

ELECTRICITY SMART METERING BUSINESS DRIVERS >>

Help investors in electricity Smart Metering projects evaluate the respective benefits.

Governments and Regulators will give indications to Distributors for investing in Smart Metering infrastructure. All actors will gain benefits in Smart Metering. Producers and Transmission System Operators will directly profit from the precise data gathered by Smart Meters whereas Distribution System Operators will manage the balance in a more efficient way. End customers will also directly benefit from the new “green” services and offers Supply Companies will market in the future.

Smart Metering will change the way we produce, deliver and consume our energy. We therefore estimate that there is no standard business case for Smart Metering Projects. Each company has to perform its own ROI calculations.

We consider that new Smart Metering systems must be “Smart Grid Ready”, to be technically able to help manage the new grids, and therefore to enhance the ROI.

In this paper, benefits and business drivers are detailed actor by actor along the electricity value chain.

These business drivers will provide precious tips towards these ROI calculations: each company should include these factors in its own business case elaboration.

With this objective in mind, Atos Consulting, the Consulting subsidiary of Atos Origin, has developed a dedicated method to assess the financial returns of particular Smart Metering projects.

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INTRODUCTION

Smart Metering is a combination of Smart Meters, Smart Concentrators (or eventually Gateways), Information Technology (IT), and two-ways communication systems.

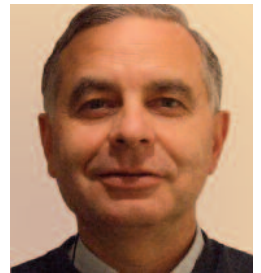
Smart Metering is a major building block towards the implementation of Smart Grid for which Utilities are preparing. We can say therefore that Smart Metering systems must be "Smart Grid Ready". However, the actors of the electricity value chain (from Governments to end Customers) are not always fully aware of the benefits they can get from Smart Metering. Utilities investing in Projects therefore need to secure buy-in from all of these stakeholders.

Based on its extensive experience in Smart Metering, Atos Origin wants to share its views on Smart Metering business drivers, so that all stakeholders are able to base or enhance their ROI calculations.

In this document we will first review business drivers for implementing or using Smart Metering, all along the electricity value chain, stakeholder by stakeholder. It is to be noted that the electricity value chain will be transformed with the evolution towards Smart Grids as for instance new services companies will appear (in this paper we shall also look at potential business drivers behind these new services companies). In the second part of this document we will present Atos Origin's experience in Smart Metering and Smart Grid.



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BASIS FOR ROI CALCULATION

THE ELECTRICITY VALUE CHAIN

The main evolutions in the electricity value chain in the past decade have been driven by the opening of energy markets to competition, insuring security of supply and emissions reduction objectives. Now that the technology has come of age, Smart Grids and Smart Meters are considered as two of the bricks towards building greener, more secure and cheaper ways of consuming energy.

The value chain in electricity encompasses:

- » Power Generating Companies;
- » Transmission System Operators;
- » Distribution System Operators;
- » Resellers and Supply Companies;
- » Smart Energy Services Companies, and;
- » End Customers.

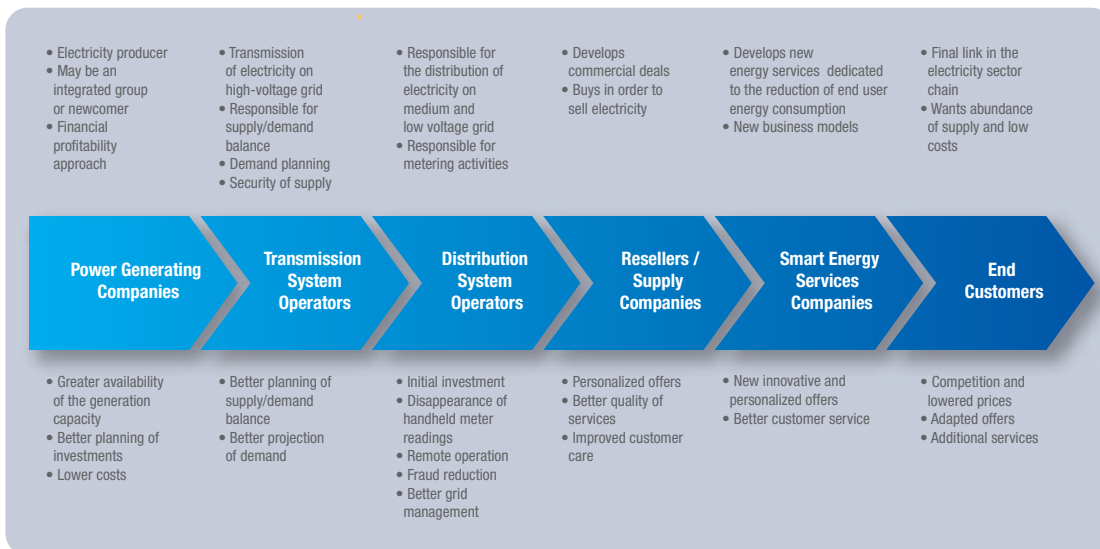
The electricity value chain is mostly centralised today: most of the electrons are sent to distant customers and distributed generation only accounts for a small percentage of the total production of electricity.

Besides, customers have very few options at hand to follow and reduce their net consumption and change their behaviour.

