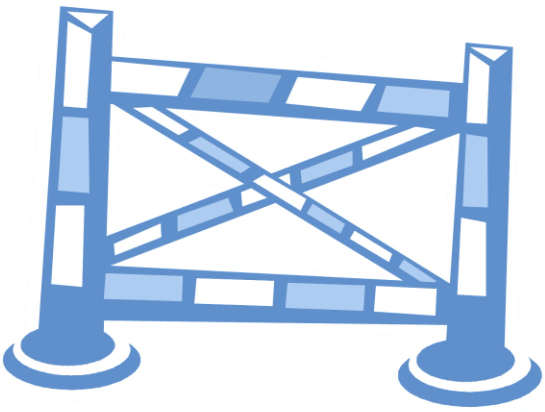
Report on non-technical barriers for smart energy solutions

Report by the e-harbours expert group on Smart Energy Networks



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Preface

This is a condensed and updated version of the preliminary report on non-technical barriers produced by the e-harbours Hamburg Team in 2012. The preliminary report is available in German in the Hamburg showcase section of www.e-harbours.eu.

Despite growing activities over the recent years, a broad, market-driven dissemination of smart energy solutions in the industrial sector can still not be observed. The aim of this report is to identify and analyze the main barriers that currently impede a broad implementation of smart energy solutions in Germany. The insights are based on recent studies on the subject, talks with experts in the field (researchers, company energy managers, professional providers of flexible energy solutions) and information the e-harbours expert group gained throughout the implementation of the showcase.

The findings of this report will be discussed further with local and national stakeholders and will serve as a basis for the final recommendations of the e-harbours Hamburg showcase.

1 Introduction

Over the last years, a multitude of "smart grid" pilot projects were carried out in Europe. Experts agree that the transition of the electricity supply towards renewable energies is hardly feasible without implementing intelligent and decentralized energy solutions: Demand side management for larger consumers, smart operation of CHP plants and intelligent storage options.

In Germany, the political relevance of this subject became clear when in 2011 the Federal Government decided to phase out nuclear power plants until 2022, and to increase the share of renewable energies to 80 % by 2050. While not all other European countries follow this path with the same commitment, the EU target of 20 % power from renewables until 2020 also puts the subject on the agenda elsewhere.

Beyond the funding of pilot projects, some first steps have since been undertaken in order to foster the market-based implementation of smart energy networks: For example, electricity providers in Germany since 2011 have to offer "load variable" and time-of-use electricity tariff models [JURIS].

The realization of a smart energy solution requires some substantial technical modifications compared to a "non-smart" system – an interface to remotely control each connected device, an "intelligent" central management unit and an ICT infrastructure to allow communication between the elements. However, different sources indicate that technical requirements do not represent barriers to the implementation of smart energy solutions: Pilot projects have demonstrated the technical viability in a wide range of applications (compare results of the German *E-Energy* program, www.e-energy.de).

A survey by the market research institute *trendresearch* among energy experts and grid operators showed that only 3 % see a lack of technological solutions as a market barrier. Much to the contrary, non-technical barriers predominated: Mainly, high investment costs were mentioned as barrier (47 %) followed by the difficult overall economic situation (19 %) and current high energy costs (14 %), which makes it difficult allocate investment costs to customers. Missing standardization is a further barrier (8 %) and would facilitate national and international communication. [HELLER2010].

For this reason, this barrier report will focus on non-technical barriers. Barriers are classified in, economical, legislative, acceptance-related and organizational barriers.

2 Economic barriers

Generally, economic barriers towards an innovation can exist both on the cost side and the return side.
On the cost side, **direct expenses** occur for planning, installation and operation of the smart energy solution. Depending on the business case, **administrative overhead costs** apply - these are often hard to foresee for companies due to missing experience in the field. Apart from that, indirect costs may be caused by more **complex management requirements** and higher maintenance costs of devices due to frequent switching. Also, if productive processes are involved, eventual productivity losses have to be compensated by the revenues.

For the implementation of smart energy solutions, various business cases are imaginable, depending on the type of solution and the respective framework conditions (for a comprehensive insight, see the e-harbours report "Strategies and business cases for smart energy networks" [E-HARBOURS2012]).
However, companies only commit to business cases that are **manageable with reasonable efforts** and achieve appropriate **return on investment**. According to Thomas Gobmaier, energy expert at FfE GmbH, the currently available business cases in Germany often fail to provide an acceptable return on investment: "Many companies, especially larger ones, expect a payback period of as little as two years. Under the current circumstances, that impedes larger investments."

A central drawback for many business cases is that **benefits cannot be predicted reliably**. For example, prices on the reserve capacity market have varied substantially over the last years, and are hard to predict even for the next 1-2 years.

On the market side, the validity of business cases is closely linked to administrative and legislative aspects, since the electricity sector is a heavily regulated market. Regulatory adjustments that **develop the market** and thus strengthen business cases would be the prime area of intervention, as stronger and more reliable business cases will help to reduce many economic barriers.

