Report on drivers and barriers and Recommendations for action

Project: European Smart Metering Alliance

Author: Carmelo Rodríguez, Endesa Ingeniería, S.L.

Work Package 2, Deliverable 9

Project Contract: EIE/06/031/S12.448010 – ESMA

Version 1.1, August 2008

1. EXECUTIVE SUMMARY 3

2. INTRODUCTION 5

2.1. AIMS 5
2.2. STRUCTURE OF THE QUESTIONNAIRE 5

3. TECHNICAL DRIVERS AND BARRIERS 6

4. ECONOMICAL DRIVERS AND BARRIERS 9

5. REGULATORY DRIVERS AND BARRIERS 13

6. CONCLUSIONS 15

7. REFERENCES 16

APPENDIX 17

1. EXECUTIVE SUMMARY

Smart metering is a topic that recently has attracted much attention. Many countries within the EU and outside Europe are already involved in projects with smart metering on a demonstration scale or larger.

There is no doubt of the potential benefits of smart metering:

- for metering companies or DSO to decrease meter reading.
- for grid operators who want to prepare their grid to the future.
- for energy suppliers who want to introduce new, customer made services and reduce call centre cost.
- for governments to reach energy saving & efficiency targets and to improve free market processes.
- for end users to increase energy awareness and decrease energy use and energy cost.

On the actual deployments that are taken place all around the world, each market has different drivers to implement smart metering. In some markets the main driver is to reduce the cost of meter reading, in others is to reduce fraud while in others is to reduce peak demand or prevent black-outs in certain areas.

Additional benefits of smart metering are foreseen in relation to distributed generation, variable pricing schemes to attract new customers or improved processes for customer switching between RESC's.

Energy savings and increased security of supply will be the main drivers and to believe in smart metering as a means to reach these goals is indispensable.

On the other hand, the most important issues that prevent the general introduction of smart metering are:

- There is still much uncertainty about the quantification of benefits as practical experience and historical data are lacking.
- There are many parties involved, and the benefits of smart metering may accrue to

other parties than the ones that bear the costs.

- In a big scale, is a very long and costly process, requiring considerable capital expenditures from the responsible market actors while in many EU countries, there is a big opposition from regulators to increase the tariffs to final users to pay for it.

- There is not interoperability between different owner's assets: no open registered standard exists which properly scopes the different functions (metering, communications, presentation, and network). The lack of adequate common requirements on functionality and open interfaces (interoperability) fractionalises the market and increases costs both for smart metering and for the applications and services that use metered data.

- There is also a lack of modularity and lack of flexibility of present mass smart metering so special needs regarding distributed generation, demand response, power quality, customer information, energy efficiency automation and services, etc. will only be met with extra high costs.

To end up, the future of smart metering will depend heavily on the policy and decisiveness of the governmental bodies involved.

2. INTRODUCTION

Smart metering is a topic that recently has attracted much attention. Many countries within the EU and outside are already involve in projects with smart metering on a demonstration scale or larger. A variety of benefits are generally attributed to smart meters while important barriers hamper the general introduction of smart metering.

2.1. Aims

It has been sent a questionnaire to ESMA members with the purpose of getting information about the legal, economical and technological situation related to Smart Metering in those countries. This analysis will allow us to identify the drivers and barriers in the implementation of a Smart Metering System, as well as elaborate a report with recommendations to the European Community.

2.2. Structure of the questionnaire

The questionnaire is compound of:

a. “Aims & Instructions”

- It goes into detail of the pursued aims with the questionnaire sent to ESMA members. Those objectives are the following ones:

  - Identify the drivers and barriers to the complete implementation of a Smart Metering System in the countries belonging to ESMA.
  - Make the report.
  - Establish recommendations to the European Community trying to eliminate the barriers as well as boost the drivers.

- It indicates the instructions which are necessary to fill in the questionnaire.

