ISSUE 2: DATA MANAGEMENT

Landis+Gyr
manage energy better

pathway 02

managing data in a smart world

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from the editor

Dear readers,

The future is here, the transition to the digital age is happening at breathtaking speed. As usual, it took a little bit longer than the early enthusiasts thought it would. In 2012, however, we can safely say that digital technology is making an impact on every aspect of our life. Sensors and smart devices have become ubiquitous; millions of people are using smart technology every day.

The amount of data generated is growing exponentially and the utility industry is at the forefront of this development. Smart meters are being rolled out in huge numbers all over the world and their role is becoming clear: they are a lot more than handy tools enabling an easy way of exact billing. They are a crucial link in the chain of sensors that constitute a vital part of the smart grid. The smart grid, in turn, is a necessary premise for the sustainable society that we owe our children and grandchildren.

Times of transitions pose exciting challenges – in this issue of "pathway" we will look at the data management challenges companies in the energy industry are facing. Instead of spreading fear about drowning in a flood of data, we will discuss ways of putting the new abundance of information to good use. Getting the transition to the digital age right isn't as difficult as it may seem – what energy companies need are trusted partners to help them. This is what we've been doing at Landis+Gyr for more than a century and this is what we want to do by providing you with the second issue of "pathway", our customer magazine.

Jon Stretch
Executive Vice President EMEA, Landis+Gyr

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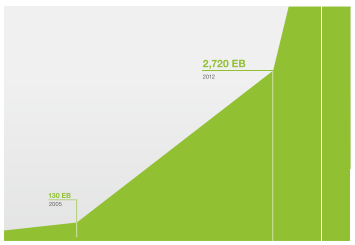


FACTS AND FIGURES

smart figures

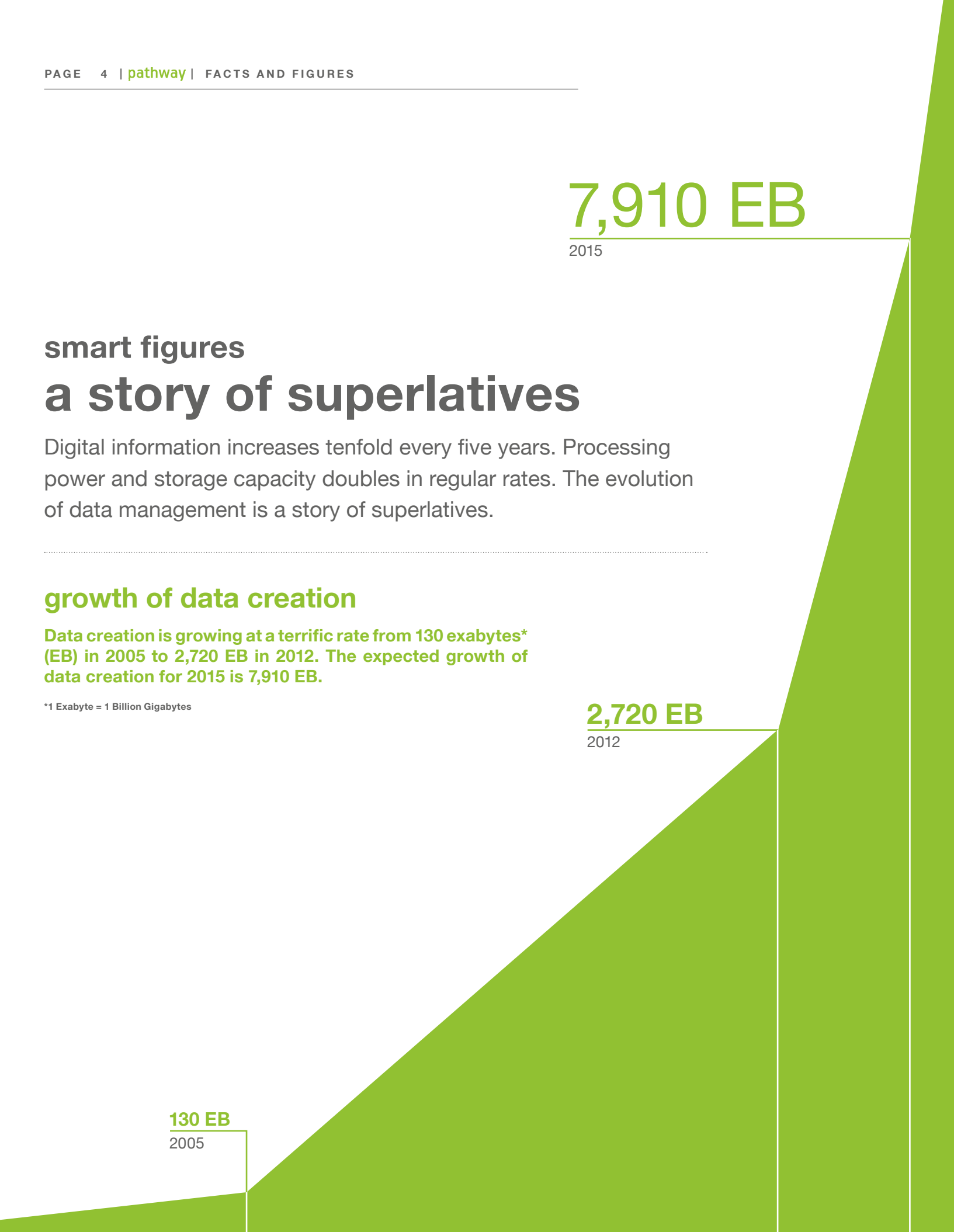
a story of superlatives

Digital information increases tenfold every five years. Processing power and storage capacity doubles in regular rates. The evolution of data management is a story of superlatives.

growth of data creation

Data creation is growing at a terrific rate from 130 exabytes* (EB) in 2005 to 2,720 EB in 2012. The expected growth of data creation for 2015 is 7,910 EB.

*1 Exabyte = 1 Billion Gigabytes



how much data is that?

Kilobyte, megabyte, gigabyte – do you really understand how much data it means or what it could represent? Here are some examples:

20 Kilobytes (KB)

correspond to the whole text of this issue

5 Megabytes (MB)

correspond to 5,000* KB or the complete works of Shakespeare

2 Gigabytes (GB)

correspond to 2,000,000* KB or a compressed 2-hour-movie

100 Terabytes (TB)

correspond to 100,000,000,000* KB or the expected wave of data from meter readings per utility/year

1 Petabyte (PB)

corresponds to 1,000,000,000,000* KB or the data Google processes per hour.