In the near future Smart Meters will transform the electricity value chain: all along the value chain, actors will be forced to adapt and proactively offer new services to ever more demanding customers. New companies will appear and existing companies will have to shift their business model to achieve price competitiveness and security of supply in a context of growing environmental pressure.

We will review one by one the business drivers along this value chain, and mention also impacts for Governments, Energy Regulators and Conceding Authorities.

THE ROLES PLAYED BY THE ELECTRICITY VALUE CHAIN ACTORS AND TRANSFORMATIONS BROUGHT ABOUT BY SMART METERING



DRIVERS FOR GOVERNMENTS AND ENERGY REGULATORS

Governments, Policy-Makers and Energy Regulators are not directly part of the value chain as such, but are the most important stakeholders in the process. Indeed States give the initial kick-off for Smart Metering projects at a country level, through their Energy Regulators.

The European Union is putting more and more pressure on Governments to install Smart Meters in their respective countries as with the EU Directive on energy end-use efficiency and energy services (Directive 2006/32/EC).

Throughout Europe and considering the specificities of each electricity market, Governments have formulated different answers to these pressures. Some countries like Italy, Sweden or France have opted for rapid deployment of the technology; others like Germany or the UK have refused mandatory rollouts.

However national Governments and their respective Energy Regulators will always find benefits in Smart Metering to attain the objectives of:

- » Emissions reductions;
- » More competition in the energy markets, and;
- » Security of electricity supply.

LOWER ENERGY DEMAND AND ATTAIN EMISSIONS REDUCTIONS OBJECTIVES

The EU has set ambitious emissions reduction objectives for member countries to reach, like the 3x20 objectives in the EU energy conservation pact:

- » 20% reduction in energy consumption;
- » 20% reduction of CO2 emissions from 1990 levels, and;
- » 20% share of renewable energy present in the aggregate energy supply by the year 2020.

These objectives were fixed according to international acts, like Kyoto (8% reduction in GHG emissions from 1990 levels by 2008-2012).

In order to follow these international targets and the technology being now mature, Smart Metering offers customers a way to save energy, hence avoiding the emission of GHG produced by burning fossil fuels (mainly oil, gas and coal).

This has a several impacts:

- » The countries' energy independence will be improved by reducing the importations of fossil fuels;
- » Governments will reduce the environmental footprint of their country as a whole, and;
- » The image of the country will be shifted to one of a modern and green country.

Furthermore the integration of renewable decentralised energy production, storage and usage (Solar, Wind, Electric Vehicles...), will be eased by Net Metering (2 ways meters measuring consumption + production) and decrease needs for additional central Generation, Transmission and Distribution capacity which represent huge long term investments. Let us not forget that these investments always come with long political debates because of the "Not In My BackYard" (NIMBY) syndrome preceding each new high voltage line project or the renewal of nuclear capacity for example. Distributed Generation could save also up to 7% of electricity normally lost in technical losses.

REGULATE ENERGY MARKETS AND FOSTER COMPETITION

Since the 1990s, Europe has pushed member countries to liberalise, unbundle and deregulate their respective energy markets in order to foster competition and lower prices. Smart Metering will enhance the efficiency of these markets by allowing easier and faster switch of supplier. Smart Metering will allow suppliers to unlock tariffs and will support them in providing variable pricing (which also represents a push for customers to install their own decentralized generation and storage).

In addition, the vast amount of information that Smart Metering will produce will be easier to audit and share between actors. This will greatly improve transparency and efficiency of the electricity market and support end customers in getting accurate information regarding their consumption.

Technical options offered by Smart Metering will also allow Governments to maintain social justice in the consumption of this essential commodity which is electricity (as for instance allocate a minimum capacity for customers in need during winter for heating). Smart Metering will liberalise and open electricity markets while checking the fair share of costs and benefits to customers.

IMPROVE SECURITY OF ELECTRICITY SUPPLY

By reducing peak and global demand, Smart Metering will improve security and continuity of electricity supply, a strategic issue for each country (as proven by the Italian blackout of 2003) by:

- » Reducing the need to burn imported fossil fuels;
- » Reducing the need for new production capacity, and;
- » Allowing a better management of the real time production-consumption equilibrium.

This will benefit all of the customers by increasing the quality of service.



Society in general will benefit from competition (lower prices) and better quality of service (security of supply).

Smart Metering promotes these two issues while contributing to meet strict CO2 emissions reduction objectives.

BUSINESS DRIVERS FOR POWER GENERATING COMPANIES

The business model of today's Power Generating Companies is based on evaluating substantial long-term investments, even more so today as colossal new capacity is needed to replace aging power plants. However Power Producers must face a chronological paradox: Generators must demonstrate short-term flexibility to meet real time changes in electricity demand.

What's more Power Producers are directly targeted by CO2 emissions reduction programs like the EU ETS. Smart Meters will answer the environmental issue and the paradox of the generation process.

REDUCE ENERGY PRODUCTION AND GHG EMISSIONS...

Smart Metering will allow a reduction in peak electricity demand because end customers will have the tools to measure, follow and reduce their energy consumption. Peak loads are usually met by switching on Fuel or Gas units which are expensive and highly CO2 emitter units.

Better management of these loads will have both an environmental and a financial impact:

- » Smart Metering will globally reduce the environmental impact of Power Generating Companies and help them follow international regulations towards the decrease of CO2 emissions, and;
- » The better management of peak loads will allow Generators to reduce operating reserve and to get Energy Saving Certificates (White Certificates, White Tags, Energy Efficiency Credit ...) and retrieve their financial value.

