a financing model used in Rwanda's $60.8 million Kigali Bulk Water Supply project as the 2018 Water Deal of the Year.

The Dubai Electricity and Water Company was named the Smart Water Company of the Year, Bangalore Water Supply and Sewerage Board scooped the Water Leaders Award and Xylem was named the Water Technology Company of 2018.

"It is an exciting time for the international water industry, with some of the most significant opportunities the water sector has seen in a decade presented on the agenda for this year's conference. It heralds a new paradigm for the water industry as the arrival of new technologies, businesses and sources of finance are empowering the water industry to rethink the way it does business," said Claire McCollum, master of ceremonies at the global summit awards.

Global smart water meter penetration to reach 82.1 million units by 2026

Frost and Sullivan predicts the number of smart meter installation by water utilities to increase from 13.8 million units in 2017 to 82.1 million units by 2026.

Driving the increase in smart meter penetration are efforts by governments and utilities especially in water-stressed regions to reduce non-revenue water losses, improve billing accuracy, enhance the effectiveness of their water networks and manage consumption levels.

China is expected to be the fastest growing market owing to its rapid urbanisation, smart city development and favourable policies.

Paul Hudson, senior research analyst, Energy & Environment, Frost & Sullivan, said: "The communication module of smart water meters has undergone rapid technological transformations. There is a steady rise in the demand for IoT-enabled advanced metering infrastructure (AMI) smart water meters due to their multiple capabilities of real-time visualisation, leak detection, and machine-to-machine (M2M) communications.

"Utilities are exploring and adopting low-power, wide-area network (LPWAN) cellular communication technologies like long-range (LoRa) and narrowband(NB)-IoT for their efficiency and longer battery life."

Key growth areas within the market will include new business models such as Cloud-based data analytics solutions, software/data as a service and financial solutions. The smart water management solutions segment is forecasted to be a key potential growth area.

"While there are significant opportunities in the global market, the price sensitivity of utilities has led to intense competition among leading players," noted Hudson. "Players that are eager to compete in high-potential markets can test them with pilot-scale projects and regional collaborations. Once they establish a footprint, they can set up manufacturing plants with scalable capacity that can be used to supply other promising markets like India and the Middle East."

Spain: Utility to deploy smart meters under smart city project

FACSA has announced plans to implement a full-scale rollout of LoRa-enabled smart water meters in Castellon.

The initiative will include the installation of 30,000 smart meter units and will be deployed in partnership with Semtech and IoT solutions company IoTsens, to help consumers accurately track and control their water management.

Vivek Mohan, director of IoT for the wireless and sensing products group at Semtech, said: "The IoTsens' system can also quickly detect leaks, breakdowns and manipulation of the water supply network in real-time, preventing loss of service and costly repairs. More cities are adopting IoT technology..."

United States: Half of analogue meters in Fort Smith due life span

The city of Fort Smith in Arkansas state will over the next two years deploy Itron's OpenWay Riva IoT solution as part of efforts to modernise its water distribution, billing and management systems.

The project will include the installation of water communication modules and smart meters in replacing ageing infrastructure, a development which will help improve meter reading efficiency and lower operational costs.

The new system will enable real-time access to consumer usage data and performance of water distribution assets. This eliminates manual meter reading, which is associated with human error and corruption, and will help improve customer services through improvements in consumer water efficiency.

Fort Smith will use the communications infrastructure to offer smart city services in future.

Jamaica orders additional 450,000 static water meters

The National Water Commission has signed a contract with Diehl Metering Germany for the provision of 450,000 static water meters to accurately bill customers.

The deal follows a previous contract which included the supply of 60,000 HYDRUS ultrasonic smart water meters.

Diehl Metering claims its water meters withstand the extreme environmental conditions experienced in Jamaica, have no moving parts, have a longer life span than traditional analogue meters, and hence will reduce the utility's operational and maintenance expenses.

Stefan Raeder, Caribbean regional manager from Diehl Metering, said: "The technology also recognises existing leaks and thereby sustainably reduces wastage of this important resource."

The project is expected to help reduce non-revenue water losses, and improve the service and the customer experience.

CLARION ENERGY STRENGTHENS GLOBAL PRESENCE

Clarion Events – one of the world's leading event organisers – has announced the acquisition of the PennWell Corporation, in an exciting international deal which will have far-reaching effects in the global smart energy events and publishing space.

The acquisition brings together two of the industry's most well-respected names to create one of the largest events companies in the world and means that a number of the key Power and Energy events PennWell run will be integrated into Clarion Energy's *Power and Energy Series.*

It also marks the latest in a series of global acquisitions by Clarion, which includes its 2015 purchase of Urban Expositions, now rebranded as Clarion UX.

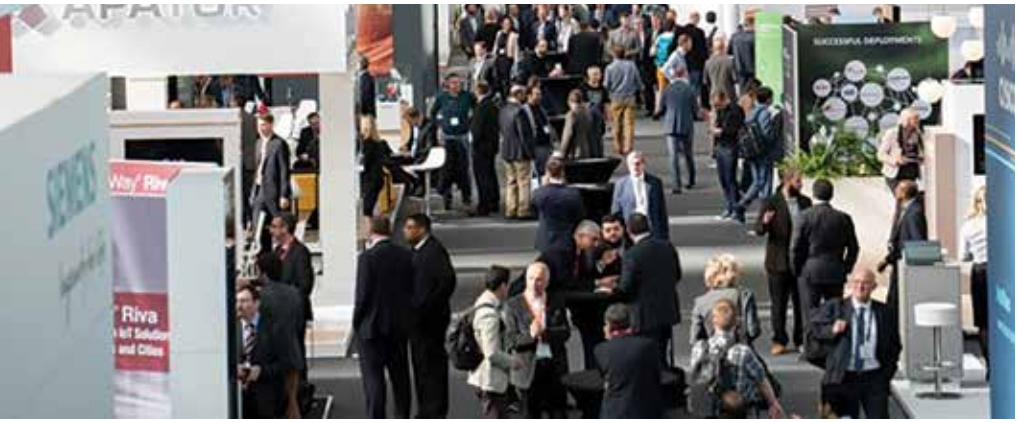
Metering & Smart Energy International is also part of the Clarion Group and the new partnership with PennWell is set to hugely boost the reach of this publication, both in terms of its audience but also the scope and richness of its content.

PennWell comes with a rich pedigree, producing both events and publications considered to be industry-leading, including those in the Power and Energy domains. They organise POWER-GEN International, DistribuTECH, Electrify/POWER-GEN Europe, HydroVision, ICCI, POWER-GEN Africa, POWER-GEN Asia and the Waterpower Week in Washington DC.

The integration of these events strengthens the Clarion Energy-produced *Power & Energy Series* which already comprises the 'Utility Week' events taking place across Africa, Asia, Australia and Europe. The portfolio is further complemented by Future Energy East Africa & Future Energy Nigeria completing the list.

Positive steps have already been taken following the acquisition, including developing the PennWell-produced Electrify Europe event. Clarion Energy has taken the decision to rebrand Electrify Europe to POWER-GEN Europe, in line with its international counterparts. As well as this, POWER-GEN Europe will be co-located alongside European Utility Week taking place in Paris, France in 2019.

Clarion Energy Managing Director Rick Wall said: "This is a very exciting proposition for Clarion Energy, our community and the industry as a whole. By co-locating Power-GEN and European Utility Week, we will be able to offer a truly end-to-end power event for the whole electricity value chain. The co-location will facilitate an unparalleled meeting place for the entire power & energy sector in Europe and one which will help to facilitate the acceleration of the clean energy transition."



In total Clarion Energy run over 40 events that cover the Oil, Gas, Power and Energy sectors, making it one of Clarion Events' largest portfolios. The portfolio covers power generation, transmission and distribution – through capital markets and investment to resource extraction and processing – in both mature and emerging geographies.

Global Head of Clarion Energy Duncan Reid said: "We are delighted to welcome PennWell, including their world leading energy events POWER-GEN and DistribuTECH to our *Power and Energy Series* from Clarion Energy. These events complement our existing offerings to create a World Leading Portfolio of Events."

With 550 employees, PennWell organises and manages more than 40 exhibitions and conferences around the world. The company also has 130 media properties and provides quality content and integrated marketing solutions for industries that include energy, fire and emergency services, dental and industrial technology.

PennWell President and CEO Mark Wilmoth said: "Clarion has market-leading brands that are complementary to PennWell's, and an enviable presence across Europe, Asia, Africa and the Middle East. Merging with Clarion will enhance our offerings to the worldwide customers of PennWell's diversified portfolio of events, including the POWER-GEN series, DistribuTECH for electricity distribution, and FDIC for the fire market, as well as media brands such as the Oil & Gas Journal."

Clarion is owned by funds managed by Blackstone, one of the world's leading investment firms. MI

NEXT GENERATION MODULAR GATEWAY AND SMART METER PLATFORM

While smart meters have been available since the 90s, an understanding of smart meters is largely determined by the development of smart grids, local history, resources, regulations, and the functional requirements for smart meters in different countries.

Undoubtedly, in Europe, the USA and even China, the application of smart meters has been quite successful. In Eastern Europe, power companies have effectively improved local power supply quality based on the power supply quality curve provided by smart energy meters; in China, AMR systems have enabled the State Grid Corporation to save on the high manpower cost of manual meter reading. However, in the promotion of smart meters, there are many cases of failure, especially in cases where the quality of the local power grid and the level of infrastructure construction to develop smart meters has been neglected.

> *The vast majority of smart meter communication networks currently in operation around the world are based on a combination of technologies.*

Communications is one of the key technology requirements of smart meters. Major communications technologies include RF, SFSK PLC, G3-PLC, Hi-PLC and 2G/3G/4G/, although none of these communications technologies can suit various global environments and demands individually. In fact, the vast majority of smart meter communication networks currently in operation around the world are based on a combination of technologies;

In Japan, 83% of Tokyo Electric Power's smart meters use 920M RF mesh to cover high-density areas, 16% use 3G/4G to cover mountain and rural areas and the remaining 1% use PLC technology to cover basement and high-rise users.

In China, among the smart meters of Zhejiang Electric Power Company, 68% use PLC technology to cover high-density areas, 25% use RS485 to cover high-rise buildings and 7% use RF to cover urban-rural combined areas.

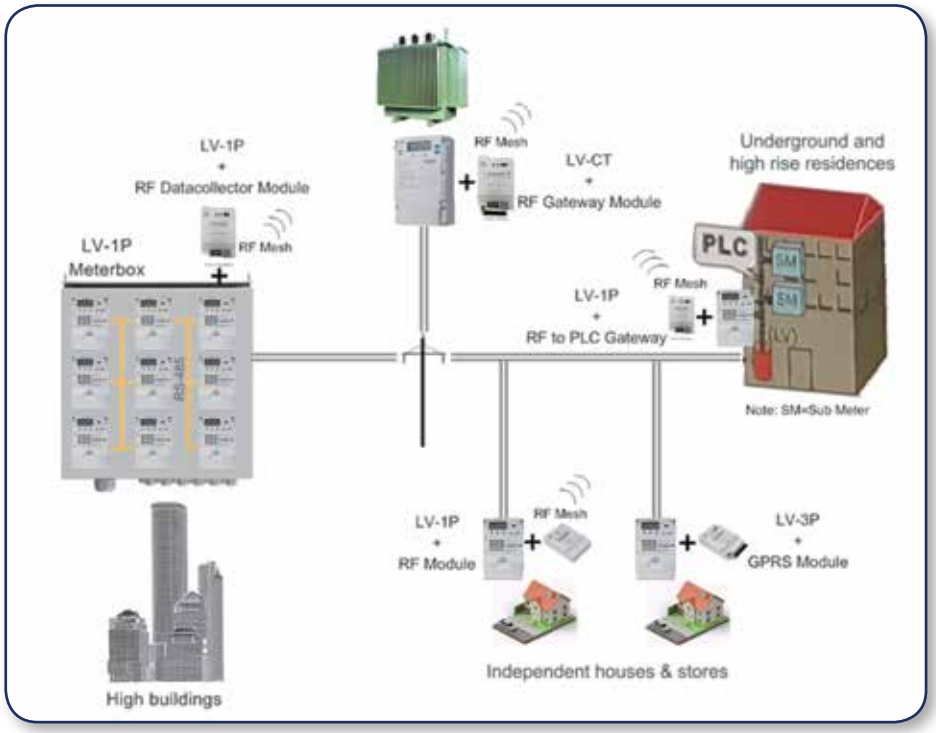
With the increasing demand for reliable power supply quality and real-time energy consumption monitoring by power users, real-time monitoring of power grids and efficient distribution by power companies is becoming more and more urgent. The trend of smart meters seems to be unstoppable.

TXGB embedded gateway modules

Based on the above background, Inhemeter's R&D team decided to explore "a modular gateway and smart meter platform based on open standards."

The design had to meet the following characteristics:

- Based on open standards to ensure compatibility and interoperability
- Openness, independence, long life and high reliability of metering equipment



Embedded gateway modules AMI Network B

> *A completely isolated electrical system.*

- Flexibly to adapt to current and future communication solutions
- Easy to install and easy to maintain
- Must minimise the complexity of low-pressure collection and copying systems, reduce installation and purchase costs.

The smart metering platform includes a CT meter, 3P-DC meter and 1P-DC meter, all based on the DLMS design. In addition to a highly reliable metering device, the meter itself also supports the standard replaceable embedded module interface. To ensure the independence of the metering equipment, the metering part of the meter is designed as a completely isolated electrical system.

The embedded gateway device adopts the latest large-scale integrated circuit technology and embeds all the components required for the gateway device in a space the same size as an ordinary power meter communication module. The embedded gateway device AMI network is an indication that:

- Smart meters based on the DLMS standard with electrical isolation of the communication interface ensure openness, independence, long life and high reliability of metering equipment.
- The gateway module not only replaces the traditional concentrator/collector, but also makes this AMI platform flexible, easy to install and maintain, and low cost. It is very easy to upgrade the communication technology. MI

G3-PLC data collector	RF data collector	G3-PLC to RF Gateway	RF to G3-PLC Gateway
Type: TGGB1-06 Uplink: G3-PLC Downlink:RS485 up to 32 meters	Type: TRGB1-06 Uplink: RF Mesh Downlink:RS485 up to 32 meters	Type: TGGB0-03 Uplink: G3-PLC Downlink:RF up to 32 meters	Type: TRGB0-03 Uplink: RF Mesh Downlink:G3-PLC up to 32 meters

ABOUT THE AUTHOR

He Zijin is senior R&D project manager with more than 10 years of experience in the smart meter industry. He has extensive experience in the development and management of various communication solutions, DLMS, M-bus and other standard communication protocols.

ABOUT THE COMPANY

SHENZHEN INHEMETER is an international high-tech company consisting of a team of professionals with years of experience in metering . The company's goals are to "Make Metering More Smart" and "Excellent Enterprise in Global Metering Industry".

SMART METER EVOLUTION TO MANAGED SERVICES

The term 'smart meter' has been fluid over time, with a somewhat different meaning in 2018 than in 1998, and potentially something else entirely in 2038. Today, a smart meter is a two-way communicating digital meter, found most prominently in the electricity sector.

Smart meters are also used by water and gas utilities, though adoption has been slower in those sectors. Smart meters are often described as the building blocks of the oft-mentioned 'smart grid,' and are integral to any discussion of smart grid infrastructure. It is important to understand not only the technological functionality of smart meters, but also the evolving framework by which utilities are procuring these systems and how the value of smart meters will be maximised in the coming decades.

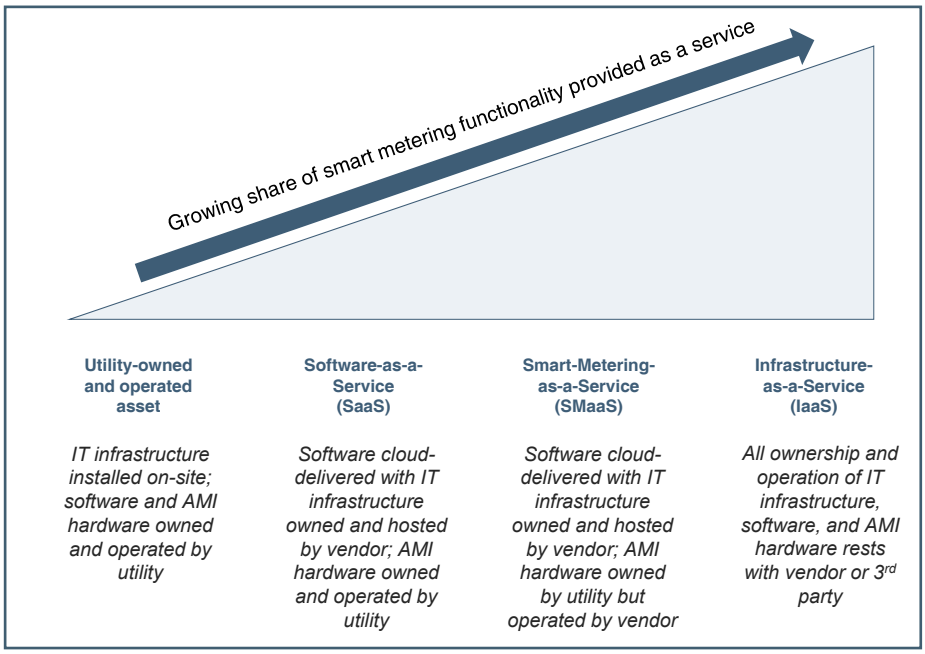
The basics of smart meters

The smart meter itself is part of a broader 'advanced metering infrastructure,' or 'AMI' (the terms AMI and smart meter are often used interchangeably). Internal to the smart meter are its components such as microcontrollers, disconnect switches and network interface cards. The other infrastructure includes components such as the communications network, a meter data management system, and other software and analytics. The smart meters themselves are only one piece of the smart grid puzzle, albeit a very important one. So, what is the role of meters in all of this? Their primary purpose has remained the same as any energy meter for the past century: to measure energy use. Even if their functionality was limited to this purpose alone, smart meters would still represent a significant improvement over their predecessors, as they provide more accurate readings, allowing for more accurate billing at lower costs. This results in a more efficient 'meter-to-cash' process at utilities.

Other benefits of smart meters with vast potential are the ones created by all of the new data. Older non-communicating legacy meters measure total energy consumption, and only do so at monthly or quarterly intervals. That's one data point per month or less. AMI meters are capable of measuring consumption, voltage, and other parameters in real-time. That's a lot of data from which many important patterns and insights can be gathered. Smart meters serve other basic functions too: they are watchdogs for electricity theft. They can also quickly launch notifications when there are power outages (the so called 'last gasp' function). They can allow utilities to implement dynamic pricing, time-of-use rates (TOU), and related demand response programs. Broadly speaking, they can improve the reliability of electricity service. But like any emergent technology, the rise of smart meters has been accompanied by challenges.

Challenges

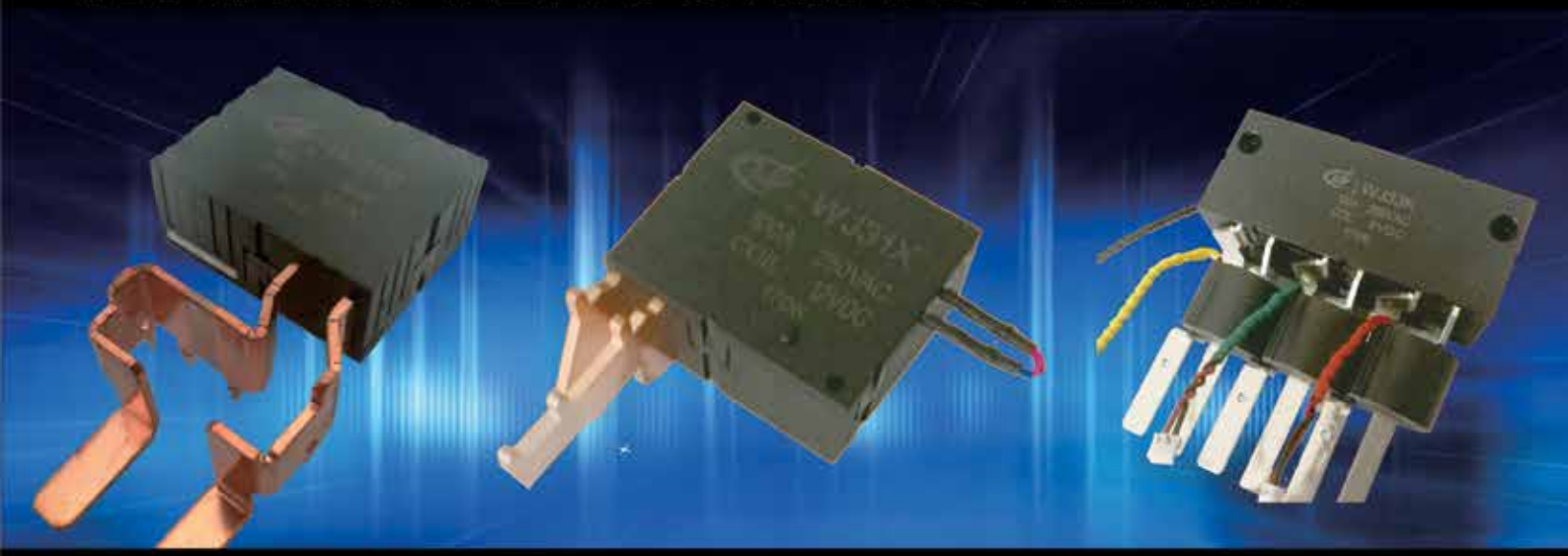
Unsurprisingly, smart meters are significantly more expensive than legacy meters, with an all-in cost that can rise above $200 per endpoint in developed countries. This is a significant investment for any utility, and for many can prove to be an unsurmountable obstacle to AMI deployment. Another concern is security, as is to be expected when the accumulation of personal data is at play. A cautious approach to data security has slowed the adoption of smart meters in some major markets, notably Germany. AMI deployments are also large and complex undertakings, often taking years to plan and carry out.



TXGB embedded gateway modules

THE STRENGTH OF

WANJIA LATCHING REALY



WJ31D

IEC 62055-31 UC2

WJ31X

IEC 62055-31 UC3

WJ33K

IEC 62055-31 UC3

Mingguang WANJIA is one of the biggest professional manufacturers for Latching Relay in china, which has over 30 years history focus on relay's R&D and manufacture, over 1200 employees.

Product covers single phase: from 40A to 120A,three phase: from 80A to 120A.

Annual output more than 20 million pieces.

Meets UC2 or UC3 standard of IEC62055. Obtain UL, VDE & TUV certificate for requirement of relay in smart meter industry.

Mingguang Wanjia Lianzhong Electronics CO.,Ltd.
Sales office: Room 611, Building 1, Burton Building,
No.2369,East Rongle Road, Songjiang District,
201613, Shanghai
Tel: +86-21-57864080
Fax: +86-21-57863535
Email: sales@china-wanjia.com
www.china-wanjia.com

SANYOU ®

> *...smart meters would still represent a significant improvement over their predecessors...*

Of course, the pre-eminent challenge remains cost, and the required investment must be justified by the expected returns. A key challenge for smart meters today is that the real-time data is not being fully leveraged for maximum benefits. As illustrated above, a utility that uses smart meters for its basic function will see some benefit, but there is immense potential left on the table. In the United States, for instance, only about 10% of utility customers with AMI meters are utilising dynamic rates. Beyond this, utilities must make further investments for complex data analysis in order to realise benefits from the original investment. Unfortunately, it costs money to save money, and many utilities are not in a position to spend after having just made a large investment in smart meters in the first place. A new trend known as 'managed services' is beginning to change this.

Managed services: Changing the game

Managed services represent the outsourcing of physical and operational aspects of a smart meter system to third parties, usually specialised smart grid vendors. At the most basic level, managed services can be software-as-a-service, in which software applications that support AMI are cloud-hosted on a subscription-basis, not unlike cloud software in any other enterprise. In more comprehensive service agreements, operational responsibility for the AMI system is also entrusted to a third-party in what is often called smart-metering-as-a-service. At the end of the spectrum, full managed services (often called Infrastructure-as-a-service) delivers the entire AMI system as a service, in which physical infrastructure is owned by third-parties and leased to the utility, while all IT needs are cloud-hosted rather than installed on-site.

Why would a utility opt for service-based smart metering? Because it addresses many of the AMI challenges described above. Entrusting data to a sophisticated third-party usually provides more security than can be accomplished by the utility alone where cybersecurity skillsets may be underdeveloped. Deployment time can be cut in half when IT infrastructure is hosted in the cloud, while in-house staff does not need to be trained to operate the complex new systems. Perhaps most importantly, managed services can help mitigate the significant upfront costs of smart metering systems. Service-based offerings convert costs from an upfront capital investment to a recurring operational expense. This opens the door for utilities that cannot make such a large initial investment. These utilities, usually smaller in size, do not have the benefit of economies of scale. In essence, they are borrowing economies of scale from vendors.

However, there is an inherent obstacle to this new opportunity: most utilities are still regulated under the traditional cost-of-service model in which SaaS and other service-based investments are still treated as O&M and not capital investments. There is a disincentive against those service-based products that remove the need to invest in sometimes inefficient and outdated capital equipment. To give managed services a fair chance, regulations must evolve. Regulators in some states such as New York and Illinois are taking the lead in this regard, and the lessons are sinking in slowly in other regulatory jurisdictions.

Managed services give a glimpse into where the industry is headed, how those utilities that have yet to deploy smart meters can do so, and how those that have completed smart meter deployments can extract greater value from them. It will also be an economic opportunity as the service-based model, which creates affordability and flexibility for customers, provides recurring revenue for vendors. Several major metering vendors are pivoting to a services-oriented business model in which smart meters are one feature of a larger, services-based package. These packages are often designed around promised results backed by Service Level Agreements (SLAs).