667 Exabytes (EB)

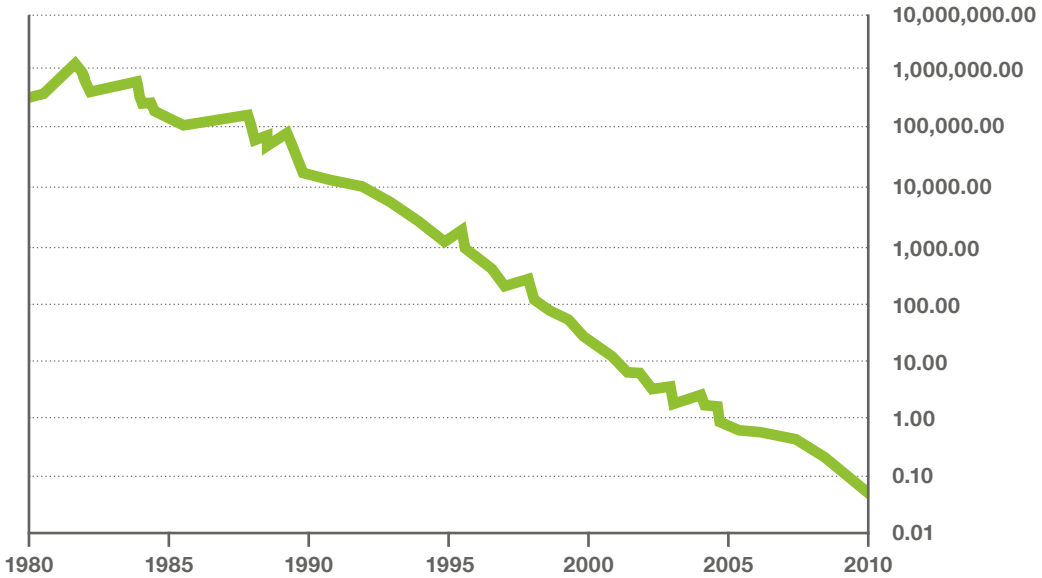
correspond to 667,000,000,000,000,000* KB or the estimated amount of traffic annually flowing over the Internet in 2013

***The numbers describe the hard drive storage capacity and are rounded accordingly in decimal intervals. The processor or virtual memory capacity may vary.**

cost of storing

Over the last 30 years storage space per unit has doubled roughly every 14 months. The cost of storing 1 gigabyte has fallen from 1 million Dollar to 10 Cents.

storage costs in USD



Source: http://www.mkomo.com/cost-per-gigabyte

data all around

the challenge of big data

With smart meters set to be rolled out in tens of millions all over Europe, utilities will be faced with torrents of data measured in units most people outside IT have never even heard of.

Smart meters capturing usage data in 15-minute intervals means more than 3,000 readings a month for each meter. This translates into terabytes of data being collected and stored every year. And this is only the beginning: with smart appliances and plug-in electric vehicles coming online, utility companies could be looking at the storage and management of petabytes and maybe even exabytes of data in the not so distant future.

TOO MUCH INFORMATION?

There is some disagreement within the utility industry whether it really needs the often mentioned quarter hourly meter readings which would lead to those terabytes of data. In their 2011 report on meter data management, analysts from Pike Research claimed that in order to implement daily time of use billing for the peak hours between 5 and 8 pm at most three meter readings were needed to identify peak and off-peak usage: midnight, 5 pm and 8 pm. Some utility executives told the Pike researchers that for billing purposes one meter reading per hour would be completely sufficient.

Others disagree with this assessment and state that from an operations point of view, it would be preferable to receive meter readings at a much higher frequency in order to improve their ability to manage the grid and to predict outages before they occur. Either way, with the possibility to obtain readings at any given time there is the potential to generate enormous amounts of data from smart meters.

LET MACHINES DO THE TALKING

A large part of big data growth will fall under the category of machine-to-machine communication and meter readouts are an obvious example for this category. Sensors and intelligent devices are becoming

a ubiquitous part of the physical world. The number of connected nodes making up the internet of things is predicted to grow at an annual rate higher than 30 percent over the next five years. The nervous system of the smart grid, the smart meters and other sensors will be partly responsible for this growth rate.

Dealing with all this data also spells out a challenge in terms of meter data management tools and software. It's a challenge, however, that utilities and vendors have been preparing for. Landis+Gyr's comprehensive Gridstream Suite with its advanced AMM system Gridstream AIM and the SAP Qualified Business Solution MDUS 2.0 are solid data management software platforms which will ensure that no customer drowns in floods of data. With the acquisition of Ecologic Analytics in January 2012, Landis+Gyr has shown again how serious it is about turning floods of data into additional streams of revenue for its customers.

DATA MINING FOR THE "NEW" GOLD

The need to manage enormous volumes of data provokes the obvious question: what exactly is data? And how can it be distinguished from related categories like information and insight? Common definitions describe data as being raw indicators, information as the interpretation of those indicators made intelligible by assigning meaning, and insight as a piece of knowledge which can be acted upon.

In terms of smart metering, this means to distil information about consumption patterns, for example. Data generated by frequent readouts allow to create very precise models of individual power consumption and can be used to optimize energy consumption of households.

Questions are powerful tools to structure and derive meaning from large amounts of data. The key questions for players in the energy industry are: what are the business implications of the big data age and how can we adapt and make use of them in the best possible way? In the strategy section we will try to provide answers, as far as definite answers are possible in the nascent field of big data management for the energy industry. ■

Data generated by frequent readouts allows to create very precise models of individual power consumption and can be used to optimize energy consumption of households.

SECURING PRIVACY

Cyber-attacks by hackers or foreign governmental agencies, terrorist attacks that switch off whole areas from electricity or other energy sources; these are some of the worst case scenarios that might result from a breach in smart meter security.

The interpretation of a household consumption data graph, on the other hand, can reveal information about the behaviour and the daily habits of the people living in a particular household: the time people in the household get up in the morning, have their breakfast, leave their house or flat for work, return home and go to bed, for example.

The more pervasive smart meters become and the more data they send, the more urgent those questions about the protection of communication gateways and data storage become. It's important to distinguish between privacy and security.

Privacy concerns in particular the right of an individual to control or restrict access to details about their situation and behaviour. Security typically concerns maintaining the confidentiality, integrity and availability of information only to authorized parties. Both are important issues that need to be addressed, and guaranteeing privacy usually requires the use of secure systems. While privacy is certainly important and legally protected, the worst case scenario in a case of privacy abuse is not as serious as the potential damage that a breach in security might cause. To be more concrete: while a breach in privacy could lead to embarrassing revelations or reveal somebody's absence from home, a security breach might lead to a whole city being cut off from the power supply. Energy distributors and utilities handling sensitive data focus on keeping sensitive material secure, and have to be on their guard against the rise in the theft of trade secrets, private data and financial information which could cost lost revenue, fines, lawsuits and severely damage the company's reputation.

From a technical point of view, privacy issues can be reduced by using "privacy by design", which means integrating privacy friendly solutions into technology and business processes. To support this, smart meters can use encryption and authentication algorithms.

Landis+Gyr has taken on the challenge of providing secure smart metering solutions, and is playing a leading role in the drive to establish standards for smart metering security in the EMEA region. As a founding member of the IDIS association, Landis+Gyr co-operates with other leading manufacturers to offer utility customers interoperable devices and a high level of communication security. At the same time, IDIS takes its customers' concerns regarding the financing of their rollouts seriously and aims to keep the costs of implementing a secure system in relation to the benefits it offers.