...AND TRANSFORM THE BUSINESS MODEL

Reducing peak load will also put less stress on existing or new generation capacity. This will offer greater availability of the power plants and extend the life of those that are aging. This will also defer or avoid the need for new capacity, hence allow better resource optimisation and better planning of new investments. By reducing the need for centralised power generation capacity, Generators will then be able to invest massively in Decentralized Power Sources: solar, wind, hydroelectric, batteries, biomass,

With the announced reduction in global and peak consumption of end customers equipped with Smart Meters (hence the announced reduction in "kWh" sold by Power Generating Companies), traditional Centralised Power Producers will have to adapt their generation capacity to fulfil emissions reduction objectives and change their business model to that of Decentralised and Renewable Power Producers.

BUSINESS DRIVERS FOR TRANSMISSION SYSTEM OPERATORS

As well as Power Generating Companies, national or regional Transmission System Operators (TSOs) are also facing a chronological paradox of their own. They hold the difficult mission of insuring the real time production-consumption equilibrium, while supporting long term investments in high voltage transmission lines.

The vast amount of information that will be gathered by Smart Metering networks will directly benefit them for these two missions.

MANAGE THE PRODUCTION-CONSUMPTION EQUILIBRIUM IN REAL TIME

The information given by real time data coming from end customers will allow more accurate demand forecasts (short, medium and long term). The short and medium term data will allow a better planning of the supply and demand balance, and of electricity operating margins (i.e. the difference between forecasted demand and available supply).

The possibility given by Smart Meter Management Systems to use massive switch-offs on large groups of meters (e.g. up to 3 million meters in less than 5 minutes) to avoid a total blackout will allow TSOs to

optimise customer interruption and customer minutes lost. TSOs will then benefit from enhanced delivery resilience.

OPTIMISE THE PLANNING OF INVESTMENTS IN INFRASTRUCTURE

Reduction in peak load will improve security of supply by putting less stress on the existing transmission grid hence less need for new investments in high voltage transmission lines.

TSOs will then be able to focus on strategic investments as, for example, linking European countries to optimise the European grid as a whole, which will in its turn offer a better security of supply and unify European markets for more exchanges.

OPTIMISE OPERATIONS AND COSTS

Better short term planning of demand will bring better risk management and reduce cost for trading on the wholesale market to balance supply and demand. This will also bring more players and more competition on the wholesale markets with third-party balancing aggregators bidding on Demand-Response programs.

The extra information from Smart Meter Management Systems will offer TSOs more insight into what is happening in real time in the MV/LV networks and what will happen in the medium and long term, allowing optimisation of security of electricity supply and costs.

What's more Smart Metering will support decentralised energy production hence avoiding losses on the national transmission grid.

SMART METERING MUST BE « SMART GRID READY »

DRIVERS FOR CONCEDED AUTHORITIES

Like Governments, Conceding Authorities are not part of the value chain as such. However they are the actors who grant concession rights to Distribution System Operators.

GUARANTEE CUSTOMER SERVICE AND SATISFACTION

Smart Meters will come with improved quality of service on the concession perimeter and improved security of supply for local customers.

Modernised assets and asset management tools with automatic reporting will provide improved data

information and reliability on concession perimeter.

ATTAIN ENERGY SAVINGS OBJECTIVES

Smart Metering will globally reduce the environmental footprint of Conceding Authorities and help them to fulfil their energy savings targets.

The potential sharing of installed electrical smart metering infrastructure with gas, water and heat is also a driver for infrastructure costs savings.

Without having a strong decisional role in the process, Conceding Authorities will nevertheless benefit from Smart Metering with a greener image : emissions reduction of local customers as well as energy savings for the Conceding Authorities own consumption (town halls, hospitals, local schools, ...) will both improve the carbon footprint of their perimeter.

Distributed Generation in their perimeter will also improve their energy independence.reduction objectives.

BUSINESS DRIVERS FOR DISTRIBUTION SYSTEM OPERATORS

Distribution System Operators (DSOs) are the main actors of Smart Metering projects. Indeed DSOs will have to support the substantial costs of installing the Smart Metering infrastructures. In return they will find the most benefits in the transformation of their activities.

MANAGE PERFORMANCE IN REAL TIME

Smart Metering infrastructure will allow DSOs to measure and report in real time the network operational performance. For example, DSOs will monitor precisely and in real time:

- » Loss Of Load Expectation (LOLE);
- » Loss Of Energy Expectation (LOEE);
- » Expected Demand Not Supplied (EDNS);
- » Frequency of Loss Of Load (FLOL);
- » Energy Index of Reliability (EIR), etc.

These information will be displayed on a geographical perspective (linked to Geographical Information Systems) and will allow to follow precisely the quality of service (load, voltage regulation, harmonic distortion and flicker, disturbances, frequency, number and duration of short and long interruptions, customer minutes lost, annual unavailability, ...). By looking further, Smart Grids will be introduced by installing Smart Sensors - replacing present "too-late" sensors (customers with their telephone) - connected to Smart Concentrators.

