ZOOM ON ENERGY

A new challenge:

Intelligent energy

BearingPoint. Management & Technology Consultants

THE BEARINGPOINT ENERGY & UTILITIES REVIEW

#2

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ABOUT BEARINGPOINT

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“A new challenge: Intelligent energy”

Until now the utilities market has moved in a protected environment but is now at a turning point in its history. In recent history we have seen the opening-up of markets, a profound transformation of the organisation of the historical players, the development of competition and the emergence of new players, and convergence between operators, but has not led to radical changes or major progress from the final customer's point of view. The coming changes will have a major impact on the industry and its customers, making a deep impression in the market and establishing new balances. The emergence of the “Smart Grid” concept, which covers the introduction of greater intelligence at all levels of the network (from the distributor to the meter, and even into the end-user's home) will bring more opportunities for innovation and bring about a change in the relationship between suppliers and their customers above and beyond just the tariff equation. Pressured by customer expectations, encouraged by capabilities for convergence with telecommunications, spurred on by objectives for integrating distributed generation capacity or more environmentally friendly uses, operators will have to take advantage of these innovations to make significant changes to the nature of their offerings.

We are still uncertain of the speed at which this new paradigm is spreading, as it depends on political consensus and tested technological standards to back up costly deployments with an economic rationale. But it is an established reality, as is the desire of all traditional operators to tap into this vein before the new entrants who are particularly innovative and motivated.

Emmanuel Autier
Partner

Highlight

The deployment of Smart Meters

In the introduction of a new paradigm for the relationship between power technicians and their customers, the foundation stone is located at the physical interface between place of consumption and its many applications and the electricity grid. The meter, long viewed as a simple electromechanical measuring device, is now the keystone of the edifice. The capability to implement all the concepts of the Smart Grid, whether downstream or upstream of the measuring device, relies on its capability to distribute a wealth of information automatically, with a high frequency, that reflects whether power is actually being fed or drawn. The deployment of Smart Meters is becoming an unavoidable step for any new policy on services or for steering renewable generation, as shown by many projects all over the world, mainly driven by Europe and North America.

ALL UTILITIES ARE INVOLVED TODAY: FIRSTLY ELECTRICITY, MAJOR DEPLOYMENTS PLANNED FOR WATER, AND GAS IN THE MEDIUM TERM.

FROM AUTOMATION TO ENERGY SAVING

The first projects for installing communicating meters looked for justification in automating tasks of low added value and in obtaining reliable flows for billing purposes. The first projects in France date back to the early 1990s, at a time when neither energy saving nor market deregulation were even being talked about. In Italy, where deployment is almost complete, the economic justification relies entirely on combatting fraud and cutting staff costs. In this context, ENEL reckons on a five-year return on investment of some 2.1 billion euros, quite exceptional in an industry accustomed to long cycles. However, it was the opening-up of the markets that provided a new rationale for this trend towards automation. Indeed, this new tool can awaken competition by facilitating a change of supplier by means of remote readings to enable almost instantaneous and relatively inexpensive connections/ disconnections. Furthermore, the wealth of information captured should blow a wind of change on a tariff policy that is as yet very timid in many countries. These developments will herald offerings and sales arguments on grounds of added value rather than simply price wars. More recently, the importance given at European level to reducing energy demand has added a new dimension to this movement. Indeed, whether or not it is coupled with devices in the home (such as the Energy Box), the information gathered and made available to consumers should enable them realise how much they are really consuming. Energy saving has now become a crucial factor in all countries, whatever the carbon footprint produced by the power generation mix. To achieve these ambitious objectives, the need to consume less and consume better must be presented in a playful way and not by making people feel guilty, to educate the consumer, via suitable feedback opportunities (display, website, iPhone or iPad app, etc.). Studies show that merely having a detailed knowledge of their consumption enables consumers to start improving their behaviour.

However, it is important to spread and magnify this first reaction by providing means of influencing the sources of consumption and financial incentives to save.