The introduction of a legal obligation, both at the European and National levels, will serve as a clear, safe, and sustainable way of encouraging smart meter security. The European Union, as well as the legislative bodies of the its member states, are creating regulation that will balance the needs of the utility industry with the rights to privacy of consumers. As a result, DSOs will be required to set up secure smart metering systems which guarantee the privacy of consumer data.

The German Federal government has taken such a step by defining very clear standards for smart meter communication gateways. To facilitate the process of an EU-wide rollout of smart metering, the European Commission has set up a task force on smart grids. If adopted by the European Commission, the legal and technical guidelines set by the task force will serve as a valuable basis for dealing with the security issues. ■

how to handle big data

from energy to information

Intelligent devices like smart meters and sensors are set to become sources of large amounts of data flowing the way of utility companies.

There is some debate, however, about the actual extent of so-called "big data" that companies in the energy industry will have to handle. To give an example: Southern California Edison, an American energy provider, expects to be handling only an annual 2 megabytes per meter.

The amount of data utilities have to deal with cannot easily be handled by traditional meter data management.

Utility IT experts Andres Carvallo and John Cooper offer a much higher estimate in their book "Ecomergence". According to them, what lies ahead for the average utility, could look something like this: "Four readings per hour – 15-minute interval readings – produce 96 readings each day. In a year, the number of meter readings will increase from 12 to 35,040. And that's just for a single account. For a utility with one million residential meters, the number of interval meter readings each year by that single utility will be over 35 billion. If each single meter produces 400 megabytes of data per year, then a utility with 1 million residential meters will have the challenge of managing 400 terabytes of new data each year."

Obviously, there is a strong element of uncertainty. What is clear, nevertheless, is that energy companies will have to deal with a lot more data than ever before. This is a new situation for most utilities; the data they will have to handle is voluminous, arrives at high velocity and is by nature time-series data that is not easily handled by traditional meter data management tools. "Another challenge is the variety of data utilities will have to deal with," explains Richard Haagensen, Head of Smart Grid and Business Strategy, Smart Energy Solutions at Landis+Gyr. "It will include unstructured data providing information about power quality, logs, events and other measurements apart from active energy consumption."

Beyond having to manage large and varied data volumes, the question is how utility companies will make use of them. "To my mind, these are the key questions: how can we minimize duplication of data and still provide timely access to it for all functions? And how can we manage the evolution of the smart grid, new assets and upgraded functionality while building future applications and handling analytic needs?" says Haagensen.

MANAGING CHANGE

Meter Data Management (MDM) systems are the central point of managing data from metering environments. MDM systems validate and edit the data received.

They aggregate, standardize and make the data available for other applications while serving as repositories for long-term data storage at the same time.

The analysts from Pike Research are convinced that MDM systems are at an inflection point. Utilities now expect MDM systems to enable more efficient grid operations. The new requirements are different from traditional MDM and require a different approach to building and delivering MDM.

The European Smart Metering Industry Group (ESMIG) lists the following characteristics for a modern MDM system: it acts as a hub for metered consumption and event data originating from an energy metering or display device, independent of the specific AMM system used to collect the data. It also provides short and long-term data storage for energy measurement data and is able to aggregate and perform calculations on individual meter reading data.

At the same time, it is a platform for interoperability between AMM systems from multiple vendors. Finally, an independent MDM system needs to assure that the development of new functionalities and features of business systems and operational systems can be done without any interference with the central gateway to the advanced metering infrastructure. This way, it minimizes the cost and risk associated with the customization of systems. Landis+Gyr's Gridstream AIM solution already enables MDM capabilities for a number of customers in the EMEA region.

CHOOSING THE BEST PARTNERS

Landis+Gyr has recently boosted its MDM capabilities through the acquisition of Ecologic Analytics, one of the world's leading providers of MDM solutions. With Ecologic Analytic's know-how and product portfolio at their disposal, Landis+Gyr is able to strengthen its MDM offering for utilities. The first outcome of this cooperation is now available: Gridstream MDUS 2.0 for SAP customers. Gridstream MDUS is a Meter Data Unification and Synchronization system pre-integrated into the SAP for Utilities™ system. It uses the efficient and proven MDM platform of Ecologic Analytics. Gridstream MDUS is a flexible, configurable and scalable energy data management solution, able to receive and manage data from various head end systems with IEC interface.

EcoMeter is the energy consumption visualization device for end customers.

Dramatic change is moving utilities to information abundance.

As a strategic development and sales partner to SAP, Landis+Gyr has been working together with Ecologic Analytics in the development of data management systems tailor-made for the SAP customers in the energy industry. With Gridstream MDUS 2.0, the two companies developed an IT platform that integrates smart metering infrastructure into utility SAP systems and enables powerful and efficient management of enormous amounts of smart metering data. This kind of seamless integration with strong data management engine is a crucial prerequisite if big data is to realize its full potential as the raw material from which growth will be generated in the 21st century.

RECOGNIZING PATTERNS

MDM taps into a new area: The utility takes its new assets – reams of data – and begins to analyze it for purposes beyond digital billing. Meter Data Analytics (MDA) is emerging from behind the shadow of MDM, and MDA could hold tremendous potential for utilities not only in how they manage their utility, but also in how they work with their customers.

Energy companies are starting to apply advanced analytics to smart metering data for a number of purposes, very frequently to optimize operations and maintain physical assets. Utilities can make good use of big data on a variety of levels: at a micro level, utilities will be able to analyze usage patterns at the meter level and return this usage information to consumers with the intent of achieving demand-side energy reduction. At a macro level, they will have the chance to analyze energy usage patterns of neighbourhoods and whole cities to facilitate infrastructure capacity planning and load demand in their coverage areas.

Utilities can also return the information they glean from their smart infrastructure to enhance the overall customer experience. For instance, by integrating advanced metering and load management systems, energy providers will be able to more proactively address outages that occur in their coverage areas and provide more accurate outage information. Overall, utilities will be able to make use of big data and address operational issues, energy delivery, customer care and security through noninvasive, near real-time data analysis. They will be able to spot trends, anomalies and patterns to identify opportunities and threats.

MOVING DATA SOURCES

There is a broad range of further applications, which are being discussed in the industry. Big data from the smart grid could be used to make precise assessments of buildings and evaluate ways to reduce their energy consumption. Factors like weather conditions, the demographics of people using the building, and the building's historical energy consumption can be used to create an accurate projection. The best way to make an existing building more energy-efficient is by getting as much detailed data about the buildings' energy use as possible.