OPTIMIZE ENERGY MANAGEMENT

By switching to Smart Metering, DSOs will gradually improve network management with Smart Grids¹, thanks to:

- » The global management of demand, storage (flywheels, compressed air storage and turbines, batteries, electric vehicles, ...) and supply (and no longer generation supply side only);

- » The management of Distributed Energy Resources DER (current operating practices only ensure that they are quickly disconnected if needed, but Smart Grid will provide flexibility and controllability towards a more secure system operation);
- » The accurate and timely knowledge of the status of meters and lines (thanks to Power Line Communication using actual electric lines and through concentrators);
- » The optimisation of the sizing of transformers and other distribution equipments;
- » The surveillance of transformers and other distribution equipments, and the monitoring of control and condition (through sensors and concentrators);
- » The surveillance of weather conditions (globally through direct links to weather forecasting, and locally with temperature, humidity and light sensors through concentrators);
- » The improvement of power flow management through earlier event detection, faster reporting, easier alarm management, and quicker recovery / restoration time;
- » The optimisation of user profiling and forecasting;
- » An enhanced delivery resilience and flexibility (early developing overload conditions detection, peak shaving / clipping / smoothing / shifting using demand response programs, smart cold load pick-up management, alert on misuse, load and phase balancing, smart fault detection and outage mapping, predictive maintenance, smart load shedding; remote collective gradual distributed load limiting in shifts at concentrator level, self-healing, sub-network island management: micro-Grid enhancing local reliability seen from the Grid as a single aggregated load, or micro-Grid isolation as autonomous communities back-up providing continuity of supply to emergency units, ...).

¹ Smart Grid: An electricity delivery infrastructure that leverages advancements in IT, communications technology, and energy technology to improve delivery utilisation / resilience and empower customers to address environmental concerns (Gartner, 2008). It will be characterized by a two-way flow of electricity and information.



ENHANCE CUSTOMER SERVICE AND SATISFACTION

The Smart Meter infrastructure will allow a quick switch between suppliers, an easier switch between tariff, billing schemes or load limits for end customers. Typically the delays will be reduced from several days to 2 hours.

This will therefore increase competition between suppliers, as requested by Regulating Bodies, and End Customers will directly benefit from the increased competition and better service levels.

CONTRIBUTE TO ENVIRONMENTAL OBJECTIVES

Smart Meters will allow DSOs to follow national or international regulations (for example: EC 2006/32, USA EPAAct 2005, ...) and save energy (less CO₂ - direct savings from less crew cars and less mileage and indirect savings from end customers energy savings) with the direct impact on the environment. Smart Metering will let end customers become local producers (by allowing net metering), and therefore distribution technical losses will be saved. Furthermore, DSOs will improve their public image to that of a modern, positive, green, innovative and high-tech (and also now accurate!) company.

ATTAIN FINANCIAL EXCELLENCE

Not only will Smart Metering allow attaining operational excellence but it will also boost the competitiveness of DSOs by:

- » Reducing operating expenses (OPEX) through remote meter reading, remote meter management, remote meter supervision (which reduces the number of crew interventions, associated management and administrative support for manual reading, and configuration of the meters);
- » Reducing maintenance costs (OPEX) through reducing maintenance crew interventions, and improving their efficiency due to :

- » Remote meter supervision and software upload (which reduces the number of crew interventions, associated management and administrative support, and configuration of the meters), low failure rate not exceeding for instance 0,5% per year and longer life span of the meters, up to more than 20 years, which reduces maintenance interventions;
- » Interoperability and "interchangeability" of smart meters and smart concentrators provided by open protocol, "standardisation" and shared specifications of the equipments and communication protocols. Even if there are 10 different hardware providers, maintenance crew can plug any meter in any home with unique installation procedures and tools, and have it automatically connected to the nearest concentrator. They can also plug any concentrator. Stocks are therefore smaller and easier to manage and to dispatch (the need to check availability of the right equipment in the car or to go to a regional stock will no longer exist).
- » Asset Management software integrated to the solution which provides all information on the meter and its location, with additional functions implemented to provide crew planning, life duration statistics for preventive maintenance purpose, or even predictive maintenance based on condition monitoring, ...

The main financial benefits of Smart Metering for DSOs usually include cost savings through the reduction of manpower, crew cars, fuel, and CO₂ emissions. Financial excellence will also be allowed in particular through:

- » The ability to invoice precisely distribution network usage;
- » The decrease of non technical losses thanks to real-time automatic fraud detection (tampering, removing, bypassing, ...);
- » The reduction of peak electricity demand and the better management of load hours, therefore alleviating the need for expanded distribution capacity or infrastructure installation (CAPEX investments).

Distribution System Operators can really make great savings from Smart Metering and have a rather quick pay-back for their initial big investment.

However and although the international regulations are pushing for Smart Metering, national regulations vary from country to country and the initial investments are as high as the transformations Smart Metering projects will bring.

Distributors should therefore ponder the various technical options (AMR or AMM, two-way communication system options ...) and assess precisely the ROI that their respective Smart Metering project carries.



BUSINESS DRIVERS FOR RESELLERS AND SUPPLY COMPANIES

Electricity Sales Companies provide electricity and services to End Customers. They will directly benefit from Smart Metering by enhancing service levels in particular.

OFFER IMPROVED AND NEW SERVICES

For Electricity Suppliers, Smart Metering will provide accurate real time metering: there will be no longer estimates every 2 months and yearly actual metering. At the same time, Suppliers will provide to their customers informative bills based on actual tariffs, actual time of use, as well as energy saving information and advice, maybe even simulations to promote end customers' subscription to new energy saving schemes.

Smart Metering allows more frequent billing and faster reading to cash: frequent enough to enable customers to regulate their own energy consumption...

