SMART METERING REQUIRES SMART REGULATION

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ABSTRACT

Meters present not only a link between the consumer and the market, but also is the availability of metered data a prerequisite for efficient liberalised energy markets.
Various EU Directives aiming at a sustainable, competitive and secure single European electricity market also have an impact on metering. Mainly economic reasons but also technological developments have lead to the introduction of a new generation of "smart" meters. At least in theory these modern meters can support many requirements of an efficient energy market, mainly by introducing transparency and efficiency. Yet experience in frontrunner-countries such as Italy, Sweden or the Netherlands shows that appropriate regulation as well as embedded (in contrast to unbundled) metering services are drivers for large scale smart meter roll-outs.
This however increases the risk that not all market participants can fully enjoy all the benefits of smart metering. The authors conclude that the regulation of smart metering, particularly meter access and meter data availability will be a key challenge for future regulatory frameworks.

INTRODUCTION

Metering plays a key role in (liberalised) electricity markets and has a major impact on market design and market processes. Competition in energy markets and the idea of increasing energy efficiency in the European Union impose more stringent requirements of metering systems in distribution networks. As a result of this, and developments in communication technology and IT more and more smart meters (AMR, AMM) are deployed on a large scale. The cost of modern meter systems as well as the efficient and non-discriminatory use of smart meter systems calls for adequate regulation to ensure that all market participants can fully benefit from the possibilities arising from modern metering systems. This paper looks at the (smart) metering schemes in place or currently planned and describes the relevant legal framework. It analyses drivers for smart metering and regulatory models.

EUROPEAN LEGAL FRAMEWORK

Electricity Directive (Directive 2003/54/EC)

According to the Directive 2003/54/EC [1] all electricity customers in the EU member states will become eligible by 1 July 2007 at the latest. From this time on all national electricity markets should be fully open to competition. In addition to the conventional requirements for metering (e.g. billing, grid operation), market liberalisation necessitates new market processes which heavily depend on the availability of accurate metered data to various market stakeholders (e.g. supplier switching, clearing and settlement of balancing energy).

Energy efficiency Directive (Directive 2006/32/EC)

In Directive 2006/32/EC [2] on energy end-use efficiency and energy services the EU has laid down amongst others its plans to achieve an overall national indicative energy savings target of 9 % within 9 years.
The improvement plan for energy efficiency will benefit from an exchange of information and best practice on all levels. Article 13 of the Directive stipulates that final customers be provided with competitively priced individual meters which accurately reflect the customers' actual consumption and provide information on actual time of use.
Large scale deployment of smart meters e.g. in Italy and Sweden has yet to show, whether the implementation of Article 13 for household customers is technically possible, financially reasonable and adequate to the energy savings made.
According to the rules for billing the EU stipulates that customers get bills based on actual energy consumption were this is appropriate.

Measuring instruments Directive (Directive 2004/22/EC)

The Directive 2004/22/EC [3] describes the conformity assessment procedure for manufacturing and production checks of measuring instruments. Once a meter has passed the conformity tests, it can be introduced in every European country. This Directive applies only to instruments measuring active energy intended for residential, commercial and light industrial use.
However the Directive does not standardise interfaces for data collection and remote control.

REGULATORY ASPECTS OF METERING

The liberalisation of the electricity market brings new requirements especially for distribution system operators and for the metering businesses.

Distribution system operators (DSOs) with more than 100.000 customers connected to their network are obliged to be independent from other activities of integrated electricity companies in terms of their legal form, organisation and decision making. The DSO has to take measures to ensure that discriminatory conduct towards market participants is excluded. Metering of customers' energy consumption and the transmission of data to market participants play a major role in liberalised electricity markets. Although some member states have chosen to liberalise the metering business or have plans to implement databases which will provide this information to the market participants, this information is administrated by DSOs in most of the member states. Regardless of the responsibilities for metering and data transmission there is a need for regulatory arrangements concerning transparent processes for data acquisition and transmission and monitoring of their compliance with these arrangements.

DRIVERS FOR SMART METERING FROM A REGULATOR'S PERSPECTIVE

Technology
Developments in communication technologies (wireless communication, IP) and IT enables real time communication between demand and supply.

Energy efficiency
Smart meters allow for various energy efficiency measures to be implemented such as the introduction of time-based tariffs to shift load from peak times and other demand response measures. Additionally electricity theft or technical losses can be more easily detected and resolved.