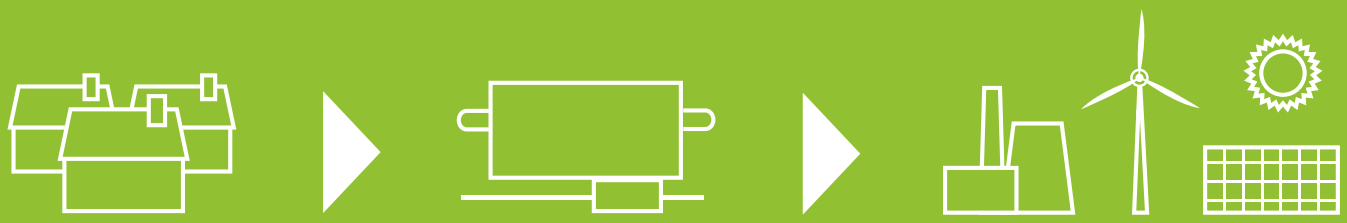
Another point to take into consideration is that many data sources probably won't be static. For example, as smart, electrically powered cars hit the roads, they'll be streaming data to and from the electric grid, IT-embedded "smart roadways," charging stations, the driver, other vehicles, and navigational equipment – all at the same time. Collecting and crunching all this data in microseconds could go a long way toward allowing vehicles to travel hyper-efficiently and safely, saving time and reducing the need for recharging.

THE AGE OF ABUNDANCE

While it is still uncertain to what extent industry will expand the use of data beyond their traditional sources, one thing is clear: utilities monitor constant flows of information – every part of their complex systems can be quantified and studied, making them prime candidates to adopt big data analytics. Landis+Gyr expert Richard Haagensen sums it up: "When utilities go into smart grid operation, they will need a proven IT architecture and MDM software as the backbone to support transformation from all this new data into information and then finally into intelligence in the utility."

Smart meters and other smart grid technology are bringing dramatic change, moving utilities from information scarcity to information abundance. Used in the right way, this abundance is certain to lead to significant improvements in energy management. A smart infrastructure and smart communities like the one piloted in Lyon (see report page 22) are set to make important contributions to the sustainable society of the future. ■

FUTURE-PROOF LAST MILE COMMUNICATION



A reliable communication network is a necessary premise for the successful rollout of a smart metering solution: every meter must be able to reliably and securely communicate the information it collects to the data concentrator or directly to the head end system.

The rapid development of communications technology requires a high degree of flexibility from the smart meter. Whereas the life cycle of the metering units can last up to 20 years, changes in communication technology happen significantly faster. Currently, there are basically four communication technologies used for smart metering: Power line carrier (PLC), RF mesh and point-to-point communication using a broadband connection (e.g. FTTH) or point-to-point communication using a public mobile network (2G / 3G / 4G networks).

The decoupling of base meter functionality and communication part is “a key issue” according to Jürg Haas, Product Manager Residential Communication Devices at Landis+Gyr. The meter itself constitutes the stable technology that remains in place; the communication modules can easily be upgraded or even replaced. This way, the system can be maintained at the cutting edge of technology.

HIGH SPEED PLC

A promising development in terms of PLC communication is the introduction of OFDM (Orthogonal Frequency Division Multiplex) PLC. With OFDM, the communication speed for data transfer via power lines will increase significantly. While today’s PLC technologies offer at the physical layer a throughput of 2 to 5kb/s, the new OFDM PLC increases throughput by a factor of 10. PRIME PLC, supported by the PRIME Alliance with over 50 members, has already acquired a strong position in the Spanish market. By the end of 2011, 200,000 PRIME meter points were installed in Spain.

G3 PLC is supported by the G3-PLC Alliance. The driving force behind G3 PLC is ERDF in France. In the next two to three years, ERDF will bring G3 PLC to maturity for mass rollout expected to start around 2015. Both technologies are open and have become an official International Telecommunication Union standard. Landis+Gyr will support both technologies and is committed to take its PLC portfolio over the coming years to the next level.

STANDARDS AND TAILOR-MADE SOLUTIONS

Landis+Gyr continues to lead the major standardization activities and supports the evolution towards PLC OFDM technology as well as the known point-to-point communication technologies. Currently, energy suppliers have two primary WAN/cellular technology options: second-generation (2G) and third-generation (3G). Most cellular point-to-point smart metering infrastructures today are part of Global System for Mobile Communications (GSM) networks and use the General Packet Radio Service (GPRS) data service. New cellular Smart Metering infrastructures, however, are more likely to use new mobile network standards as G3 (UMTS) or in the near future even G4 (LTE).

While providing proven and reliable communication solutions, Landis+Gyr remains agnostic in terms of communication technology. Consequently, Landis+Gyr is willing and able to support customers on a case by case basis with technology that a utility might require, like for example in the EMEA region rather uncommon RF mesh supplied to Helen Electricity Network Ltd. in Finland. ■ (see report on page 16)

Communication modules guarantee future-proof investments. One example: the recently updated E35C PLC modules that can be used with a baud rate of either 1.200 b/s or 2400 b/s. They allow high transmission velocities and a stable technology basis: the modular E350 meter platform.

expert round table

no journey of adventure

Drowning in the data deluge or obtaining a new level of granular insight? A round table conversation between three experts deeply familiar with the challenge of making the most of big data for the utility industry.

pathway: *Terabytes or even petabytes of data – the deluge of smart metering data is coming. What is your reaction to this statement?*

Craig Norman, President, Ecologic Analytics

Richard Haagensen (RH): I'm not too happy with the expression "deluge", but we will see an exponential growth generated by smart infrastructure compared with what we are seeing today.

Craig Norman (CN): I agree with Richard. "Deluge" is an unfortunate expression. The transition into the digital age won't be a journey of adventure for our utility customers. The increased data volumes will enable utilities to monitor their physical assets much better and provide an extra level of granular insight.

pathway: *How exactly does a utility benefit from this new level of insight?*

CN: A key area is outage management, of course. More granularity significantly improves the accuracy of outage and restoration data supplied to the Outage Management System (OMS). When an outage occurs, the affected world practically stops, and returning to normal requires a more effective use of available information. In order to do this, our MDM solution employs intelligent scoping logic. Intelligent scoping determines how many and which meters to ping and it ensures that the OMS receives the data only when necessary, protecting it against a flood of unnecessary outage data. Intelligent scoping is an extremely useful way of maintaining the efficiency of an Outage Management System and to deal with outages quickly and effectively.

RH: Basically, what we are looking at are several stages on the way to a smart grid. In the first phase, smart metering rollouts were about automated billing processes and improved customer service. When we get to the stage of advanced meter management, we see a stronger focus on demand side management, Time of Use (ToU) based tariffs, network optimization and load forecasting. The final stage is what I call Smart Operation: here we are talking about real time supervisory control and infrastructure management, for example. The MDM component of this last stage means advanced integration of MDM into the utilities' SCADA (Supervisory Control And Data Acquisition) systems, sophisticated supply and demand management and the integration of Virtual Power Plants, to name just some of the benefits.

CN: For us at Ecologic Analytics, it's crucial that we make those benefits available to small and medium-sized utilities, too. We provide them with a fully operational product, a working, blinking system, which allows them to focus on their core competencies.

pathway: *How do you gauge the potential of Meter Data Analytics?*

Maher Chebbo (MC): MDA have enormous potential. A medium-sized utility will definitely have to deal with data in the range of 100 terabytes. This wealth of data allows large or medium-sized utility companies to engage in predictive analytics and run "what if" critical scenarios. If you ask the right questions, you can receive fascinating answers, thanks to these new services.