There are several options to consider, such as monitoring consumption and its environmental impact, adding devices in the home that help to regulate use (air conditioner alert at peak periods, for example), or introducing incentive tariff structures that can smooth out users' consumption to avoid generation peaks. All these initiatives can also be boosted by suitable advice or the emergence of 2.0 communities on green efficiency.

All these factors now come into play for analysing the value chain of communicating meters, although their profitability has yet to be proven, especially as increasing fragmentation of utilities makes it harder to achieve savings in generation (upstream) as a result of lower instantaneous consumption (downstream). On the European scale, we also need to take account of differences in legislation. Value cannot be found in the same way if metering is part of the regulated domain or if it belongs to the vendor.

DISPARATE DEPLOYMENT AND INTEROPERABILITY NEED COORDINATING AT EUROPEAN LEVEL

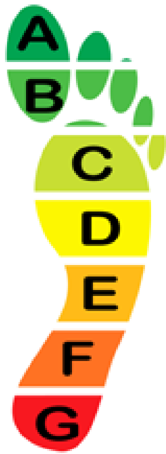
Progress in European countries on deployment in electricity is very disparate. Today, for instance, only Italy and Sweden have nearly completed their programmes, while three countries have decided to start deploying Smart Meters (Finland, Greece and Spain) and twelve countries are still talking about it or beginning to experiment, including Germany, France and the United Kingdom.

In France, widespread deployment, scheduled over 2012-2017 has yet to be decided and experimentation by the national distributor ERDF is still in progress. It began in the first quarter of 2010 by gradually installing "Linky" Smart Meters for 300 000 customers, or 1% of the total, in two regions, one heavily urbanised and the other more rural.

Apart from the issues of national acceptance and deployment, the major trans-European challenges are taking on increasing importance as talks progress. Most of the systems used are based on different standards and functionality, and very limited interoperability. The operating bases (mono- or bi-directional, measurement intervals, exchange protocols, life expectancy, data transmission method) are still very diverse.

THE SMART METER, THE FOUNDATION STONE OF SMART GRID PROGRAMMES

Despite the technical difficulties and the scale of deployment required, there is now a clear underlying trend in the metering industry towards the Smart Meter. Indeed, the growing desire to control our energy footprint, whether by cutting consumption or by injecting more and more renewable generation onto the grid, requires stronger leadership to optimise the exercise. Building intelligence into the grid will only reap the expected rewards if it is based on capturing real-time flow information, which relies on Smart Meters.



Point of view

THE BOOM IN NEW USES: A CHALLENGE FOR THE ELECTRICITY GRID

Following the adoption by the European Community of the “climate” package on 23 April 2009, many European countries are setting an objective of 20% REn in their energy consumption by 2020.

The Directive provides for priority or guaranteed access for REn and incentive policies for tariffs to buy back the electricity they generate, strongly encouraging the sector to develop.

For wind energy, according to the French electricity distributor, ERDF, the power connected to the grid grew 36% over the first half of 2009 in relation to the first half of 2008; generation for the first half of 2009 was 3.3 TWh (equivalent to the average annual consumption of around 1.5 million inhabitants), up 22% on the first half of 2008. For solar energy, the photovoltaic power connected to the grid is going sky high, growing 66% over the first half of 2009 in relation to the same period of 2008; photovoltaic electricity generation is 140 GWh (equivalent to the average annual consumption of 62 500 inhabitants).

However, the electricity injected onto the grid is not always synchronised with demand and is therefore lost because it cannot be stored. Moreover, the intermittent nature of REn makes synchronisation difficult. It is crucial to gain fine control of this new form of injection in order to achieve the objectives set by the EU directives and make the most of renewable sources.

While the number of electricity injection points to the grid is growing, the same is true of take-off points with the arrival of new sources of consumption, such as the electric car (initial target: 450 000 electric cars by 2015) and heat pumps (400 000 heat pumps in 2009, a target of 2 million heat pumps by 2020). Regarding electric cars, the synchronisation of a large number of fast recharges assumes that the grid is able to mobilise the corresponding electricity, taking account of the intermittent nature of REn and limiting the use of expensive and CO_2-emitting peak generation methods. The success of the electric car as a genuine low-carbon alternative depends on this; it is also true that these vehicles run for only two hours a day on average and so are a means of storing energy and returning it to the grid.