- It gives information about the country that is being analysed and also about the person that has filled the questionnaire.

b. “Drivers & Barriers”

- Technical.

- Economical.

- Regulatory.

The aims of this report are the following ones:

- Evaluate the current situation of the Smart Metering in the countries that belongs to ESMA.

- Appraise the current situation of the Smart Metering in the countries that do not belong to ESMA.

- Identify the economical, technical and regulatory obstacles and the legal requirements to the implementation of a Smart Metering System.

The countries that have sent the questionnaire filled are the following ones:

- Finland (Pekka Koponen, VTT).

- Denmark (Mikael Togeby, Ea Energy Analyses).

- The Netherlands (Henk van Elburg/ Josco Kester, SenterNovem/ ECN).

- Spain (Carmelo Rodríguez, Endesa).

- England (John Parsons)

- Czech Republic (Pavel Kárník).

- France (Pierre Bezzina)

- Poland (Dariusz Koc)

- Other countries that decided to keep their answers anonymous.

3. TECHNICAL DRIVERS AND BARRIERS

Metering is a fundamental business enabler for companies in the utility sector. At the beginning of 2006, there were approximately 246 million electricity meters, 101 million gas meters and 3 million district heating meters in EU. Electricity meters reaches virtually every household and business in the whole of Europe, while gas is most widely used in Netherlands, the UK, Italy, Germany, France and Poland.

Almost all the interviewed countries, except England, France, Poland and the Czech Republic, have recent experience in AMM and have installed pilots with the aim of advancing in the implementation of a Smart Metering System.

The meters in Europe are relatively young. In the case of industrial and commercial customers, the age of the meters in all the interviewed countries is under 15 years. In Denmark, Spain, Poland, the Netherlands and France the residential customers has older meters (between 15 and 30 years).

A challenge to be taken in account is the issue of so-called stranded assets, related to replacement of the old electromechanical meters. These meters have a lifetime of approximately 25-30 years and are difficult to utilise after their replacement. This is especially important in the countries, where a considerable part of the housing stock is new. It is possible to reduce the significance of their problem by the introduction of gradual implementation of the meters, where the Smart Meters will be first used in new installations during the first implementation.

For industrial and commercial customers, almost all the meters are electronics. Related to the residential customers, in Denmark, France, Poland and Spain the quantity of electronic meters is insignificant from the rest of the countries where there is a higher amount of electronic meters.

In every country, except in Finland, Poland and Denmark, in the case of residential customers, the proportion of single-phase meters is much higher than three-phase meters.

In relation of the ownership of the meter, in Denmark, France, Poland and the Czech Republic they are owned by the distributor while in countries like England they are owned by meter operators. In Spain 20% of the meters are owned by the customer which would complicate a mass roll out.

All the interviewed countries have a communication infrastructure capable to transmit additional features based on a two-way real-time data: data communication technologies for smart metering include major challenges regarding costs, quality of service, future existence, agreements, etc.

Finland, Spain, Denmark and England do not demonstrate problems with non technical losses so fraud is not a driver. However, The Netherlands and France consider that their problems related to non technical losses promote the need of having a Smart Metering System.

None of the analysed countries reveal problems with technical losses with the exception of Spain, France, Poland and the Czech Republic.

The Netherlands, France, and Finland needs better measurement accuracy, while Denmark, Poland, Spain and England do not need it.

In that countries where there is poor metering of energy at present so it may be more pressing to get basic metering to an adequate level rather than press ahead to full smart metering first.

Related to the grid capacity, the majority of the interviewed countries do not have problems with it so this could not be a driver for smart metering.

An important barrier is the not interoperability between different owner's assets: no open registered standard exists which properly scopes the different functions (metering, communications, presentation, and network). The lack of adequate common requirements on functionality and open interfaces (interoperability) fractionalises the market and increases costs both for smart metering and for the applications and services that use metered data.