RH: I totally agree. Data mining is a major topic in the context of big data for utilities. The recognition of pat-

terns, the transformation of raw data into intelligence will have a significant contribution to make to the successful operation of businesses in the energy industry.

MC: In traditional analytics, you need to make assumptions during modelling to deal with very high data volumes. This way, you can reduce the data set to a manageable size. The problem is that such simplified models don't provide an accurate reflection of multifaceted operational data. More often than not, this leads to suboptimal forecasting, planning, or

Maher Chebbo, Vice President of Utilities & Services Industries, EMEA, SAP

trend analysis. With HANA, SAP's High Performance Analytic Appliance, we have launched a breakthrough technology. Using this in-memory technology, SAP customers can process huge volumes of operational data to gain business insight while those operations are running.

pathway: *Data security is another topic which is becoming more and more important. What is the current status in terms of security regulation for the EMEA region?*

MC: I think there is progress being made. The EU Task Force on Smart Grids has asked the Expert Group 2 for regulatory recommendations for data safety, handling and protection. The experts have issued their recommendations in February 2011. In their paper, they also take a close look at how other industries dealing with sensitive information have responded to the challenges, like the financial and telecommunication industries for example.

Another interesting case study that can be found in the report draws conclusions from what happened in the Netherlands. The Dutch rollout was stopped because many people felt that security concerns hadn't been sufficiently addressed. The solution found in the Netherlands and initiatives like the Smart Meter Gateway Protection Profile in Germany are important steps in the right direction. We are addressing the problem in the industry, too. As the Chairman of the European Business System Integration and Interoperability (EBSII) group within ESMIG, I'm very much involved in these efforts. In the EBSII group we work on secure system interactions, data definitions and architectures based on international standards such as the IEC 61968. We have also defined around 15 Business Cases for Smart Metering per role and have evaluated their benefits.

CN: Ecologic Analytics continues to lead in applying standard-based approaches to MDM – IEC for interoperability, MDUS for integration with SAP solutions and NISTIR 7628 access control guidelines that not only provide security, but allow us to extend the scope of application to stakeholders across the utility business.

RH: Another platform which is used by the industry to make headway on implementing comprehensive security standards is the IDIS association that Landis+Gyr founded with a number of other leading manufacturers. At the same time, Landis+Gyr is a key contributor to the EBSII group which Mr. Chebbo leads. It's our way

Richard Haagensen, Head of Smart Grid and Business Strategy, Smart Energy Solutions, Landis+Gyr

to establish best practices of MDM/MDUS in the EMEA market and it's a key forum for our software products. Landis+Gyr also contributes a lot to the IEC/CIM integration standard, mainly via our US organization, which aims towards standard integration interfaces for MDM software as well as interoperable software solutions. Some of our key tools in this area are defining standard use cases and performing interoperability tests. We are taking security concerns very seriously. ■

"The transformation of raw data into intelligence will have a significant contribution to the successful operation of businesses in the energy industry."

Richard Haagensen

advanced metering in finland

lighthouse project for europe

Landis+Gyr is the provider of choice for the delivery and installation of a smart metering solution for 200,000 customers of Helen Electricity Network Ltd. in Helsinki. The project management and integration of the smart metering system with Helen's information systems are also part of the rollout agreement, one of the largest to date in Europe.

New power line design in Helsinki

Mass installation in the smart metering project of Helen Electricity Network will be completed in the course of 2012. The speed of installation is impressive, with installation of up to 1,600 meters per day with 25–30 meter installers working at the same time. In 2013, the entire customer base, 350,000 customers, will be covered by smart metering technology.

Landis+Gyr smart metering solution for Helen Electricity Network is based on E350 meters with RF mesh communications and Gridstream AIM software. The metering room solution optimizes both reliability and costs: devices can act as meters and as communication routers to other meters. The system enables remote on-demand operations like instant readings, switching electricity on or off as well as load controls. The smart metering solution provides up-to-date information on hourly energy consumption, network status and power quality data to support the daily operation of the utility.

TRACKING ENERGY USE ONLINE

Thanks to the comprehensive data delivered by advanced smart metering, Helen is also able to offer its customers an online portal where customers can track their energy use in near real-time. "We expect that the availability of this information will lead to changes in behavior and reduce energy consumption," explains CEO Risto Harjanne. Helen Electricity Network also plans to offer dynamic load control to its residential customers. Helsinki is growing and the overall demand for electricity will continue to grow.

Landis+Gyr is responsible for delivering readouts to Helen for a population of more than 200,000 smart meters at least over the next 10 years. "It's part of our task to check that the data is complete that there are no gaps, like missing hours, in it," explains Mauri Patrikainen, Senior AMI Consultant for Landis+Gyr. Meters actually push out values every hour instead of reading them once a day, how it is often done. "This way, the customers get information about their consumption almost in real time," comments Patrikainen.

KEEPING DATA VOLUMES LOW

Another way in which Landis+Gyr helps its customer to manage their energy data better is by providing

Risto Harjanne, CEO Helen Electricity Network

Helsinki Ruoholahti residental area

readouts for low power generation sources, like for example small wind energy generators. Landis+Gyr's software is able to recognize when local generation actually occurs and passes on data from only those metering points to Helen. This way, Landis+Gyr keeps the data volumes transferred to the MDM system as low as possible. "If we didn't do this, we would deliver almost double the amount of readouts, not 5, but almost 10 million values per day," says Patrikainen.

The data flow from the smart meters also contributes to better control and visibility of power quality because all smart meters are actually monitoring it. The system is capable of reading power quality log data and transmitting alarms of power breaks and power restoration to Helen's network management system, thus making it possible to monitor these events online.

Not surprisingly, Harjanne sees the deployment of smart meters as a crucial step on the way towards a smart grid. "Increased information flow will ensure that the power grid will be able to deal with peak load hours. At the same time, smart meters will play an important part in demand side management," concludes Harjanne.

THE FINNISH MARKET IN BRIEF

Area: 338,000 sq km

DSOs: 81 companies

Electricity customers: 3.2 million

Annual consumption: 7,400 kWh per household

Finland is the third largest of the Nordic countries in terms of population and the second largest in size. The country has rich supplies of hydroelectric power and is also one of the few European countries that is developing and constructing new nuclear power plants. The average electric power consumption of 7,400 kWh annually per household is among the highest in Europe. Finland's average electric power consumption per household is among the highest in Europe.

interoperability: a smart way to adapt

The great thing about standards is that there are so many to choose from; that's how you could sum up much of the current state of affairs when it comes to interoperability of smart meters. While there are plenty of smart metering communications standards, there is still a lack of smart meter interoperability.