This need for the grids to evolve explains the emergence of the Smart Grid concept.

SMART GRIDS OR GRIDS 2.0

A "Smart Grid" is an electricity grid incorporating a computer and telecommunications infrastructure that enables it to convey and process data, and automatically to take decisions to optimise energy flows.

With control distributed within the grid itself, it will be capable of taking account in real time and in an "intelligent" way of the actions of all users, so as to ensure that electricity is routed efficiently and economically, and be more environmentally friendly.

A Smart Grid is made up of several components:

- The Smart Meter, to measure the power that the consumer's installation draws from and feeds into the grid. This advanced metering system offers new functions in relation to current meters, such as recording of data flows, remote interruption or limiting of the power supply, and remote changes of subscribed demand and tariff structures. Smart Meters are the foundation of the Smart Grid infrastructure;
- Smart Operation which involves monitoring and controlling the grid in real time at dense, multiple points;
- The Smart Home which embraces devices for domestic power management (energy control panel, household appliances capable of cutting themselves off from the grid, etc.).

Initially designed to route the electricity generated in power stations and carried over the transmission grid, distribution grids nowadays have to deal with increased complexity as a result of the growing number of decentralised injection points (wind generators, photovoltaic systems, etc.) and eventually take-off points, e.g. for recharging electric vehicles. The grids still route power from the transmission grid, while bringing together all the decentralised generation at a constant level of quality and security of supply.

Managing the intermittent nature of REn is therefore a major challenge for the distribution grid. Smart Grids could take up that challenge in two ways:

- By combining local markets and network intelligence to balance electricity demand and generation in real time;
- By using decentralised or centralised storage devices controlled by the Smart Grid so that electricity can be stored and released under the control of the manager of the distribution grid.

POTENTIAL ACTIVITIES AROUND THE SMART GRID

We are convinced that the costs associated with implementing the Smart Grid should be partly offset by the development of new services, each with its own specific business model (energy saving, for example). The Smart Grid will then act as a diversifying lever for existing players and could allow new activities to emerge. Storage of energy generated by decentralised REn will become possible, for example, for generators wishing to sell part of their production later, or for offsetting the challenges of controlling the grid posed by intermittent REn generation.

Storing electricity is a fundamental challenge to be overcome to facilitate the development of REn. When these are available and demand is low, the electricity generated has to be stored and fed back onto the grid when demand is high. Storage helps REn to penetrate and to limit the use of alternative peak generation methods that are expensive and emit greenhouse gases, and to mitigate the difficulties of controlling the grid as a result of the intermittent nature of REn. The role of the Smart Grid will be to orchestrate the integration of electricity stored on the grid while taking account of both demand and intermittence.

Photovoltaic installations and wind generators installed on an isolated site, i.e. not connected to the grid, already use batteries so that renewable electricity can still be used when weather conditions (no sunshine or wind) prevent it from being generated. In France, on the other hand, installations connected to the grid generally do not have batteries as it is not worth storing the power generated, since the network operator buys it at an advantageous subsidised price. Other countries, such as Germany, have decided to change their tariff structure to regard electricity stored and generated by REn as renewable energy. The users concerned can also record their own energy consumption and recover the subsidies from it.
A tariff structure offering incentives for storing electricity and proper regulation could give rise to new activities linked to the installation and control of storage systems.

This is already happening in the United States where in 2009 the leading wind energy generator, xcel Energy, installed a giant battery near one of its wind farms, the size of two semitrailers and capable of supplying 500 households for about seven hours. This battery is controlled by GridPoint, a company specialising in the Smart Grid.

In France, the research demonstration project PREMiO (Production Répartie, EnR et maîtrise de la demande, intégrées et Optimisées) in the PACA region is building an experimental platform on a pilot site. Hosted by a local community, this project aims to test an innovative and replicable energy architecture that can promote REn and energy performance, optimise local generation and distributed storage, and dynamically control electricity supply and demand.