The arc of technological growth in smart meters is beginning to level out, and the major innovations are now taking place in models of smart meter use, delivery, and ownership. The emergence of managed services has opened the door to new potential customers and new possibilities for existing customers. Only a small share of smart meters are currently under these service contracts, but that figure is expected to increase over the next several years. Thanks to these innovative business models, the full value of smart meters – made possible by decades of technological advances – will be achieved on a wider scale. In addition to improving utility customer satisfaction, this will create significant gains in energy efficiency and reliability, which has been the essential promise of the smart grid all along. MI

ABOUT THE AUTHOR

Steve Chakerian, is a senior analyst at Northeast Group, LLC.

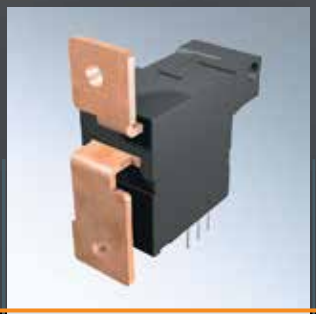
ABOUT THE COMPANY:

Northeast Group, LLC is a smart infrastructure market intelligence firm based in Washington, DC.

www.northeast-group.com

Want to be positively surprised?

736 3-phase 100 A



723 1-phase 120 A

741 2-phase 100 A

The metering market is full of surprises. For example, a counterfeit product that cannot match the genuine Gruner quality of the original. As the pioneer and technological leader in everything to do with latching relays, Gruner is helping to secure your investment. We prefer to attract your attention with innovative products for energy-management applications that set benchmarks in performance, reliability and functionality.

Innovation, not imitation.

GRUNER AG
Postfach 1149 · 78560 Wehingen · Germany
Phone +49 7426 948-0 · Fax +49 7426 948-200
www.gruner.de · info@gruner.de

GRUNER

Schalten und Bewegen

HARVESTING ICEBERGS: SOLUTIONS TO SOLVE WATER AND ENERGY CHALLENGES

Harvesting icebergs and learning from forests on how to run a city were offered as solutions to Cape Town's water woes during African Utility Week this year.

Nick Sloane delivering a keynote session at African Utility Week in Cape Town.

Salvage expert Nick Sloane addressed delegates during a keynote session where solutions from nature were explored to address increasing energy and water constraints.

His address followed director of water and sanitation in the City of Cape Town Peter Flower's presentation on the water crisis in the city. Flower told delegates the city still needs to reduce consumption to 450 million litres of water per day to keep Day Zero at bay. With the current usage at 500 million litres per day, the situation remains dire despite measures employed by the city to reduce consumption.

"It sounds like a crazy idea but if we break it down, it is not so crazy after all," Sloane started his address.

According to Captain Sloane the answer may just be in "mother nature's icebergs" – a total of 140,000 icebergs to be specific – drifting in the southern oceans and melting. Harvesting icebergs, he said, can help provide at least 20% of Cape Town's water needs.

He told attendees that icebergs break off in Antarctica and hold some of the purest quality water that is between 15,000 and 20,000 years old. "About 2,000 million tons of ice are breaking off every year," he said.

The idea is to use the current system to guide these icebergs towards the Cape. "So, they are coming our way, we just need to know how to deal with it."

Sloane said the iceberg can be captured in the area round Gough island and will ultimately have to be guided and moored about 40 km offshore from St Helena island to be harvested.

He said they will then have to "create a saucer to capture the melting water that can deliver up to 60 million litres per day". With milling this volume can increase to 150 million litres a day that is then pumped into tankers and ferried to land where it will be treated before it goes into the water system. "With four to six of these tankers, 150 million litres can be harvested per day for one year." According to Sloane this is something that can be viable. "Can it be achieved? Well we are looking into it."

Director of BiomimicrySA Claire Janisch also shared case studies on how nature's "wisdom can be copied" to help with the increasing pressure on and challenges with natural resources. "Solutions to our problems already exist in nature," she said. "We can improve our physical world by following nature's example.

Examples included emulating the humpback whale's attack manoeuvre in wind turbines to increase efficiency; and learning about desalination through the example of the mangrove trees that use sea water to survive.

Janisch told delegates humankind can learn from termites on how to design buildings with efficient energy use for air-conditioning. She referred to the Eastgate building in Harare that is built on the model of termite nests that mimic the self-cooling nature of these nests. MI

ARGENTINA IS MOVING FORWARD IN THE USE OF RENEWABLE ENERGIES AND THE DEVELOPMENT OF SMART GRIDS

As more renewable energy is fed into the Argentinian grid, the impetus to implement smart grid technology is increasing. Yet, coordination on a national scale remains a challenge, along with a lack of incentives from government to encourage implementation.

In recent years, Argentina has begun to modify its energy matrix, giving an important boost to renewable energy sources. The starting scenario is an interconnected electricity system in which, approximately, 30% of generation comes from large hydroelectric power plants, 62% comes from thermal power plants and 4.5% comes from nuclear power plants, where less than 2% comes from wind and photovoltaic systems.

Although the first experiences with wind energy in Argentina date back to the 1990s, it was only from 2010 that the construction of large wind farms began. The accelerating element of the present transformation process was the approval, in 2015, of Law 27191, "National Development Regime for the Use of Renewable Energy Sources for the Production of Electrical Energy". This law establishes that all grid users consuming more than 300kW must incorporate a minimum of 8% of their own total electricity consumption with energy from renewable sources by 31 December 2017, reaching a step-by-step increase of 20% by 31 December 2025.

Based on this legal framework, the Ministry of Energy and Mining instructed the Electricity Wholesale Market Management Company, CAMMESA, to issue a national and international open call for proposals, called "*Programa RenovAr Ronda 1*", for the qualification and eventual awarding of bids for contracts for the supply of electricity generated from renewable sources, with the aim of

increasing the participation of renewable energy sources in the country's energy matrix, in accordance with the provisions of Law No. 27191. This first call, made in the second half of 2016, was successful, and resulted in two additional calls, called *RenovAr Ronda 1.5* and *RenovAr Ronda 2*.

Current status of the projects awarded in the programme RenovAr:

- RenovAr Ronda 1: 29 projects were awarded, totalling 1143MW of power. Of these, 12 projects were wind generation systems (708MW), 4 photovoltaic solar (400MW), 6 biogas (9MW), 2 biomass (15MW) and 5 small hydroelectric projects (11MW). To date, there are still pending 7 wind generation projects, for 334MW, and one solar project, for 100MW, which have not yet started to be built due to economic and administrative reasons.
- RenovAr Ronda 1.5: 30 projects were awarded, totalling 1281MW of power. In the case of wind energy, 20 projects were awarded with an average price of 53.34 USD/MWh, reaching a power of 765.4MW. In photovoltaic solar energy, 20 projects were selected at an average price of $54.94 per MWh, totalling 516.2MW of power. In this case no contracts were awarded for other types of renewable energy sources. Of the total of 30 projects, there are still 20 that have not begun construction, which involve 5 wind power generation projects for 436MW, and 15 solar power projects for 396MW.
- RenovAr Ronda 2: in this case the projects still have time until May 2018 to sign their respective contracts with CAMMESA. A total of 1400MW of generation based on renewable sources, mainly wind and photovoltaic solar, were awarded, but the definitive number will be known in the second half of 2018, at the start of the construction of the power plants.

From renewable energies to smart grids

The advances in the energy sector that have been taking place since 2015 will bring about a substantial change in the country's energy matrix. However, this change involves many challenges, including the need to build new transmission lines, or expand their transportation capacity, and the modernisation of the entire electrical system's monitoring and control support. Moreover, the incorporation of renewable energy-based generation, in addition to the future regulation of distributed generation systems at the household level, makes it imperative to move forward on a much broader issue: smart grids.

The road to smart grids in Argentina has begun to move very slowly, without strong support from the national government. To date, there are about a dozen small pilot projects being developed in medium-size towns in the interior of the country. In general, excepting some particular pilot projects (eg the towns of Armstrong, Salta and Centenario), the smart metering projects have been deployed by small or medium-size electric cooperatives, without explicit official support. In almost all these cases the cooperatives have an important number of rural and semi-urban users, and this is one of the main reasons that justify the installation of the smart meters.

One of the aspects highlighted by the cooperatives starting to install smart metering systems is the reduction of meter reading costs and the control of connection/disconnection of network users remotely, without having to send a crew of operators to the site. In some cases, reductions of up to 800km have been observed in the monthly travel of the staff assigned to meter reading. Other interesting questions arising from the use of smart meters is the possibility of using prepaid systems. Experiences conducted so far, although not statistically significant, show interesting behaviour in the use and conservation of energy. For example, average recharge periods of almost a week have been observed, with minimums of two days. This reflects a microeconomic behaviour in which energy use, at household level, is managed almost on a daily basis.

As previously mentioned, most of the smart metering/smart grids projects are uncoordinated with each other, and there is no overall impulse or incentive programme from the Ministry of Energy and Mining or the government itself. However, the analysis of some of these specific cases shows that the implementation of smart metering systems is an accelerating process, and that a critical mass is gradually being reached which may lead to the launch of massive installation plans.

With regard to the monitoring and control of transmission/distribution systems, which is another part of a real smart grid, it is important to note that CAMMESA is making progress in the implementation of Phasor Measurement Units (PMUs). In the course of 2017, 36 PMUs were purchased to be located in different locations in the interconnected electricity system that covers 90% of the country. It is expected that over the next few years, progress will be made towards covering all the points of interest in the national grid, in order to configure a wide area monitoring, protection and control (WAMPAC) system for the entire grid.

> *There is no overall impulse or incentive programme from the Ministry of Energy and Mining or the government itself.*

The immediate future

Gradually, the conditions are becoming clearer in Argentina for the use of renewable energy sources and smart grids to be a daily reality. The launch of the RenovAr programmes, together with the approval of the law on distributed generation at the household level (still pending to be regulated) and the installation of smart metering systems, through pilot projects and medium-scale installations, are a promising scenario, although not without difficulties. The massive deployment of smart meters, and the insertion of distributed generation systems will not be fast unless the government generates incentives to speed up the process, or the socioeconomic context evolves in such a way that large distribution companies invest in the massive replacement of electricity meters, reaching the service users in the country's largest cities (which, in turn, show the greatest demographic growth). MI

ABOUT THE AUTHOR

Patricio G. Donato is currently working as Independent Researcher at the *Consejo Nacional de Investigaciones Científicas y Técnicas* (CONICET) and Adjunct Professor of the Universidad Nacional de Mar del Plata (UNMdP), Argentina. He received a degree in electronic engineering from the Universidad Nacional de la Patagonia San Juan Bosco (UNPSJB), Argentina, and a Ph.D. in electronics from the Universidad de Alcalá (UAH), Spain.

He leads a line of research on Smart Grids within CONICET and UNMDP, focusing primarily on issues related to the measurement and evaluation of power quality problems and also signal processing applied to the detection of signals in noisy environments, such as powerline communications (PLC). He has directed several doctoral theses and published scientific articles, in addition to lecturing courses and conferences on the matter. He is currently focusing his attention on studying the evolution and impact of smart grid on the Argentine electricity system.

THE GROWTH OF THE EV MARKET IN THE US AND EUROPE

Metering & Smart Energy International spoke with Preston Roper, chief operating and marketing officer for eMotorWerks, a division of Italian utility ENEL, to understand the future of electric vehicles in the US and Europe.

Roper predicts that 2018 will continue to see more EV models and continued sales growth. The sheer number of automakers that have announced new electric-vehicle models or electric versions of their existing models indicates the industry is embracing the electrification transformation. Expect to see more Tesla Model 3s, and new longer-range models from Nissan, Jaguar, Honda, Audi, Kia, BYD, Hyundai and more.

He believes we will see more utility programmes to support EV adoption.

According to the Rocky Mountain Institute, having 2.9 million EVs on the road by 2022 could add over 11,000 gigawatt-hours of electricity demand to the world's grids. Utilities are under pressure to meet this demand without building new fossil fuel generation plants. As utilities often work on 25-year planning horizons, forward-thinking power suppliers will likely get into the deployment of charging infrastructure.

Deployments and customer rebates from energy providers in the US and Europe for smart-grid charging systems will allow them to remotely manage and aggregate the charging loads of EVs over time, limit the need for additional fossil fuel plants and optimise renewable energy when it is abundant on the grid.

Roper predicts that more utilities will leverage EVs as grid assets. Thousands of EVs charging at the same time hold the potential to either cripple the reliability of local utility grids or prove to be a windfall in electricity sales. It all depends on the willingness of these organisations to embrace new technologies that allow them to aggregate charging load over the course of a day, while still making sure cars are charged up when their drivers need them. As noted above, these solutions can provide a variety of services beyond grid balancing, such as optimising charging loads for times of the day when demand is low, renewables are abundant, or prices are at their lowest.

Additionally, some software can also allow drivers or charging equipment providers to be rewarded for allowing their systems to act as virtual power plants and bid into demand response programmes. Forward thinking utilities are expected to roll out this smart-grid charging technology in 2018 and leverage it to avoid unnecessary grid infrastructure upgrades to meet EV charging demand,

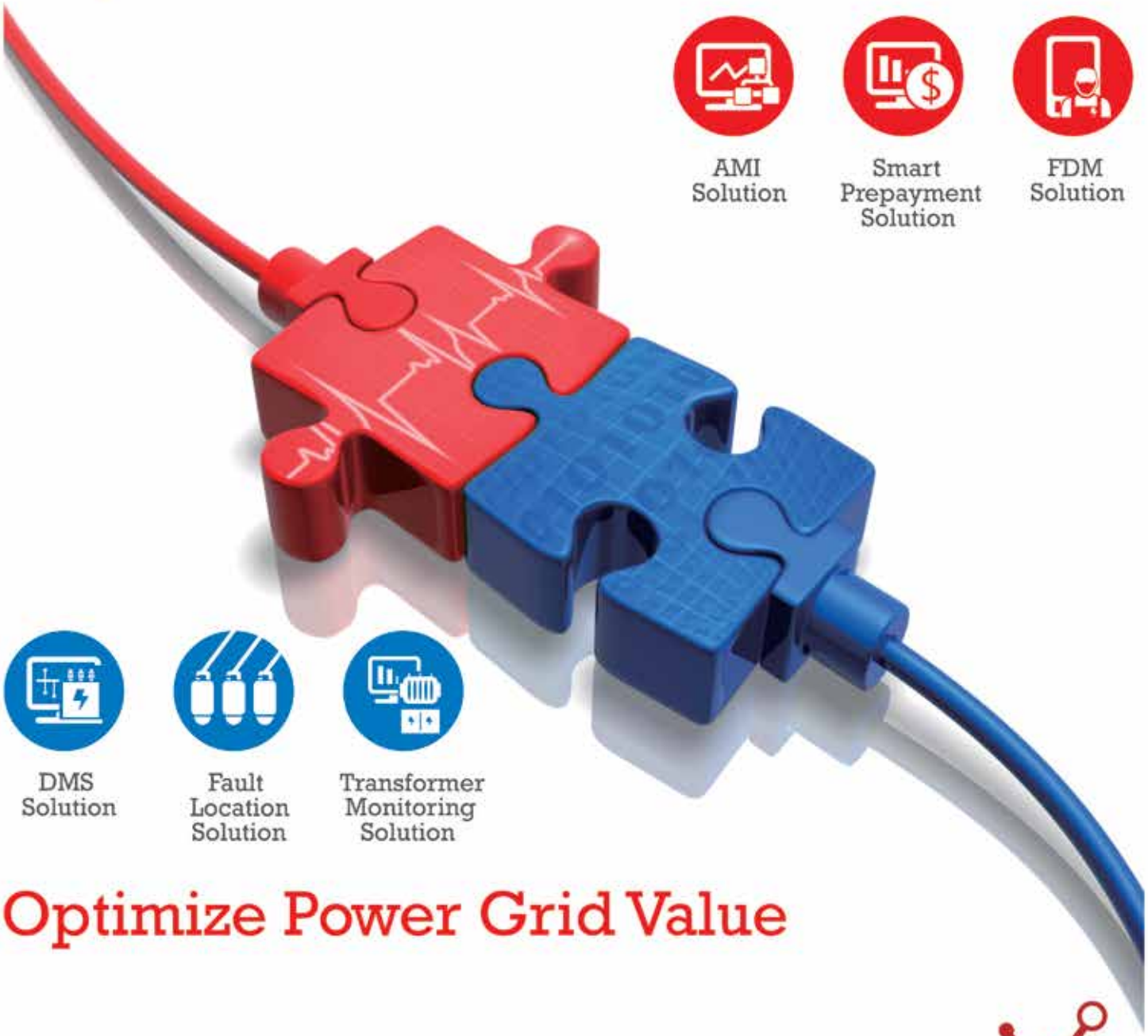
> *Several countries have set targets to ban ICE (internal combustion engine) vehicles*

SanPlat™

www.sanxingelectric.com

SANXING

Distribution and Utilization Integrated Solution



AMI Solution

Smart Prepayment Solution

FDM Solution

DMS Solution

Fault Location Solution

Transformer Monitoring Solution

Optimize Power Grid Value

NINGBO SANXING MEDICAL & ELECTRIC CO.,LTD

Tel: +86-574-88072211
Fax: +86-574-88220583
E-mail: info@overseas.sanxing.com
Add: No.17 Fenglin Road, Jiangbei, Ningbo, China, 315031

FUTURE ENERGY EAST AFRICA

12-13 Sep
Nairobi, Kenya

Booth 505

reduce their dependence on peaking plants, and enable vehicle-to-grid integration.

As most innovations go, the electrification of consumer cars is going to unsettle existing business models built around internal combustion engine (ICE) vehicles, and it is anticipated there will be a shift in service and dealership business models. With fewer parts and lower maintenance requirements, EVs are expected to reduce demand for part supplies and mechanics. "We can even expect dealerships, which bank on service as a recurring revenue generator, to begin to make adjustments to their business models in the face of the pending EV boom," says Roper.

Several countries have set targets to ban ICE (internal combustion engine) vehicles in favour of electric ones – including Norway by 2025, India and China by 2030, and the UK and France by 2040. California is also contemplating something similar as a way to meet its greenhouse gas emissions goals. Democratic Assembly member Phil Ting recently proposed a bill that would require all new passenger vehicles sold in the state to be battery-electric or hydrogen fuel cell cars. Considering that nine other states have announced their intention to follow California's lead on vehicle emission regulations, such an announcement could have sweeping implications for the United States automobile industry. In 2018 and beyond, expect these bold goals to be backed up with implementation plans – and Roper warns we should keep an eye on California.

As a part of the $14.7 billion settlement reached by Volkswagen and the United States government, Volkswagen plans to infuse $2 billion into the nation's zero-emission vehicle infrastructure over the next 10 years. In total, 44 states from Ohio to Texas, North Carolina to California are currently contemplating how to use the Volkswagen "Dieselgate" windfall to reduce emissions in their communities. Comments Roper: "It is expected we will see announcements in 2018 on their plans. Also, expect to see California firm up how it will spend its $800 million portion for the 2,000 to 3,000 non-proprietary chargers Volkswagen plans to install across over 400 individual stations in the state."

The Enel company is focused on serving the US, Canadian and European markets such as Germany France, the UK, Italy, and Spain.

China, of course, is still very much the country leading the EV charge. Not only do they have incentive programmes that are consistently being updated, but their electric fleets of buses and trucks are also steadily being used in major cities and supported by government-purchased or supported charging infrastructure.

"Alongside China, you have Norway and Sweden who are seeing year-on-year EV growth as well as electrifying city fleets much like China. Lastly, there is an increase in market share from the US. More US manufacturers are releasing EV models, and the Tesla Semi has also been a buzzed about item, despite not yet being released, but if the US leads the charge on the semi-front, it could be huge for US dominance of e-trucking."

> *It all depends on the willingness of these organisations to embrace new technologies that allow them to aggregate charging load*

Challenges facing the market

The current challenge isn't necessarily growth related. With 2.9 million EVs expected on the road by 2022 this increase could add over 11,000 gigawatt-hours of electricity demand to the world's grids and this is a significant consideration. There is growth in EV adoption; however, this needs to be supported by growth in technology that shifts load and lessens the future burden of grid demand. Installation and permitting costs are expensive, so local subsidies and streamlining of installation codes will assist in reducing the expense of installations. Dealers still, however, in many cases are not all well versed on their EV fleet options and don't have enough qualified salespeople on staff.

Factors driving the uptake of EVs

State Federal incentives are of course key in encouraging people to go electric. Additionally, word is spreading from EV drivers to ICE drivers about how much better the driving experience is for EVs, the lower costs for fuel and maintenance, and how range anxiety isn't as scary as they thought, since most drivers actually cover only 30-40 miles per day on average. We're also seeing more manufacturers releasing EV models, with some even vowing to eventually go all-electric, which continues to give consumers confidence in the space.

EV in emerging markets

In September of last year, Intersolar was held in Dubai and focused heavily on the regional leadership that Dubai is showing when it comes to EV adoption throughout the UAE. Dubai has a goal of 15% carbon reduction by 2020 and EVs are a large part of that goal.

Another large opportunity that comes to mind for Latin America, Africa and the Middle East is solar. There's obviously a lot of sun in desert and rural regions, alongside countries below the equator. These renewables can be integrated for EV charging which can alleviate grid demand.

What does the future hold?

"After the Enel Group purchased eMotorWerks in late 2017 we have started joint expansion into the EU and will soon follow into other geos already broadly covered by Enel, such as southern Europe and South America," according to Roper. The company has around 60 million customers worldwide, and many of them will purchase EVs and require EV charging infrastructure, as well as smart-grid control of charging – assisting both the driver via lower costs and rewards and their respective utility by minimising energy procurement costs and grid infrastructure upgrade requirements, while also integrating more renewables into the overall energy mix. MI

All eMotorWerks' smart charging features and grid services regulate when and how much EVs charge and shifts their charging to times of the day when renewables are abundant or when demand is lower. This means utilities can maximise generated load on the grid, optimise the mix of renewables, offset needs from conventional power sources, as well as avoid load disruption.

Sonoma Clean Power utilises eMotorWerks EVSE for data collection and in order that their scheduling coordinator can analyse usage and model to broadly participate in retail and wholesale markets and to integrate more renewables into their service territory (by timing charging to when those resources are most broadly available). The charging stations charge vehicles when energy is at its cleanest and offers smartphone controls alongside a reward programme to encourage drivers to participate in demand management programmes.

Premset MV switchgear

Because a reliable network depends on safe, flexible, and maintenance-free switchgear

Switchgear designed for enhanced peace of mind. Because business relies on the availability of electricity, buildings need their medium voltage distribution systems not only to be reliable, but also to be energy efficient, durable, and able to adapt to changing business needs. But the operators of these systems require more. Peace of mind is paramount, and can only be achieved with low-maintenance switchgear that helps ensure the safety of both people and assets. Switchgear that enables monitoring and lowers the total cost of ownership is critical.

www.schneider-electric.co.za

Life Is On | Schneider Electric

FOR TOO LONG, WE HAVE BEEN IN THE BUSINESS OF 'NO'

"Cybersecurity is not given the level of importance within utilities as it should be, because it slows things down and gets in the way of progress and innovation. In addition, it's hard and it's expensive. If you have something that is difficult, costs a lot of money and slows down progress, innovation and business, this is a real barrier to business operation."

This is the beginning of my conversation with Patrick Miller, a cybersecurity expert and keynote speaker at the recent SAP International Utilities conference in Lisbon. Miller, who describes the security sector as the least sexy in the utility business, is talking about why utilities and businesses generally don't prioritise security.

He believes that security is not seen as a business imperative – yet – because we are changing from a traditional analogue physical world to a digital world; and we haven't yet quite come to terms with our own constructions of business obstacles.

Miller continues: "We have a lot of responsibility from a security discipline to change that perspective. We have been the business unit of 'no' for so long, and we are so busy trying to secure things, that we are not trying to make it secure in a way that doesn't impact the user or slow the business down. This requires a unique and different way of looking at security and not a lot of people are ready or willing to think about it that way. They just want to say no, that you have to slow down and that you have to go through numerous security checks before a project can be brought to

the table – and the way we are currently doing it means security is getting in the way of business progress."

We are sitting in the exhibition area of the conference shortly after Miller's keynote address. In the keynote, Miller brought some thoughts to the table about security; including that security is not seen as an enabler to transformation and, importantly, that compliant does not mean secure and robust.

A lot of the challenge, Miller believes, can be addressed by properly framing the business implications of the lack of security – particularly in the boardroom – instead of moving straight to doom, gloom and possible digital Armageddon. Saying that a project needs to be delayed by a few days due to risk and exposure if the project goes live as it is, conveys the message that changes need to be made, but in a different, easier to accept, way.

Too often, Miller tells me, security systems seem to need to be engineered from scratch, adding to the time to operation and increasing. This, he says, is simply not true. By segmenting operational siloes, similar functions are grouped together, minimising the impact of a breach across the entire organisation. But silos can be configured in very similar ways, making replication easy and cutting down on the need to 'reinvent the wheel' each time a system is architected.

I wondered if this doesn't open a company up to increased risk of being easily hacked due to repeatability. Miller says not. He says homogeneity is always a concern – in the physical world as well as in the digital world. Yet, heterogeneity is only good when it is balanced. By having just enough differential between plant will result in a model that looks the same, but the actual implementation of the end point technologies will be different, albeit based on a common blueprint. The difference between innovations in each iteration of a plant will ensure sufficient variances, but the basic concept will remain the same. "It's similar to saying we are going to build cars with headlights, steering wheels and blinkers or indicators, but each one you get into will be sufficiently different that you will need to check where the radio on button is, or where the high-

> *"We have a lot of responsibility from a security discipline to change that perspective. We have been the business unit of 'no' for so long... that we are not trying to make it secure in a way that doesn't impact the user or slow the business down.*

beam switch for your lights is. This will happen naturally, so even by designing a standardised system, it will always have sufficient technological differentiation. This system will reduce your overheads and time to operation and gives you the business advantage of volume purchases for software licences. Even if you do buy everything from one vendor, from one year to the next, the workstations, components and interfaces will evolve. However, in the architectural diagram, workstations go 'here', servers go 'here' and how they communicate is a similar model."