New smart services that Supply Companies will provide include:

- » Preferred bill (based on the real consumption and not an estimate) due date for end customers;
- » New competitive tariff packages and competitive or incentive offers (e.g. Time of Use, Dynamic Pricing, Demand Response, Automated Load Control, Prepaid with same smart meter, Cost Reporting, ...), and easy opt-in / opt-out of the deals;
- » Smart invoicing concepts (e.g. invoice each time bill exceeds 100 €, or a single invoice for two households in two different countries with two different currencies, ...);

Existing service levels will also be increased:

- » Customer calls will be decreased, in number and in duration, due to higher reliable data, reduced errors, improved analysis process time, more reliable network, and outage mapping and restoration. Therefore Suppliers will save on CRM - Customer Relationship Management (especially when prepaid is used) and increase customer satisfaction and loyalty; this is even more important for prepaid customers with present calls increased from +30% to +100% when compared with normal post-paid customers.

- » Smart Metering will help new entrants (or companies wanting to increase their market share) in the Supply Market and ease the change of supplier (e.g. switching in 2 hours vs. 5 days);
- » The process for customers moving into / out of homes will be eased.

CHANGE CUSTOMER BEHAVIOUR

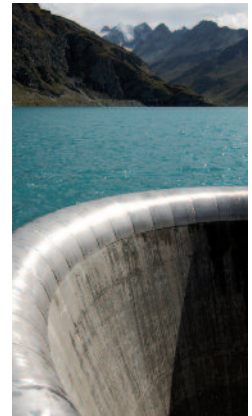
User load profiling (i.e. allowing logical or geographical aggregation and also detailed marketing analysis and customer segmentation) will provide a basis for customer targeting, with differentiated value added services.

The new services that will be elaborated will also help to:

- » Change customer behaviour from fixed consumption user to smart customer with self regulation of energy consumption, thanks to frequent billing, local dynamic display, usage of Short-Message Service (SMS) and/or web portal, Demand-Response programmes like load curtailment scheme, or direct load scheme;
- » Allow to define customer energy profiles for targeting Energy Efficiency/Demand Response programs;
- » Allow Distributed Generation (DG) and buying electricity back (net metering) from renewable alternative decentralized micro-generation like solar, wind, hydroelectric, biomass;
- » Allow Distributed Storage (flywheels, compressed air and turbines, batteries, EV electric vehicles ...).

OPTIMISE CASH FLOW

Since Smart Metering will provide accurate real time data, suppliers will bill customers with the exact real consumption (no more estimates). Suppliers will then have lower payables and less unrecoverable. Furthermore, the future infrastructure will authorise more frequent billing and faster reading to cash and therefore in the same time, Smart Meters will improve company cash-flow.



Suppliers and especially new entrants will be able to offer new services or more complex and adapted tariff packages allowing them to differentiate their electricity supply offers.

These new offers and services will help end customers change their way of consuming energy while improving cash flow.

Now is the time for suppliers to imagine the services and offers of the XXIst century!

SMART ENERGY SERVICES

BUSINESS DRIVERS FOR SMART ENERGY SERVICES COMPANIES

New market roles and new business models will emerge in coming years thanks to Smart Metering. These new Energy Services Companies will need to get Third-Party access to Data through the Regulator. The services these new Smart Energy companies offer may sometimes be compared to the services a supply company might offer. However, we have already identified some potential new areas for Energy Services Companies.

ELABORATE DEMAND RESPONSE PROGRAMS

Independent Third-Party Aggregators (or Curtailment or Balancing Service Providers) could represent an important opportunity for consumers who would otherwise be unable to participate individually or as a community in Demand-Response (DR) programs. These new companies will:

- » Aggregate several customers into a single more powerful purchasing unit to negotiate the purchase of electricity from supply companies;
- » Bid coordinated DR programs on wholesale market on behalf of customers, as an intermediary for smaller individual loads;
- » Manage Energy Interruption or Curtailment programs of individuals and communities through Smart Meters: Economic Curtailment Program and/or Emergency Curtailment Program;
- » Create and run Virtual Power Plants VPP (clusters of distributed energy providers and/or bundling of local curtailment volunteers for “Negawatts” – curtailment of Megawatts, including innovative forms of electricity storage, able to help the DSO to regionally balance supply and demand;
- » Manage financial compensation (Incentive and/or Penalties schemes).

Competition and Innovation could lead to a greater variety of DR programs that will introduce more flexibility and therefore promote participation to such programs.

OFFER NEW SMART METER SERVICES

Smart Meters will probably see Independent Third-

Party Smart Metering Companies provide outsourcing services like:

- » Two-ways meter management;
- » Remote meter readings;
- » Billing information or even full bills to customers on behalf of small utilities.

These 3 deliveries could be even provided by 3 different companies.

Another aspect of Smart Energy Services Companies will be the analysis of the huge amount of data that will be gathered daily. These Independent Energy Audit Companies will provide:

- » Knowledge of the detailed energy consumption patterns and consumer profiles;
- » Identification of potential energy savings;
- » Tailored advice to individuals or to group of customers (with the same profile);
- » Advices in energy saving appliances (“smart appliances”).

INTEGRATE SMART METERING INTO SMART GRIDS

Smart Metering is only a step towards larger Smart Grids. A hot topic of Smart Grids is the integration of Mobile Plug-In Electricity Vehicles (PEV).