There is also a lack of modularity and lack of flexibility of present mass smart metering so special needs regarding distributed generation, demand response, power quality, customer information, energy efficiency automation and services, etc. will only be met with extra high costs.

A large scale roll out of AMR/AMM without adequate requirements and standardisation may prevent the development of services and applications that are based on smart metering infrastructure until it is time for the next roll out after 10 years or so. On the other hand

poorly designed standardisation can prevent development and innovation.

It was also pointed out that there is a weak cooperation between DSOs/RESCs and AMR equipment manufacturers: joint efforts, common approach and consensus, especially on AMR technologies and data transmission, could speed up development of SM. Also important in this context seems to be an issue of integration of measuring all grid mediums delivered to the consumers (electricity, heat/cool, natural gas, water, sewage) in one data transmission device/unit and additionally serviced by one operator. Integration of much more parties could support development of Smart Metering.

Installation of Smart Metering also requires skilled manpower, necessary to replace the meters. If the implementation period is short or/and several DSOs are running the process simultaneously, it may create serious problems due to limited access to local manpower.

Furthermore, when a single country implements a mandatory requirement for implementation of Smart Metering within a relatively short time period, it may easily create a shortage of the Smart Metering equipment on the market and cause unnecessary complications for the process.

Several potential risk factors are caused by the present situation in production of Smart Metering equipment. It is a fairly small industry, which is still growing and evolving, with few well-established and renowned vendors and several middle-sized and small ones. During the last years it has happened several bankrupts, mergers and takeovers in this sector. In some cases it resulted to discontinuation of supplies and support to already installed equipment. Several utilities share a concern that it is difficult to find reliable and competent suppliers of equipment, especially when it comes to small utilities, which do not have as strong bargaining position as big ones. There are several examples of big utilities purchasing a share in Smart Metering vendor companies in order to secure their projects.

4. ECONOMICAL DRIVERS AND BARRIERS

The key drivers of smart metering are the functionality of the smart metering system, which provide many benefits for both utilities and customers, including the following:

- Time-of-Use Metering: Customers can be billed based on their time of use; therefore, demand can be shifted from peak periods to off-peak periods, improving energy efficiency

and allowing CO2 reduction.

- Remote collection of meter data: It should reduce the cost of data collection, eliminate estimated bills and provide accurate data for usage information on bills

- **Remote Connect/Disconnect**: Remote power connect/disconnect using a remote service switch will make system operations more efficient, provide customers more options for how they consume and pay for energy consumption, will increase operating flexibility and reliability and provide improved processes for customer switching between RESC that will support market liberalization and retail market opening. It can support prepayment services, lessen the burden on utility personnel and improve employee field safety.

- **Remote Threshold Change**: Remote threshold change can be used in case a shortage of electricity should be anticipated. It can also be used on an individual basis, in case the maximum current for a customer should be lowered, because of bad payment.

- Customer Access to Information: Customers can view a variety of information through diverse methods, permitting those customers to make energy-efficient choices and to shift demand to off-peak periods.

- **Demand Response**: Demand response can improve electric grid reliability, manage electricity costs, and provide systems that encourage load shifting or load shedding during times when the electric grid is near its capacity or electric power prices are high. It also can provide quicker and better information for when to use distributed renewable resources or where to use market-based rates to reduce peak demand.

- Prepayment: Customers can prepay their accounts and read their current balance, and utilities can enforce disconnection when the prepayment balance reaches zero.

- Theft Detection: Utilities are facing revenue losses due to energy theft. The smart metering system can be used to report when customers are stealing energy or tampering with their meters.

- Outage Management: Outage management programs allow utilities to achieve faster and complete outage response, reducing customer downtime, lost revenues, and safety risk, which greatly increase operational efficiency. Smart metering systems provide an opportunity to automate processes in case customers have to receive financial

compensation due to an outage longer than a defined period.

- Network Operation: By providing information from every supply point the DSO will receive greatly increased level of monitoring of the distribution system that can be used to improve their operation of the network and investment decisions related to system upgrades.