A group of leading European meter manufacturers has been making progress towards committed choices from the menu of standards to provide true multi-vendor interoperability. Some two years ago, Landis+Gyr, Iskraemeco and Itron formed the Interoperable Device Interface Specifications (IDIS) Industry Association. Their collaboration was the result of the work the three vendors did for ERDF in France. The association's goal isn't to specify one more set of standards. Instead, the aim is to provide detailed instructions on how to implement the existing standards in order to achieve interoperability.

TAKING THE LONG-VIEW

"Up to now, interoperability has been driven by big players like ERDF and Iberdrola. IDIS is our attempt to step up and help the process along," says Thomas Schaub, Head of Standards and Interoperability at Landis+Gyr. The market leader has a tradition of promoting interoperabilitiy. Landis+Gyr is committed to strategic thinking and looking at the long term. "On the device level, interoperability means exchangeability. All points of contact between the devices have to be exchangeable. On the system level, it means that data can flow through logically identical interfaces." The initiative taken by the IDIS founders will be especially beneficial for small and medium-sized suppliers without the clout to define their own criteria. By specifying IDIS-compliant systems, they can get multi-vendor competition and flexibility and reduce their overall risks. The IDIS association develops, maintains and promotes publicly available technical interoperability specifications. The specifications are based on open standards and the IDIS quality label guarantees rigorous interoperability testing.

ON VIRGIN SOIL

IDIS and KEMA, the global leader in consultancy, testing and certification for the energy and utility industry, have signed a cooperation agreement for

the conformance testing of IDIS meters. In July 2011, KEMA successfully performed the first IDIS smart meters conformance tests. The approval process for the IDIS label depends on KEMA's confirmation. In its approval criteria, the IDIS association specifies that conformance testing of the meters considered for the IDIS label is done independently by the consultancy. The provision of a "neutral testing ground" in combination with the public availability of the IDIS specifications makes IDIS interoperability achievable for all manufacturers. Oliver Iltisberger, Executive Vice President Asia Pacific at Landis+Gyr and the founding president of IDIS, called the initiative a "step on virgin soil" and recognized how challenging his association's goals were. Nevertheless, the IDIS interoperability specification "Package 1 PLC profile" has been released and the association is moving forward with a growing number of IDIS certified equipment.

The Landis+Gyr E450 PLC meter is among the first IDIS metering devices launched on the market. TAURON Dystrybucja GZE, formerly Vattenfall, in Poland for example, has already taken advantage of an IDIS certified solution. The association's success shows that there is a very real market demand for interoperable solutions.

"IDIS is a smart way to compensate for the regulatory reluctance to take the decisive steps necessary to achieve interoperability," says Thomas Schaub. The first IDIS package is focused on mature PLC standards, rather than on the very latest technologies being pushed by some PLC technology providers. Future packages adding IPv6 and OFDM (Orthogonal Frequency-Division Multiplexing) based PLC protocols are planned for 2012. Pike Research analyst Bob Cohen comments on IDIS: "This is the only truly open, multi-vendor interoperability effort we can point to worldwide."

TEARING DOWN WALLS

In the early days, meter vendors focused on functionality, building systems that deliberately walled off competitors. In spite of Cohen's comment, there are some hopeful signs now, at least when it comes to the big vendors. Those steps in the right direction are not limited to Europe: in the United States, Landis+Gyr and Elster have agreed to develop communications firmware that will work on each other's metering platforms. Landis+Gyr is developing Gridstream™ communications firmware that will operate on Elster's residential REX meter platform and will also allow those meters to work in the Gridstream network without Landis+Gyr's specific communications module. "We know that utilities want flexibility and future readiness from their advanced metering systems," says Jerry Figurilli, COO, Landis+Gyr, North America. "By enabling hardware interoperability, we will be able to provide utilities more choice in the selection of advanced meters."

Thomas Schaub, Head of Standards and Interoperability at Landis+Gyr

What is in it for the vendors? First and foremost, they hope to accelerate and grow the overall market, moving beyond the strong proclivity for pilots that their customer base has shown in recent years. Answering the call from utilities for multi-vendor systems, Landis+Gyr and the members of the IDIS association are working closely together to develop interoperable solutions for the EMEA market.

The world goes smart. Interoperability is of great value to ensure a seamless flow of data and smooth upgrades to new applications. Considering the variety of technical smart metering standards currently available, a commitment to developing interoperable products based on these standards is crucial. In tomorrow's smart world, interoperable smart meters will form the foundation of an interconnected system expanding from smart metering to smart grids and smart home applications. ■

The Interoperable Device Interface Specifications (IDIS) Industry Association provides detailed instructions on how to implement existing standards in order to achieve interoperability.

the lyon confluence project

a glimpse into the future

Positive energy buildings, a fleet of electric vehicles and the necessary charging stations, high-end photovoltaic and battery technology, chains of sensors feeding big data into various layers of systems partly managed in the cloud: the Lyon Confluence project underway in France is one of those exciting smart technology pilots that just might provide a glimpse into the future.

Toshiba is responsible for a large part of the smart energy management infrastructure in Lyon Confluence.

The peninsula where the development is taking place is a picturesque spot situated at the confluence of the Saône and Rhône rivers; no part of the Confluence district is more than 500 yards away from a riverbank.

The involvement of Toshiba and NEDO, the Japanese New Energy and Industrial Technology Development Organization, comes in the final stage of Phase 1 for Lyon Confluence and will last at least until 2015. Alain Kergoat, Toshiba's French Strategic Marketing Director, is deeply familiar with the project. Toshiba is responsible for a large part of the smart energy management infrastructure in Lyon Confluence. Kergoat spells out three of the key items on Toshiba's agenda: "The positive energy buildings, the deployment of an electric car sharing system powered by solar energy and setting up the Community Energy Management System (CEMS) as the dashboard to steer the project as accurately as possible. In the long run the information gathered and analyzed in the CEMS will also help us to draw up better energy policies in the future."

VERY POPULAR REAL ESTATE

Lyon Confluence, with Toshiba as the leader of a Japanese consortium implementing the technology, is NEDO's first smart community demonstration project in Europe. Landis+Gyr, an independent growth

platform of the Toshiba Corporation, will most likely be involved in the project in a number of ways, one of them being as a supplier for ERDF's smart Linky Meters. The Linky meters will be installed alongside Toshiba's Energy Boxes. Energy boxes provide consumption graphs, alerts for high power consumption and graphically customized recommendations for energy saving.

Kicked off by Greater Lyon in 2003, much of Phase 1 has already been completed, dramatically changing the face of the area. An attractive new neighbourhood has been steadily taking shape. Confluence Phase 1 boasted a number of innovative and modern apartment buildings on the border of the Saône. When apartments went on sale in June 2006, they were priced at €4,500 a square metre, making them the most expensive real estate in Lyon's history. They were nevertheless quickly sold and the first occupants moved in October 2009.