New Load Companies will take the advantage of Smart Grids and provide the following services:

- » Public Plugs scattered around cities;
- » The rental of Public PEV (this new service could be compared to what has happened for bicycles in many European cities);
- » Net Metering: Companies will for example buy electricity at high rate from PEV at peak hours, or sell electricity at low rate when distributed generation is running to high;
- » Smart Billing for PEV drivers (prepaid, post paid, free 1h offer while shopping, ...);
- » Roaming facilities: plug-in to public plugs or to private plugs while charging your usual supplier.
- » On-board Meter: Smart Meter included in a PEV could ease roaming and more importantly PEV usage as storage unit.



We are convinced that new entrepreneurs will take advantage in the coming years of the enormous potential of Smart Metering and Smart Grid to propose new innovative services, unknown and unimagined today, as it happened with mobile phones or with Internet.

BUSINESS DRIVERS FOR END CUSTOMERS

End customers should benefit a lot from Smart Metering: they will be able to lower their bills and consume less (hence emit less) while at the same time enjoying new services.

SAVE ON ENERGY BILLS

- » End customers will clearly save money, with cheaper energy bills, through both new competitive offers and direct energy savings (thanks to exact billing, smart meter display and web portal). It is still to be noted that some may pay more, but in the future they will know precisely why and when.
- » Each customer will proactively manage and reduce his energy use through direct load control program (for example: use of a smart box, smart “price responsive” appliances or computerized thermostats, Home Area Network - HAN) or through smart “time of use” outlets.
- » Customers will now play an active central role in reducing electricity demand. This will help them manage their energy bills and control (at their level) further price increases.
- » Competition will be enhanced and customers will also take advantage of an increased number of potential suppliers in the market, providing a variety of time-based rate options (and therefore again lower costs).

BENEFIT FROM BETTER AND NEW SERVICES

As discussed in the chapter above, new services will be offered by either Smart Energy Companies or Supply Companies and End Customers will enjoy these innovative solutions:

- » End customers will benefit from better meter management services while reducing the number of complaints, thanks to early detection of meter failures and faster service restoration, fast meter reconfiguration after a change request in the energy supply contract, ...;

- » Customers will benefit from new adapted offers and additional services, like flexible billing cycles;
- » They will get accurate and real time bills (no longer estimates and staying in for home readings), frequently enough to be able to regulate their own consumption;
- » Switching suppliers will be facilitated as well as changing tariff or billing schemes (e.g. switch to prepaid for one month of seasonal rental) and moreover without physical visit implying staying into their homes;
- » Get information on actual quality of service.

REDUCE ENERGY CONSUMPTION AND CO2 EMISSIONS

Reduction of CO2 emissions will be carried out in two ways: direct energy savings and indirect CO2 savings (through remote reading / management of their smart meter, and reduced peak consumption).

Thanks to Net-Metering, End Customers will find it easier to generate their own alternative renewable electricity (solar, wind, hydro ...).

These personal installation will help them save on peak pricing, save transmission and distribution technical losses (around 7%) and will let them sell electricity back.

With the future emergence of Smart Grids, Electric Vehicles or Plug-In Hybrid Electric Vehicles (PHEV using the “Vehicle-to-Grid” V2G concept) will help customers not only reduce the energy consumption of their homes but also reduce the energy consumption of their vehicles.

Smart Meters will therefore add more and more value to a customer's home, as potential buyers will spend more in the coming years for a residence including renewable energy (green certification).

At their own level, each customer will gain insight into better understanding their household energy footprint, and will be able to compare with similar neighbours.

As end customers manage electricity demand, they should always be placed at the forefront of the Smart Metering topic. Companies will have to anticipate their needs of new services while packaging new pricing offers to help them reduce their bills and their CO2 emissions.



BUSINESS CASE

TIPS FOR SMART METERING ROI CALCULATIONS

Investments in Smart Metering infrastructure represent one of the biggest investments in attaining Smart Grids. This is why investors should methodically and systematically elaborate precise business cases for their respective projects.

Calculations should be made on a more or less 25 years period (5 years rollout followed by a 20 years life cycle).

Main business case parameters depend on the non exhaustive list of following factors:

- » **Whom the global infrastructure belongs to (smart meters, IT...): the distributor, a third party, the end user, suppliers, shared between several actors...;**
- » **SLA requirements;**
- » **Regulatory obligations;**
- » **Legal restrictions and recommendations (for communication, privacy, security...);**
- » **Existing manpower status in the distribution companies (number of manual reading staff, and associated management staff, number of CRM staff, age pyramid, retirement schedules, ...);**
- » **Openness of the solution:**
 - proprietary solutions are not open and therefore are globally more costly;
 - open standard / protocols promote competition and lower costs;
 - interoperability decreases installation and maintenance costs;
- » **Consumers population density:**
 - If population density is high, then:
 - » less concentrators are needed (Meters to Concentrator ratio varies usually from 10 in countryside to 200 in cities, with a min of 1 and a max of 1000 and e.g. from 50 on average in France to 90 in average in Belgium Flanders);
 - » moreover meters installation is much faster ;
 - » old meter reading was faster also, therefore manpower savings are lower;
 - If population density is low, then:
 - » more concentrators are needed;
 - » meters installation is slower;
 - » old meter reading was slower also, therefore manpower savings are higher;
- » **Ratio of meters outside/inside the residence;**
- » **Ratio of prepaid meters;**
- » **Ratio of existing meter annual replacement;**
- » **Number of different types and status of existing meter cabinets (Ratio of needed replacement)**
- » **Peak shaving and postponement of additional costs (CAPEX);**
- » **Available Communication technologies on the WAN (GPRS coverage, PSTN, ADSL...);**
- » **Existing level of Non-Technical losses;**
- » **Change Management at end customer level to get full benefits from DR programmes;**
- » **Level of prepaid metering;**
 - Normal smart meters allow prepayments, but are cheaper than specific prepaid meters;
 - Customer calls are much higher in the old prepaid segment.