Supply chain vetting is another subject worth touching on. Miller spoke in his keynote about the need to get rid of the 'snowflakes' as he calls once-off, bespoke programmes which are hard to maintain, reliant on one out-dated operating system, are unsupported and rely on that one operator in the most remote plant who knows how it works. By standardising software and suppliers, he believes you have access to more effective software engineering, but also to constantly improving supply chain vetting. In point of fact, Miller points out, many manufacturers are making their own cables or components in an effort to secure the supply chain, adding to the degree of assurance you get from the product you buy. Depending on the vendor, you can therefore get a fair amount of supply chain security.

The standards that apply to this include IEC 66243. There are some from NIST and some international standards as well, which are designed to give you the tools to ask the right questions of your vendors. You may get answers you don't like, but at least you know the lie of the land, what the risks are and how you can insert mitigating controls, instead of wondering where all the problems are. Over time this will improve; and each time you ask your vendor the security questions, they will be better prepared and soon enough provide you products that state what the controls and security considerations are. This will likely end up becoming a differentiator for ICS system providers.

Where does regulation come into play?

Regulation takes time, says Miller. It should take time. Fast regulation is generally bad regulation. Yet the challenge with regulation and technology is that technology moves very fast – faster than any legislative body can move.

"There are some that are very good at it compared to others and there are some who write legislation to certain types of technology, yet when the legislation is done and voted in, the technology has already changed.

"Yet, trying to write legislation that is technology future proof is exceedingly difficult and ends up being very vague, is hard to implement, hard to interpret and leaves lots of room for variation in how you read it.

"The challenge is how do you write it to be specific enough so everyone understands what it means and are implementing it in similar ways; and where it is futureproof enough for you to have a chance to write the new legislation before all the technology has changed under your feet?"

Legislators write laws based on common practice, yet security regulation doesn't conform to a norm, because security includes malice and malice has no place in the norm; Nor can you predict how much time or resource will be directed against your company in the event of an attack.

The best regulation is regulation that clearly establishes: "This is the low bar. This is the minimum requirement that you need to meet. Our expectation is that you are going to do more than this, but this is the minimum."

"Yet this is clearly not communication. So what we should see as the floor we see as the ceiling; and it creates an artificial norm where the legislation is as far as people go and they stop."

Often businesses will take the approach that if something is not necessary in order to be compliant they won't do it, despite the risk they may be exposing themselves to.

The NERC CIP regulation is compulsory and comes with penalties and sanctions of up to $1.3 million per day per violation – maximum fine – although no one has been penalised to that extent thus far. There was recently a $2.72 million fine issued for information leakage related to the NERC CIP standard, Miller says.

"The challenge is we have multiple agencies in charge of regulation. The electric sector generally, however, is probably the most experienced when it comes to regulations and even it is struggling when it comes to issuing penalties and sanctions as there are multiple implications when it comes to issuing fines and the potential impact on a business."

If you think you are not a target...

Utilities are definitely targets for cyber criminals, Miller says. "There haven't been a lot of published attacks on utilities," he continues, with emphasis on the word 'published'. In the industrial security

> *There was recently a $2.72 million fine issued for information leakage related to the NERC CIP standard.*

Great-relay

CNGRT

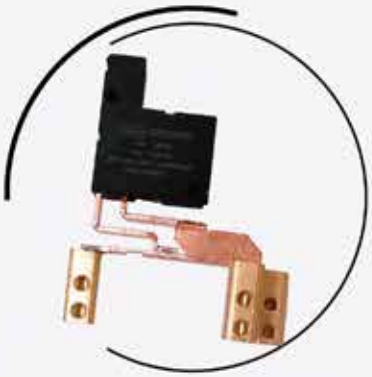
GRT508Y–50A

GRT508EC–16A

GRT508F–120A

GRT508FH–100A

GRT508HA–100A



GRT508H–100A

GRT508M–120A

GRT508B–90A

As a science and technology manufacturer specialized in latching relay, shunt resistors and current transformer. We focus on the quality of the products and brand building,enables each product to become the hard advertisement. We have good cooperation for many years with foreign customers.Our products are sold throughout the country and Southeast Asia and Europe,more than 10 countries and regions.We have complete industry chain and are becoming increasingly international high–end markets.

Zhejiang Great Electrical Co.,Ltd

RoHS

No.38 South Taoyuan Road, Yaozhuang Town,Jiashan County, Jiaxing City, Zhejiang Province, China

Tel:+86–573–84776266 FAX:+86–573–84776699

E–mail:sales9@great–relay.com Web:www.great–relay.com

space, no one talks about any of the security incidents.

There is virtually zero actuarial data upon which to base risk decisions, with the result that utilities don't know where to focus their time, money or resources because there isn't enough data available. "We are just guessing where we need to focus," Miller says, continuing that the lack of published incidents creates a false sense of security as the tendency is to think if no one is reporting it, it must not be happening.

"If you were hit, would you talk about it?" he asks.

Reputational risk aside, Millers says the unintended consequence of regulation is that if an incident has occurred, even if it was completely outside of the regulatory space, from a perception perspective you are assumed guilty until you can prove your innocence. The amount of effort that goes into doing that is enormous. Hence, no one talks.

There have been situations where test systems have been breached and then incorrectly reported by the media, creating all sorts of challenges. While it is true that a system may have been breached, because it is a test system, it is not subject to the same level of security as operational systems. The impact on the operations of the business is therefore zero. However, the consequences for the business can be serious. Even if nothing was stolen and only a test system was affected. In terms of the system impact – zero impact. In terms of the PR impact – HUGE.

What about within utility associations and organisations? Are discussions taking place among utilities? Miller has argued that legislation should take 'data breach' and 'data compromise' into account, allowing a critical infrastructure organisation, if compromised, to report the breach and be given 'safe harbour' from any potential fines or penalties, because it is providing a ton of actuarial data.

"We now know what the threat actor did, how they operated, what they exploited, what they went after, and we can now share that information with others as a use case. In a lot of cases what you see is that no one talks because of the obvious issues. If they have an incentive to talk, they probably will.

Being hacked, ironically, allows companies an opportunity to show how they successfully managed a breach. Miller is of the opinion that it is not a case of 'if' but 'when' a breach will occur, and the response to the breach is what will set successful companies apart from others.

> *"If you can show how quickly you contained it, and how quickly and successfully it was handled, this will set you apart and history has shown, will likely positively impact on your stock price too"*

"If you can show how quickly you contained it, and how quickly and successfully it was handled, this will set you apart and history has shown, will likely positively impact on your stock price too," explains. Intentionally covering it up is going to negatively impact business but if you have a team that is well trained to manage breaches and contain the damage, it should be a situation that is manageable. Despite all the protections you have in place, a hacker is still likely to get through, but you can then show that the breach or attempted breach has allowed you to shore up your defences, preparing you for the next time an attempt is made.

Just not enough people

There is a severe cybersecurity workforce issue right now. Miller believes it is because utilities are not seen as being an exciting space compared to technology companies such as Google or Apple, especially if you are a millennial who is very talented. "Utilities are known for long term job security, but they are not known for high salaries and the new talent pool has an expectation of being in the same company for between two and five years before they more on. They have a transient mindset when it comes to employment. What we are offering them is nowhere near that which they are interested in."

What does the landscape look like?

The reason we haven't seen more public or visible issues is because taking down a power grid, or blowing up an oil refinery is considered a nation state level response. NATO has stated that infrastructure based cyber attacks can and may warrant a physical response to that attack. That is a severe situation.

But what if you can't determine who the attacker is? False flags are used often whereby an attacker will make it look like another country/person is responsible. Yet, "once you get past all the posturing, hackers have a fingerprint and it is difficult to exactly replicate the way someone writes a programme or an exploit and links code together so there are ways we can get to a level of assurance and attribution. We could be about 90% sure that a specific nation or state may be responsible. The residual is handled with the intelligence community, so if you can correlate a high degree of certainty from a digital fingerprint, along with intelligence and corroboration from other allies, you can get to a high degree of assurance. It's not quick and it takes time, but it's not impossible."

Yet, surely if more companies were encouraged to share breach attempts, it would be possible to build up a comprehensive database of coding styles and fingerprints? Miller agrees. Code databases make it possible to compare samples via artificial intelligence and identify patterns that humans may not even be able to pick out.

"Sadly, there's not much sharing happening, and we need to get over that."

Miller believes the most effective ways to share information are through multiple rings of trusted individuals, each sharing information with their individual circles. It's a more social, less institutional, formalised form of sharing, but it is highly effective. "These rings of trust create a network of sharing," he says. It is important to utilise expertise from other professionals who work within the same field but in order to do that, utilities should encourage and allow security professionals to engage and network with other professionals.

"Form relationships with other professionals in your field," Miller recommends. "Spend time networking because at the end of the day, it will take a human to stop another human. There is no machine that can stop a determined human adversary." MI

BLOCKCHAIN

SPECIAL REPORT

Published by

METERING & SMART ENERGY INTERNATIONAL

WHY BLOCKCHAIN IS SO OFTEN MISUNDERSTOOD

In an exclusive interview, Jo-Jo Hubbard, co-founder and chief operating officer of UK blockchain platform company Electron, explains why the technology is often misunderstood.

"The reason a lot of people don't understand blockchain comes from the fact that it is usually explained as a particular blockchain."

She says: "People are making claims like, 'blockchain is transparent, blockchain is opaque; blockchain is secure, blockchain is not secure; blockchain is fast, blockchain is slow' – and they all might be true for 'a blockchain', but they aren't really true of blockchain in the abstract.

> *"blockchain allows them to do it without the central intermediary – which can improve the cost efficiency function and also the trust function."*

"Blockchain in the abstract is a technology. Essentially, it's a protocol, a set of rules, which is enforced across participants in a network. And when all those participants adhere to those rules, they are able to essentially update the status of the network and maintain that network together.

"So, in the energy space, blockchain is very exciting in terms of being this co-ordination mechanism."

She says in an increasingly decentralised energy world, "we need a new co-ordination mechanism that is capable of enforcing a set of rules across all those different assets. A mechanism that gives them the ability to access a market in a rules-based, auditable fashion. And that's why I think the energy industry is getting very excited about this technology."

Blockchain in itself is not a business model: rather "it's a technology that enables much more granular business models and much more asset participation in the energy industry.

"What's almost been misleading about recent waves of press coverage, is blockchain does not necessarily enable new business models. Business models like peer-to-peer or vehicle-to-grid are possible with a central intermediary: blockchain allows them to do it without the central intermediary – which can improve the cost efficiency function and also the trust function."

Hubbard highlights decentralised energy as one aspect of the energy industry that is "particularly ripe for co-ordination. Co-ordination across potentially competing, potentially non-competitive parties. And that's Electron's core focus – the flexibility markets.

"There's a really exciting component of the flexibility trade that doesn't really exist on any other exchange product today.

"Our application is an enterprise application that is solving a problem that a lot of asset owners or flexibility providers or aggregators want solved and participants on the other side who are buying this flexibility haven't been allowed to solve themselves."

"Co-ordination is key to realising the full value of digitalisation. There are three core platforms that need to be co-ordinated

> *Decarbonisation, decentralisation, digitalisation and democratisation are four factors driving change in the sector.*

and shared. It's the asset register: what is it; where is it; there's the trading platform and the rules around how you are allowed to interact; and then there's the data repository.

"Everything else – all the other competitive business models – can be built on top of that structure, but that infrastructure needs to exist first."

Hubbard says the key to developing the blockchain platform is "about building something that's future-proof. We know we need to build an infrastructure that enables greater asset participation in the system. Because that creates more competition, it increases the efficiency of the system, and it also increases the resiliency of the system."

Transformation drives inclusion, efficiency

The energy system transformation has been well covered in a myriad of newspapers, articles and conferences. Hubbard believes that the transformation of the industry isn't just affecting the physical assets of the system, but the digital architecture as well. She says: "We will need to transition to a more inclusive and extensible digital infrastructure, capable of far deeper levels of asset inclusion," and argues that in order to fully realise the potential and benefits of all these new engaged assets the system needs to be open, fair, low cost and "highly extensible*."

This is where blockchain, as a decentralised technology, will show huge potential. Particularly, blockchain offers the opportunity to integrate vertical and horizontal elements of the energy market – "bringing efficiency, innovation and co-ordination together. That way, everyone is speaking the same language, everyone has access to the market and you can still get the benefits of innovation and competitive effects."

Decarbonisation, decentralisation, digitalisation and democratisation are four factors driving change in the sector and blockchain enables the full engagement of multiple assets, allowing a market that is responsive to pricing signals.

In a recent interview**, Hubbard shared that "Blockchain is a tool not just for co-ordination but also for co-operation. That is why a number of new consortia have been launched lately, which is moving things in the right direction. What we need now is a greater focus on governance – we need a common set of rules that we can work towards so that we can collaboratively build the 'roads' we need to run the systems of the future on.

"We will see greater collaboration and a stronger focus on governance in the next 12 to 18 months, I think. The energy sector may even end up moving faster than banks and financial services. There is so much to be done to unpick silos and ancient technologies – things like still using faxes and DVDs. These are the things that are going to be unwound very quickly. In the meantime, we need a big industry and policy dialogue about what our common standards and rules of engagement should be."

She adds: "Blockchain adds a new impetus to those discussions and can give an added sense of security by providing a way in which those rules could be enforced.

"Rather than looking at the hype cycle as a way of judging adoption of blockchain or other distributed technologies, we might want to consider what Gartner calls a 'pace layering' approach and which is a methodology for identifying the different levels at which a new technology will be adopted. We are moving on from peer-to-peer alone as one application into "peer-to-peer as a service", and then into working on the infrastructure layer. Governance will be the next – and perhaps the most fundamental – step." MI

Parts of this article originally appeared in Power Engineering International magazine's May 2018 edition.

* *https://www.cornwall-insight.com/newsroom/all-news/blockchain-and-the-transformation-to-digital-energy-jo-jo-hubbard*

** *https://unblockedevents.com/2018/02/28/blockchain-energy-interview-joanna-hubbard-electron/*

ABOUT THE AUTHOR

Jo-Jo Hubbard is a keynote speaker at Electrify Europe in Vienna and will be speaking on 19 June 2018.

Joanna Hubbard is the co-founder and COO of Electron, a London based energy tech firm, and a thought leader on the topic of digital transformation in the energy sector. She is a frequent keynote speaker at energy and technology events, sits on advisory boards for several UK utilities on digital transformation and community trading models and writes for national newspapers on these topics.

THE GRANTHAM PROTOCOL – AN EXECUTIVE'S GUIDE WHEN CONSIDERING BLOCKCHAIN

If you are involved in the future of energy, then you will have heard of blockchain, a decentralised technology that is offering the promise of transforming every aspect of our industry's value chain, writes Wayne Pales, CEO of the Chapel Group. The primary claim is that physical trusted central authorities can be replaced, reducing costs and improving outcomes. Despite all the hype, blockchain technology is still in its infancy.

As someone whose job it is to advise energy executives on their digital roadmaps, this is a technology I need to pay attention to. At this point I must stress, I still have my learner plates on. The more I read and the more 'experts' I talk to, the more questions I have. So when, a few weeks ago, I was asked by Matt Grantham of Beyond Zero Emissions to take part in a podcast about the blockchain, I jumped at the chance. In recent months Matt and his co-host, Anthony Daniele, had been interviewing the likes of Dr Jemma Green (co-founder and Chair of Powerledger), Julius Tan (CEO of ElectrifyAsia), and Nikolaj Martyniuk, (CEO and co-founder of WePower).

During the podcast, Matt introduced the audience to the GRNTHM protocol. This play on his surname described the framework as relating to "how these platforms address the value streams associated with generation, retailing, network costs along with more platform-specific factors such as technology risk (i.e. scalability, privacy, security), hardware risk and market decentralisation ratio (centralised vs decentralised)."

A bit of a mouthful, but I feel Matt is onto something. Executives who know very little about blockchain need a framework so they can ask the right questions. While the GRNTHM protocol is not perfect, it's a good starting point to build on. For anyone who knows me, or has read my books, you will know I am a fan of frameworks. Frameworks enable us to break down complex problems into manageable chunks.

So, with the GRNTHM protocol as my starting point, I set about looking at how this can be further developed and put into a format that would be useful to utility executives. With further research complete, we now have the fully-fledged GRANTHAM protocol, which stands for generation, retail, architecture, networks, technology risk, hardware lock-in, assets in scope, and markets. As you will see from the following breakdown, this is not a step by step process but a series of domains that you, as a decision maker, need to be thinking about when considering the applicability of blockchain to help solve a problem.

Generation

In the generation space, we see many blockchain start-ups. For example, WePower is a green energy-based trading platform and Positive EnergyCommunity is a social platform for renewable energy accumulation and distribution and are just two of many blockchain-enabled start-ups entering the market, primarily looking to lower the barriers to entry to invest in renewable energy projects. Any executive responsible for investments in, or access to, generation capacity must understand what problems these start-ups are trying to solve, which markets they are focused on, and what challenges they face to then determine how and when to start getting involved.

Retail

The retail part of the energy value chain is no less exciting. New entrants such as ENOSI are looking to disrupt the existing status quo, lowering the barriers to entry for new community-based energy retailers, enabling peer to peer trading and reducing the cost of doing business through smart contracts. For retailers, they need to be clear what problems these start-ups are trying to solve and whether they are potential partners or competitors. If the latter, they need to decide how to respond.

Architecture

The architecture piece of the protocol is about understanding how everything works together. Blockchain, like TCP/IP, is an enabling technology. Blockchain in and of itself will not disrupt anything. It is the applications that leverage blockchain technologies that have the potential to disrupt. Think BitCoin; it

is an application leveraging blockchain, threatening to disrupt the financial sector. However, until the general public adopts Bitcoin, it must interface with high street banks so Bitcoin must convert into a fiat currency.

You will face the same challenge in the energy industry. Very few processes that can leverage blockchain can do so without interfacing with other technologies and business processes. The most obvious example is where a blockchain solution needs to source consumption data from a smart meter. Carefully think through how your solution will work end to end, with a focus on the edge cases, to work through how blockchain deals with exceptions.

Networks

I can imagine network businesses must have a love-hate relationship with blockchain. If we look at Powerledger, at one end of the spectrum, they are working with network businesses, encouraging consumers to trade energy across the grid, thus increasing its value. At the other end of the spectrum the same company is working with retailers, helping them improve the value of their embedded (private) network solution by also offering peer to peer trading, thus reducing a network business's footprint and therefore revenue.

Network businesses should be exploring how blockchain can be used to identify where electricity was generated from and dispatched to, helping with the introduction of cost-reflective pricing.

Technology risks

Blockchain has a series of well-documented issues, such as throughput, latency, security, usability, and so on. While it is essential to understand these issues, they should not scare you off. We are starting to see many different blockchain technologies coming to market that address one or more of the known problems.

The flipside to all of these blockchain technologies coming to market is that there are no globally agreed standards. It is the Wild West out there when it comes to blockchain technologies. I would state that, more than any other technology on the market today, you must clearly understand what problem you are trying to solve, and methodically work through what you need from your blockchain solution before making any bold investment decisions, given none of them will be without their challenges.

Hardware lock-in

In a way, this is an extension to the 'technology-risks' part of the protool, but worthy of its own section due to the adverse impact it would have on outcomes if overlooked. During Beyond Zero Emissions' interview with ElectrifyAsia, they mentioned the need to install a hardware device at the consumer's premises for their solution to work. Other blockchain solutions have said they must have granular and timely consumption data from smart meters, or similar devices. Be sure to find out what hardware, if any, you need to install, and where. Your business case would look very different if you omitted to factor in the costs associated with connecting devices at your customers' premises.

Assets in scope

Blockchain in its purest form is the transfer of value (an asset) from one party to another. Therefore, you need to know what assets are in the scope of your opportunity. If we take Electron in the UK as an example, the problem they are looking to solve is to eradicate errors when customers are moving from one retailer to another, and to expedite the process so it takes minutes or even seconds, as opposed to the days and weeks it takes at the moment. In this example, this is about having a central register of all the premises in the UK and who their retailers are. In this example, there are tens of millions of assets in scope, distributed across every property in the UK. To capture and maintain the accuracy of such information is an enormous task and one that you need to understand before embarking on scaling out.

Markets

Finally, you need to think about markets. Are you operating in a liberalised market such as the UK or Australia? Are you on the journey to become a distribution service operator (DSO) like in New York? Are you now rewarded based on outcomes and not assets, such as in Hawaii? Alternatively, you may be in a more traditional market that is fully regulated and integrated. Your market doesn't determine if a blockchain solution is relevant or not, but it does profoundly influence some of the challenges you will face. Every marketplace has its challenges. The more players in a market, arguably the more significant the opportunity blockchain has to add value; however, it also means the more complicated it will be to gain consensus and implement a solution. On the flipside, a vertically integrated utility, operating in a regulated market is unlikely to be as interested, or have as many opportunities for a blockchain solution to deliver value.

I am hopeful that, over time and with your feedback, we can build on and refine the GRANTHAM protocol and make it the industry-standard approach to assessing the applicability of blockchain solutions in our industry. MI

ABOUT THE AUTHOR

Wayne Pales is the author of the bestseller, The Digital Utility, a lecturer at the Asian Institute of Technology and CEO of The Chapel Group.

Wayne works with energy companies to develop and deliver digital roadmaps that result in benefits to the consumer, the community and its shareholders.

SOLVING POWER'S CRYPTO CONUNDRUM: HOW BLOCKCHAIN TECHNOLOGY CAN HELP EASE BITCOIN'S BURDEN ON THE GRID

Blockchain uses a lot of electricity. So much so that Bitcoin transactions alone put pressure on the grid. As power companies work to adapt to this new technology, Maher Chebbo, chief business innovation officer for Global Digital Energy at GE Power and a member of the advisory board for Electrify Europe, argues that blockchain itself is the answer. And so much more.

Blockchain. Even the word alone is exciting, so vividly does it bring to mind images of a future full with possibility. And it's not just a flash in the pan. The initial hype and subsequent unviable offerings have largely passed. Now blockchain is making a notable impact in a range of spheres, away from cryptocurrencies – from large businesses' global supply chains all the way down to individual citizens' birth, wedding and death certificates. Put simply, the technology is here to stay.

But that poses a problem for utilities and power producers. The issue is that blockchain transactions are hugely energy intensive. So much so that Bitcoin alone is having a marked effect on the grid. Each Bitcoin transaction is currently estimated to consume enough energy to power a home for nine days, meaning the currency's network consumes 32TWh per year – the same as the population of Denmark. And it continues to grow rapidly.

> *"blockchain is making a notable impact in a range of spheres, away from cryptocurrencies"*

Providing the power infrastructure to support this development is no small task. It's difficult to imagine adding capacity to the grid quickly enough to keep up. Fortunately, blockchain itself could provide the solution by providing the flexibility upon which tomorrow's electricity network will be built.

Rock around the block

The flexible power system of the future will see low-carbon energy produced at scale – not only by big utilities, but also by end users' own renewable sources. A world of smart, internet-enabled devices and sensors will then measure who needs how much energy, in real-time, and, with the help of battery technology, facilitate a truly efficient and waste-free market to ensure everybody gets exactly what they need as cheaply as possible.

However, our ability to realise this future depends on four interlocking trends: decarbonisation, digitalisation, decentralisation and electrification. Blockchain can help them reach full throttle.

First, take decarbonisation, which requires the replacement of carbon-intensive fossil fuel generation with renewable energy. This won't be achieved with large wind and solar farms alone. Rather, such installations will be supplemented by small-scale local generation by communities, businesses and even individual households. It's an inherently decentralised set-up, which means a shift from a world of passive energy consumers to one filled with 'prosumers' – not only buying energy, but also selling it back to the grid as well.

This will entail a series of complex contractual arrangements, which is where blockchain comes in. The technology creates peer-to-peer transactions, so consumers won't just pay the

utilities for power, but utilities will also pay prosumers, and prosumers will pay each other. The entire transaction process – including contracts, billing and payment – can take place on the chain in the blink of an eye. It's a crucial step towards a flexible system that makes use of all available energy.

Blockchain also plays a role in enabling the digitalisation of the power sector. Predicting the supply and demand of electricity isn't possible through the application of sensors alone. Rather, the masses of data they produce need to be analyzed and decisions made in real-time. But it's far too much for a traditional centralised database.

Again, blockchain can help. At its heart, the technology provides a method for aggregating and storing data from a range of distributed sources. And blockchain-enabled platforms allow users to bring predictive analytics to bear quickly – so that power flows from those producing a surplus to those in need, all without needing any human oversight.

Finally, electrification. This refers to the role of batteries and energy storage technologies in helping to manage supply and demand by charging when surplus power is available, ready to be spent when there is a subsequent shortfall – as well as enabling the decarbonisation of transport through electric vehicles.

It is the use of these two technologies in tandem, with electricity being stored and distributed for use in a flexible and efficient way, that will ultimately result in less and cheaper energy meeting our needs.

> *"Many CIOs and IT managers are still unsure of how best to integrate the technology into their existing platforms."*

Sharing is caring

This future is within reach. All it takes is for blockchain technology to be built into software solutions across the full length of the electricity value chain.

However, while people recognise and are excited by the technology's potential, we're not quite there yet. First, we need a regulatory landscape that supports such a development. One that recognises the role blockchain could have in reducing, rather than exacerbating, demand for power on the grid and

> *"The biggest obstacle to integrating blockchain into the system is a lack of understanding."*

easing the burden of building new capacity. And that makes it easy to innovate, providing funding for the research and development required to facilitate a flexible future.

But perhaps even more important is education. The biggest obstacle to integrating blockchain into the system is a lack of understanding. On the one hand, consumers and power professionals alike are more aware than ever of cybersecurity issues, and every new solution is subject to scrutiny, no matter how innocuous. On the other, many CIOs and IT managers are still unsure of how best to integrate the technology into their existing platforms.

Power companies should seek to educate their employees on these issues. There are a number of training courses available, but just as important are events, which provide a platform for professionals from across the electricity value network to come together and exchange ideas.

Power producers and sensor manufacturers alike can share lessons from their own unique experiences with cutting-edge technologies and decide how best to realise blockchain's full potential to bring forward a flexible future.