A way to overcome economic barriers is the externalization of investment costs and risks through **innovative contracting or service models**. In such a case, an external operator takes care of planning, installation and operation of the smart energy network. In Germany, there are already a handful of independent companies that offer marketing of flexible potentials, and various power suppliers have started pilot programs to tap customer flexibility. However, these models imply that the profits are split between facility owner and service provider, and thus further reduce economic benefits. Also, service providers face regulatory hurdles (see next section).

Another option would be the **introduction of incentives** to companies willing to exploit potentials for smart energy solutions, for example in the form of investment supports, tax concessions or reductions in energy-related fees. From a macroeconomic perspective, this may be an efficient way to quickly tap flexible potentials. As a side effect, it could lead to the additional creation of high-level jobs in knowledge intense business sectors and local installation companies, much alike the successful development of the renewable energy sector through feed-in tariffs. On the other hand, such measures usually imply a substantial bureaucratic overhead and may lead to suboptimal results, if applications mainly aim at fulfilling subsidy criteria instead of meeting market demands.

As mentioned, implementing smart energy solutions in existing facilities and devices implies high costs – however, whenever facilities are newly constructed, remodeled or modernized, additional costs and planning requirements for Smart Energy Networks are modest. Legal standards that already require new buildings to use a certain share of renewable energies could be modified to

make the implementation smart energy infrastructure obligatory, for example a smart metering and load management system for industrial properties.
Also, in newly developed areas, zoning regulations could enforce the implementation of a district heating grid and decentralized CHP.

3 Legislative / regulative barriers

Energy market regulations

In the heavily regulated energy sector, legislative and regulative barriers have an enormous leverage on business cases and implementation strategies for smart energy solutions.
Thorsten Nicklass from entelios AG, Munich, is managing a pool of flexible consumers. He demands: *"We need an open market for flexibility products where both the production and the demand side can participate, and where providers or aggregators of demand response potentials have a clear-cut role – that would really make the business cases take off."*

Smart energy solutions always have to be assessed in the context of the existing market mechanisms. In their majority, these still reflect **the logic of a centralized electricity system**: Electricity markets in Germany and most other North Sea Region Countries are currently laid out to trade kilowatt hours, i.e. amounts of energy. Whether a producer or consumer is able to quickly provide a certain (positive or negative) load, is currently not valued [compare AGORA2013]. In a future power system mainly dependent on renewables, however, there will be an abundance of energy produced in some moments, and an acute shortage in others. This means that it will be essential to have flexible *capacities* on hand at all times – to ensure this, it will be necessary to **develop a market structure which rewards the provision of flexible potentials**, regardless of how much they are actually called upon.

Markets for reserve capacity already do exist in the current market structure, but **regulations are tailored to suit traditional production units** like larger gas power plants. The minimum amount for offered load is often too high for flexible consumers, even within pooling concepts. A further barrier is the obligation to offer reserve capacity throughout a rather large time slice (currently 4 hours in Germany) – which excludes many potentials on the demand side (for a detailed description of reserve capacity markets and the related possibilities for consumers, refer to the report on smart energy network business cases [E-HARBOURS2012].
In order to exploit relevant potentials in the industrial or commercial sector, **market access requirements should be adjusted** so that smaller load amounts can be offered, and/or for a shorter time.

Secondary regulatory barriers

Besides from general market structures not favoring demand side potentials and flexible producers, there are secondary regulative barriers that are indirectly affecting business cases:
For example, even though the possibility exists to pool several smaller demand side potentials for the reserve capacity market, the operators of such pools face difficulties in the implementation. They mainly result from the **unbundled structure of the energy sector**, meaning that electricity generation, transmission, distribution and sales have to be conducted by individual companies. Demand Side Management measures have implications *across* these separated areas. For example, each load shifting operation within a reserve capacity pool has to be cleared afterwards with the respective energy supplier and the distribution system operator. Currently, there are no established

procedures for that, so that a handful of separate contracts and agreements have to be concluded to connect a single consumer to such a pool. Thorsten Nicklass from Entelios: “We need to **define the market role of a Demand Response Aggregator**, who is able to bundle and market demand response potentials without facing regulatory hurdles.”

In Germany, some market instruments are currently even **counteracting the exploitation of flexibility**: Biogas-powered CHP plants, for example, would be perfectly suited for flexible operation – however, under the current fixed feed-in tariff in Germany, they are most profitable when run at full power 24/7.

4 Acceptance-related barriers

Generally, skepticism towards new technologies can be an important barrier to innovations. Additionally, the power system as well as the energy market mechanisms is complex with many stakeholders involved, pursuing different economic interests. In order to understand the interrelation between generation, transmission, consumption and trading, basic knowledge about principles of the energy market is necessary. **Smart grid technology is especially abstract**. Its mechanisms operate in the background, and it’s **not as “visible” as a PV system** on the roof.

The majority of consumers is **not preoccupied about the electricity supply in detail**, but focuses on the running electricity costs. Generally, the quality of grid power supply is still very high and power outages currently do not notably affect customers [IHK2012]. Also in the industries and businesses that were examined within the Hamburg showcase it showed that electricity costs are usually not the top priority, compared to prices for other resources or other cost factors.
Additionally, energy suppliers to this date provide **little incentives to change customer behavior**. The lack of awareness concerning smart energy solutions may therefore partially result from this passiveness on both sides.