Transparent pricing
Smart metering makes specific energy costs more transparent for individual consumers. By introducing real time (interval) meter reading, the individual customer can be priced for her actual consumption and there is no cross subsidisation between customer groups (standard load profiles) and over broad time periods. Customers only pay for the costs they actually cause.

Price signals
Transparent pricing helps create a well functioning electricity market providing signals to investors. It can also result in moderating price movements in wholesale markets and reducing demand for peak power generation.

Cost
Smart meter installation costs have declined substantially in recent years, also (operational) costs for data communication have decreased significantly due to competition. Manual meter reading costs will be minimised. However, cost of capital and installation costs for new smart meters have to be taken into consideration.

Monitoring of power quality
Yet another advantage of smart metering is the possible provision of data to regulators and network operators for quality regulation schemes.

Improved grid operation
With centrally operated smart meters grid system condition can be monitored and service outages immediately identified.

Data availability
Data retrieved from smart meters has to be made accessible any time not only to customers themselves but also to appointed third parties (suppliers, energy service companies - ESCOs, grid operators, etc). This will improve processes such as supplier switching, demand forecasting and clearing & settlement.

Distributed generation
The integration of distributed generation into established (despatched generation dominated) grid systems is aided by the real-time availability of consumption/generation metered data.

Improved service level
Through real-time data access, customer management will be facilitated (remote meter activation, change in price scheme, etc), bill accuracy enhanced and additional services (domotics application) can be provided.

Competition
Real-time metering enables suppliers to offer individual tariffs tailored to their customers' needs. By offering a choice of tariffs suppliers can differentiate themselves from other suppliers not only by price or quality but also tariff type.

STATUS QUO AND PLANNED SMART METERING SCHEMES IN EUROPE

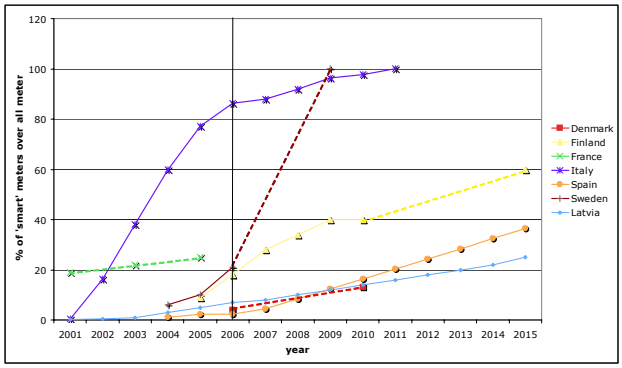
Current installation of smart meters [4]:

As of today there are only very few countries in Europe, which already have a significant part of (household) customers equipped with smart meters. These are in order of their smart meter proportion: Italy (86%), France (25%), Sweden (21%) and Finland (18%). However, it must be stressed that due to the ambiguous definition of the term "smart meter" above figures also include meters which have been in place for some time (PLC receiver for tariff periods, short distance remote reading multiple time-frame metering). This instance also shows that there are several

"smart" metering schemes in place in many countries, which feature some of the functionalities of today's smart meters (two way communication, load profile measuring, remote (dis-)connection, etc). Furthermore many of the functionalities of smart household meters have already been in use in industry and SME for several years.

Future installation plans of smart meters:

Within the next 5 years there will be at least two countries with 100% coverage of smart meters. Sweden's legislation demands a full roll-out of smart meters by 2009, Italy requires a certain degree of minimum meter functionality installed by 2011, and countries such as Spain, Finland and Latvia have detailed plans for increasing the percentage of smart meter installations within the next 10 years. See also graph below. Other countries like the Netherlands have just recently decided to make smart meters mandatory for all consumers. Additionally there are voluntary smart meter roll-out projects or pilots initiated by grid operators in various European countries.



Graph 1: % of smart meters over all meters installed

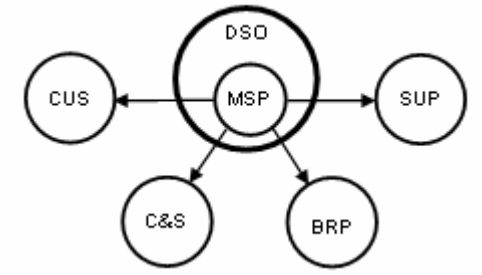
Current legal framework for metering services in the electricity market

Metering service has initially been carried out by the incumbent electricity company, as part of its historic monopoly position. With the deregulation of energy markets a few countries unbundled not only the unregulated supply and generation part of their business from regulated grid operation but also the metering service. However this is only true for a few countries, namely the UK, the Czech Republic, Belgium, Italy, Portugal, and Turkey. Furthermore, only the UK has fully liberalised metering service, Germany has currently only opened meter operation (installation, operation, maintenance) to competition, data collection has not been liberalised so far. The overall legal framework, market design and the organisation of the energy market itself have also impacted the way metering services are organised nationally.