A WORLD PREMIERE – THE POSITIVE ENERGY MULTI-PURPOSE BUILDING

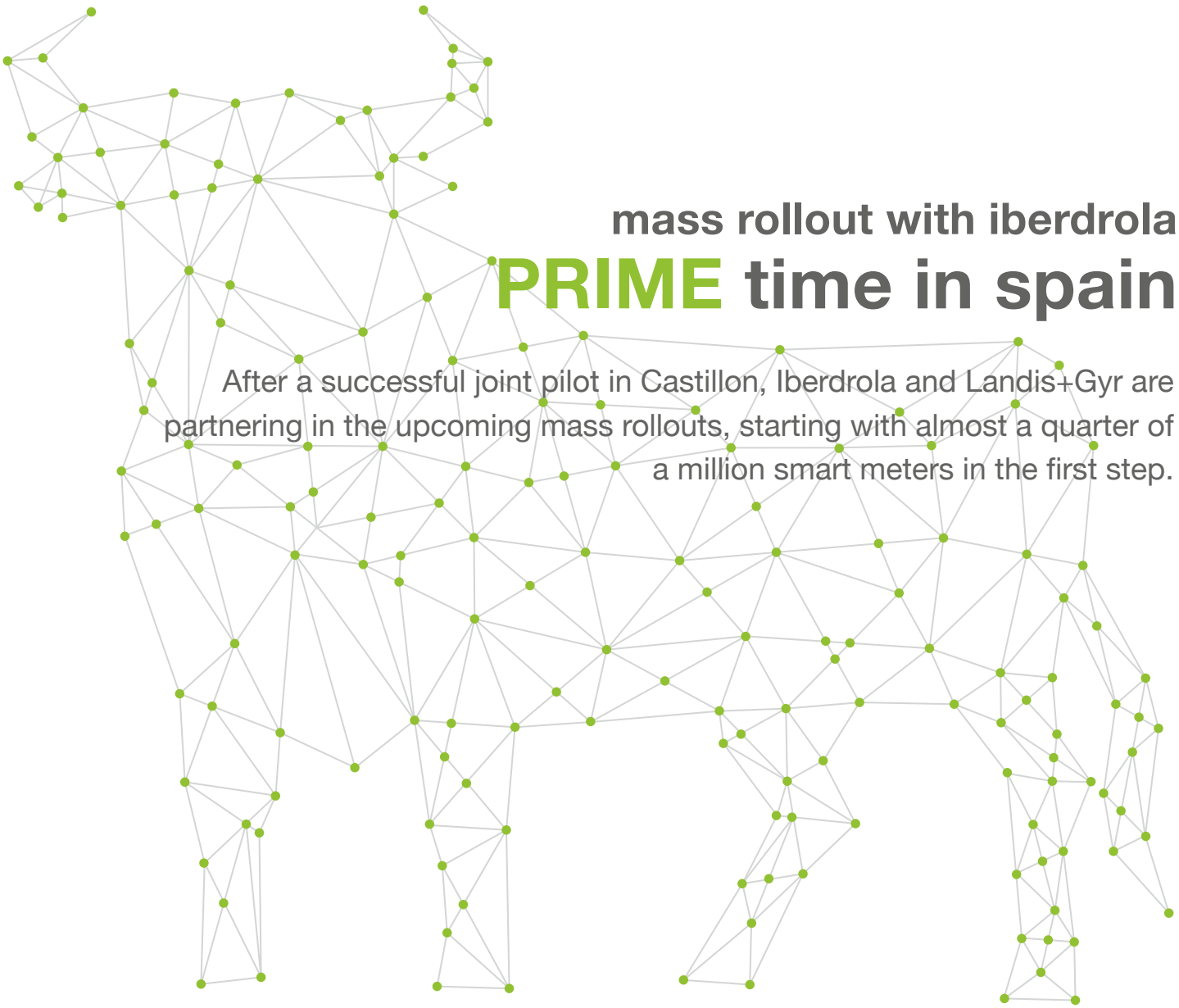
The French government has recently issued RT 2012, a new directive on low energy consumption for buildings that has been effective since of November 2011 for offices and that will be extended to dwellings as of January 2013. The new buildings concerned in the project in Lyon will produce energy from solar panels, biomass and micro cogeneration. Kergoat highlights the construction of 3 plots totalling 12,000 square metre multi-purpose positive energy buildings, the very first of their kind. The rooftop as well as the southern side of the buildings will be covered by photovoltaic cells and Toshiba will make use of high-performance batteries especially developed to deal with the tricky problem of power storage from intermittent renewables.

Energy efficiency is also promoted by the use of a comprehensive Building Energy Management System (BEMS) for the shop and office space, and for the dwellings by making information available through in-home displays and the Energy Boxes mentioned earlier. There will be the option to automatize optimum use of energy by letting the Home Energy Management System (HEMS) take the job over.

"Urban mobility in Lyon Confluence Area is expected to triple in the next ten years," adds Kergoat. A special feature of Toshiba's EV car sharing approach is that the EVs' are powered by solar energy to ensure the right balance between the EVs' energy needs and the production of green and conventional power.

Landis+Gyr will supply the meters operated in the charging stations. The next layers of data aggregation are the building and community energy management systems, BEMS and CEMS. Both of those applications are hosted in the cloud and will take advantage of the insights big data crunching has to offer to optimize sustainable energy usage throughout the system. Smart community pilots like Lyon Confluence are important as beacon projects, turning sometimes abstract sustainable visions into tangible reality. ■

Energy efficiency is promoted by the use of a comprehensive Building Energy Management System (BEMS).



mass rollout with iberdrola

PRIME time in spain

After a successful joint pilot in Castillon, Iberdrola and Landis+Gyr are partnering in the upcoming mass rollouts, starting with almost a quarter of a million smart meters in the first step.

With 10.7 million customers, mainly located in the central, northern and eastern regions of the country, Iberdrola is among the three big players in Spain. As one of the key drivers of the deployment of smart meters, Iberdrola initiated a collaborative framework to set power line specifications based on real field measurements – the power line intelligent metering evolution, PRIME. The targets were challenging. A low cost solution was to be developed, with open and public specifications that enable interoperability. Furthermore, high performance targets needed to be met; the throughput of data had to be superior to that of existing PLC technologies. A future-proof concept, as Javier Jiménez, CEO of Landis+Gyr Spain & Portugal, points out: "PRIME has potential beyond Spain; it could be used as a part of the IDIS specifications, for example."

Landis+Gyr participated in the project right from the start, as its global experience in smart metering and the strong local presence in the Spanish market were important factors for the overall success of the project. The PRIME architecture is based on the OFDM (Orthogonal Frequency-Division Multiplexing) modulation, which allows high-speed, low cost data transfer via power lines.

The PRIME Alliance was founded with eight principal members in 2009. Today, the group actively works to promote multi-vendor interoperability for markets and equipment and compatibility under the PRIME standard. The number of members has grown to 47, including utilities, meter manufacturers, semiconductor companies, IT companies and research institutes. As one of the original eight members, Landis+Gyr continues to play an important role in the PRIME Alliance. The project in Castillon covered 100,000 metering points both in urban and rural areas and was successfully completed in the summer of 2011. Landis+Gyr contributed to the meter technology, delivering 40,000 E450 PRIME meters.