So the electricity sector can not only solve its crypto conundrum, but can also sustainably scale to support society as its needs continue to grow and develop. MI

Maher Chebbo is a speaker at Electrify Europe in Vienna.

ABOUT THE AUTHORS

Maher Chebbo is chief officer global power digital solutions at General Electric. He is leading the digital transformation at Power & Utilities across the globe, transforming GE from being an industrial provider to being a digital industrial leader of solutions to the energy market.

TRANSLATING THE BLOCKCHAIN VISION FOR THE ENERGY SECTOR

In this article by Thomas Steinberger, Robert Schwarz and Sergiu Maznic of Pöyry Management Consultancy, we examine how the blockchain vision can be translated for the energy sector, and the benefits of near real-time information in an intermediary-free environment.

Blockchain has the potential to change the business world as we know it today. Entire value chains can be shortened by it – including in the energy industry. In the field of renewables, this shift can lead to new business models, from peer-to-peer trading to flexibility schemes or investment incentives, to name just a few. Although start-ups and even classical utilities are increasing their efforts in developing blockchain-based applications and processes, nevertheless the number of scalable case studies is marginal right now and developers have difficulties realising their promising ideas.

So how does the blockchain vision translate into the world of energy, utilities and renewables?

As a digital transaction system that allows for secure data storage and execution of smart contracts in peer-to-peer networks, blockchain can eliminate the need for intermediaries in transactions. Instead, they are performed peer-to-peer in near real time, as integrity and security are guaranteed by the blockchain.

From an IT perspective, blockchains solve the double spending problem – a phenomenon of the current state of the internet where a copy of each set of data is sent from server to server when information is transferred. For any transaction system this issue needs to be eliminated, which so far has been the job of trusted institutions.

By taking over this task blockchains make any intermediary superfluous and are therefore referred to as the Internet of Value – an evolution of the current Internet of Information. A next step might be the application of blockchains in the energy sector as the Internet of Energy, which leads us to the ever-growing startup scene around the technology.

Blockchain technology gained relevance for the energy sector at the beginning of 2016 with an experiment in Brooklyn, New York, when owners of PV systems sold their power in the neighbourhood using the Ethereum blockchain without a utility.

A recent survey indicates that today, around two years after the launch of a major blockchain microgrid research project, there are 122 organisations involved in blockchain technology and 40 deployed projects. Between Q2 2017 and Q1 2018, over $300 million was invested in the blockchain in the energy industry.

While it is still much too soon to speak of a triumph as blockchains must continue to evolve, the technology has the potential to radically change the energy industry. It provides the opportunity for new or more efficient business models and thus the opportunity for entirely new companies entering the market.

Starting points

The years 2015 and 2016 were starting points for blockchain in the energy sector. Recently we have seen relevant infrastructure layers like the Tobalaba test network of the Energy Web Foundation or IOTA – a blockless distributed ledger, so in the coming years we will see numerous rollouts of new, relevant application layer and business models.

There are at present many new players who are currently developing entirely new areas of value creation, with a variety of startups and established utilities working hard to test blockchain technology. These possible platforms and distributed database systems are striving for acceptance in order to become the leading players in the decentralised world.

Following the example of over 70 banks and financial institutions and their R3 consortium, utilities could also attempt to enable a decentralised power grid and compensate for lost revenues by providing the business platform as a service via such community chains — a kind of consortium. Since the consortium's participants are known and thus have a particular level of trust among each other, the integrated governance of these kinds of blockchains is much easier than for free accessible public blockchains. This, in turn, also leads to the advantage of a less energy intensive performance.

There are many indications that blockchains will gain a foothold in the energy sector — an efficient decentralised energy world requires appropriate decentralised technologies. Blockchains could represent and execute various business processes of the

energy world and would be an ideal instrument for IoT devices to manage their transactions.

Blockchains are also useful as a trust-building element to provide transaction logs for energy to manage power flows and the accounting of cellular systems, automate proof of origin, enable P2P trading and the administration of asset registers. Companies and foundations are currently developing the next generation of blockchains for the energy industry, which protect privacy, are fast enough, and have the usual interfaces.

For a wide implementation, developers still struggle to identify the specific business model for the different use cases and simultaneously comply with regulatory requirements. A tremendous regulatory hurdle is the European General Data Protection Regulation and the right to be forgotten. Blockchain is actually not designed for meeting the current state of regulation since one of its major features is immutability. Another hurdle is the handling of personal data. With peer-to-peer deliveries one can draw many conclusions on the personal behaviour. From this aspect a way to aggregate and de-personalise data has to be found. In addition, energy law varies from country to country, which means that the application must be adapted to national law or national law has to assimilate to the principles of blockchain.

Euphoria and reality

In truth, blockchain technology can barely justify the current hype around it. Blockchains are not a panacea but should rather be seen as one of many technologies that could form the basis for next-generation service infrastructure in the energy sector.

Many digital services are already possible today without blockchains. While many ideas are being developed around the technology, a clear direction of where and with what economic benefits blockchain-based applications could be used is still far from apparent. Most of the current applications are attempting to solve fractional parts of the energy market problems, being far away from the often-named vision of a blockchain of everything.

Meanwhile, research and use would clarify limitations of the technology in the state of the art; for example, limited rate of transactions, long response times between the connected network peers, or the ever-growing volume of data. We are currently experiencing a phase where the blockchain energy pilots from a few years ago are under pressure to deliver concrete results and pathways for commercialisation.

> *“In truth, blockchain technology can barely justify the current hype around it.”*

The blockchain euphoria alone is not sufficient to maintain the funding for projects in eternal proof of concept stage. Therefore, the priority at the moment should be to prove the existence of a viable business model by focusing on a real, existing problem that consumers or energy actors are facing.

Disruption vs enabling

Although utilities should actively engage with blockchain technology, there is no reason to be alarmed as the technology is still young for use in the energy sector. Blockchain technologies work wherever transaction costs exceed the transaction value – for energy trading, processes in high temporal resolution (real-time energy economy) become necessary. However, both the related opportunities and risks are already apparent. They should be examined with respect to each company's own position and strategy in order to derive strategic options. For the majority of companies, the fast-follower strategy is possibly the most appropriate one, but future-proofing the business is even more important.

As with any new technology, the existing market players should invest time and resources to understand the potential and develop use cases. The incumbents can be disrupted if they stop innovating and adapting to new business models. A number of European utilities have understood this and they are actively researching this area.

Another relevant question that remains unanswered is: “Will blockchain enable a renewable future?” Interestingly enough, the majority of the existing projects, especially crowdfunding-focused startups, are somewhat exaggerating the *greenness* in their communication.

Despite this, the reduction in market friction by the future blockchain application will have a positive impact on the future of renewables. The current electricity market is still struggling to integrate a high share of intermittent generation and operate the grid in a smarter way. The blockchain applications that we are seeing today could create the basis for a more digitalised and automated market where it will be easier to trade flexibility, cheaper to balance intermittent generation, or perhaps even remove the need for balancing by implementing real-time nodal pricing.

Although the technology is not yet sufficiently scalable and regulatory hurdles have to be overcome, these examples set the vision for a number of passionate players to develop the market of the future. MI

Stephen Woodhouse, Chief Digital Officer at Pöyry, is one of the speakers in the Blockchain Arena at Electrify Europe in June.

THE TIPPING POINT APPROACHES FOR SAAS IN ELECTRIC SMART METERING

Electric utilities are one of the leading industries in the adoption of IoT, a trend set to only increase as the power of "software as a service" offerings are on the rise, says David Green.

Utilities are not typically considered to be 'early adopters' of technology, and many will recognise long periods of uncertainty in recent years as all industry stakeholders have been in a paralysis of choice between individual connectivity technologies. For example, should a utility choose RF Mesh, LoRa, SIGFOX, NMB-IoT or others?

Instead, utilities are simply becoming one of the first 'optimisers' of the IoT proposition, as there is an increasing realisation that IoT is not a connection-only issue.

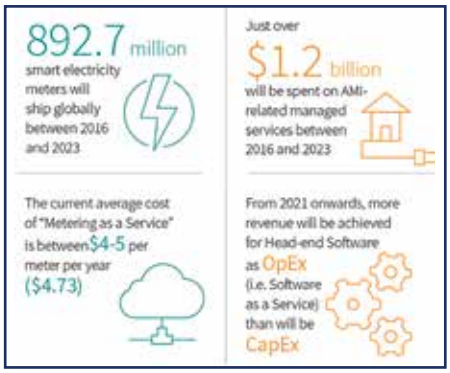
Where is the value in the utilities' IoT spend?

IoT solutions for electric utilities tend to focus on the overall goal of all component parts – the rise of the 'smart grid'. This typically focuses on the distributed network of sensors, hardware and communication infrastructure, but central to the optimisation of the IoT solution for utilities is the spend on the final piece of the puzzle – software and analytics.

Smart metering is the leading edge of IoT adoption and the first smart grid application to be gaining widespread adoption across the world. Adoption has been strong in North America in particular, where over 90% of all electricity meters shipped to the region in 2016 were communicating meters. As this market continues to evolve, the focus is shifting 'beyond the meter' too.

According to new IHS Markit research (Electric Grid Managed Services Report – 2018), $58.2 billion will be spent on meter-to-cash focused AMI solutions by utilities between 2016 and 2023, including the purchase of almost 900 million smart meters. Only 6% of the spend during this window will be on the non-physical elements of the solution (i.e. not hardware or man-hours of work) and yet the entire value and ROI of the system relies on this.

The network connection remains an important issue and a large part of the investment, but the IoT solution is only as strong as its weakest element.



New services and business models are driving more spend

There are four foundational pillars of IoT technology; collect, connect, compute and create. Applied to the AMI solution, this becomes:

- Collect – the smart meter device itself
- Connect – the communication network

- Compute – the software and IT back-end infrastructure used to hold and process the data
- Create – the analytics, output reporting and actual usefulness of the data

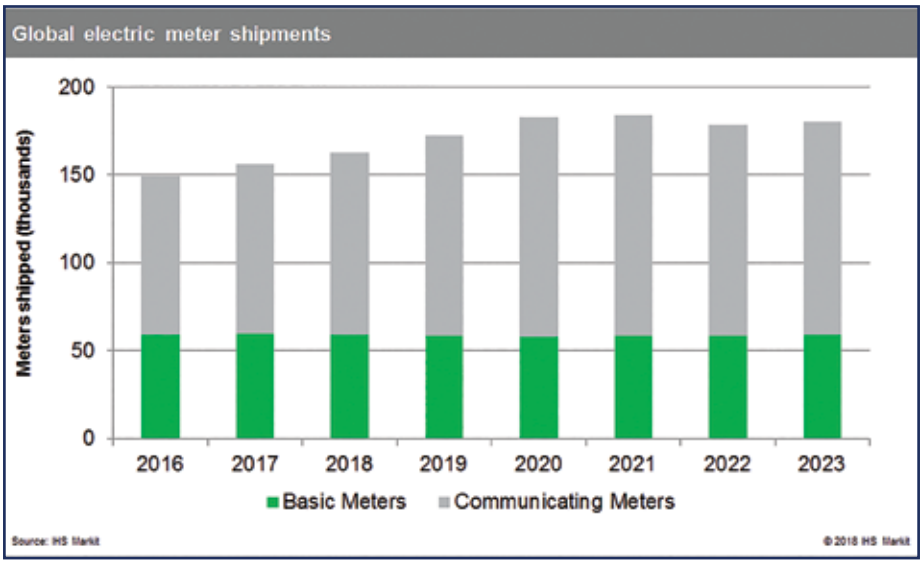
Beyond the labour savings from remote meter reading, it is the computation and creation of actionable insight from smart metering data that creates the higher value and maximised ROI from the network and hardware spend.

Electric utilities will still invest in AMI systems primarily justified on the meter-to-cash process – but increasingly anticipate that later in the process they will layer new uses and applications for that data on top.

An end-to-end "metering as a service" offering for meter-to-cash AMI could currently cost a utility around $4-5 per meter per year. 'AMI 2.0' type solutions such as the use of AMI data within distribution automation (e.g. outage management solutions) as a managed service could attract 10x that level of spend when considered on a "$ per endpoint covered" basis, but can further leverage the same hardware and network spend to achieve that.

New business models help drive the adoption – in particular software as a service (SaaS)

As utilities start to focus their strategy on the overall solution and not just the connection, the rise of 'as a service' business models is also helping to speed up the adoption. Managed services offer a path of greater flexibility, faster scalability and a lower capex cost in the adoption of new technology. Every utility has its own unique circumstances, but many are already moving fast towards the managed services model.



Communicating meters will take an increasing proportion of the electricity metering market.

> *$58.2 billion will be spent on meter-to-cash focused AMI solutions by utilities between 2016 and 2023*

Within this movement, the SaaS proposition has seen rapid adoption. Indeed, by 2021 more revenue will spent by electric utilities on head-end software 'as a service' than will be spent on one-off capex head-end software purchases. By comparison, the tipping point in balance of opex to capex on software is reached even sooner within the water utility sector.

In both cases, adoption from utilities in the US and European markets is strong, even accounting for the variation in circumstance between each utility. Whilst the relative adoption of meter data management software as a service currently lags slightly behind that of head-end software in the electric utility sector, the move towards the SaaS model is universal.

SaaS together with network as a service will help drive over $1.2 billion in spending by electric utilities on meter-to-cash focused AMI managed services during 2016-2023. However, more than half of the managed services spend in North America falls on the SaaS portion. Looking to the future, the potential upside on AMI 2.0 applications further leveraging the existing AMI hardware and network is then heavily invested on the side of software and analytics too.

One size does not fit all

Despite this optimisation and clearer understanding of the IoT proposition by the most forward-thinking electric utilities, general progress remains steady. Utilities will remain cautious and risk-averse (one of the reasons SaaS can be so popular) and many do not want to feel tied to one single vendor's end-to-end solution for long-term contracts.

Instead, a focus on interoperability and 'vendor agnostic' solutions is winning utility trust and therefore their revenue. The modularity of the solution, especially with the ability to layer new software applications at a later stage of the project, increases the value of AMI solutions to the utilities and the revenue to the vendors.

The move to SaaS is one of the few trends in AMI solutions to span multiple utility types and global regions. Every rule has an exception, but step by step the electric utility is finding a path to a software-centric view of the big picture, as the perception of IoT technology moves on from 'connection only' and towards truly connected thinking. MI

ABOUT THE AUTHOR

David is research manager for the Smart Utilities Infrastructure group at IHS Markit, leading a team of analysts focused on our intelligence services, research on key technology trends and consumer analysis for smart metering and AMI-related software/services.

COMMUNICATIONS SPECTRUM FIT FOR UTILITIES USE

According to the findings of a recent study spectrum ownership and creative deals will become more attractive for long-term utility solutions. Yet, deciding between licensed and unlicensed spectrum requires an understanding of the benefits and challenges.

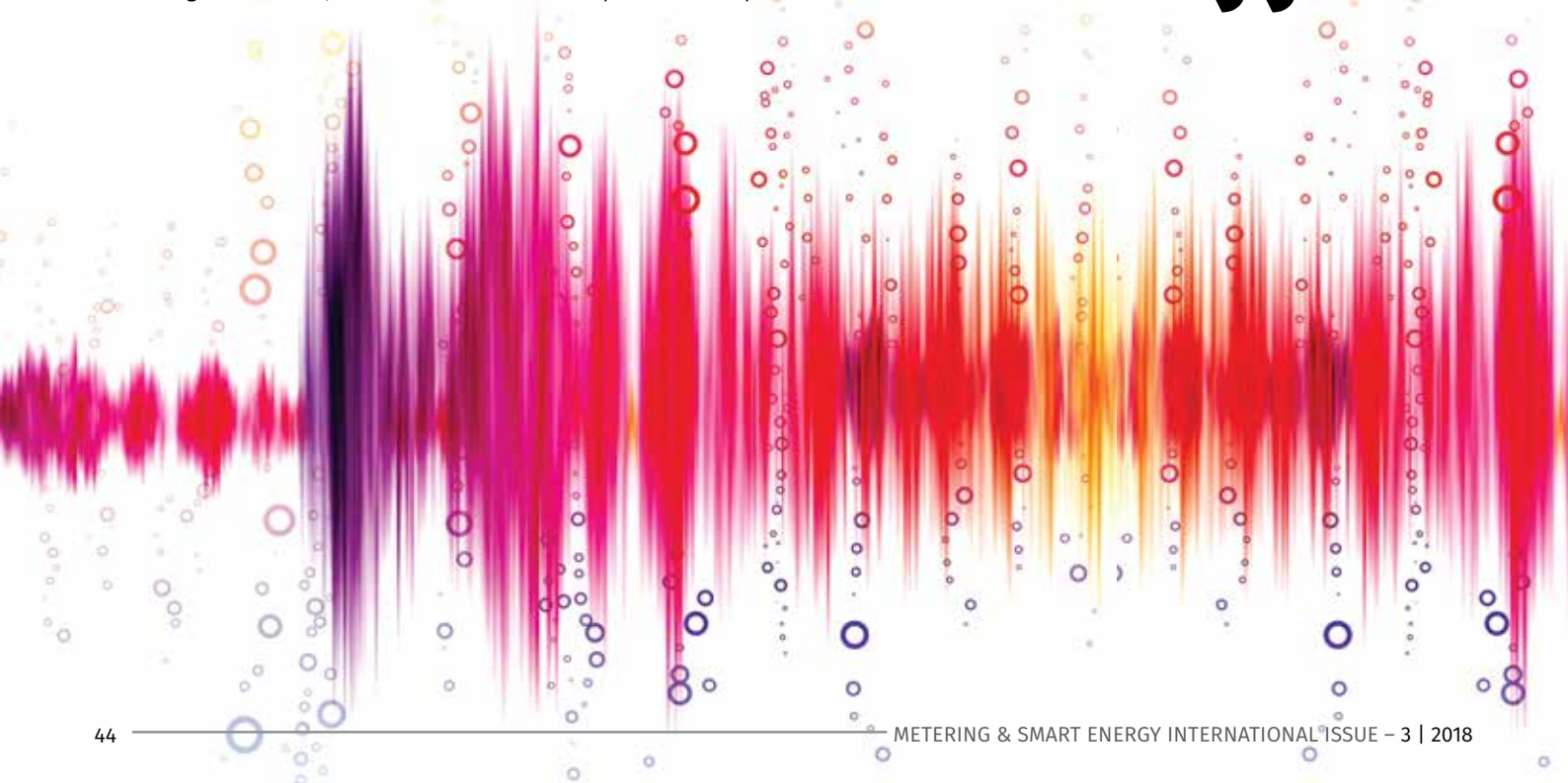
Market intelligence firm Navigant Research released its latest study on wireless communication solutions available for utilities.

According to the findings of the study, there are at least a dozen licensed spectrum options readily available and affordable for utilities today. Navigant forecasts *spectrum ownership and creative deals to become more attractive for long-term utility solutions*.

Richelle Elberg, principal research analyst with Navigant Research, commented: "While smart grid solutions that use unlicensed spectrum bands are readily available and have done the job for utilities to date, as more people and things become connected, there is a real risk of interference and performance degradation in unlicensed bands."

Metering & Smart Energy International spoke with Elberg, author of the report *Accessing Licensed Spectrum for Future-Proof Utility Networks* to understand licensed and unlicensed spectrums, their similarities and differences and factors driving utilities' adoption of each spectrum.

> *The Utilities Technology Council has lobbied for years to get the FCC to allocate specific bands to critical infrastructure providers, but to date with no success.*



> *Utilities must be aware of the differences between licensed and unlicensed spectrum as the risk of interference is the biggest disadvantage with unlicensed spectrum.*

Elberg reports that radio spectrum – the airwaves around us – used for wireless data transmission ranges from the single kilohertz (kHz) level all the way up to hundreds of gigahertz (GHz).

In the US, spectrum is carved into hundreds of thousands of licences divided into hundreds of licensed and unlicensed bands with defined use cases. The FCC oversees spectrum allocation, use case definitions, licensing and auctions. Newer spectrum-sharing schemes have also been approved.

Unlicensed spectrum

In spectrum that is designated as unlicensed or licence-exempt, any user can operate in the band without a government-issued licence. They must, however, use certified radio equipment and comply with technical requirements, including transmission power limits. This is to minimise interference; yet because users do not have exclusive access to the spectrum, as usage increases, the likelihood of interference grows. Range limits and higher latency may also result.

Unlicensed bands commonly used by utilities are typically in what are known as the industrial, scientific, and medical (ISM) bands. These include the 2.4 GHz band and the 5.8 GHz band (available globally) and the 902 MHz-928 MHz band in the Americas.

Licensed spectrum

Licensed spectrum allows for exclusive use of frequencies or channels in specific locations. They generally offer higher transmit power (which also means fewer nodes and lower infrastructure costs) and better signal-to-noise ratios. But the licences must be paid for.

Some licensed frequency bands are made available on a site-by-site basis, meaning that the licensee has exclusive use of the specified spectrum bands in a point location, with a radius around that location.

In the US, the rights to use commercial spectrum have generally been auctioned and licensed by geographic area, such as economic areas (EAs) or cellular market areas (CMAs), among others. These areas may also be further divided into smaller licences by dividing the band into narrower spectrum slices (disaggregating) or dividing the geographic area into smaller regions (partitioning; e.g., into a single county or an even smaller area).

Elberg cautions that utilities must be aware of the differences between licensed and unlicensed spectrum as the risk of interference is the biggest disadvantage with unlicensed spectrum as there is no limit to who may use the bands. The cost of the licence is the big disadvantage of licensed spectrum, with licence costs varying greatly, depending on requirements.

Uptake by utilities

Most utilities to date have used unlicensed spectrum for their non-critical applications, such as AMI and most distribution automation (which tends to leverage the AMI network).

For more critical applications, utilities may use licensed (or unlicensed) microwave bands, or more often, a wired solution – although that is changing. Fibre is being widely deployed to substations but it's too expensive to put everywhere. Hence there is more interest in licensed spectrum as it gives the utility more control and security.

Unlicensed spectrum bands are used by utilities globally for many applications. Outside of the US you see more utilities using public cellular carriers – for AMI or DA. But in the US utilities more often want to own and control their networks, for several reasons. First, the IOUs are compensated based on capital expenditures and a return based on those investments. Second, in the US, cellular carriers have been slow to adopt M2M appropriate pricing schemes (although most have now) and they have also not been the best at providing high level service level agreements (SLAs) which most utilities demand.

Challenges

Utilities don't deploy spectrum – they deploy a network which utilises communications protocols that rely on a specific spectrum band/channels. These may be unlicensed, in which case they only have to use certified equipment; for licensed, they have to buy or lease the licence to get exclusive access to those airwaves.

Primarily getting sign off on the cost of the licence and lack of affordable equipment standards has been the biggest challenge to utilities wanting licensed spectrum-based networks. The Utilities Technology Council (UTC) has lobbied for years to get the FCC to allocate specific bands to critical infrastructure providers, but to date with no success.

Going forward, it is probable the pressure to ensure grid reliability and security from cyber threats will make this a more likely end result – but the wheels of government move very slowly.

Elberg says "utilities should consider licensed spectrum for a variety of applications. In this way they can build a more 'future-proof' network that will accommodate new applications and functions as the traditional utility business changes, and as the IoT means the deployment of billions of sensors that will all try and use the traditional unlicensed bands. It's not really a trend yet but there is growing interest and some investment in spectrum licences on the part of utilities." MI

FIGHTING NON-TECHNICAL LOSSES IN ENERGY, WATER AND GAS UTILITIES – A SUCCESS STORY

The article describes the project implemented for reduction and control of non-technical losses, supported by revenue intelligence software on top of the HANA in-memory database.

This analytics software, with artificial intelligence and machine learning technologies, operates on EPM Group's electricity, water and gas network data. The results, in the first months of operation of the solution, already show an increase of 98% in energy recovery from fraud and the total benefits of the project in 2017 exceed $6 million.

Background

EPM Group is the second largest economic group in Colombia, only below the oil group Ecopetrol. EPM is a group of 48 companies owned by the Municipality of Medellin and operates in six countries – Colombia, Chile, Mexico, Guatemala, El Salvador and Panama.

EPM Group serves more than 20 million consumers in the supply and distribution of energy, water and natural gas. EPM Group has been building its vision to achieve operational excellence and business sustainability with competitive rates, in supplying the services that are its strategic objectives. To achieve these objectives, EPM created a programme for the reduction and control of electricity losses with the participation of the following companies at the national level: EPM energy, CHEC, EDEQ, CENS, ESSA, EPM Aguas, EPM Gas as well as ENSA Panama, internationally. This programme seeks to reduce and control non-technical loss indicators from 9.25% to 8.00%, recovering 183 GWh in no more than five years in the National Energy Companies, through four fundamental pillars:

- Culture and legality
- Access to services and purchase capacity
- Technology excellence
- An advanced computer solution, with state-of-the-art analytical technology to support the programme.

EPM proceeded with its search for the desired technological solution, first via literature research and consultation with market research institutes. The selected technological solution was with Choice Technologies; their Revenue Intelligence software uses analytical technologies based on artificial intelligence and machine learning and operates on a HANA in-memory database provided by SAP. HANA provides the processing speed necessary to give agility to revenue intelligence algorithms.

A proof of concept coordinated by SAP and Choice was implemented and yielded excellent results, propitiating a great vision of the situations causing the commercial losses and demonstrating practical results greater than the previous ones.

The solution implementation of the revenue intelligence solution started in May 2015.

Implementation

The project implementation was organised in several stages, and the planning brought an important benefit as the implementation was carried out simultaneously in all the companies. The production environments went live subsequently, with a difference of weeks, in EPM Energy, CHEC, EDEQ, CENS, ESSA; ENSA Panama, EPM Aguas, and EPM Gas:

- Blue print
- Conceptual design
- Implementation (ETL from exchange area to HANA, configurations, component and report development) distributed in

> *"The results, in the first months of operation of the solution, already show an increase of 98% in energy recovery from fraud..."*

KAIFA

Your Reliable Partner

for Revenue Protection

Shenzhen Kaifa Technology (Chengdu) Co., Ltd.
Add: No.1218 Hezuo Rd., Hi-Tech Development Zone (West), Chengdu, P.R.C. P.C. 611731
Tel: +86-028-65706888 Fax: +86-028-65706889 E-mail: metering@kaifa.cn
www.kaifametering.com

three business milestones: addressing, verification, balances
- End-user testing
- Solution training, operational training and knowledge transfer, following the methodology of learning by doing
- Deployment to the production environment
- Follow up to optimise the implemented models
- Solution and project acceptance.