- Network Optimization: Smart metering systems can be used to analyze the quality of electrical power by reporting harmonic data; RMS variations, voltage and VARs, and can communicate directly with distribution automation networks to improve power quality and fault recovery times.

- Distributed Generation: Smart metering systems can be used to detect, measure, regulate and dispatch distributed generation by customers, which can help utilities manage the islanding issue related to the use of distributed generation in the system grid.

- Third-Party Access: The smart metering system can be used to permit gas, district heating and water utilities, contract meter readers, aggregators and other third parties to read electrical meters, read gas, thermal and water meters, or control third-party equipment on customer premises. Multi utility metering enables cost savings both for smart metering and services (= benefits) based on it

Energy savings and increased security of supply will be the main drivers and to believe in smart metering as a means to reach these goals is indispensable.

But there are economical barriers that hamper the introduction of smart metering:

- There is still much uncertainty about the quantification of benefits as practical experience and historical data are lacking.

- There are many parties involved, and the benefits of smart metering may accrue to other parties than the ones that bear the costs several market actors are expected to have direct or indirect benefits from mandatory implementation of Smart Metering but they will not share the costs and benefits: capital and installation costs are normally solely covered by a local DSO (metering is controlled by Energy Suppliers companies ONLY in UK) which is responsible for the metering but perceive only partial benefit while many benefits go to the RESC but they cannot influence on the

design of the system.

- The result of the questionnaire shows that there is no expectative of obtaining grant aids or subsidies from the governments (excepting for the AMM investigation in Finland, England and Denmark) besides there is a general doubt about an increase of the tariffs.

- In a big scale, is a very long and costly process, requiring considerable capital expenditures from the responsible market actors while in many EU countries, there is a big opposition from regulators to increase the tariffs to final users to pay for it.

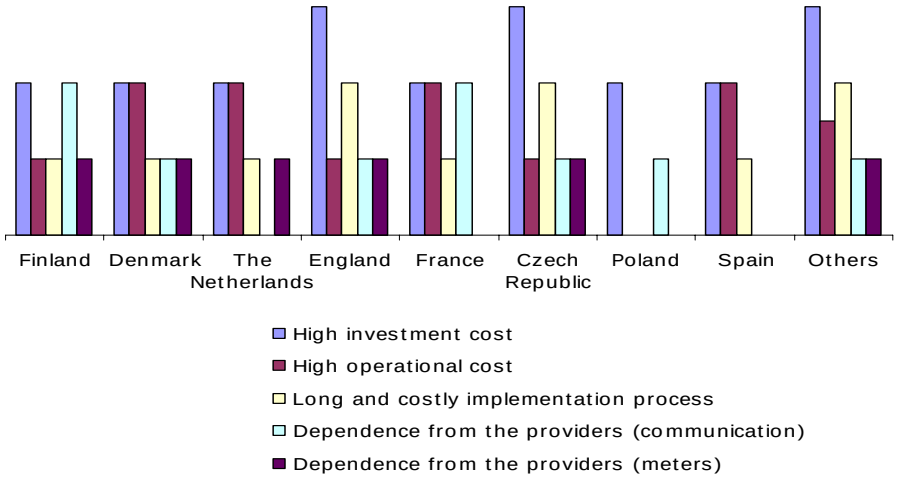
- It was also pointed out by almost all the responding utilities that high investment costs expose the responsible actor to considerable financial risks both during the implementation, commissioning and regular operation period, so such a big investment requires at least to be sanctioned by governments to prevent short sighted and unpredictable regulation in the future.

- Smart metering also requires an organization challenge. The purchase and commissioning of Smart Metering equipment requires involvement of high-skilled personnel. This is often a problem for small- and medium-size market actors, which do not have sufficient technical expertise for the initial procurement process. Additionally there are several cost-driving during installation of the equipment, related to logistics and working crews.