It is therefore not really possible in our opinion to give reliable indicative figures of Pay Back period or ROI for a generic Smart Metering Programme.



CONCLUSION

Smart Metering is no longer a question of “GO” or “NO GO” it is now only a question of “when?” and “how?”. Smart Metering represents a paradigm change for the energy sector and provides strategic benefits from Smart Grid by transforming current electricity grids into innovative real-time interactive (between customers, suppliers, distributors, ...) service networks. TSOs were managing the generation side: DSOs will now manage the demand side and the supply side.

By strongly reducing manual reading and interventions on the meters, by allowing decentralized electricity generation and storage, by saving distribution losses, we can state that Smart Metering and Smart Grid are “Green”.

We are convinced that new entrepreneurs will take advantage in the coming years of the enormous potential of Smart Metering and Smart Grid to propose new innovative services.

Benefits listed in this document, stakeholder by stakeholder, accrue all along the value chain from the power generator to the end customer. However, it is not really possible in our opinion to give reliable indicative figures of a Pay Back period or for a ROI regarding a “generic” Smart Metering Programme: each Smart Metering Project should comprise a detailed Business Case.

We hope this document will help Smart Metering stakeholders manage Smart Metering programmes and make them a success.

We are of course open to discussion and welcome readers’ comments and feedback.



ATOS ORIGIN'S EXPERIENCE IN SMART METERING AND SMART GRID

ERDF AMM PROJECT

ERDF is the largest electricity distribution grid operator in France and is a 100% subsidiary of EDF.

Atos Origin is leading ERDF Smart Metering programme (called AMM Automated Meter Management or Linky within ERDF) which will culminate in the deployment of 35 million electric Smart Meters.

AMM Smart Metering programme provides:

- » remote near real-time metering (up to 10 consumption indexes on a daily basis with data interval from 10 mn to 1 hour), via 700 000 Smart Concentrators
- » easy switching of suppliers in a liberalized energy market
- » remote services on Smart Meters (2 ways intelligent communicating meters, standardized and interoperable) such as data and load profile collection, meter disconnection and reconnection, meter programming of new load limits, new tariff, and microcode uploading and downloading
- » remote services on Smart Concentrators (2 ways intelligent concentrators, communicating with the meters via an open PLC (Power Line Carrier) protocol, with ERDF IT systems mainly via GPRS, standardized and interoperable and local substation RTU via Ethernet interface and IEC 104 protocol), such as grid surveillance, and microcode uploading and downloading
- » net metering
- » first smart grid services such as grid surveillance and management, massive switch-off, smart cold load pick-up management, and quality of service measurement on the low voltage grid
- » the whole metering asset management functions,
- » direct integration to 10+ ERDF IT applications, communicating with 50+ ERDF IT applications
- » future-proof openness, performance and scalability
- » administration and monitoring of the global AMM IT system and communication infrastructure.

ENDESA SISTEMA DE TELEGESTIÓN BT PROYECTO

Endesa is a leading Distribution company in Spain. Atos Origin 85% subsidiary Mundivia was in charge of the design and development of the system architecture including the software for the concentrator and the central services in Endesa Smart Metering / Intelligent Network project:

- » Interoperability: independence from hardware and software providers: no vendor-locking in
- » Distributed architecture: intelligence in the concentrator
- » Predictive attitude: external sensors in the substation, Smart Grid Ready.
- » Self configuration, self recovery capabilities
- » Lean-budget mindset
- » Single data repository with links to Metering System, Business Systems and Technical Systems
- » Use of XML, SOA, EDA, IP standards

ERDF TELEREL PROJECT

Atos Origin's Smart Metering Competency Centre is maintaining ERDF Telerel project.

This project is a PLC protocol experimentation conducted with Landis+Gyr, for data collection of 5000 industrial and residential meters.

Several types of equipments are supported, up to 15

different meter types and 3 different concentrator types. The application provides AMR (Automated Meter Reading) functions, concentrator administration functions (for configuration purpose), network and topology supervision...

ERDF SAR / GEC PROJECT

SAR and GEC applications are bespoke developments by Atos Origin for ERDF:

- » SAR is an automated massive meter reading and programming system for Commercial & Industrial (C&I) electricity meters.
- » GEC is the associated meter asset management system.

These projects were fully developed by Atos Origin, from design to final acceptance. They involved integration with several external applications such as Data VEE / settlements and Contract management applications for SAR.

SAR also interfaces with GEC: SAR receives meters configuration from GEC and transmits alarms and meter maintenance data to GEC.

SAR is used for:

- » Daily Meter data reading: Status information, Interval Data, Energy Data Readings (index, maximum power demand, exceeded demands, functioning time...), Configuration data (load limit,...), Energy Quality Data (events, defects, outages, ...) of 500 000 I&C Meters

- Meter configuration: all configuration operations are possible in a remote way:
- Synchronize the meter clock (and generate alarms when there are important time shifts)
- Program changes of legal time (Daylight Saving Time)
- » Program load limits
- » Operations management (data acquisition scheduling, calling zone management, authorization check, communication optimization, completion follow up, failure management...)
- » Data processing (normalization, filtering, up to 24 months storage in a Data Base, dispatch to other ERDF applications, auditability, traceability, ...)