SAP was in charge of the certification of the appliances, consulting services for deployments to QA and production environments, sizing of HANA and business object, and HANA tuning.

Learning process of the artificial intelligence system

The learning process of the intelligent system is achieved through the training of the algorithms and the mechanisms of artificial intelligence and machine learning. That included the generation by the system of a process of extraction, transformation and data loading, carried out carefully and with high-quality standards, to guarantee a successful learning start.

Results of the commercial operation

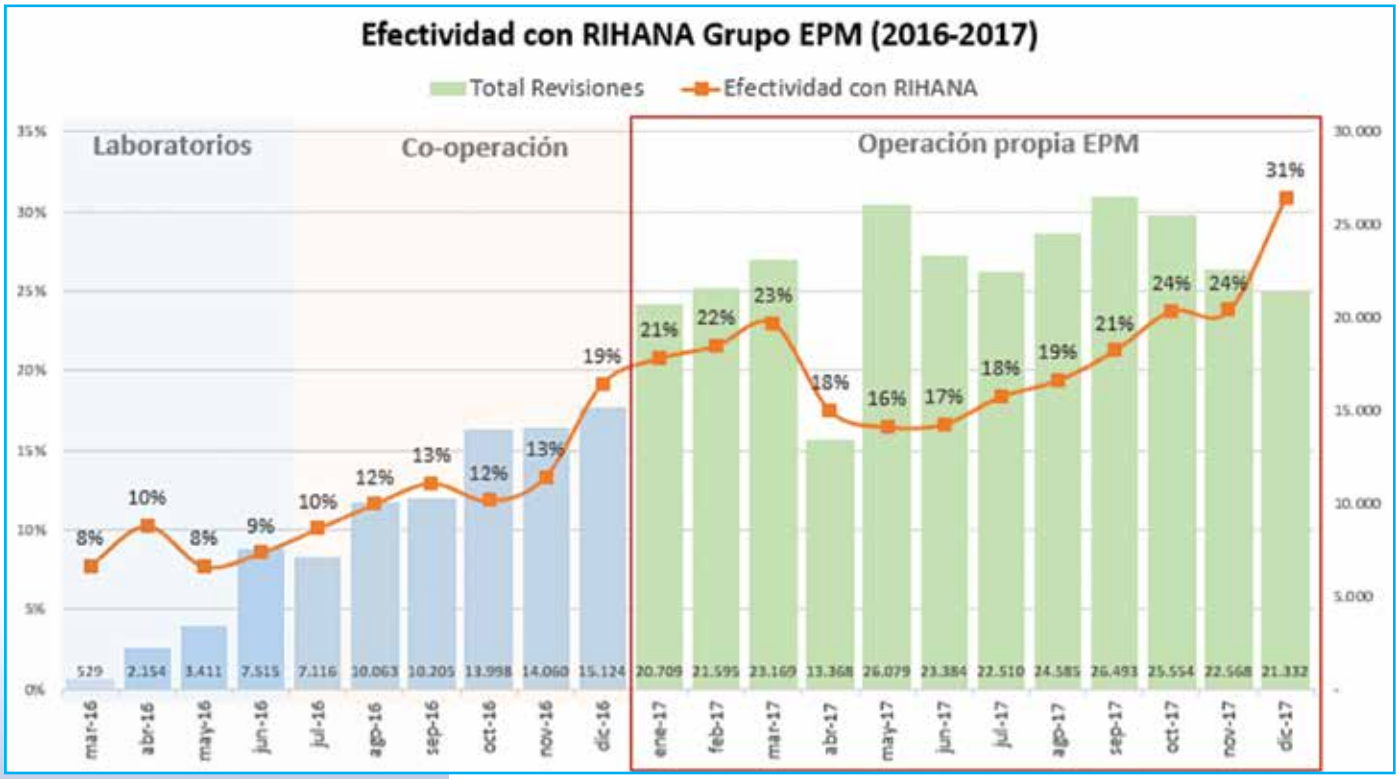
Operation begins in EPM Energy with two phases of selection and sending of field revisions: as a first step, an initial tuning phase, nicknamed the Laboratories phase, which allowed EPM Energy to start training the algorithms via the machine learning process, through a few operations directly addressed by Revenue Intelligence (RI). In this initial process, the processes that support the routing through RI were evaluated. This phase had a duration of four months. Subsequently, the co-operation phase started. A joint working group was formed with the implementation team and EPM business experts and initiated the formal process of addressing inspections using the software.

> *An important KPI for the selection process is the effectiveness index, which represents how effectively the detection process finds real issues.*

An important KPI for the selection process is the effectiveness index, which represents how effectively the detection process finds real issues (fraud and irregularities) and is defined as the relation between the number of effective revisions (with fraud or irregularity) and the total number of executed inspections. The historical effectiveness of the EPM Group before implementation was 16%.

During the initial stage of laboratories, an average effectiveness of 9% was obtained, which was similar to the indexes immediately before the project was implemented. The second phase, co-operation, was developed between July 2016 and December 2016, with addressing all done through the revenue intelligence solution and, in December, the effectiveness reached 19%.

The next stage and having started the software on its machine learning process, the EPM Group started its operation



Source: Reports obtained via Business Objects HANA

Graph 1: Effectiveness with Revenue Intelligence since implementation

independently, achieving the highest effectiveness obtained in 2017 with 31%. These results demonstrate the successful incorporation of Revenue Intelligence use in the losses combat processes and the adequate alignment of the actors in the non-technical loss detection production chain. These results show an increase of 194% in the effectiveness indicator, compared with EPM historical results before the implementation of the project.

Regarding the number of inspections carried out, EPM Group made gradual increases on the number of revisions addressed through the software. For 2016, an average of 31% of the inspections for non-technical loss detection (84,175 revisions) were addressed via RI. In 2017, 271,316 revisions were executed, and all were addressed under this concept.

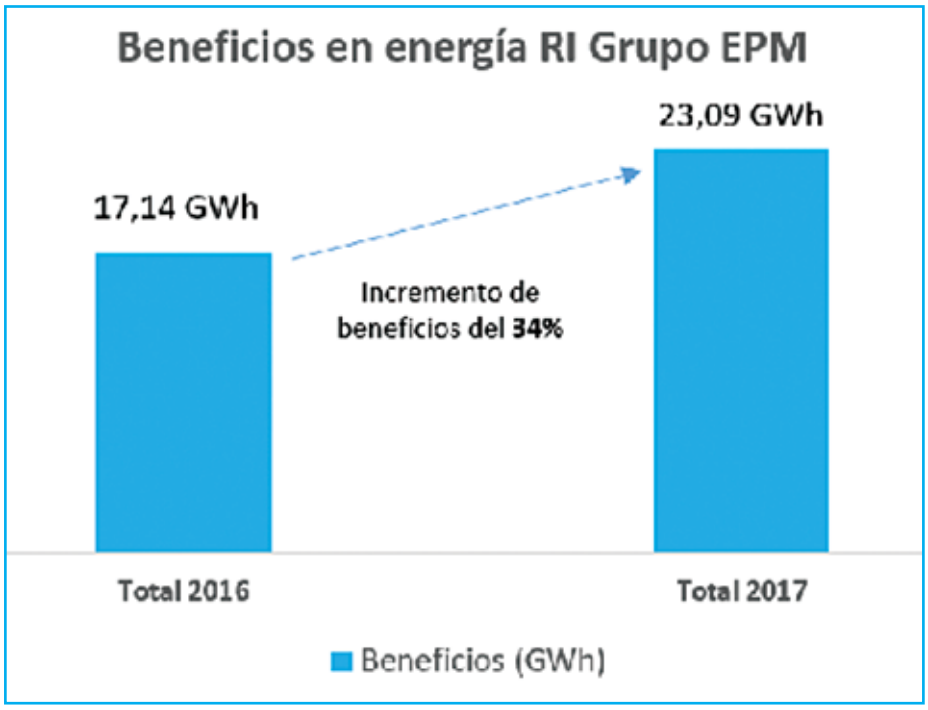
The productivity indicator represents how effective the detection is in uncovering significant amounts of non-registered energy. This is another key indicator to determine the value of the process and the software tool in the detection of installations with irregularities. This is calculated as the monthly average of the amount of energy recovered (kWh) divided by the total number of frauds or irregularities registered in the period. For this indicator, the EPM Group evolved from an average of 701kWh/fraud (historical data before RI) to an average of 1,184kWh/fraud obtained through the software during 2016, an increase of 98%.

Quantifiable benefits

The quantification of committed energy in cases detected with irregularity is performed for the estimation of benefits. There are two components in the measurement of economic benefits: the first is recovered energy, defined as the energy consumed but not registered (measured in kWh). On the other hand, the incorporated energy is calculated as the consumption increases presented by facilities after the normalisation, which is once the causes of energy under-registration is fixed.

In 2016, with the execution of a limited number of inspections directed by the software, 17,15GWh were already recovered,

> *Data quality plays an essential role in the detection of non-technical losses strategy to achieve effective results*



Source: Reports obtained via Business Objects HANA

Graph 2: Economic Benefits – RI Group EPM 2016-2017

bringing an increase in revenues over previous years. For 2017, with a majority share of the inspections directed by RI, higher revenues were generated corresponding to 23.09GWh, which represents an increase of 34% in the measurement of economic benefits over the previous year.

Another important identified benefit, on the operational side, corresponds to the OPEX savings by the execution of fewer inspections. In 2017, the EPM strategy was focused mainly on increasing effectiveness. With the higher effectiveness in detecting irregularities, with an increase of 34% over 2016 (as seen above), it became possible to reduce the number of revisions while maintaining the planned recovery objectives. Before the implementation of Revenue Intelligence in the EPM Group, 14% of the EPM Group energy consumers were inspected each year, and in 2017 this proportion decreased to 10%, which represents a significant cost savings of approximately 30% on the field inspections operational costs (OPEX).

Adding both, there is a total benefit for the EPM Group of USD 6.1 million in 2017.

Soft benefits

At the level of processes, other benefits obtained by the EPM Group through the implementation of the software are the increase in the opportunity to improve non-technical losses internal processes and the achievement of loss reduction objectives at each company and group level. On the other hand, the benefit of a greater rapport between the energy companies within the EPM Group was obtained, and it opened scenarios for teamwork to share strategies and experiences and thus achieve a permanent benchmarking within the Group in the energy segment. Additionally, strategies for continuous improvement of the loss detection and combat process were implemented, as well as synergies with the teams in the field.

It is evident there has been a substantial change in the analysis of data to detect irregularities, obtaining information management advantages at the Big Data level, sharing information among the public services provided (energy, gas and water), and providing the opportunity to standardise processes to obtain higher business efficiencies.

Conclusions

The solution allows EPM Group to make supported decisions based on data and user behaviour, eliminating the subjectivities of the teams in charge of detecting losses and the wear and tear of strategies established by the experience in the business. Thus, professional experts in non-technical loss detection can focus on the development of business rules and optimisation of strategies to increase the productivity of energy recovery activities and reduction of non-technical losses.

Revenue Intelligence's machine learning machine, in its models of fraud probability of fraud and financial impact estimation, is a self-adaptive inference machine using fuzzy logic. These are sets of intelligent algorithms that were developed to interpret business rules in a dynamic and easily adjusted knowledge base to achieve effective non-technical loss reduction strategies.

Data quality plays an essential role in the detection of non-technical losses strategy to achieve effective results. Also, the permanent refinement of the models is a critical success factor, facilitating the business processes knowledge discovery and providing an efficient framework for the development of irregularity detection rules. Likewise, the joint work with the operation (field inspections, compliance with the PDCA cycle) and the strengthening of the analytical capacity of analysts using analytics software are of great importance for the achievement of business objectives.

For the EPM Group, good results have been realised to date since the effectiveness of the programme is over 30% and its revenues in 2017 increased by a 34% compared to the benefits of 2016. MI

ABOUT THE AUTHORS

Carlos Mario Galeano

Carlos is an electrical engineer and director of the non-technical losses management programme for the EPM Business Group. He is head of the control unit of energy losses for EPM.

Norela Quintero Montoya

Norela is a system engineer and manager. She is an EPM IT professional specialist in systems and technology.

Katherine Avendaño

Katherine holds an M.Sc in economics, and has extensive experience and knowledge in the fight against non-technical losses of energy, water and gas. She is a specialist in utilities and smart meters and a project manager at Choice Technologies Colombia. Katherine is an expert consultant in the application of big data techniques for the detection of non-technical energy losses and analysis of regulatory policies for utilities.

Rui Mano

Rui is VP at Choice Technologies and an electronic engineer experienced in smart grids, automation, IoT/SCADA/EMS/DMS systems and analytics for the detection of fraud/theft. He was previously managing director and principal consultant of KEMA Brazil and a Professor at the Pontifical Catholic University, PUC Rio de Janeiro. Rui is a senior member of IEEE PES, CS and CIS and a member of CIGRE B5.

THE GLOBAL SMART ENERGY ELITES 2019

PROJECTS AND PEOPLE

POSITION YOURSELF AS A MARKET LEADER IN THE GLOBAL SMART ENERGY INDUSTRY

Position yourself among the Global Smart Energy Elites, a showcase of projects and individuals driving excellence and innovation in the areas of data and analytics, cybersecurity, AMI and smart metering, utility transformation and billing and customer engagement.

These projects have been recognised as replicable, scaleable and innovative by a Metering and Smart Energy International panel of industry experts and this is your opportunity to show your support and position within this dynamic sector.

Published by:
METERING & SMART ENERGY INTERNATIONAL

INTEROPERABILITY IN IRAN'S SMART METERING PROJECT

In the second part of a three-part series, we examine the Iranian smart metering programme and the challenges of ensuring interoperability across a variety of legacy systems.

Based on the importance of interoperability in the implementation of AMI, it is essential to introduce a detailed solution, protocols, and international standards, in both meter and control centre levels, in order to consider different implementation challenges.

The Iran smart grid road map objectives and Iran AMI use cases identify that smart meters and smart grids are mostly likely to include the following technology options:

Smart grid portfolio:

- **HV networks:** automation, transmission line sensors, FACTS devices such as SVC and STATCOMs, short current circuit limiters for lines and HV substations with related communication and IT infrastructure, cybersecurity and management systems.
- **MV networks:** automation, identification and recovery of network faults, voltage and/or current sensors for voltage control, smart inverters, intelligent reclosers and switches, SCADA and DMS systems, with related communication and IT infrastructure, cybersecurity and management systems.
- **Generation:** new generators' adaptation to technical developments (such as synthetic inertia, low voltage ride through, four-quadrants inverters, frequency response) as required by technical standards or grid codes.

Smart meter technologies:

- Remote meter reading, two-way communication for software upgrades, customer account management, multiple tariffs and other key functions as covered by the functional requirements detailed.

With respect to the communication architecture for smart meters, there are a number of options and combinations of technologies that could be implemented. This choice will be a key element for the success of the overall programme and at the same time must take a prudent view of likely advances in the telecommunications field. Possible solutions could consist of a mix of data concentrator models or a direct communication model, both using a variety of mediums such as power line carrier, meshed wireless networks (Wi-Fi, RF), private or public fibre optic networks, public mobile networks (GPRS) and others.

As regards to communication standards and protocols, the IEC 62056 (DLMS/COSEM 3)

and IEC 61968-9 are being widely used by worldwide suppliers of smart meters and would give a good chance of achieving full interoperability (and exchangeability) of metering components from different manufacturers. Interoperability in Iran's AMI system means that meters from different manufacturers should be able to work with all various types of concentrators made by other manufactures. Every O&M device should connect to different types of meters and concentrators and the central access system (CAS) manage all AMI devices regardless of their manufacturers. All these items shall be fulfilled without any additional devices or protocol convertors and without interfering with the system on line operation.

Figure 1 describes the smart metering project's information exchange architecture (conceptual architecture of FAHAM interoperability between smart meters, AHEs, MDM, and application systems). This system is made up of various elements as illustrated, namely:

- FID 1: describes the data exchange between the meter data management (MDM) and the advance head end system (AHE) along the interfaces DI1 – SI3;
- FID 2: describes the data exchange between the advance head end system (AHE) and the meters. This package is divided into 3 parts:
- FID 2-1: describes the data exchange between the advance head end system (AHE) and the high consumption meters (electricity, water and gas) along the interfaces SI2 – MI2;
- FID 2-2: describes the data exchange between the DC and the PLC meters (electricity) and gas/water meters via M-Bus along the interfaces CI1 – MI1
- FID 2-3: describes the data exchange between the advance head end system (AHE) and the data concentrator (DC) along the interfaces SI2 – CI2;
- FID 3: describes the data exchange between the MDM and legacy (application) systems (billing, OMS, CIS, etc.) along the interface DI2.

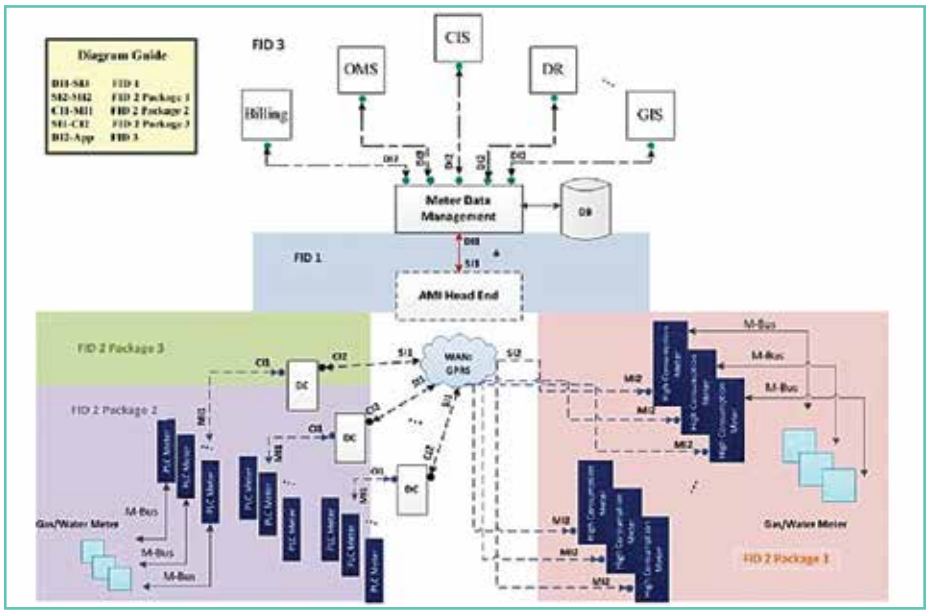


Figure 1. The smart metering project's information exchange architecture (conceptual architecture of FAHAM interoperability between smart meters, AHEs, MDM, and application systems).

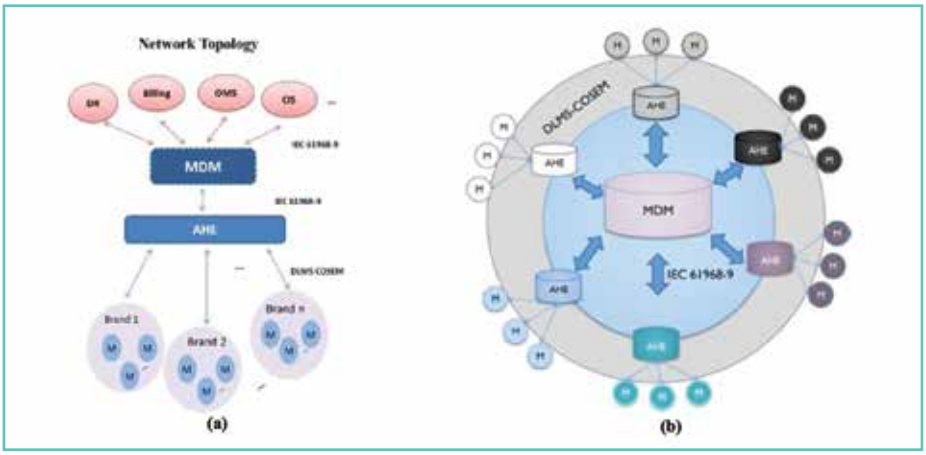


Figure 2. Interoperability concept in IRAN smart metering project (high-consumption costumer).

Iran smart metering information exchange architecture

In general terms, the interoperability architecture of the smart metering project is presented in Figure 2. As it can be seen, interoperability can be classified between application systems and MDM (based on IEC 61968-9), MDM and AHE (based on IEC 61968-9), AHE and data concentrator (for high-consumption costumer, based on IEC 62056-9), AHE and smart meters (for low-consumption costumer, based on DLMS/COSEM), and finally between data concentrator and smart meter (based on DLMS/COSEM).

It is worth mentioning that the FID 2-1 package actually refers to the direct communication between AHE and meters through GPRS regardless of the meter type.

The DLMS/COSEM protocol specifies the data model and communication protocols for data exchange with the metering equipment. However, the protocol has a lot of open issues which cannot implement interoperability completely. According to the DLMS/COSEM specification to obtain interoperability, there is a three-step approach which must be implemented as follows:

- Step 1 (modelling): The aim of this step is to obtain a unique data model for the metering equipment as well as rules for data identification.
- Step 2 (messaging): In this step, the required protocols and methods to access attributes and methods of the defined objects in the previous step will be presented.
- Step 3 (transporting): This step covers services and protocols for the transportation of the messages through the communication channel. In order to perform interoperably at the DLMS/COSEM level, the first step is to define the data model.

Interoperability protocol layers in DLMS/COSEM

There are different interoperability protocol layers for upstream (central access system) and downstream (smart meters) based on the IEC standards and DLMS/COSEM protocols that are presented in Figures 3 and 4.

One-to-one comparison between the interoperability concept in upstream and downstream is presented in Figure 4 (between IEC 61968-9 and DLMS/COSEM).

Interoperability documents for the Iran smart metering project

Similar to other AMI projects in the world, the most important challenge for the massive deployment of smart meters

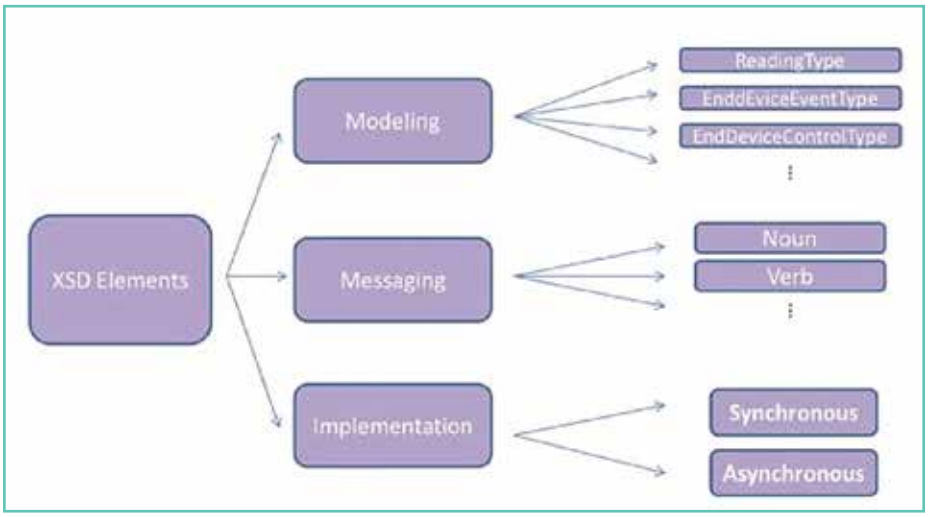


Figure 3. Interoperability in IEC 61968-9.

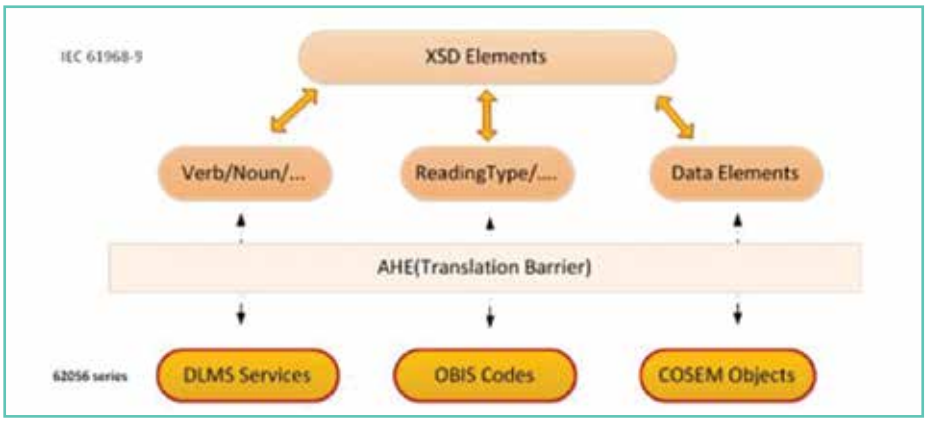


Figure 4. One-to-one correspondences between IEC 61968-9 (upstream) and DLMS/COSEM (downstream).

is the interoperability between all the components of the system by providing unique data models in each communication layer.

Monenco Iran as consultants for the AMI project decided to develop specifications for the manufacture of interoperable devices by using international standards and global successful experiences in these years. These specifications are developed by cooperation of all stakeholders as an expert working group during intensive meetings. These specifications are prepared in three colour-books that include interoperability specifications (White book), object lists (Green book) and event lists (Orange book).

FAHAM Interoperability document 1 (FID-1)

In accordance with Iran's smart metering use cases, to establish interoperability between the MDM and AHEs of local manufacturers, the message structure should comply with IEC 61968-9. As this is an open standard, there should be some kind of consensus between manufacturers. After reaching consensus regarding message structures, AHEs should be tested to verify the accuracy of the implementation.