The upcoming deployment is part of the third phase of Iberdrola's STAR project; STAR is the Spanish acronym for Remote Grid Management and Automation System. Iberdrola has started the STAR project in 2010 and will see the installation of 1,000,000 smart meters by March 2013. As a key supplier, Landis+Gyr will deliver almost a quarter of a million smart meters. With its significant role within the project, Landis+Gyr maintains its position in the Spanish energy market. Javier Jiménez is confident about the overall market share Landis+Gyr will be able to capture: "Our target is to acquire a market share of about 25 to 30 percent." To date, Landis+Gyr has received orders for more than 300,000 smart meters and a significant number of smart grid solutions for secondary substations.

Spain was one of the first European countries to apply regulation for smart metering. ROYAL DECREE 1110/2007 (August 24th) and ORDER ITC/3820/2007 (December 28th) stated that all the new electricity meter installations had to be equipped with remote management and Time of Use capabilities from 2007 onwards. By the beginning of 2014, all utilities will be obliged to have an AMM system in place. The country's entire 30 million electricity metering points have to be replaced with smart meters by December 2018. ■

THE SPANISH MARKET IN BRIEF

Area: 504,000 sq km

DSOs: 325 companies

Electricity customers: 28.0 million

Annual consumption: 2,900 kWh per household

Spain is the EU's fifth largest member state and economy. The country uses a mix of fossil fuels, nuclear power and hydroelectric power for electricity generation. Due to the virtual lack of transmission links to Portugal and France, imports and exports of electric energy remain at a minimum level. Median household electricity prices are below the EU average as most customers have opted to remain on regulated tariffs with incumbent suppliers, even though competition has been introduced in all segments of the market.

The Ministry of Industry, Tourism and Commerce has set the following requirements for future smart meters in Spain:

+ **Up to 6 programmable registers of active and reactive, as well as 15 of peak demand.**
+ **Hourly load profile of active and reactive, 3 months storage.**
+ **Power control: peak demand register and power control switch.**

data and computing in a nutshell

The magazine you are holding in hand while you are reading this constitutes about 20 **kilobytes** of data, if we count just the printed text. A **megabyte** is 1,000 kilobytes: the complete works of Shakespeare total about 5 megabytes. With megabytes, we are already in the area where sending data packages as email attachments can become a little tricky: everybody who has tried uploading and sending high-quality digital images knows this. A **gigabyte** equals 1,000 megabytes. A two-hour film is normally compressed into one or two gigabytes. The hard drive of a modern laptop has a storage capacity of about 500 gigabytes.

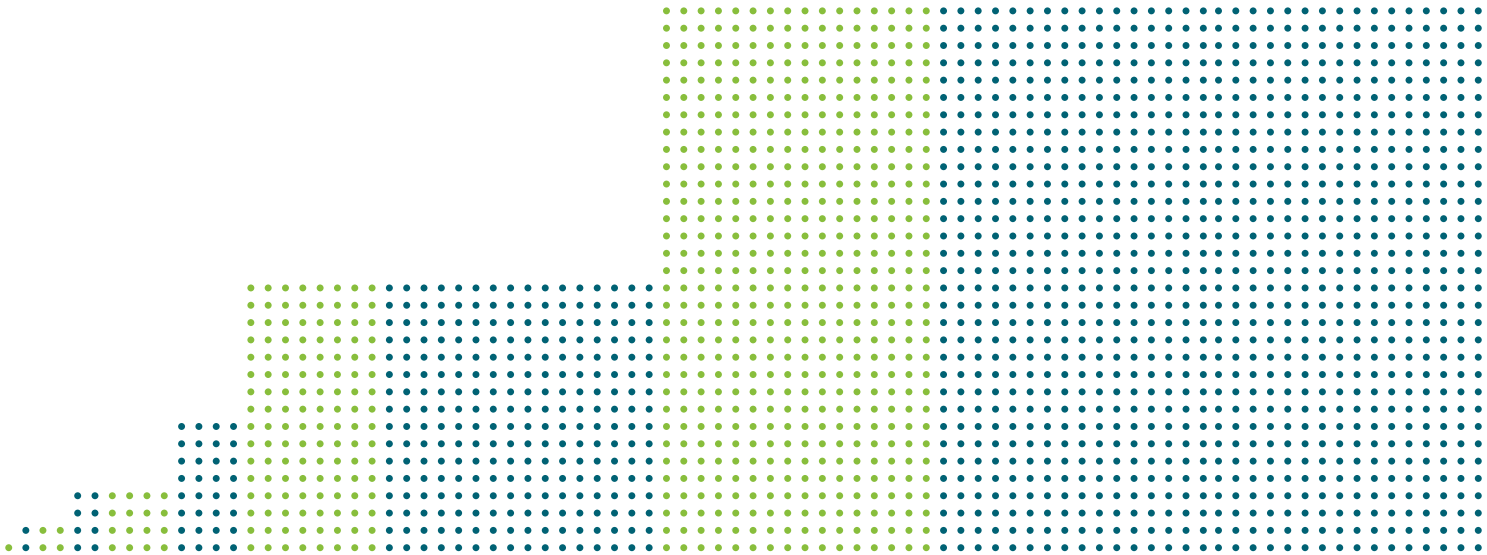
A **terabyte** equals 1,000 gigabytes. The prefix "tera" means "monster" in Greek and all the books catalogued in the US Library of Congress, one of the world's biggest, total about 15 terabytes. According to some estimates, the initial wave of data from meter readings will amount to over 100 terrabytes a year. Which brings us to the **petabyte**, i. e. 1,000 terabytes. Google processes around 1 petabyte per hour. An **exabyte** equals 1,000 petabytes. According to an estimate by Cisco, the amount of traffic annually flowing over the internet will reach 667 exabytes in 2013.

MOORE'S LAW AND EXPONENTIAL GROWTH

The amount of digital information increases tenfold every five years. Moore's law, which the computer industry now takes for granted, says that the processing power and storage capacity of computer chips double roughly every 18 months. Moore's law is certainly not a law in the way we talk about laws in the natural sciences. However, the observation made by Gordon E. Moore, co-founder of the Intel Corporation in 1965, has held true ever since then and may continue to apply in the foreseeable future.

It's important to emphasize that this growth in processing power and storage capacity is exponential, meaning it doubles regularly. To highlight the extraordinary acceleration that this implies after a certain point, take the example of starting an exponential growth experiment of doubling 1 cent every day. On day 15, we have 164 Euros. On day 30, we have over 5 millions of Euros. Keep on going for another 30 days, and you will end up with nearly six quadrillions of Euros.

In terms of computing power, smartphones today have several times the computing power of mainframe computers that filled whole rooms in the 1980s. It is unclear how long Gordon E. Moore's observation will hold true, but it might just go on long enough to prove that inventor R. Kurzweil was onto something when he wrote: "Exponential growth is deceptive. It starts out almost imperceptibly and explodes with unexpected fury." ■



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