Such projects are opening doors to the development of associated services for:
- Optimization of the integration of renewable energies;
- optimising the integration of renewable energies;
- controlling demand by generating short-term alerts (several times a day) for the control needs of the grid manager or on

prior notice for the needs of a manager of sales offers;
- optimising the integration of renewable energies.

The development of the electric car could also foster the emergence of new offerings. For instance the city of Newark is the first to experiment with "Vehicle to Grid": since electric vehicles should preferably be recharged at off-peak times, electricity utilities can invite their owners to express their needs via a variety of internet protocols. Interested owners respond to these needs by simply connecting to the grid and are rewarded in return. The advantage is obvious: the average American driver is at the wheel of his car for one hour a day, while as much as 19 kW of energy can be stored in his car (the equivalent of the daily consumption of a dozen households), which is far in excess of his needs. Such services using the Smart Grid could be developed to offer electric vehicle owners the chance to sell back all or part of the electricity stored in their cars, depending on their needs.

For recharging electric vehicles, other services using the Smart Grid could also be used to enable users to recharge at the optimum cost.

IMPLEMENTING SMART GRIDS

In France, the Smart Grid is still at the experimental stage. ERDF plans to develop the first functions and test them during the pilot phase of deploying smart meters in 2010 in the cities of Lyon and Tours.

In Sweden, the ABB group, a world leader in power transmission, has teamed up with the Finnish power generator Fortum to implement a Smart Grid for the new Royal Seaport district of the capital, Stockholm. This ambitious project aims to completely eliminate the use of fossil energy in this district by 2030 through a combination of REn power generation and a Smart Grid to control distribution.

In the context of the European Smart City project, the city of Amsterdam aims to become Europe's first smart city. It will set up a Smart Grid based on 500 Smart Meters installed in private households. Amsterdam's goal is to cut its greenhouse gas emissions by 14%.

The United States is also adopting a pioneering stance where the city of Boulder in Colorado, known as the Smart Grid Capital, has a Smart Grid City project which allies power technician xcel Energy and its partner Grid Point. The Boulder network has 300 km of optical fibre connecting 4 600 homes and 16 000 Smart Meters already connected to this network.

Despite the encouraging prospects and these initial experiments, the fundamental question remains as to how to fund and spread the costs of these investments. At a time when we face the issue of the rising cost of generation and the need to modernise the grids themselves to improve the quality of the supply, can we also find the funding needed for this technological revolution? And it will be necessary to manage not only the actual grid, but also the resulting transformation of the information systems, the utilities' organisation and processes, and even the relationship with customers, which will be profoundly affected. The current experiments will therefore be decisive for demonstrating the soundness of such investments.

Smart Home: the battle for control of the final customer

Up to now the utilities have been living in a simple world. The value chain was always focused on one dominant solution (electricity, gas, water, etc.). Deregulation in America and then in Europe did of course bring new players into certain segments of the chain (marketing), but did not radically change its structure. The major utilities often displayed a very robust capability to control the interface with the consumer (acquiring customers, billing, physical access), as we have seen from the limited changes in the French market as a result of the liberalisation of electricity.

The Smart Home concept, which brings together all the teleservices offered in the buildings of the future, raises questions as to how long that model will last. BearingPoint studies, mainly on the American market, suggest that a new type of player, "aggregators", could challenge this stability and attempt to take control of the interface with the final customer.

The Smart Home, offspring of smart meters

The Smart Home concept takes up the old dream born from the internet bubble of the "wired" home via internet in which various appliances are connected in real time to a central control unit that can not only transmit information (such as energy consumption) out of the building, but also receive data (such as a "cut-off" instruction to turn off a power-hungry appliance at a peak period).