METERING MODEL

As outlined above, third party access and availability of metered data is crucial for an efficient electricity market. Market processes such as customer switching, clearing & settlement, billing, scheduling, but also energy efficiency measures rely on non discriminatory and efficient meter data handling between market players. The following figures illustrate the basic meter process models.

Figure 1 shows the most common model. All metering services are carried out by the distribution system operator, which is responsible for providing meter data to all other market stakeholders (supplier, customer, balance responsible party, etc.) Advantages of this model are established data exchange processes and a limited number of data interfaces. Non discriminatory data access for third parties is ensured if the unbundling of the DSO is provided for.



MSP ..... Meter Service Provider
DSO ..... Distribution System Operator
CUS ..... Customer
SUP..... Supplier
C&S ..... Clearing and Settlement
BRP ..... Balance Responsible Parties

Figure 1: Metering Model - Distribution System Operator

In the second metering model, shown in Figure 2, metering service is unbundled and provided by an independent third party. All market stakeholders receive data through the independent Meter Service Provider. However additional market players add to the complexity and may cause inefficient market processes.

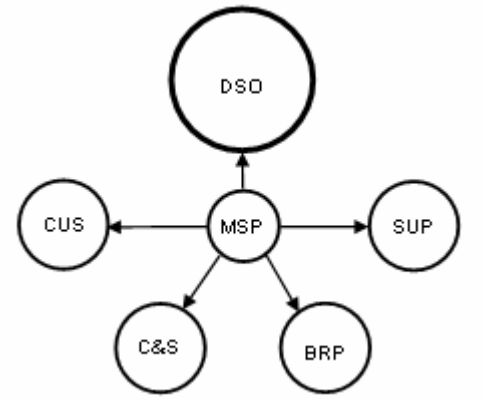


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Figure 2: Metering Model – Meter Service Provider

In addition to the two basic models illustrated above there are various sub-models:
Metering services can be further subdivided into four main services: 1.Meter ownership 2.Meter operation 3.Meter collection 4.Meter data management (including data verification, aggregation, and exchange). These sub-services can be carried out by either one or several parties. E.g. in the Netherlands, due to the latest proposals for meter market regulation, the supplier is responsible for meter data collection and meter data management, the distribution company however owns and operates the meter [5]. The main possible variations of metering models with multiple parties involved, are illustrated in Table 1 and are common in European electricity markets. In Austria the customer as well as the DSO can own and read the meter. Meter operation and data management is the sole responsibility of the DSO.

	CUS	SUP	DSO	MSP
MOW	Yes	(Yes)	Yes	Yes
MOP	-	(Yes)	Yes	Yes
MCO	Yes	(Yes)	Yes	Yes
MDM	-	(Yes)	Yes	Yes

MOW Meter Owner
MOP Meter Operator
MCO Meter Collector
MDM Meter Data Manager (Verification, aggregation, data exchange)
CUS Customer
SUP Supplier
DSO Distribution System Operator
MSP Meter Service Provider (Independent third party providing meter service)

Table 1: Roles involved in providing meter services

The way (meter) data is exchanged and can be accessed by market parties is also crucial. Currently most data is exchanged using standardised data formats transmitted by request or by a fixed schedule to the various market players. Electronic registries (for meter data but also meter point administration data) guarantee easy and non-discriminatory access for authorised users.

In modern two way smart metering systems not only meter retrieval but also remote access to the customer's meter has to be regulated. Remote (dis-) connection, meter software update, price signal forwarding are only a few features of smart meters. However, these functionalities provide a challenge for the current regulation of electricity markets.

CONCLUSIONS

Meters present not only a link between the consumer and the market, but also is the availability of metered data a prerequisite for efficient liberalised energy markets.
Modern meters can support many requirements of an efficient energy market, mainly by introducing transparency and efficiency. However experience in frontrunner-countries such as Italy, Sweden or the Netherlands shows that appropriate regulation is a prerequisite to initiate a large scale smart meter roll-out.
Recent examples show that while integrated meter services (within grid operation) seem to encourage smart meter implementation they also increase the risk that not all market participants can fully enjoy the benefits of smart metering. The authors conclude that regulation of smart metering, particularly the aspect of (two-way) meter access and meter data availability, will be key to an effective energy market regulation in the future.

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