- The accreditation / approvals of equipment and systems are often onerous and expensive and are controlled by the suppliers.

- In Finland, France, The Netherlands and the Czech Republic the operational costs, related to reading and metering, are high and generate uncertainty.

The economical barriers to the AMM, in each country, are the following ones:

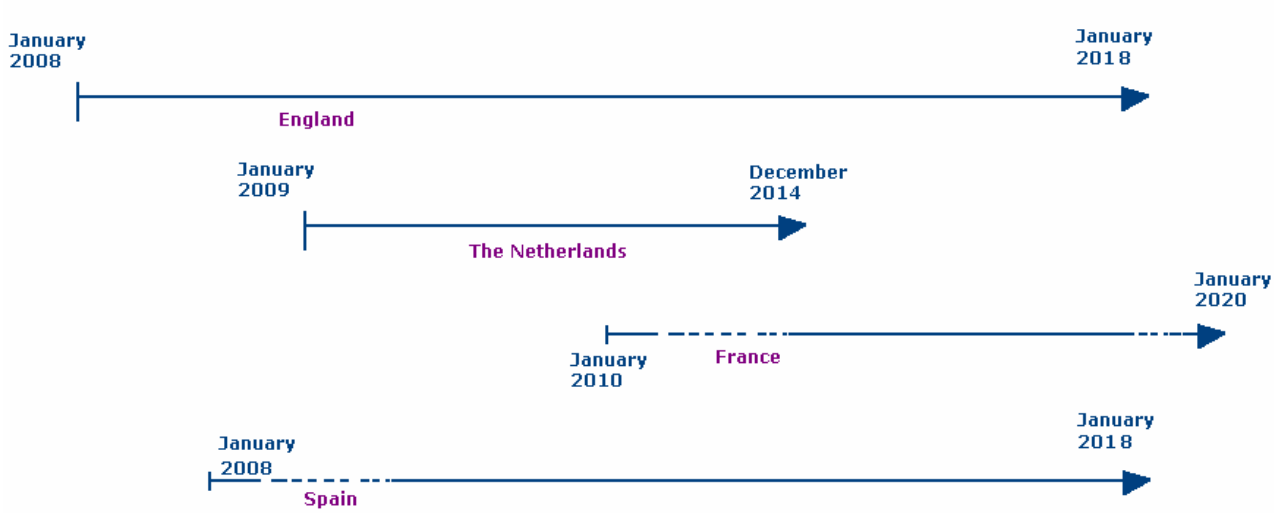


5. REGULATORY DRIVERS AND BARRIERS

Smart metering initiatives come mostly from governments as the main drivers to its introduction are security of supply, energy savings and the EU End User Directive <1>.

All the countries that has filled the questionnaire belongs to the liberalized electricity market but liberalization of the market does not speed up decisions about introduction of smart metering

Over the 50% of the countries has legal requirements related to AMM. In Denmark, Spain, France, England and The Netherlands, the law is consolidated. There are legal requirements in Finland only for customers over 3X63 A. In The Netherlands, the government has established that the implementation of Smart Metering System must start in January 2009 and must be completed before 2015 and also has set technical requirements for the System. The implementation period established in Spain starts at the beginning of 2008 until the end of 2018 <2>. In France, the implementation should start in 2010 and finish in 2020.



A broad support in society such as from important consumers organisations is needed: end users stand to benefit most, but are not well-informed and do not know what to ask for, accept reasons against too easily, and very often do not obtain realistic offers of reduction in pricing from energy suppliers when providing own automated readings.

It is also pointed out that mandated roll out instead of gradual market introduction among residents needs careful operation to avoid bad public opinion and/ or slow social acceptance. Eurelectric, the professional association which represents the common interests of the electricity industry at pan-European level, recommends flexibility on implementation <3>.

All the countries interviewed shows that their governments are committed in the environmental protection.

All the countries, except Spain, agree in the advantages, related to energy savings, that an AMM System could produce showing useful and real time information. (Price of the energy, predicted rises or slopes of the price).