This interaction with the outside relies on two essential links: the unit that transmits to the outside world (the "transmitter") and the unit that controls the various local appliances in the building (the "box"), by analogy with the equipment sold by telecommunications operators to connect our PCs, televisions and telephones to the transmitter). There is no technical obstacle to these two components being housed in the same piece of equipment, but a conceptual distinction helps us to understand that, through the box, new players will endeavour to compete with the utilities.

Because the utilities already control the transmitter, in the form of Smart Meters, already in service for several years in Italy and Sweden or being deployed in France (ERDF's "Linky" meter). These Smart Meters can transmit data such as power consumption and, in certain cases, receive it too. Nearly 67% of American power technicians have apparently chosen to deploy these systems as a lever to improve their customer service (transparency, accuracy, less human intervention, speed). In Europe, the rate of penetration of smart meters should attain 32% by 2013.

Interestingly, not only electricity utilities and telecommunications operators but also water distribution companies or security firms (especially in the United States) have developed or are developing similar solutions for managing this exchange with the outside world (e.g. to detect a water leak or an intruder). The vast majority of these Smart Meters have two characteristics in common, however: they are designed more to upload data from the building than to download it and, especially, they are still restricted to the "solution" (water, gas, electricity, security, telecommunications) for which they were designed.

For utilities, this first characteristic is a result of their historic business model: optimising central generation by gathering detailed and accurate information about demand. To achieve this, meters basically need to be just robust and simple transmitters. On the other hand, widespread installation of a transmitter coupled with a "box" able to optimise local sources of consumption (freezer, radiator, etc.) would cost a lot more (no standard local communication protocols) for a small financial advantage that the end consumer would not generally be prepared to pay for immediately. Indeed, the savings made by adjusting consumption are estimated at $3.78 (per month and per meter) for the final customer and $4.02 from the power technicians' point of view.

The same applies to the second characteristic: a telecommunications operator makes its living by selling communication, just as a security firm makes its living selling surveillance to its customers. It would be an insult to the utilities' strategy departments to claim that they had not envisaged and tried to develop additional services outside their historic markets, but the organisational "DNA" still runs very deep, and the position of gas utilities on the electricity market or power utilities on the gas market prove just how difficult this Copernican revolution is. Moreover, leaving their historic market to offer new services (such as security for a gas utility) represents an investment and a perceived risk well above those of their historical business.

Accordingly, the market is still very segmented, each player still (with rare exceptions) focusing on its historical solution, relying on transmitters (and sometimes boxes) that are all specific home automation solutions. This segmentation offers an opportunity to newcomers who aim to combine these solutions into a Smart Home.

THE TELESERVICES WORM IN THE FRUIT OF THE UTILITIES

BearingPoint studies on the market for teleservices, or remotely administered services, in the United States revealed three phenomena: The growth in demand, a rapid increase in the number of players and the utilities offering teleservices under subcontract.

The growth in teleservices responds mainly to four needs: to cut consumption of power and fluids (electricity, gas, water), to optimise electrical appliances under remote control (home automation), property security services (remote surveillance, detection of water or gas leaks, etc.) and to protect personal health and safety (remote medical diagnostics, monitoring of older people, etc.).

With energy teleservices utilities can carry out remote readings while customers can now identify and optimise their consumption more accurately according to the building and their needs. Potentially, the box allows this optimisation to be automated by connecting the transmitter to the heating and air-conditioning instruments. Home automation type services facilitate routine operation and remote control of domestic appliances (such as blinds) and are more a response to expectations of home comfort. They also rely on a box.

Property security teleservices consist principally of a remote surveillance market that is already mature, but also of new remote services such as real-time detection of water leaks and faults. They rely on alarms and sensors communicating with the service company's network via a box and a transmitter, so that it can offer a fast response for home visits.

Finally, teleservices associated with personal health and safety offer devices designed to provide routine assistance to vulnerable people (children, older people, the disabled) and facilitate their upkeep and institutional or home care. They are based, for example, on video-surveillance systems and electronic bracelets.