Manufacturers should consider the following points:

- Messages should be completely based on IEC 61968-9 and there should be no innovation in messages;
- All elements used in the messages should be based on the FIDs.

According to IEC 61968-9, the general structure of messages is defined in Table 1 below.

According to IEC 61968-9, three kinds of messages are defined:

- **Request message:** Request messages are used for sending queries or commands. For example, a request message might be sent from a MDM to an AHE to obtain a set of meter readings.
- **Response message:** Response messages are used for returning the corresponding data or status information to a request message. Response messages are also used to indicate whether a given request succeeded or whether there were any failures in performing the command. Response messages may also be used for sending simple acknowledgements in the context of web services.
- **Event message:** Event messages are used for sending unsolicited data such as asynchronous data or status information. For instance, such messages may be sent to notify a MDM such as installing a meter or other entity of an asynchronous event such as a power outage to a meter. Event messages may also be used to send meter readings according to a pre-configured schedule. For example, an AHE might maintain its own schedule of meter interrogations and push these data to a MDM at regular intervals as required.

Message	Header
	Request
	Reply
	Payload

Table 1. IEC 61968-9 general structure of messages.

Any IEC 61968-9 message, whether it is a request message, response message or event message, is composed as an XML document. These different message types are distinguished by the top-level element in the XML document.

FAHAM Interoperability document 2 (FID-2)

The FID-2 is divided into three main packages as follows:

- **FID2-Package 1:** MI2-SI2 Interface;
- **FID2-Package 2:** MI1-CI1 Interface;
- **FID2-Package 3:** CI2-SI1 Interface.

System Architecture and DLMS Structure

The system architecture of FID-2 Package 1 is presented in Figure 5. The data exchange between the electricity meter and HES (Head-end System) is based on an IP backbone, SMS services and DLMS protocol. The AHE acts as a DLMS client and the electricity meter takes the role of DLMS server.

Multi-utility meters (gas and water) and IHD (In-home Display) are connected to the system via electricity meter. For multi-utility meters/IHD interfaces (MI4 and MI5), the required functions (and data model) are defined in this specification. The default physical interface for communication with multi-utility meters is wired M-Bus, but the provisions shall be provided to convert it to wireless (by using convertor/transceiver) in wireless M-Bus applications.

Interface specifications

Interface specifications are explained in the following.

MI2-SI2 (Meters-HES)

This interface is based on an IP network and SMS service. The DLMS protocol is used for

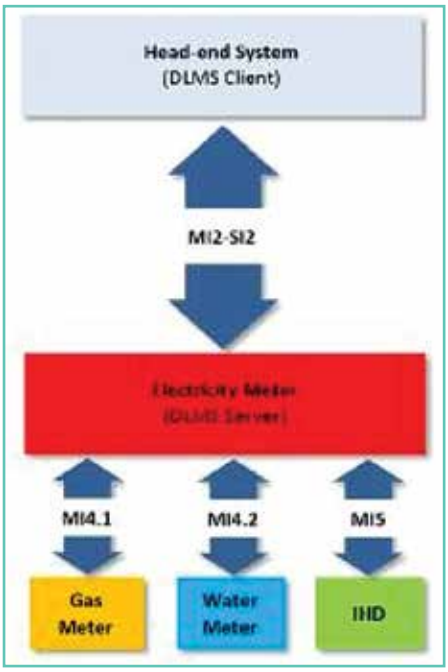


Figure 5. FID-2 package 1 system architecture

data exchange between electricity meters and HES. The HES acts as the DLMS client and the electricity meter as the DLMS server. The following communication services shall be provided in this interface:

GPRS CSD/SMS (Wake-up)

Two operating modes are used in this interface as follows:

Pull/Push: The "Pull" mode is initiated by HES. It is used for collecting data from meters or sending commands/information to meters and consumer's interface. The "Pull" is realized by using the following DLMS services:

OPEN RELEASE GET SET ACTION: The "Push" mode is initiated by electricity meter to send some critical information such as Alarms and so on to Head-end system/IHD. The DATA-NOTIFICATION service of DLMS is used in this mode. Table 2 shows the DLMS services in Pull and Push modes according to the type of communication (IP-based or SMS).

MI4 (electricity/gas/water meter)

The M-Bus is used in this interface. The data of M-bus devices is mapped to COSEM objects in electricity meter (According to EN 13757-3). The M-bus devices are accessed via COSEM objects in the electricity meter (not transparent access through electricity meter). The required functions and data mapping model are defined in this specification. The default physical interface for communication with gas/water meters is wired M-Bus, but the provisions shall be provided to convert it to wireless (by using convertor/transceiver) in wireless MBus applications.

Wired M-BUS

- The format class FT1.2 of EN 60870-5-1 and the telegram structure according to EN 60870-5-2 is used.
- The wired M-Bus is based on the EN 13757-2 physical and link layer.

FAHAM interoperability document 3 (FID-3) (Interoperability at legacy systems)

Application systems (or conventional legacy systems) use load profiles (available through the smart electricity meters) to control and manage the power system and guarantee the effective operation of the whole system. The most important parts of the application systems are billing, outage management system, customer information system, demand response management, management and engineering, power quality, energy management system, GIS, asset management etc.

The Iranian smart metering system must provide and process the information related to metering equipment in an information infrastructure and this information is then shared in order for application layer usage. Billing is the first and the most important application system that already is used for processing of captured metering information in order to process customer payments. Different billing periods, on-demand and accurate billing are the most interesting features of the billing application system. Other application systems such as an interface between the network operator and customer are in pilot phase and offline test procedure. The complete implementation of application systems in FAHAM needs software and hardware upgrading and other consideration.

These documents (FID3-40 and 41) aim to present the steps toward collecting periodic meter readings for the billing process. Periodic meter readings are typically daily and monthly readings. Monenco Iran Consulting Engineers designed and developed software to test the WebService process and the receipt and transmission of data between MDM and billing in order to solve technical problems and enable a successful billing process. (Implementation of interoperability among billing system and MDMs, based on FID3-40 and 41).

In Iran, the most successful experience of the billing system is in Semnan province where all the features of the billing system are now fully implemented. Other provinces such as Tehran and Mashad are in the final implementation stages. MI

In March 2009 implementation of the Iranian national advanced metering infrastructure plan (FAHAM) was placed on the agenda of the Iranian government and Power Ministry of Iran. The target was to decrease electricity losses by at least 1% per year and a 14% decrease in overall network losses by 2015. Afterwards preparation of a seven-year roadmap to exchange electricity meters for all customers was started.

The FAHAM project is funded by the Power Ministry of Iran and under the supervision of the Iran Power Generation, Transmission and Distribution Management Company (TAVANIR).

FAHAM transforms the meter from a simple measuring and counting device, to one element of an integrated system of hardware, software and people that can be used to better manage the electricity service which customers find essential to their lives.

FAHAM is not simply a tool to capture customer consumption of energy, but hardware and software architecture capable of capturing real-time consumption, demand, voltage, current and other information.

In the next edition of Metering & Smart Energy International, we will conclude our examination of the implementation in Iran with a comparison of Idis, Faham, and International standards and future trends for the application system.

Operating Mode	DLMS Services	
	IP Communication	SMS Communication
Pull	GET, SET, ACTION (Confirmed)	SET, ACTION (Unconfirmed)
Push	DATA-NOTIFICATION (Unconfirmed)	DATA-NOTIFICATION (Unconfirmed)

Table 2. DLMS Services in Pull/Push modes

PLATFORMS, PLATFORMS EVERYWHERE

David Socha discusses the proliferation of technology platforms across every aspect of IT, OT, data and analytics and considers the lack of a consistent definition of what exactly a platform might be.

Everything's a platform nowadays, huh? There are smart grid platforms; smart metering platforms; all-encompassing utility IT platorms[1]; big data platforms; analytics platforms; IoT platforms of course; AI platforms...obviously. In fact, I could probably fill my allocated word count for this column and still not name every variation. But what is a platform? Or perhaps more importantly, what do vendors mean when they talk about platforms? Because that might not be the same thing.

The Truth is Out There

Let's see if we can make some sense of this whole platform concept and at least have a go at cutting through the marketing doublespeak. And let's start with trying to define what a (technology) platform actually might be. Techopedia's definition is a good place to start. It says a platform is "*a group of technologies that are used as a base upon which other applications, processes or technologies are developed.*"

I can work with that. Take, for example, a smart metering platform. The above definition might suggest such a thing to be a group of technologies that do some undefined number of basic tasks that are likely to be common to a lot of smart metering processes. It might not do the more complicated stuff, or stuff that's specific to your business's or your regulators' unique requirements – that would need to be *developed* on the platform. Or perhaps we don't need development. Perhaps some of that more complicated stuff might come as optional additional pre-configured apps or modules from the vendor. With me so far?

Brand X

Well yes David, I hear you say – but what are those common basic tasks? Who gets to define what functionality is basic (i.e. part of the platform) and what isn't (i.e. stuff I have to buy or develop separately)? And how do I know if the platform is going to cover all the things I need it to cover? Who gets to decide the minimum set of functionalities allowed before a vendor can call their product a smart metering platform at all? Is there some International platform police organisation that I don't know about that makes sure everyone is conforming to the same set of standards?

Hopefully, you're starting to see the problem. In the absence of said platform police, there is no way to immediately know what a vendor means – or what they're avoiding telling you – when they proudly introduce their particular Brand X platform to you. Some platforms are comprehensive, proven, flexible, scalable and extremely valuable. My own employer's analytics platform is one of those. But then I would say that, wouldn't I? Many more platforms are a rough cobbling together of some tools and applications that the vendor has created, procured, inherited in mergers and/or is still working out how to integrate. And they may or may not cover all of your needs.

> *does your chosen platform include appropriate data storage and curation?*

Deceive, inveigle, obfuscate

Here's where we get to that part about cutting through the marketing doublespeak. It's absolutely critical to go into a conversation with a platform vendor with eyes wide open. Some platforms are based on data integration and flexible, managed access to that data, creating a...eh...sound *platform* for all sorts of applications and processes to leverage a single view of an enterprise's "truth". Others focus on applications, development toolkits and point-to-point data integration, or can only integrate specific types of data, limiting your view of the business by maintaining (or even creating new) silos of information. Some are tied to vendor-specific ways of developing new front-end apps, limiting your ability to use existing tools your business might already have paid for – and that users know and love and deliver valuable insights with. But each will be called a platform, irrespective of what capabilities they have and what functionality they offer.

I want to believe

So how to navigate this ambiguous world of confusion and obfuscation? We all want to believe that the right platform for our needs exists out there somewhere. And also, that we can evaluate apparently comparable/competing platforms objectively to come to the right conclusion for our business.

So we still haven't got as far as coming to any real conclusion on the definition of a technology platform, simply because... well...it doesn't matter what we decide, does it? Vendors have always called whatever they sell whatever they think will make you buy it. And everything's a platform nowadays, huh?

Take this example: While I still subscribe to the definition of a platform we used earlier in this article:

"*a group of technologies that are used as a base upon which other applications, processes or technologies are developed.*"

... others are determined to convince us that a platform has nothing to do with technology at all and is in fact a business model.*

And hey, who is to say they're wrong?

So how to navigate this ambiguous world of confusion and obfuscation? First, let's assume we are indeed still focusing only on technology platforms. Now, you may not be the IT expert in your business. And if that's the case, you shouldn't need to be either. I get that. But, so does the vendor. And at times they can...eh...gloss over a few things that it might have been more useful for you to know before you do engage with your IT colleagues and ask them to help you deliver some new value for your business.

With that in mind, let me propose three areas for consideration and questions. There's more to it than this, of course. But I hope these three can help you to cut through some of the pretty marketing images and over-hyped buzzwords to understand what it really is that your platform vendors are offering you – and what they're not.

Coverage

At the simplest level, ask your vendor which key groups or layers of components their platform provides. Is it just a suite of useful applications and software development kits (SDKs) so you can make more applications? If so, I'd suggest that what you have there isn't a platform at all. It's a suite of applications. You'd be surprised how many vendors will fall at this hurdle.

Of course, a suite of useful applications may well be attractive to you. And that's fine. But let's consider what it is that actually makes those applications useful. It's data. Does the platform also include comprehensive data acquisition and processing tools and capabilities? In other words, will the platform ensure that the right data are sourced, processed and securely delivered to its applications at the right time and in the format they require? Or do you need to do that yourself?

Finally, on this topic, does your chosen platform include appropriate data storage and curation? Many don't. Many will expect you to already have your data in an ecosystem that allows fast access to already curated data. Without it, their platform may still be able to function, but data may be sourced from point-to-point integrations: increasing costs; multiplying the likelihood of duplication and errors; and reducing performance. Or, there will be an expensive change request on the project to deliver said data ecosystem. This is perhaps the single most common 'misunderstanding' encountered when investing in a technology platform.

> *Does your vendor's platform allow your existing applications to take advantage of the platform's infrastructure too?*

Openness, connectivity and interoperability

Now let's think about the fact that you might not only want to use the applications that come in the box, or that you can develop with that neat SDK. Does your vendor's platform allow your *existing* applications to take advantage of the platform's infrastructure too?

Can your Data Scientists apply Open Source analytics tools to the data in the platform, to complement those the vendor may have provided? And what of cross-functional analytics? Let's illustrate this issue with the familiar example of smart meters, as I have before. Can you quickly, easily and regularly extract smart meter data from your platform to create new insights across a wider environment including, say, billing and geospatial data from other sources? Or is the data in your new platform now stuck there forever, next-to-impossible to extract without specialist skills?

Real scalability

Do you know the data volumes your platform needs to be able to handle? Perhaps more importantly, do you know how much it may have to handle in the near future, as digitalization and the IoT deliver unprecedented amounts of data to the enterprise? Again, it may well not be your role to know such things. And that's OK. However, if you're the business user assessing the capabilities of a new platform, make sure you – or a colleague better placed to ask the difficult questions – do ask searching questions about scalability.

Any platform vendor should be able to demonstrate lightning-fast responses on small, or even relatively large test data sets. But, sticking with the smart metering theme: Enedis is rolling out 35 million smart meters across France. TEPCO is rolling out 27 million across the Tokyo area. That's a lot of data. IoT platforms may have to be able to handle even more, as more and more sensors send back their data to the enterprise. And what of those cross-functional analytics platforms, potentially looking across *all* of that data? Scalability, scalability, scalability.

Over to you

So, should you find yourself talking with a platform vendor any time soon and it seems they might have something that could be of use to your business, I hope you'll consider the three lines of questioning I've outlined. First, in a simple three-layer model, does the platform deliver at the application, data processing *and* the data storage & curation levels? Second, is it open, accessible and interoperable, or a closed shop? Third, does it scale? I mean *really* scale?

If you can get the answers you need to these questions, it's a fair bet that you're on the route to securing a platform that could deliver what you thought it might when you read that first marketing headline or heard the first elevator pitch. If you can't ... well, don't say I didn't warn you! MI

*"Platform business model definition: a business model that creates value by facilitating exchanges between two or more interdependent groups, usually consumers and producers."[ii]

ABOUT THE AUTHOR

David Socha is Teradata's Practice Partner for the Industrial Internet of Things (IoT). He began his career as a hands-on electrical distribution engineer, keeping the lights on in Central Scotland, before becoming a part of ScottishPower's electricity retail deregulation programme in the late 1990s. After a period in IT management and consulting roles, David joined Teradata to found their International Utilities practice, later also taking on responsibilities in Smart Cities and the wider Industrial IoT sector.

[i] The first one of those I found on the web had pictures of cute robots all over it. I'm not sure what cute robots have to do with Utilities IT, but hey they *are* cute. And so ... modern. Sigh.

[ii] https://www.applicoinc.com/blog/what-is-a-platform-business-model/

ARE SUPERCONDUCTORS THE KEY TO A MORE EFFICIENT FUTURE?

Superconductors have received a lot of attention in recent years, with superconductors being used in studies across the globe, and specifically in Korea and Germany.

In Germany, the city of Essen is home to the world's longest superconducting cable of more than a kilometre long, connecting two transformer stations within the city. By using advanced materials to eliminate inefficiency within the transmission and distribution of power, it may be possible to save billions of dollars in technical losses around the world.

The AmpaCity Project examines the concept that "a cable with almost-zero transmission losses can transfer power over long distances at residential voltages. Rather than using the amped up transmission voltages required by regular cables, superconductors could reduce the need for large, expensive transformers by eliminating the need for certain voltage conversions throughout the city."

According to Frank Merschel of RWE Deutschland, "The high-temperature superconductor (HTS) system replaced a conventional high-voltage cable system by connecting the medium-voltage busbars of two substations. AmpaCity serves as a lighthouse project because it is the first time a 1-km HTS cable system was installed with an HTS fault current limiter in a distribution network within a city centre."

Merschel continues that the cost of HTS wires is expected to drop over the next decade, due to economies of scale and the increasing current carrying capacity of HTS materials. As the current density of superconductors increases, less wire is needed to build power devices, ultimately leading to a lowering of costs.

Writing about the project Merschel says that the quasi zero resistance of HTS means "large currents can be transported at the medium-voltage level so intracity high-voltage equipment as well as high-voltage transformers become dispensable." This effectively reduces the need for medium and high voltage transformers within city centres.

Changing from traditional cables and switchgear reduces distribution losses and increases efficiency.

According to project partner Nexans, "The dismantling of numerous 110/10 kV transformer stations would help to free up valuable space in inner-city areas."

"State-of-the-art high-temperature superconductors (cooled with liquid nitrogen) such as those used in AmpaCity have been ready for deployment in energy-related applications for some years now, although they have yet to be used on a large scale. Thanks to improved production processes, superconducting wires are only now available in sufficient lengths and quantities."

According to a release by Nexans, the technical predominance of superconducting cables can be attributed to the material properties of the conductor. At temperatures of around -200°C, the material is transformed into an almost perfect electrical conductor being able to transport at least 100 times more electricity than copper. Despite the cooling jacket, the compact design of the superconductor means that it can transport five times the electricity as a similarly sized copper cable – and with much fewer electrical losses.

While it is currently unrealistic to expect that superconducting cable will replace the existing grid, replacement at critical or space sensitive areas could significantly improve efficiency, cost and overall space utilisation. MI

Superconductors are materials that have no resistance to the flow of electricity, which mostly occurs at extremely low temperatures. With superconductors, losses due to the Joule effect become essentially zero, so there is the potential for dramatic reductions in overall losses. Even with the added cost of making them cold enough for superconducting, transformers in the 10MW and higher ranged are predicted to be substantially less expensive than their conventional counterparts.

In September last year, CERN hosted a three-day Superconductor Hackathon which brought together international students from technical and business backgrounds to develop novel applications for superconductors.

According to Panagiotis Charitos, editor of Accelerating News, a quarterly online publication for the accelerator community, "superconducting magnets developed for particle accelerators allowed physicists to take a close look into the heart of matter. Superconducting materials may well have a great impact on the way we produce energy, manufacture goods, transport commodities and medical applications." At the current time, their use is largely limited to research applications, although there are applications in the medical field, namely in magnetic resonance imaging (MRI) and nuclear magnetic resonance (NMR) systems.

The attendees spent three intensive days of lectures, lively discussions and hands-on prototyping at CERN's IdeaSquare. The teams came up with ideas for, among others, uninterruptible power supplies for data centres, decentralised electrical power plants to stabilise the electrical grid and a rocket launch system that would allow exploration of the solar system at costs far lower than any new conventional rocket launch system.

INTRODUCING

THE X RANGE

Conlog's new BEC44(X) Power Line Communication range provides the building block for a revolutionary new smart meter. The compact 4 terminal DIN rail meter is packed with features to enhance customer satisfaction, whilst providing the valuable data needed by utilities worldwide. Added to this is the ability for the meter to operate as a prepayment or post-payment meter, depending on the utility's requirements.

The BEC44(X) & CIU(X) range has been designed to set a new bench mark for robustness & reliability in the PLC electricity metering market. The design principles and highest quality materials already associated with Conlog ensure that the range shall meet and exceed the requirements of a utility that seeks an efficient, and cost effective solution for today and tomorrow.

If you are looking for a robust, reliable Power Line Communication metering solution, Conlog is the partner you can trust.

Class leading (OFDM) G3-PLC communication reliability

Total functionality in extreme operating conditions

Advanced Anti-tamper functionality

Mr Viven Perumal - Marketing Manager

Tel: +27 (31) 268-1111 Fax: +27 (31) 268-1500
E-mail: info@conlog.com
www.conlog.com
www.facebook.com/ConlogSolutions
@ConlogSolutions
Conlog (Pty) Ltd Company Reg. 1982/011895/07

CONLOG
Solutions for utilities

AI, ELECTRICITY AND THE AGE OF EMPOWERMENT

Artificial intelligence is changing the world but is it for the better? Tamara McCleary, CEO at Thulium, argues that Europe's power sector has a crucial role to play in leading the responsible application of AI.

It will come as no surprise to hear that artificial intelligence is used in some of the most exciting technologies coming to the fore in the 21st century. After all, there's nothing new about dreams of technological utopias, populated by machines that anticipate and cater to our every need. Machines that empower us to do more of what we really value, better. Such visions now look increasingly as if they could be within our grasp.

Progress has primarily been made in the field of machine learning, spurred on by innovative tech giants and start-ups alike, particularly in the US and China. As the Internet of Things continues to take hold, with internet-enabled devices collecting ever more data, there will be more and more for our machines to learn – and gain in intelligence.

Clearly this process needs careful guidance – and that's where Europe can come into its own.

> *What will the world look like in 2030? Barely more than 10 years away, it's already impossible to tell.*

Europe's critical role

The biggest danger we face as we build a world defined by AI is our understanding, or lack thereof, of what this all really means. For instance, what will the world look like in 2030? Barely more than 10 years away, it's already impossible to tell. Such is the pace of change that the mere question is like asking someone in 1920 to predict the social media platforms of today.

As the likes of Silicon Valley persist with a culture of building and beta-testing their ideas, making the move to market quickly and iterating as they go, there is no reason to expect developments to slow down any time soon. Nor would we want them to, but it is important that we also dedicate great minds to the task of ensuring that innovative AI technologies lead the world in 2030 to a better, not worse, future destination than the present.

This is a chance for Europe's own AI visionaries to play a critical role in shaping our future.

Europe's culture of innovation is a little slower than that of the US and China. This is not due to a lack of talent or infrastructure, but because of an emphasis on perfecting a product before release. It's a different mindset but no less valuable, especially when the consequences of product development can be dramatic – either way.

We need European AI experts to consider not just what's possible, but also what's actually responsible. As all Black Mirror fans know, not all ideas should be unleashed on humanity.

After all, it is on this topic that Europe comes into its own. The continent is home to companies like DeepMind researching ways to apply AI to the benefit of humanity. The Future of Humanity Institute at Oxford University is also doing fantastic work diving into the social, political and economic implications of AI.

These are critical conversations, raising philosophical questions that must be answered if AI is to bring about the utopia we all hope for.

The new information grid

Perhaps surprisingly, the most important players may prove to be the European utilities and power suppliers. We've become accustomed to seeing industries disrupted by new technology but the shift we can expect to see in our energy landscape will be unprecedented.

Utility providers face disruption on multiple fronts. Not only are they expected

to adapt to smaller-scale, distributed electricity generation by active energy "prosumers", but they also face competition from technology giants moving into their space with products and services such as Google's Nest.

It's apparent that the age of utilities simply selling kilowatt-hours is coming to an end. To remain relevant power providers will become platforms, offering services to improve our lives, as well as helping to regulate supply. For instance, they may provide free electronic consumer goods to their customers in exchange for the right to collect usage data, which then impacts where power flows across the grid throughout the day.

The application of AI – and machine learning in particular – will be critical to the delivery of such services, as will a change of mindset. Utilities are moving into the people business. They'll need to think beyond chasing efficiency gains alone and really start applying emotional intelligence to everything they do. An optimally-efficient grid is no good if it doesn't fit around how people want to live.

In fact, it's this consideration that matters most to the successful application of AI in the future. It's perfectly plausible that the power grid and information grid will merge to become one and the same – the AI-dependent infrastructural foundation upon which we build our lives. It's similarly plausible that while the US and China produce technologies quickest, the first truly considered, ethically-sound and beneficial implementations could come from the European power sector.

> *We've become accustomed to seeing industries disrupted by new technology but the shift we can expect to see in our energy landscape will be unprecedented.*

An age of empowerment

This places a huge responsibility on the power sector. Its attitude towards AI and behaviour in its application over the next few years may shape not only the sector's commercial prospects, but also global approaches to AI and the future of the world we live in.

Thankfully, power professionals are taking it seriously. They're already coming together at events like Electrify Europe to share ideas and lessons across the full length of the electricity value chain; working together to develop responsible solutions that will work to improve our lives.

It's exactly the type of leadership we need if AI is truly to live up to its billing as the most exciting development of our lifetimes – and unlock a new age of empowerment. MI

Tamara McCleary is a member of the Electrify Europe advisory board. Electrify Europe takes place in Vienna in June 2018.

**This article was originally published in Power Engineering International.*

NANOTECHNOLOGY IN BATTERY STORAGE: SIZE REALLY DOESN'T MATTER

With the increased focus on decarbonisation and decentralisation, energy storage is a key component within the grid of the future.

With the influence of nanotechnology, the storage space is changing, with batteries becoming smaller but more potent, a vital requirement to support growing renewable energy and demand flux. This article explores what nanotechnology is, as well as how it is impacting on the trends in energy storage.

The advantage of energy storage is the quick response time to changes in power supply. Traditional energy generators are mechanical devices that take time to react, but batteries can react within seconds. Batteries therefore can manage power fluctuations, a challenge as more solar is integrated into the energy mix.

Nanotechnology: The science of small

Nanotechnology refers to the study and application of extremely small things, a nano-scale of 1 to 100 nanometres. The discipline refers to the manipulation of matter on a molecular scale and has proven to have several applications within the energy sector.

The market is betting on nanotechnology to be a significant game changer, with increased need for connectivity, and longer lasting and more powerful batteries. More juice means a more stable grid.