The load control is regulated in France and England for industrial customers and in France for commercial and residential customers.

It is clear that the future of smart metering will depend heavily on the policy and decisiveness of the governmental bodies involved.

6. CONCLUSIONS

Introduction of smart metering seems a logical step in a world where all communications is digitalized and standardized and where costs are rapidly decreasing. Moreover, smart metering has several potential benefits:

- for metering companies or DSO to decrease meter reading.
- for grid operators who want to prepare their grid to the future.
- for energy suppliers who want to introduce new, customer made services and reduce call centre cost.
- for governments to reach energy saving & efficiency targets and to improve free market processes.
- for end users to increase energy awareness and decrease energy use and energy cost.

Energy savings and increased security of supply are the main drivers for the introduction of smart metering; therefore the future of smart metering will depend heavily on the policy and decisiveness of the governmental bodies involved.

Uncertainty about the quantification of benefits and costs, as practical experience and historical data are lacking, hampers introduction of smart metering.

Another important issue that hampers the introduction of smart metering is that there are many parties involved, and the benefits of smart metering may accrue to other parties than the ones that bear the costs.

7. REFERENCES

<1> Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC. Official Journal of the European Union 27.04.2006

<2> Spanish Ministerial Order ITC/3860/2007 of 28th December 2007.

<3> Eurelectric Position Paper on "Building a European Smart Metering Framework suitable for all Retail Electricity Customers" (June 2008)

	COUNTRY INFORMATION						
	Name	**Finland**	**Denmark**	**The Netherlands**	**England**	**France**	**SPAIN**
	Number of utilities	**80-90**	**70**	**38 [licensed utilities according to regulator]**			**8 elec retailers (Main), 5 big distributors**
Number of customers	Industrial	-	170.000	163.000 (processing/ storage/ transp/ comm.			92.000
	Commercial	-	226.000	312.000 (office/shop/catering/sport/meeting)			700.000
	Residential	3.000.000	2.500.000	6.910.000 (households)			23.000.000
	CONTACT INFORMATION						
	Name	**Pekka Koponen**	**Mikael Togeby**	**Henk van Elburg/ Josco Kester**	**John Parsons**	**Pierre Bezzina**	**Carmelo Rodríguez Moreno**
	Company	**VTT**	**Ea Energy Analyses**	**SenterNovem/ ECN**			**Endesa Ingeniería**
	Position	**Senior research scientist**	**Partner**	**project officer**			**Business Plan Manager**
	E-mail address	**Pekka.Koponen@vtt.fi**	**mt@eaea.dk**	**h.van.elburg@senternovem.nl/ kester@ecn.nl**			**crodriguez@endesaingenieria.es**
	Country	**FInland**	**Denmark**	**The Netherlands**			**SPAIN**
	Anonymous (Y/N)	**N**	**N**	**N**			**N**
	Send answers (Y/N)	**Y**	**Y**	**Y**			**Y**
TECHNICAL DRIVERS AND BARRIERS							
		Finland	**Denmark**	**The Netherlands**			
Age of the meters	Industrial	< 15 years	< 15 years	< 15 years	< 15 years	< 15 years	< 15 years
	Commercial	< 15 years	< 15 years	< 15 years	< 15 years	< 15 years	< 15 years
	Residential	< 15 years	15-30 years	15-30 years	< 15 years	15-30 years	15-30 years
% of electronic meters	Industrial	>95	100	99	100	90%	100%
	Commercial	>95	100	?	all new	80%	25%
	Residential	>80	35	?	all new	35%	5%
% smart metering implemented	Industrial	41*	100	99	100	90%	100%
	Commercial	41*	50	?	10	80%	5%
	Residential	30	10	1	0	2%	0%
		Finland	Denmark	The Netherlands			**SPAIN**
% of three phase residential meters		80	90	?	small	15	14
% of single-phase residential meters		20	10	?	100	85	86
Average of customers per Transformer Station		23	?	200-400	100	50	150
Problems with non technical losses		N	N	Y	N	Y	N
Problems with technical losses		N	N	N	N	Y	Y
Needs of better measurement accuracy		Y	N	Y	N	Y	N
Problems with the capacity of the greed		N	N	N	N	Y	Y
Recent experience in Smart Metering (pilots)		Y	Y	Y	N	N	Y
Coverage of wide area communications at customers premises	% GSM	>99	100	outside: >=99% [website Vodafone]	95	95	98
	% GPRS	>99	100	>=99% [website Vodafone]	95	80	
	% UMTS	40		about 90% [website KPN]	?	70	
Coverage of wide area communications at transformer Stations	% GSM	100	100	>= 99	95	95	95
	% GPRS	100	100	>=99	95	80	
	% UMTS	>40		about 90% [website KPN]		70	
	% Fibre	<10 *		?	0	5	
	% xDSL	50 *		?	0	5	
	% Other	Private wireless>10 %		WIFI, mainly in towns (and some villages)		leased lines	VSAT
COMMENTARIES							