GEC is used for:

- » Asset description (including links between the different assets, equipment trees, asset configuration and characteristics)
- » Work requests and Intervention management (scheduling, follow-up)
- » Condition Monitoring of the metering equipments

SMART GRID R&D PROJECTS

Atos Origin is involved in several Smart Grid initiatives:

- » we are the Coordinator of the OpenGrid (Open architecture for secondary nodes of the electricity Smart Grid) consortium for the European Commission with Iberdrola, EDF,EDP, Siemens, Kema, Nucleo and ITE. Atos Origin manages 3 work packages out of 8. This project focuses on smart Secondary Substation Nodes (SSN) as substantial component to monitor and control the smart distribution grid. OpenGrid will focus on research and development of:
 - an open secondary substation node which is seen as an essential control component of the future smart distribution grid
 - a middleware to couple the SSN operation with the Utilities systems for grid and utility operation and
 - a modular communication architecture based on standardised communication protocols to grant the flexibility required by the stakeholder diversification and to cope with massively distributed embedded systems in the distribution grid
- » we are part of the Energy and Environmental Working Group of the Rhône-Alpes Competitiveness Pole TENERDIS in connection with the French Government initiative known as "Grenelle de l'environnement". This competitiveness forum relates to home energy control and new energy technologies, major components of sustainable development
- » we are involved since the beginning of 2009 in a research project funded by the French Ministry of Economy. This project relates to an innovative platform for smart grid and we are the integrator of the consortium with EDF R&D, Schneider Electric, Grenoble University.
- » we participate to the CIGRE committee D2.25 "Information and Communication Systems in the deregulation of electricity sector
- » we work for ETSO organisation regarding standardization of data exchanges between the different players of the Energy supply chain. Currently, ETSO and IEC 57 Working Group 16 are in touch for normalization of the standards elaborated by ETSO
- » we are the Coordinator for SINARI proposal submitted with EDF R&D, CEA, Telecom Paris Tech, INP Grenoble, and FP Conseil to ANR (French Research Agency). The topic is the security of the electrical distribution systems used in the frame of deregulated market: electrical networks, IT infrastructure, telecom networks.
- » We are a member of the Rhône-Alpes answer to ADEME (French Energy Savings Agency) call for proposals regarding Smart Grid with ERDF, GDF-Suez, GEG, Schneider Electric, Alstom, Grenoble INP ...

ACRONYMS

| | | | |
|--------------|---|----------------|---|
| ADSL | : Asymmetric Digital Subscriber Line | GPRS | : General Packet Radio Service |
| AMM | : Automated Meter Management | I&C | : Industrial & Commercial |
| AMR | : Automated Meter Reading | IEC | : International Electrotechnical Commission |
| CAPEX | : Capital Expenditure | IT | : Information Technology |
| CIGRE | : Conseil International des Grands Réseaux Electriques | LOLE | : Loss Of Load Expectation |
| CO2 | : Carbon Dioxide | LOEE | : Loss Of Energy Expectation |
| CRM | : Customer Relationship Management | LV | : Low Voltage |
| DER | : Distributed Energy Resources | MV | : Medium Voltage |
| DG | : Distributed Generation | OPEX | : Operating Expenses |
| DR | : Demand-Response | PEV | : Plug-in Electric Vehicle |
| DSO | : Distribution System Operator | PHEV | : Plug-in Hybrid Electric Vehicle |
| EC | : European Commission | PLC | : Power Line Carrier |
| EDA | : Event Driven Architecture | PSTN | : Public Switched Telephone Network |
| EDF | : Electricité de France | R&D | : Research & Development |
| EDNS | : Expected Demand Not Supplied | ROI | : Return on Investment |
| EIR | : Energy Index of Reliability | RTU | : Remote Terminal Unit |
| ERDF | : Electricité Réseau de Distribution France | SAR | : Système Automatique de Relève |
| ETSO | : European Transmission System Operators | SCADA | : Supervisory Control And Data Acquisition |
| EU | : European Union | SMS | : Short-Message Service |
| EV | : Electric Vehicle | SOA | : Service Oriented Architecture |
| FLOL | : Frequency of Loss Of Load | TSO | : Transmission System Operator |
| FP7 | : Framework Programme 7 | USA | : United States of America |
| GEC | : GEstion des Compteurs | VPP | : Virtual Power Plant |
| GEG | : Gaz Electricité de Grenoble | V2G | : Vehicle to Grid |
| GHG | : Green House Gas | SLA | : Service Level Agreement |
| GIS | : Geographical Information System | WAN | : Wide Area Network |
| | | WIFI | : Wireless Fidelity |

About Atos Origin

Atos Origin is a leading international information technology (IT) services company, providing hi-tech transactional services, consulting, systems integration and managed operations to deliver business outcomes globally. The company's annual revenues are EUR 5.5 billion and it employs 50,000 people. Atos Origin is the Worldwide Information Technology Partner for the Olympic Games and has a client base of international companies across all sectors. Atos Origin is quoted on the Paris Eurolist Market and trades as Atos Origin, Atos Worldline and Atos Consulting

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