At present, batteries need to be physically large in order to provide the power needed to ensure constant supply during the evening or inclement weather conditions. An example of this can be seen with Tesla's 100MW battery in Australia. It's about the size of a football field and has capacity to power 30,000 homes.

Traditional lithium-ion batteries have been the workhorses of storage, especially as electric vehicles and smart grids advance. Nanotechnology, however, will achieve higher charge rates, ensuring greater power density applications with a smaller physical footprint.

The nitty-gritty of nano

The nanostructured compounds used to improve the performance in batteries include nanofibers, nanorods, nanocomposites, and nanocrystals, lamellar compounds, manganese oxides and iron phosphates.

Nanomaterials as active components in lithium-ion batteries allow for shorter diffusion lengths for the lithium-ion across the active particle, as well as increasing the contact area between electrode and electrolyte – electrochemical improvements which allow for optimised performance.

> *"The manipulation of matter on a molecular scale and has proven to have several applications within the energy sector."*

Improvement as a result of nanotechnology

Using nanotechnology in the manufacturing of batteries provides many significant benefits. The electrode material is less flammable and therefore less likely to catch fire. Increased amounts of available power and reduced charge time are achieved by coating the surface of an electrode with nanoparticles. This, in turn, increases the surface area of the electrode allowing more current to flow between the electrode and the chemicals inside the battery.

This technique could enhance the efficiency of hybrid electric vehicles by reducing the weight of the battery needed to provide the required power.

The shelf life of the battery is also increased by using nanomaterials to separate the liquids in the battery from the solid electrodes when there is no draw on the battery. The separation prevents low level discharge, thereby extending battery life.

There are several developments impacting the use of nanotechnology in this space:

- Silicon coated carbon nanotubes in battery anodes have the potential to increase capacity 10-fold. However, silicon expands during the battery discharge cycle, which can cause damage to the anode. Silicon deposited on the parallel aligned nanotubes could prevent this damage from occurring. Furthermore, silicon nanowires have been grown on a stainless-steel substrate, increasing greater power density than conventional lithium-ion batteries.
- Of interest is the discovery that silicon nanoparticles within graphene cages could also decrease anode degradation.
- Lithium-air batteries are being tested with a catalyst made from nitrogen-doped carbon nanotubes, demonstrating the potential to store 10 times more energy than lithium-ion batteries.
- Researchers are developing a lithium-ion battery with a 10-minute recharge time.

Silicon nanoparticles in the anode are less likely to crack than electrodes containing solid silicon, allowing this quick charge time. Charge time can also be increased by using a graphene sheet on the surface of the anode. Defects are created on the sheet using a heat treatment, crafting pathways for greater numbers of lithium ions to attach to.

- Electrodes have been developed from carbon nanotubes grown on graphene with a large surface area and low electrical resistance. The strong atom to atom bonding allows for increased conductivity.
- Aligned carbon nanotubes are deposited on a substrate for use as an anode (and possibly a cathode) within a battery. Organic molecules attach to the carbon nanotubes allowing them to better align on the substrate, providing more oxygen atoms as points to which the lithium ions can attach, thereby boosting power density.

Many researchers have suggested that lithium sulphur batteries will be the next step in enhanced battery storage. The cathodes of the capacitor comprise sulphur encapsulated in carbon nanofibers. These batteries will boost storage capacity significantly, several times that of lithium-ion batteries.

Enter the ultra-capacitator

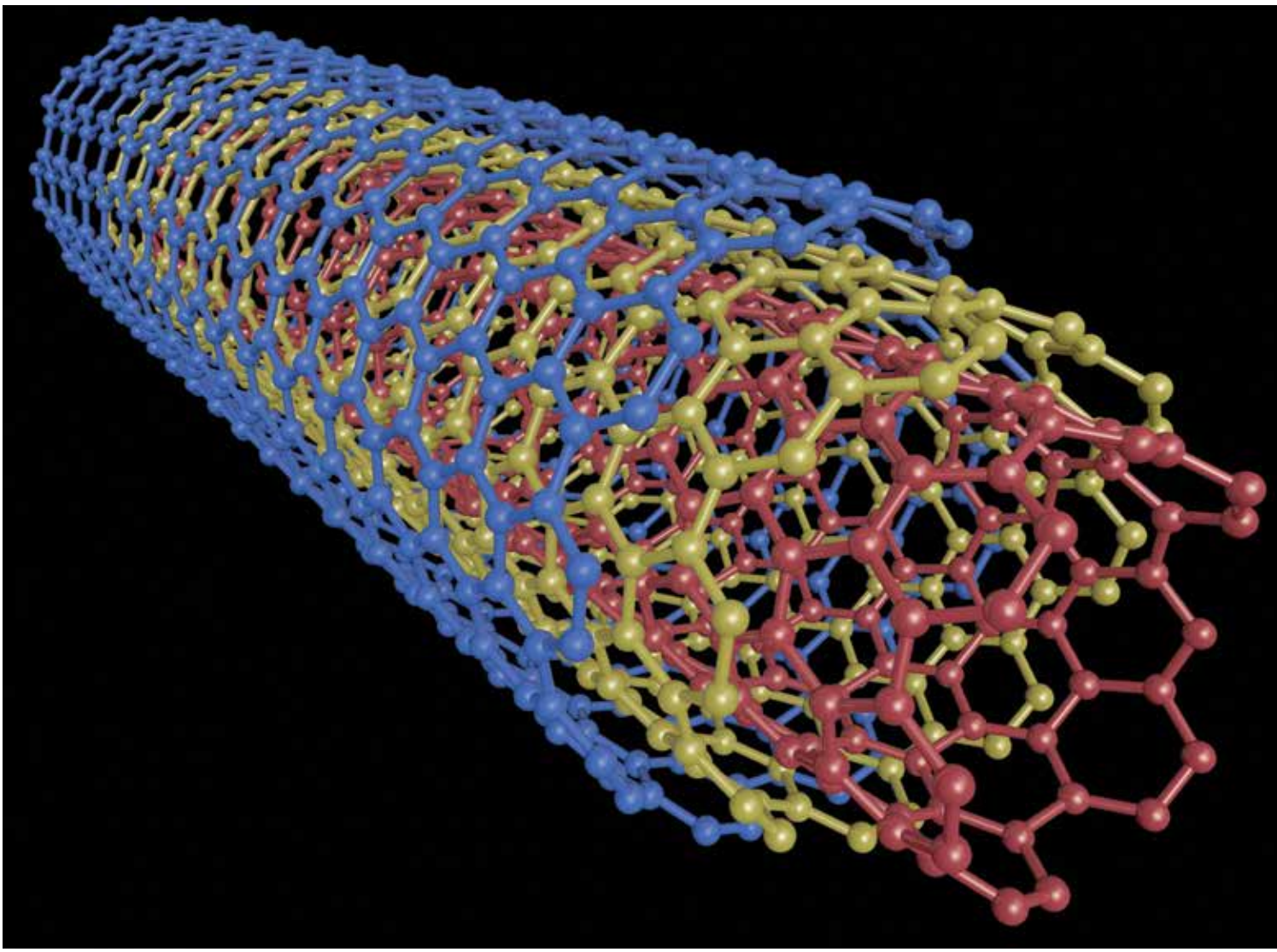
A capacitor is a device comprising a pair of electrodes separated by an insulator, each storing an opposite charge. A capacitor stores a charge when it is removed from the circuit that it is connected to; the charge is released when it is replaced back into the circuit.

An ultracapacitor is a capacitor that contains nanocomponents. They are currently being researched due to a dense interior, compact size, reliability and capacitance. A decrease in size and weight increases their capability to supplement batteries in hybrid vehicles by providing a boost of power during peak acceleration and allows the battery to supply energy over longer periods of time, such as during a constant driving speed.

Research in the field of ultracapacitors has given rise to a nano-porous carbon aerogel that is used in the design to change the pore diameter and distribution of nano-sized alkali metals, increasing conductivity.

Carbon nanotubes are another possible material for use in an ultracapacitor. Carbon nanotubes are created by vaporising carbon and allowing it to condense on a surface. When the carbon condenses, it forms a nano-sized tube composed of carbon atoms. This tube has a high surface area, which increases the amount of charge that can be stored.

Even though nanotechnology is still within the development phase, the market is forecast to grow exponentially. Key market drivers include increasing adoption of electric vehicles, plug-in hybrid electric vehicles and hybrid electric vehicles, as well as a growing focus on renewable energy. The implementation of nanotechnology in battery production and development is expected to continue to improve the compatibility of power supplies, ensuring a future grid that delivers a constant and consistence supply of power. MI



ARE ELECTRIC CARS THE KEY TO A RENEWABLE FUTURE?

Electric vehicles hold enormous potential but their deployment so far has fallen short. Jacob Klimstra, senior energy consultant and member of the advisory board for Electrify Europe, looks at how the industry could work to overcome the remaining barriers to a breakthrough.

In October 2017, London Mayor Sadiq Khan introduced the new emissions surcharge, also known as the T-Charge. It means that older vehicles are subject to an extra charge for driving in central London if they fail to meet the minimum European emission standards. It's the latest reaction to growing concerns over emissions and air quality – not just in London but internationally – and their impact on public health and global warming.

Penalising offending vehicles is one part of the solution. However, there are other important alternatives, such as electric vehicles, that could prove to be the real long-term fix. And there are encouraging moves in that direction. Also in October, the Dutch Government announced that it plans for all new cars to be zero-emissions vehicles by 2030 – with others, including Paris, already following suit.

Electric vehicles are not a new concept. Henry Ford and Thomas Edison both pursued electric vehicle production over one hundred years ago. However, the case for their much wider deployment is becoming ever stronger and it's clear they will play a huge role in the continued move away from the reliance on fossil fuels. Beyond the well-documented environmental factors, they are reliable and durable, with less wear and tear so require fewer spare parts, including brake pads. They're also cheaper to run than petrol vehicles and safer.

And they're gaining in popularity. In 2013, some 3,500 of the UK's newly registered cars were electric or hybrid electric vehicles, according to The Society of Motor Manufacturers & Traders. In 2017, there are more than 63,000. However, for them to become truly mainstream, the industry is going to have to break through some challenging obstacles.

> *It's clear that the wider deployment of electric vehicles is a crucial topic. However, it is one vital ingredient in the broader push to decarbonise energy.*

Speeding up the charge

When it comes to logistics, the main crux of the issue is the practicality of charging. To be fully functional whenever they're needed, plug-in electric vehicles require easy access to locations where they can charge rapidly. A typical domestic 24 Amps connection is simply not enough – so to achieve the required speed, vehicle owners will need a separate, expensive setup.

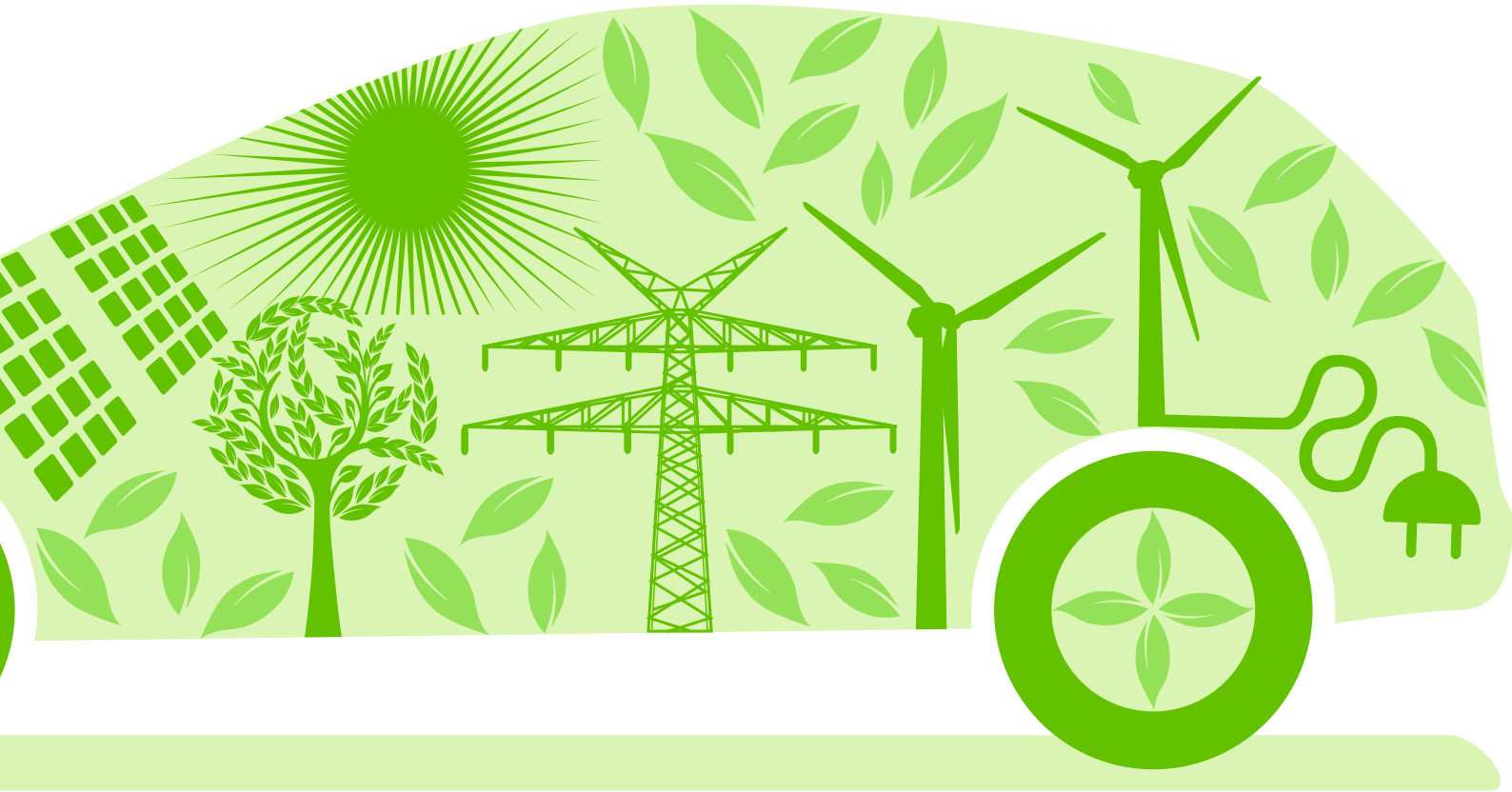
A community or business hub for charging is one option – but even this will require dedicated cables connected into a building to carry the electricity. A business hub setup will also come at a price, probably costing more than €1,000 a year over and above the usual tariffs.

Even if communal hubs become a popular option, they will likely create a bottleneck. With just one or two serving a whole business or neighbourhood, ensuring every vehicle is charged and operational could prove impossible.

Greater supply for greater demand

Let's imagine an ideal scenario where domestic charging ports are a reality. It's a sunny day and solar cells on each home's rooftop are generating enough power to charge every vehicle. Now let's imagine it's winter, the sun is hidden, and the limited solar power must be shared between extra heating as well as several cars.

Aside from the point of charging, there needs to be sufficient capacity in the electricity network to run a nationwide fleet



of vehicles. The network must also have the flexibility to distribute electricity effectively throughout the day. On top of this, the industry will need to replace old, fossil fuel-powered plants as they come offline to fully realise a world of zero-emissions vehicles – all of which is a huge shift and presents major challenges.

The new energy infrastructure

The solution lies in creating an efficient underlying energy infrastructure, including charging networks and a pool of energy providers. Crucially, that infrastructure must look at distributed power, which is essential to replace the systemic risk inherent in having one or two core power plants. However, this is a major revolution in the total energy supply for the developed world, so governments will need to play a pivotal role in defining the new landscape.

One challenge is that change will require significant investment. Use of public funds will likely ignite controversy and arguments that it perhaps detracts from healthcare and other public services. Mitigating these conversations means educating the public on the importance of electric vehicles and supporting a new energy infrastructure.

Educating the educators

On a very basic level, electricity is vital to the running of everything from banking and governments to transport and schools. Without it, there would be no healthcare. In reality, of course, these are complex arguments and the government needs representatives who fully understand their intricacies. The question is, just how well can politicians understand and explain the case for renewable energy to the public?

This is where the energy sector must play a crucial role, in educating governments and helping direct them on the key issues. The term 'lobbying' has gained some negative connotations for being self-serving. However, what's needed is a different approach – one where organisations from the industry help champion a much wider agenda that will benefit everyone.

Campaigning will be one powerful tool. Public awareness campaigns have proved successful in helping to shift perceptions and, ultimately, change behaviours. Over a decade ago, for example, the UK Government launched a multi-million-pound campaign to change attitudes towards recycling – and today recycling has become the expected norm.

When it comes to renewables and electric vehicles, we are talking about a much larger change. However, the same approach applies. Here, the industry and government will need to consider longer-term and phased campaigning to raise awareness and understanding. Might a short-term focus on air quality in cities be a good place to start, given its status as a hot topic at the moment?

The wider picture

It's clear that the wider deployment of electric vehicles is a crucial topic. However, it is one vital ingredient in the broader push to decarbonise energy. The fact is that if, collectively, nations want to move forward with the Paris Agreement, a lot more energy must come from sustainable sources. That means public perceptions need to change. Homes might have windmills nearby, solar panels will become more prominent, and restrictions on older vehicles will grow. Instead of seeing these and other changes to infrastructure and policy as burdens, we need to see them as positive advancements.

> *"Organisations from the industry help champion a much wider agenda that will benefit everyone."*

Civilisation as a whole relies on electricity and now is the time to come together to redefine its future. Electric cars could prove to be the catalyst for much-needed and widespread change – and a future where Henry Ford and Thomas Edison's plans could finally become a reality. MI

SHOULD GOVERNMENTS SUBSIDISE TARIFFS?

Cost-reflective tariffs are an on-going, much talked about topic but why do they continue to be problematic and what are the possible solutions? Daniel Njoroge Butti, energy economist lecturer at Karatina University, a public university in Kenya, explores this trending topic.

Policy makers have consistently found themselves faced with a policy dilemma, trying a trade-off between cost-reflective tariffs and subsidised tariffs – or what politicians will refer to as a pro-poor tariff. I subscribe to the school of thought that fronts the argument that all citizens in an economy should enjoy access to affordable electricity, which can be achieved through government cost-subsidising tariffs.

The entire discussion around cost-reflective tariffs versus cost-subsidised tariffs revolves around power purchase agreements (PPAs), which governments enter into with energy investors. What one needs to understand is that the manner in which PPAs are drawn up is over long-term periods – usually 20 to 25 years – and so agreements dictate that for example X amount of billions of dollars is paid for generation of electricity to grid connectors. What this does is to lockdown costs during this period. This means no adjustments; hence, the tariffs will not be cost-reflective over the term of the contract.

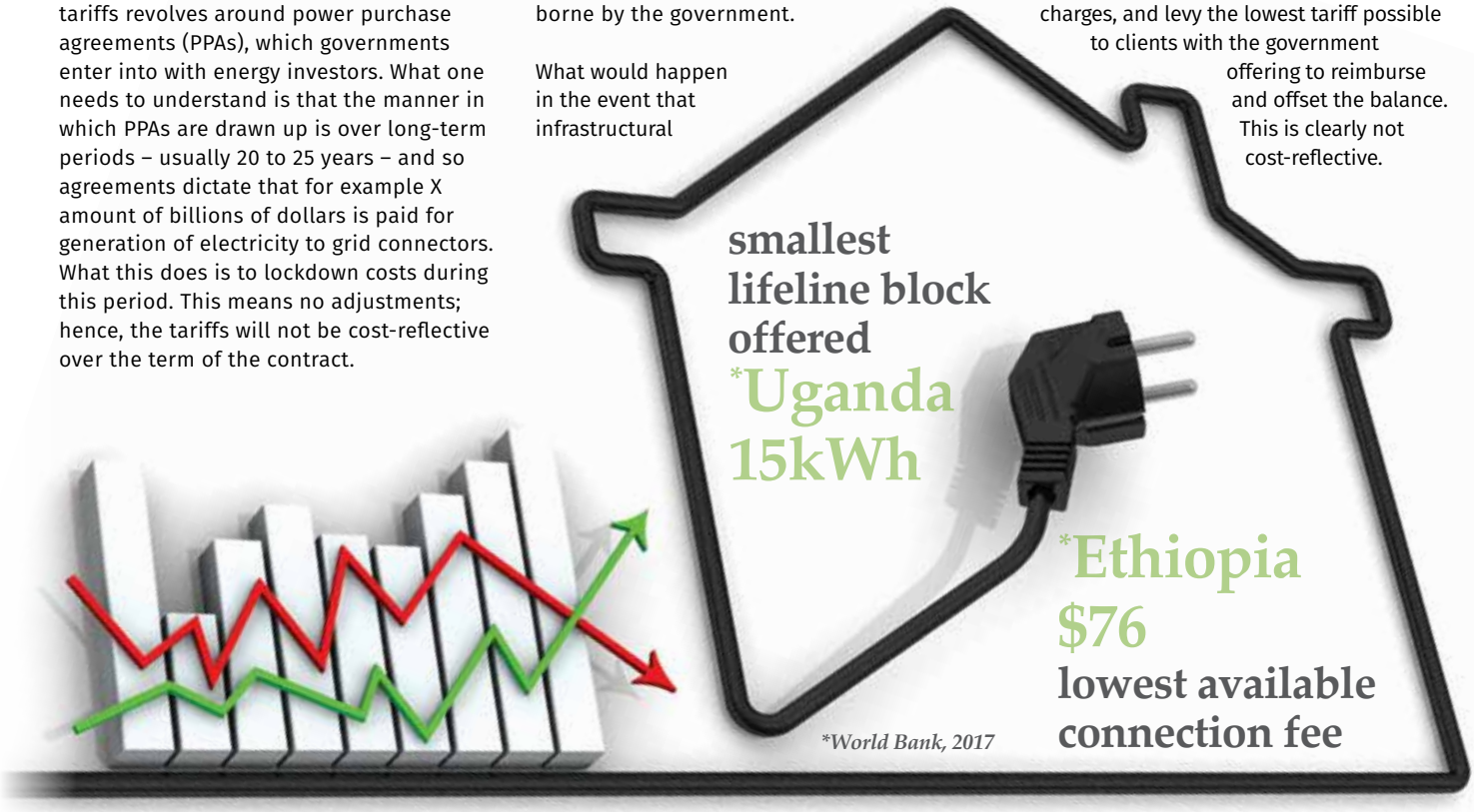
Another aspect is that, in Kenya for example, electricity consumers' and end users' bills (for both domestic and industrial consumers) have for a long time not reflected what I would refer to as pass-through charges. These are charges such as adjustments that involve inflation rates, exchange rates and cost of living fluctuations, which in a real sense periodically keep changing. As such, very few adjustments are drawn and captured in power bills. On the other hand, infrastructural costs, or what can be referred to as highway costs, are borne by the government.

What would happen in the event that infrastructural costs were passed on to consumers in the form of high tariffs? It would be chaotic, given that only a few consumers would get access to electricity, making most of the economy redundant. Furthermore, not many consumers understand the nitty-gritty or the components in their bills, which in itself is a challenge that must be addressed.

Case study into high tariff charges

In a recent scenario in Kenya, electricity generators incurred KES10 billion ($99 million) and Kenya Power – the grid connector, which is also a retailing and distribution company – believed it to be prudent to pass the cost on to consumers in the form of high tariffs. Consumers were also burdened with the higher tariff being back-dated for three months.

Naturally, this brought about an uproar among the general public, given that most of them cannot afford high electricity prices. What the government did then was to direct Kenya Power to suspend the pass-through charges, and levy the lowest tariff possible to clients with the government offering to reimburse and offset the balance. This is clearly not cost-reflective.



The resultant negative impact is that since electricity users are aware of the subsidy programmes by government, there is a tendency to be extravagant and not efficient in their power consumption. This would not be the case should the cost have been borne by the consumers – feeling the pinch would have been a good motivator to use electricity efficiently.

In another scenario, in the Southern African Development Community region, the five-year period through which all member states were supposed to have transitioned to a cost-reflective tariffs regime saw only Namibia and Tanzania attain this resolution.

In my view, this thematic issue needs to be seen in the totality of the entire economy and not in isolation. In South Africa, for instance, the National Energy Regulator has a mandate to improve social equity and address the requirements of low-income households. This is not going to be achieved if the South African government embraces a cost-reflective tariff. Rather, governments need to come in with a form of cost-subsidy tariff.

Countries such as Germany, China and most of the OECD countries in Europe are pursuing a subsidy tariff regime, particularly in the renewable energy market. Only Australia and parts of the US (New York and Virginia) have walked away from cost-subsidy tariffs.

The way forward

It is my opinion that developing economies are not ready for cost-reflective tariffs; therefore, governments ought not to rush on this issue. There are a number of approaches that African governments need to take into account as they walk across this terrain.

Firstly, there should be a mechanism developed on how to encourage consumers to be aware of the tariffs they pay vis-à-vis the amount that governments pay for them, so as to really understand the value they get on their power. By understanding the cost allocated to them, they will be more efficient in their power use and avoid extravagant use of power altogether.

This cost-subsidy can be partial or in full, depending on a case-by-case scenario but mostly partial cost-subsidies are recommended. Therefore, civic education needs to be encouraged in this area given that most consumers do not understand the components in their electricity bills.

Secondly, issues of cost-subsidy tariffs – as seen in economies such as Germany and China that have felt the burden – call for a need to allow government to conduct cost adjustments on pricing as well as introduce a legal mechanism, so as to carefully balance the need for universal access to energy for all with cost issues.

Therefore, is a need to address, encourage and initiate legal reforms that make it possible to address the contemporary dynamics in the energy industry in our countries. In this, there should be legal provisions that make it possible to have energy generators as well as independent power producers selling electricity directly to grid connectors.

As such, the issues of efficiency and affordable power to end users on the service provider's part will be attained. This will afford grid connectors the discretion as to which energy power source they should purchase, which will translate into affordable tariffs for end users.

Another issue is inefficiency in capital procurement and expenditure, and in operational expenditure, which makes the cost of providing electricity expensive. These costs inflate tariffs for poorer consumers, making a cost-reflective policy regime too high for many in developing economies.