ECONOMICAL DRIVERS AND BARRIERS							
High Probability of Grants or subsidies		N	N	N	N	N	N
High Probability of increase of tariffs		¿?	Y	N	N	N	Y
Subsidies to AMM research		Y	Y	N	Y	N	Y
High current operational costs (reading and meter operations)		Y	N	Y	N	Y	N
Barriers to AMM	**0= No influence 1= Not much influence 2= High influence 3= Blocking**						
	High investment cost	2	2	2	3	2	2
	High operational cost	1	2	2	1	2	2
	Long and costly implementation process	1	1	1	2	1	1
	Dependence from the providers (communication)	2	1	0	1	2	0
	Dependence from the providers (meters)	1	1	1	1	0	0
COMMENTARIES							
REGULATORY DRIVERS AND BARRIERS							
	Requirements from the authorities	Y	N	Y	N	Y	Y
	Long term stability in AMM regulation		Y	Y	Y	Y	Y
	Roll-Out plan from the authorities	N	N	Y	N	Y	Y
	From			01/01/2009	01/01/2008	01/01/2010	01/07/2007
	Until			31/12/2014	01/01/2018	01/01/2020	
	Technical requirements from the authorities	N	N	Y	N	Y	Y
	Government compromised with the environment	Y	Y	Y	Y	Y	Y
	Liberalized electricity market	Y	Y	Y	Y	Y	Y
	Proportion of regulated tariff customers (%)			0%	0%	98%	90%
Ownership of the meters	Customers	<1 %	0%	0%	0%		20%
	Distributors	75…90 %	100%	90%	0%	100%	80%
	Suppliers	<1 %	0%	0%	85?		
	Others	10…25 %	0%	10%	15?		
	Specify	Metering Comp.		large business customers can own meter	Meter asset providers		
Advanced tariffs	**M: Multi-tariff T: Time of use C: Contractual power control**						
	Industrial Customers	M,T,C		M,T,C	M,T,C	M,T,C	M,T,C
	Commercial Customers	M,T,C		M,T,C	M	M,T,C	T
	Residential Customers	M,T,C		M,C	M	M,C	T
Legal reading frequency	Industrial Customers	once in 1 - 2 years		15 min	Daily	Monthly	Daily
	Commercial Customers	once in 1 - 2 years		electr. 15 minutes	Monthly	Monthly	monthly
	Residential Customers	once in 1 - 2 years		daily transmission; 1 hour resolution	3 monthly, 2 yearly	bi annual	Two-monthly
Load control regulated	Industrial Customers	Y			Y		
	Commercial Customers	-				Y	
	Residential Customers	-				Y	
Regulation related to communication of useful information to the customer (to promote energy savings)		Y	Y	Y	Y	Y	N
COMMENTARIES							