This market is attracting new entrants who go further than the traditional players. Equipment manufacturers, such as Honeywell or Nokia, are offering technical solutions for remotely optimising heating appliances. The announcement of the launch of the Google PowerMeter has sparked off fantasies about the information giant muscling in on the Smart Home. However, hardly any of these players encompass the whole value chain: Google warns of excess energy consumption but does not (yet?) allow you to regulate your radiators remotely. However, these new entrants are helping to expand the range of services on offer, standardise solutions (communication protocols are essential here) and drive down the prices of transmitter/box sets.

The American utilities have not remained idle at the opportunities for teleservices and the threat of new entrants. The vast majority of them have adopted a defensive strategy based on two axioms:

staying with their core business by subcontracting the design and administration of teleservices (installation, information gathering, processing, and even physical intervention), and keeping control of the end-consumer both upstream (sales) and downstream (billing and debt collection). This has given rise to teleservices aggregators, offering the utilities' customers a raft of services going beyond the traditional solutions, such as xamboo, part-owned by AT&T, which has a presence in all teleservices. These aggregators can devise marketing products, build transmission solutions, build centres for processing the signals received from the transmitters and make service agreements with the organisations offering additional physical services (e.g., calling the fire brigade in the event of fire).

Since they control the services that cut across the various segments, they are likely to be key players in teleservices, gradually shaking off the grip of the utilities.

THE "BOX", TROJAN HORSE OF THE AGGREGATORS

Indeed, the aggregators, regardless of the fluids or services being sold, will gradually increase their control of the value chain by combining components (transmitters, boxes, processing centres) and developing a knowledge of the final customer. We can thus anticipate a three-stage emancipation of the aggregators.

The first growth phase will be linked to the utilities and telecommunications operators subcontracting data hosting, but profitability will be limited owing to the small size of the embryonic Smart Home market. The first customers will be the utilities themselves. In the second phase, the falling cost of boxes and meters will expand the customer base, increase the volume of information to be managed and increase the aggregators' profitability. Then, armed with their control of the information, the aggregators will manage to escape their dependence on the utilities or telecommunications operators by directly offering teleservices to final customers and industrial and tertiary-sector niche customers. These aggregators could even consider offering only high added value energy teleservices of the Demand-Response type (e.g. cut-off).

A crucial battle in this development will take place for control of the "box". As an essential local link for combining the teleservices of the various segments (fluids, security, gas, electricity, etc.), often through disparate communication equipment and protocols, controlling the design and physical installation of the "boxes" in a building puts the owner in a position of strength in relation to the consumer (access to teleservices) and also in relation to suppliers, including the utilities who helped to create them!

This development is by no means certain. For the aggregators, the creation of a new billing chain represents a major investment. Among the utilities, many businesses have managed to reinvent themselves to keep in step with their markets.

There are no insurmountable technological or organisational obstacles to stop one of the traditional players in the chain (utilities, telecommunications operators) expanding its offering to retain control of its customer and grow its revenue base, as AT&T is endeavouring to do with xamboo. The answer lies in the "boxes" we will be offered and the raft of services they will incorporate.

CONCLUSION

The expected upheaval in the business models of power utilities is becoming a reality and the various players are focusing their minds on consolidating or creating their positions.

In this radically changing world, other more unexpected players are readying themselves to move into the sector: local communities and real-estate businesses. After smart energy, the next frontier is smart cities, which will integrate all these innovations into a sustainable development rationale.

Sources

(1) Data for France

(2) Data for France

(3) Source UtiliPoint

(4) Source Berg Insight

(5) According to a UtiliPoint study cited by the report from the Galvin Electricity Initiative "The Path to Perfect Power: New technologies Advanced Consumer Control"

About BearingPoint

BearingPoint. Management & Technology Consultants.
We deliver Business Consulting. We are an independent firm with European roots and a global reach.
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To get there. Together.

Energy and utilities is a key industry for BearingPoint. We constantly invest in our international consultants and expert network to assist energy leaders in developing innovative solutions that address industry issues. Our engagements range from strategy to implementation, covering classical as well as renewable energies. Relying on an in-depth knowledge of the industry value chain, we team with you in ensuring that your transformation projects lead to measurable and visible results.

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