What is the remedy?

Regulators should propagate and enforce prudent administrative and managerial procedure, especially in areas of both capital procurement and operation expenditure, to reduce the cost of providing the service. This will include dealing with mismanagement, which is a corruption issue as well.

In addition, delocalisation and deregulation of the energy markets is a perfect approach. There is a need for one central control unit, perhaps the grid connectors, but the law should allow energy investors and generators to sell energy directly to grid connectors as well as provide the means to deliver electricity to end users. This is what is envisaged in the Energy Bill currently before parliament in Kenya.

Remember the contention has always been that the producers want costs to be reflective but energy consumers want costs to be subsidised. Policy makers in the energy sector need to strike a balance between these entities. In many countries, the issue of generation, transmission and distribution, and the entire supply chain, ought to be borne by the investors. This has been the case in many countries but in most African economies these infrastructural arrangements and costs have always been treated as highways, which belong to governments and are borne by the governments. MI

Stakeholder conversation

The conversation around the underlying issues must be looked at with a wide lens, by the entire stakeholder spectrum, if one looks at adopting policy around the tariff issue:

- What is the role of energy in an economy. Does it spur the economy for instance?
- Does access to affordable energy lead to new companies being established in the manufacturing industry for example? Does it lead to increased employment in various sectors of the economy?
- Does affordable power encourage and motivate foreign direct investment (FDI) as well as spur or act as a catalyst in increasing domestic investments?
- Moreover, the political constituents of support, which model when adopted will bring politicians the votes they need to stay in power. The political variable is a component that will remain at play, and cannot be wished away.

ABOUT THE AUTHOR

Armed with a Masters in Economic Policy and Management from Makerere University, Daniel Njoroge Butti lecturers at the School of Business, Karatina University on economics and policy analysis, and is a Lead Research Analyst for GBS AFRICA on energy issues. He is currently undertaking a study on: Geopolitics of the East African Oil & Gas pipeline.

ADAPT OR DIE: INTEGRATED ELECTRICITY VENDING SOLUTIONS

Olurotimi Famoroti, Head of the vigilance, strategy and loss reduction unit at Ikeja Electric, Nigeria shares his perspective on why integrated vending solutions are not just for prepaid electricity.

The term integrated electricity vending solutions refers to an integrated energy management system primarily for prepayment solutions. There are, however, a number of vending solutions that also accommodate other settlement models outside of prepayment.

The initial prepaid meters on which the Nigerian case is built were originally introduced in South Africa during the 1990s to help utility companies solve a huge financial and security risk problem. In 2004/2005 the defunct Power Holding Company of Nigeria followed suit. This heralded the pre-settlement model for electricity purchases by consumers and the creation of the first set of electricity vending systems within the Ikeja Electric network, covering two residential estates. Since then, various patches of deployment have taken place, with future installations yet to be announced.

This system of energy management by utility companies in the country has evolved over the years from proprietary on-site standalone vending systems, to a fully integrated web/cloud based smart energy solution. The advent of technology, the ever increasing demand for proper energy management, unrelenting revenue assurance and data management issues necessitated Ikeja Electric's choice for a fully automated, integrated energy management solution. This is an end-to-end system that covers customer metering, a meter data management system and a revenue management system.

Rich in data management

Aside from the advanced metering component, which brings its own benefits, other key features of this integrated vending system are:

- Customer information management, which serves as a repository for customer information;
- Tariff management, which enables effective management of multi-tariff customer structure;
- Meter operations management, which takes care of the meter-to-system integration and energy tokens;
- Retail management that enables extended vending functionality to other payment service providers to aid cash collection; and
- A credit management system, which defines the settlement framework for the retail management system.

Robust solution

Using an integrated energy management solution has yielded dividends to Ikeja Electric in the areas of:

- Improved cash collection from the metered customers
- Establishment of a robust customer data management system
- Reduction in commercial and collection losses
- Cost reduction in associated overheads
- Ease of monitoring customer energy activities and payment patterns
- Quality real time reporting and robust business intelligence data
- Reduction in financial risks and debt burden of the metered customers

Despite the huge benefits of deploying such a robust solution it was accompanied by challenges, which the distribution company (disco) overcame during the course of the project and on a continual basis in some respects. The project cost had major financial impact on the business especially due to high cost of funds and limitations on allowable yearly Capex injection by discos. To date there are costs and complexities associated with post integration maintenance and upgrades, which can be cumbersome due to constantly evolving business dynamics and institutional limitations.

> *[Introducing an integrated electricity vending solution] is definitely one of the best business decisions yet at Ikeja Electric.*

> *The advent of technology [...] and data management issues necessitated Ikeja Electric's choice for a fully automated, integrated energy management solution.*

The system's integration posed challenges and complexities, as connecting one tool to another requires flexible solutions. It's about enabling new business processes or automating existing ones, which are particularly tasking considering the extent of changes to existing business processes and creation of new ones to reflect the new system dynamics. Challenges were encountered with data migration especially as it supports existing legacy systems. Another challenge was trying to transfer same data requirements to a completely new and different system – in terms of data quality and a lot of new information that previously did not exist, which had to be sourced for successful systems integration and quality reporting.

Also limited was the required knowledge and skills to operate the newly acquired technology. Expertise was either built from the existing workforce or had to be sourced at a premium to the company. All things considered, it is definitely one of the best business decisions yet at Ikeja Electric. MI

DID YOU KNOW?

Ikeja Electric has introduced a scheme to empower new payment agents.

In February, the distribution company partnered with United Bank for Africa and E-top, a payment terminal service provider, to launch an initiative aimed at empowering communities within its network through the creation of entrepreneurial opportunities.

The initiative aims to empower members of Community Development Associations through the provision of free Point of Sale terminals and loans for the payment agents. According to the arrangement of the scheme, payment agents will be entitled to 1.8% of bills they collect from electricity consumers.

ABOUT THE AUTHOR

Olurotimi Famoroti's position at Ikeja Electric involves a cross functional responsibility for driving strategic initiatives for the disco's commercial loss reduction, metering and payment channels expansion for the business. Famoroti holds a Master's degree in Business Administration and International Business from Lagos State University.

AFRICAN UTILITY WEEK EVENT HIGHLIGHTS

Energy Minister Jeff Radebe delivered the keynote address at the African Utility Week conference in which he also assured delegates that the long awaited Integrated Resource Plan is expected to be finalised in August this year.

The conference, which hosted in excess of 6,000 international energy and water professionals, centred around the theme of building a skilled workforce to drive power and water projects on the continent.

Radebe additionally re-affirmed South Africa's commitment to partnerships with independent power producers as he hailed the South African government's "very successful independent power producers procurement programme".

Highlighting the successes of renewable energy in South Africa, he said: "To date we have concluded 91 projects with a capacity of 63,000MW. Of this, 62 projects have the combined capacity of 3,800MW which is already connected to the grid."

He said further that the country has seen a 'significant decline in tariffs of about 55% for wind and 76% for solar'. Radebe said about R136 billion has been invested in the South African economy and another R56 billion is to be invested over the next 3-5 years when construction of 27 renewable power projects, signed in April, commences. The minister further drew attention to the 39,000 jobs created for South Africans with these projects, the reduction in carbon dioxide emissions by 23 million tons and substantial savings of water. No outright mention was made of South Africa's nuclear energy plans.

European Union Ambassador to South Africa Marcus Cornaro welcomed South Africa's recommitment to the renewable energy sector, specifically the 27 renewable energy projects. Cornaro told delegates this will help "reinforce investor confidence in the sector".

"The EU sees itself in a threefold role as a development partner, as a foreign direct investor and partner in research and innovation in Africa and specifically South Africa. The EU remains a prominent investor in the energy sector," he said referring to the number of EU-based companies involved in the renewable energy power producers programme.

Cornaro also called for strong leadership and citizen participation at national, regional, multinational and global level.

"This will determine our ability to leapfrog in the development of sustainable energy and water sectors."

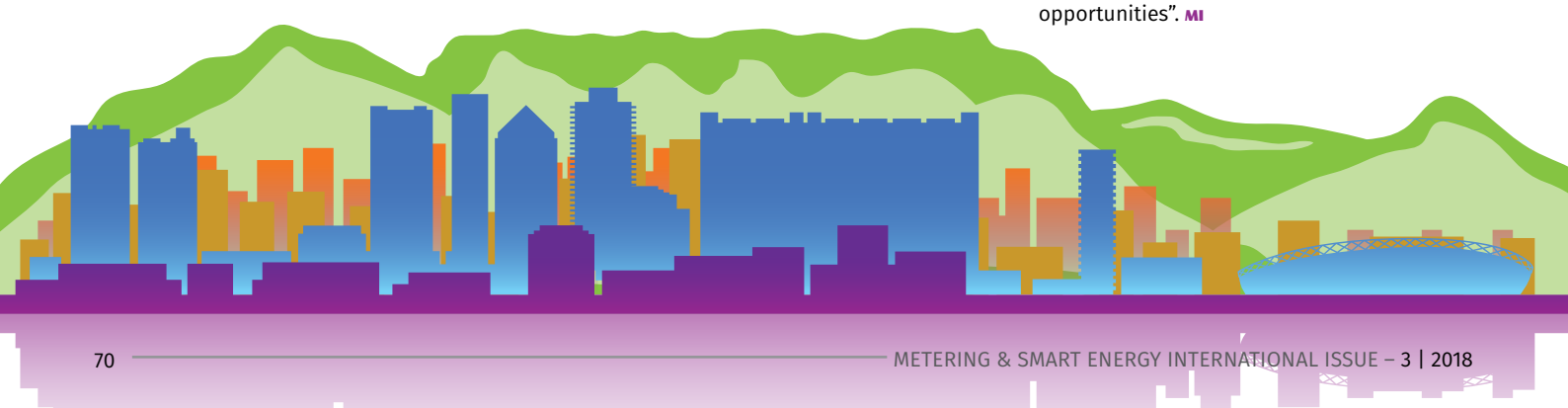
Eskom's new CEO Phakamani Hadebe said in his address that Africa must unite on energy issues, calling access to electricity a human right.

"Africa has a common purpose which we all have to pursue," he said. "The question then is how to create the infrastructure needed for growth and to create opportunities. It's a huge challenge."

Hadebe said it is only in the creation of an environment conducive to growth and opportunities that "Africans will not risk their lives to cross the ocean in search for opportunities". MI

2018 KEY STATISTICS

6411 ATTENDEES OVER 3 DAYS FROM 84 COUNTRIES	**300** EXHIBITORS FROM 35 DIFFERENT COUNTRIES	**9** COUNTRY PAVILIONS WHO HOSTED 124 EXHIBITING COMPANIES
291 EXPERTS SPEAKING IN 116 CONFERENCE AND WORKSHOP SESSIONS	**650** INDUSTRY AWARD ATTENDEED	**77** UTILITIES AND MUNICIPALITIES FROM 21 AFRICAN COUNTRIES



AN INTRICATE NETWORK FOR THE FUTURE OF SMART ENERGY

World-renowned industry leaders from the energy sector gathered at Japan's comprehensive Business-2-Business trade show for smart and renewable energy in February. The 8th World Smart Energy Week shared an outlook on the industry, the latest technology, market trends and various strategies for business and national and international energy policies.

Trending conversations

Decarbonisation

A key theme at this year's event was decarbonisation where clean fuel technologies, specifically hydrogen, took centre stage. With efforts to lower its emissions through clean and sustainable energy resources, and in accordance with the Paris Agreement, Japan will attempt to cut greenhouse gas emissions by 80% by 2050. The Japanese government is aggressively pursuing hydrogen with the vision and mission to become a hydrogen-manufacturing hub.

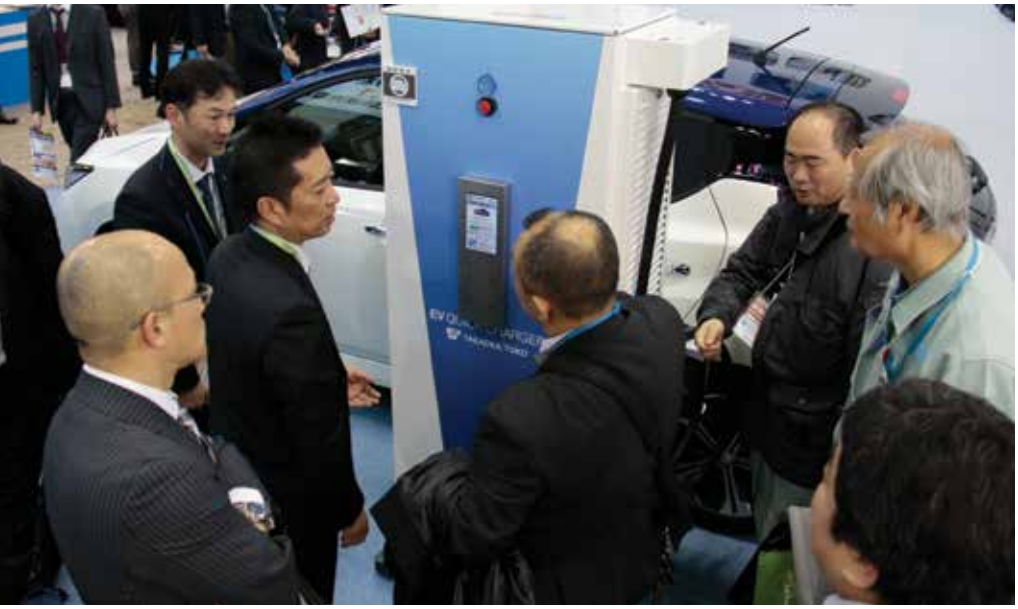
The Japanese government has identified that industry convergence, to balance and meet cost and supply demands, is necessary for hydrogen to become a feasible and sustainable option. Given the high associated costs of producing hydrogen and the necessary infrastructure required, there is opportunity for beneficiary sectors to collaborate and develop hydrogen stations, particularly in the battery storage and transport sectors.

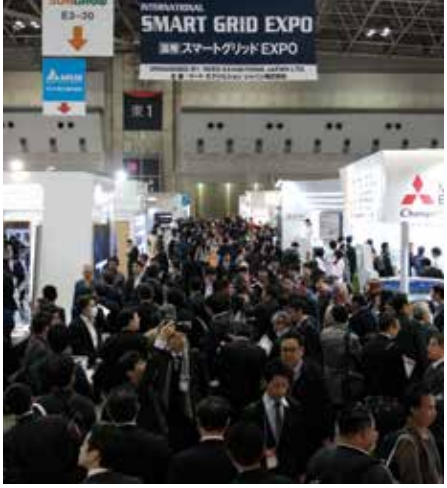
The strong connection between hydrogen and transport was evident at this year's show. Delegates who attended the Fuel-Cell Expo were treated to a fuel-cell hybrid bus or "FCHV-BUS" test ride. During the 3-day show, the FCHV-BUS operated on two routes: Tokyo Big Sight-Iwatani Hydrogen Station and Tokyo Big Sight-Shinsuna Hydrogen Station. Visitors were able to take a ride in the bus and view the bus prototype while attending the show.

Clean power

Speaking at the event, Takuya Yamazaki from the Japanese Ministry of Economy, Trade and Industry said government had determined a new strategy in December 2017, whereby renewable energy was declared to be a main power source. This was "a watershed moment," Yamazaki said. The Japanese government has set an ambitious target of 160GW from renewables by 2030 – far outweighing baseload fuels such as coal and nuclear. Having identified solar photovoltaic (PV) as a highly competitive technology, the government is piloting a utility-scale PV auction in two rounds. In 2018, bid rounds two and three are expected to open in August and November respectively, each for 250MW.

Japan's target of renewables against the total power output was 10% in 2010 and peaked at 15% in 2017, an increase that Yamazaki attributed to the Feed-in-Tariff (FiT) system. The government has set a 22-24% increase by 2030. However, having enabled the power mix to achieve the current 15%, the FiT system remains a high cost to government. Under the FiT scheme, ¥2-3 trillion has been spent annually to subsidise the renewable operators, and should government exceed its 2030 target, this subsidy could increase in the region of ¥4 trillion, which is not a feasible nor sustainable option. "We have to depart from being dependent on the FiT system. It will not last forever; it will end sometime in the future," Yamazaki concluded.





This was echoed by Solar Frontier President and CEO Atsuhiko Hirano, who underlined that more independent power sources are required that do not rely on a feed-in tariff scheme – the 'prosumer' who applies a self-consumption model is an example. Realisation of a decarbonised society is the biggest priority for Japan, Hirano said. He added that this reality will largely include solar PV and renewables.

Technical sessions

During the show period, an array of keynote and technical conference sessions were held in parallel to the exhibitions at the Conference Tower of Tokyo Big Sight. The sessions centred on carbon-friendly technologies including wind, biomass, solar photovoltaic (PV) and thermal power. The advanced technology sessions covered fuel-cells, battery storage and the smart grid.

As Japan continues to pursue its vision for a decarbonised society, teamed with the global shift towards a 'smarter' energy society, the growing potential of electric vehicles and artificial intelligence has never been more prevalent.

Attendees can prepare to network with more than 400 new exhibitors at World Smart Energy Week 2019. The show will continue to serve as Japan's largest comprehensive energy show by contributing to further developments of smart and renewable energy business. MI

EVENT HIGHLIGHTS

8
shows

1,383
exhibitors from 33 countries

64,399
exhibitors from 33 countries

16,078
seminar attendees

221
unique sessions held

16,078
seminar attendees

A ribbon-cutting ceremony was held to celebrate the opening of World Smart Energy Week 2018 which hosted 55 dignitaries, including ambassadors and energy industry leaders from Japan and overseas.

CHINA UTILITY WEEK FEEDBACK

International guests and enterprises gathered in China in April this year with the aim of accelerating technological innovation to promote the efficiency of China's energy and utilities, realizing the sustainable development of energy.

Gathering energy institutes, government agencies, network operators, suppliers, consultants, system integrators, startups, end-users and decision makers from both home and abroad, provided a perfect platform for energy industry professionals to expand their business, share innovative technologies, and promote solutions and communication.

The event is a combination of exhibition areas, Summit sessions to discuss industry strategies and development trends, and Hub sessions which focus on industry solutions analysis. Coupled with the Initiate! Startup and Young talent programme, China Utility Week showcased over 50 exhibitors, 80 industry leaders and experts from all over the world along with cutting-edge technologies and market trends.

Specific discussion topics included:

- China's new market design: The creation of an unbundled, competitive, digital and sustainable power market. Lessons learned so far, looking ahead and what we can learn from international cases.
- The creation of a new business model: The transition of the business model. How to prepare your business for the digital energy transition and the changing role of the consumer.
- Renewable disruption of the market: The roadmap towards 40% renewable generated power by 2040. What role will the uptake of renewable play in the creation of a completive and sustainable power market?
- The journey towards a liberalised market: China's electricity sector is undergoing a major transition from a state managed system to a market price based one. Lessons learned so far, looking ahead and lessons from international case studies. MI

For more information visit **www.china-utility-week.com**

Australian Utility Week

Co-located with: Energy Services Australia

21-22 November 2018 | Melbourne Convention & Exhibition Centre, Australia

Accelerating Digital Transformation for Power and Water Utilities

We are the region's only digital utility expo focused on AMI, IoT and Cloud Platforms

NEW TOPICS INCLUDE:

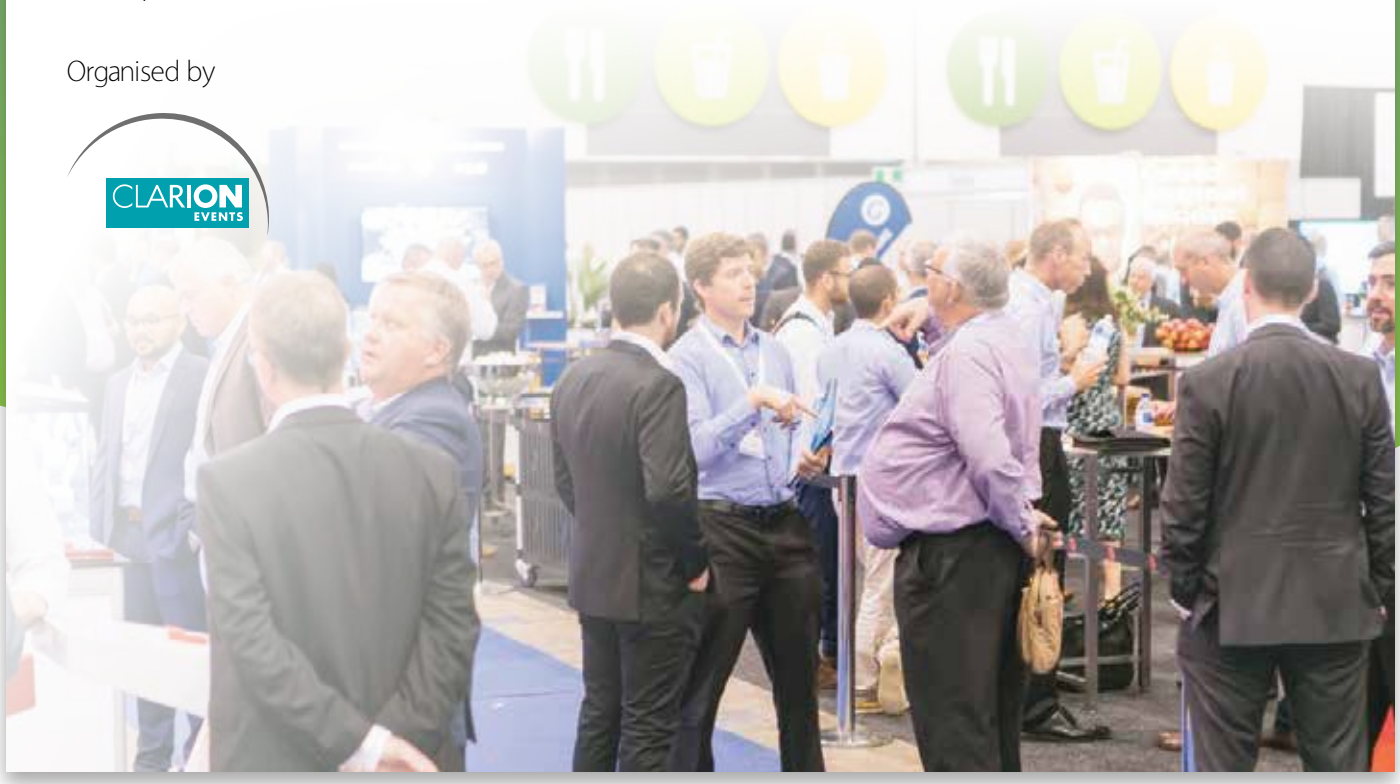
- AMI Solutions for Water Utilities
- Shifting business to the Utility Cloud
- IoT strategies for Connected Customers
- Creating value from Analytics Programs
- Digital Services for Customer Experience

SPEAKERS INCLUDE:

- George Hunt, CIO and GM, Digital Services, Sydney Water
- Andrew Bettenay, CIO, Endeavour Energy
- Edwin Shaw, Head of ICT, Ausgrid
- Cameron McLean, CIO, Yarra Valley Water

Organised by

CLARION EVENTS



For more information, visit www.australian-utility-week.com

ADVERTISERS INDEX

spintelligent CLARION EVENTS

AFRICAN POWER AND ENERGY BUSINESS HUB

CONFERENCE & EXHIBITIONS | PRINT & DIGITAL MEDIA | TRAINING & WORKSHOPS

With more than 20 years' experience in publishing and running conferences and exhibitions in the sub-Saharan utility sector, the power and energy portfolio is the largest and longest running portfolio at Spintelligent, the African leader in business-to-business events, publications and training courses. The power and energy portfolio includes our flagship event African Utility Week, which is the largest power and energy infrastructure exhibition and conference on the continent.

CONFERENCES & EXHIBITIONS

African Utility Week

African Utility Week
14 – 16 May 2019, Cape Town, South Africa
www.african-utility-week.com

FUTURE ENERGY EAST AFRICA CONFERENCE & EXPO

Future Energy East Africa
12 – 13 September 2018, Nairobi, Kenya
www.future-energy-eastafrica.com

FUTURE ENERGY NIGERIA CONFERENCE & EXPO

Future Energy Nigeria
13 – 14 November 2018, Lagos, Nigeria
www.future-energy-nigeria.com

PRINT & DIGITAL

ESI AFRICA

ESI Africa
www.esi-africa.com

METERING & SMART ENERGY INTERNATIONAL

Metering & Smart Energy International
www.metering.com

TRAINING & WORKSHOPS

spintelligent training academy

www.spintelligent-training.com

WWW.SPINTELLIGENT.COM/POWER

BPG INTERNATIONAL

HV / UHV Solutions for Overhead Transmission Lines & Substations

OUR MAJOR AFFILIATES & FACTORIES

Nanjing Electric (GROUP) Co. Ltd
Baiyun Mingxing Cable Co. Ltd
Guilin Power Capacitor Co. Ltd
Baiyun Electric Equipment Co. Ltd
Nanjing Electric Technology Co. Ltd
Nanjing Electric HV Bushings Co. Ltd
Nanjing Electric HV transformer Co. Ltd
Toshiba Baiyun Vacuum Interrupter Co. Ltd

OUR CAPACITIES & EXPERTISE

R&D, Design,Testing, Manufacturing & Supply of Products & Solutions for Energy Sector

YOUR RELIABLE PARTNER

Research & Development (R&D) & Design
100 years of experience & track records
Leader Industrial Group of Companies
HV Testing facilities & Laboratories
Manufacturing & Supply

POWER IS OUR EXPERTISE

UHV/HV 1000KV (HVDC) & 1200KV (HVAC)
Products & Solutions for Power & Energy
Transmission & Distribution (T&D)
Electric Power Substations
Subways & Railways

BPG INTERNATIONAL
International Headquarters
Commercial & Marketing

INTERNATIONAL HEADQUARTERS
54 Avenue Hoche, 75008 Paris FRANCE
Email: Marketing@bpg-international.eu
Web: WWW.BPG-INTERNATIONAL.EU