These barriers may be reduced by **stimulating public awareness** for smart energy solutions and communicating their advantages: Smart grids contribute to stabilizing the power grid at a lower cost compared to storing options. For implementing demand response solutions, no new facilities have to be planned, authorized or built. Intelligent controlling on generation and demand side also avoids bottlenecks on the local level, to the extent that costly extension and retrofitting of the distribution grid could be avoided in some cases. Throughout the whole life cycle, smart grids also cause less CO2 emissions compared to electrical storage options or grid extension [ENTELIOS2012], let alone new gas-fired reserve plants.
If companies can use smart energy solutions to **promote a greener, more sustainable image**, this could increase their readiness to address the subject.

Also when it comes to the practical perspectives of implementing a smart energy solution, acceptance problems can represent barriers: From a company`s perspective, implementing a smart energy solution in a previously well-functioning environment may reduce reliability and evokes **worries about a loss of control**, if automatic switching operations are intended. Especially if industrial production processes are involved, which often consist of a series of finely tuned successive steps, companies may be concerned about potential production interruptions or quality issues.
Experiences from practical applications show, however, that such problems can be avoided by **meticulously planning and testing** the smart energy solution. All participants have to be clearly informed about the procedures in form of staff trainings etc. Furthermore, even in a setting where

devices are switched remotely and automatically by a pool operator, local staff always has the **possibility to impede or override switching operations** if the circumstances require it.

5 Organizational barriers

Organizational barriers on company level

Talks with companies revealed that even promising business cases are not investigated further due to the lack of personnel resources. Also, even if the technical staff is interested in innovative and intelligent energy solutions

Another barrier may be the rather **fragmented structure of larger companies** in the logistics or industrial sector. For example, infrastructure may be owned by one company, while a separate company under the same holding is in charge of energy procurement, and the processes themselves fall under the responsibility of yet another sister company, or have even been outsourced to external contractors. This “owner-user-dilemma” is also known from a residential context, and can significantly hamper the smooth implementation of smart energy solutions.

Also outside of single companies organizational barriers can be identified: Business or industry associations are commonly warning against negative effects the energy turnaround may have on energy prices and supply security. However, they have only have only very recently begun to **pay attention to the chances and perspectives** that are likely to open up for flexible consumers and producers. Also in the political sphere, these organizations should use their influence to improve framework conditions for smart energy solutions.

Another significant barrier in Germany is **a lack of standards or guidelines** that regulate technical and safety standards as well as standards relating to the information and communication technology. Existing data protection rules are not designed for specific requirements of smart grid operations. Extensions are necessary so that protection of company-related data is guaranteed. There exist several roadmaps created by national institutions, industry consortia and international standardization bodies, which are currently competing.

Annex: Evaluation of non-technical barriers

As a guidance for the stakeholder involvement process, a matrix has been created by the e-harbours Hamburg team in order to evaluate non-technical barriers according to their general influence, the potential to easily remove these barriers in the near to mid future, and what relevance the barriers turned ou to have in the case studies assessed under the Hamburg showcase.
This matrix will be developed further and will be part of the final showcase report.

Table 1: Assessment results non-technical barriers

	Influence	Overcoming potential	Relevance in e-harbours show-case
Economical barriers			
High implementation and management costs	++	--	++
Limited revenues	++	--	++
Low predictability of costs and revenues	+	+	-
Legislative barriers			
Lack of market/value for flexibility products	++	--	+
Market access requirements	+	+	+
Counteracting regulations	+	+	-
Energy sector unbundling/ insufficient market roles	++	-	+
Acceptance-related barriers			
Complexity of markets and business cases	+	+	-
Limited awareness of potentials	+	++	--
Intervention in processes	++	++	+
Organizational barriers			
Owner-user-dilemma	+	+	+
Missing standards	-	+	-
Lacking support of assocations and multiplicators	-	++	-

Resources

AGORA2013 Agora Energiewende: 12 Insights on Germany`s Energiewende/ A discussion paper exploring key challenges for the power sector, Berlin, Germany, 2013, Online available at: http://www.agora-energiewende.de/fileadmin/downloads/publikationen/Agora_12_Insights_on_Germanys_Energiewende_web.pdf

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ENTELIOS2012 entelios AG: Demand Response – Geschäftschancen für Verbraucher im Energiemarkt/ Energiewende im Strommarkt: Chancen nutzen – Risiken vermeiden. Presentation held at Bayerischer Industrie- und Handelskammertag (BIHK), München, Germany, 2012. Online available at: http://www.muenchen.ihk.de/de/innovation/Anhaenge/vortrag_nicklass.pdf

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IHK2012 Industrie- und Handelskammer in Bayern: Energiewende im Strommarkt/ Chancen nutzen – Risiken vermeiden, Survey among companies of the production and energy industries about prospects and riks in the electricity market, München, Germany, 2012. Online available at: http://www.konstanz.ihk.de/linkableblob/2196254/.3./data/BIHK_Studie_Energiewende_im_Strommarkt-data.pdf