

SMART GRIDS IN DISTRIBUTION NETWORKS UNTIL 2030 – TECHNOLOGIES, POTENTIALS, MARKET DEVELOPMENTS

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ABSTRACT

Intelligent grids - Smart Grids – are the key to the integration of renewable energies and cut backs of greenhouse gas emissions. According to the European survey participants of the current trend:research study “Smart Grids in Europe until 2030” a majority of 70 percent is convinced that Smart Grids will become essential for the optimal integration of decentralised power plants and effective grid control. So far the market is still provider driven. Technology producers are already active in taking position while plant and grid operators persist in a waiting position because of unresolved questions of financing, missing technological standards and ambiguous political framework.

INTRODUCTION

To date there is no universal definition of Smart Grids but according to the findings the term is generally associated with intelligent networks between different forms of energy production and consumption to optimise distribution structures.

In the study „Smart Grids in Europe until 2030“ the expected market potential of Smart Grids is identified drawing on the existing conditions and the status quo of the electricity grids within European countries surveyed. Within the framework of the survey results this is done on a qualitative representation of European smart grid pilot projects as well as a detailed consideration of relevant technologies and applications.

The study offers insights into the technological requirements of European plant and system operators and based on a country-specific assessment, market growth rates for Smart Grids are forecasted until 2030. In addition possible market potential as well as market drivers and market barriers are identified.

trend:research applies various methods of desk and field research. In addition to the extensive analysis of internal and external databases the study draws on 63 expert interviews with market players across Europe. Interviewees included energy supplier, grid operators, centralized decentralized power plant operators, technology providers and producers as well as further experts from universities and institutes.

STATUS QUO OF SMART GRIDS IN THE COUNTRIES STUDIED

The study explores the current state of development and evaluates the influence of various factors that may shape the future. The results are largely based on views of interviewed plant and grid operators, as these are the key players

involved in the implementation of Smart Grids (see figure 1).

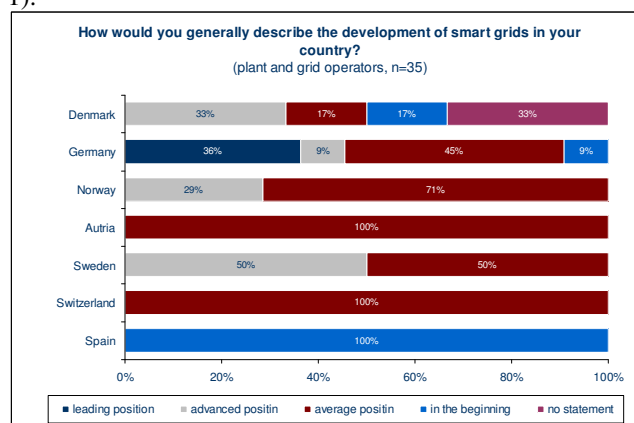


Figure 1: Development of Smart Grids Implementation in Countries studied.

The general state of development of Smart Grids has been evaluated particularly in Austria, Switzerland, Norway and Germany as mainly average. Approximately one third of the German respondents regard Germany as being in the leading position in the development of intelligent grids; at least nine percent rate the level of development as progressive.

By contrast, another nine percent of the German respondents believe that Germany is only in its early stages of development. This view was supported by the delayed implementation of Smart Grids and the vague purpose of the federal government. A progressive development of Smart Grids is recognized according to appraisals of half of the respondents in Sweden.

MARKET BARRIERS FOR SMART GRIDS

According to the network operators their needs in terms of electricity transmission technologies such as HVDC (high voltage direct current transmission) and FACTS (Flexible Alternating Current Transmission Systems) for flexible power flow control are readily available. However, to date these technologies have only been used in high-voltage grid systems, for example for the integration of offshore power plants.

In order to account for the slow growth rates within the market of Smart Grids, the respondents were asked about the major market barriers which suppress fast market growth. The most important factor was regarded to be the ability to invest (47 percent of nominations) as well as the bad economic situation (19 percent) (see figure 2)

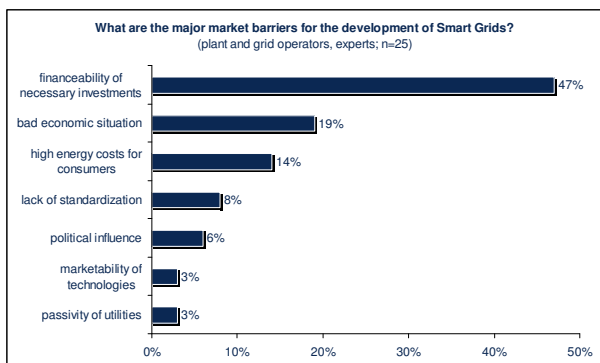


Figure 2: Major Market Barriers for Smart Grids Development in Countries studied

Another market barrier for Smart Grids are the high energy costs for consumers (14 percent of nominations). The respondents also criticised the lack of standards (eight percent of answers) to facilitate the national and international exchange of information and would provide assurance regarding to the investment in appropriate technologies and communication standards. Concerning policy interventions (six percent), the respondents essentially indicated the current legal regulation, which does not allow the realization of a market-driven price improvement. The technological market maturity of the individual technology components is perceived by only three percent of interview participants as a barrier.

ROLE OF SMART METERING IN SMART GRIDS CONCEPTS

According to interviewed industry experts, facility and network operators smart meters are an essential part of Smart Grids (54 percent resp. 17 percent of the mentions, see figure 3).

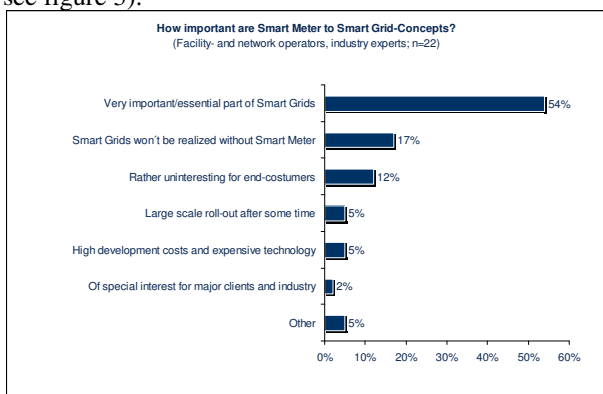


Figure 3: Importance of Smart Meters for Smart Grids Implementation

Smart metering provides a basis for further services and products, such as “Smart Home” or Smart Grids. or load management Being viewed as a product with wide reaching application potential the technology of different smart meter producers is becoming increasingly more similar to ensure better compatibility and greater flexibility. In the Scandinavian countries, Italy and England smart meters are planned to be in use throughout the whole country by 2022

at the very latest.

MARKET DEVELOPMENT OF SMART GRIDS IN EUROPE UNTIL 2030

The calculations of market volumes for the variously sub-markets (e.g. grid extension, ICT, Smart Meter) as well as for the total market are based on the survey results as well as further analyses, plausibility checks and general market information.

Using the theoretical market volume of 2010 as base value the possible development of the market for Smart Grid technologies through the introduction of Smart Grids in Europe is forecasted. Thereby the relevant market factors such as the development of the electricity supply and demand, the transmission network expansion and network load in the European context of conventional and renewable energy sources will be analyzed in various scenarios. In order to view the characteristics of the influencing factors in a differentiated way, the reference scenario, which is considered the most likely, is joined by a “progressive/optimistic” and a “degressive/conservative” scenario.

In the reference scenario, the overall market volume in the Smart Grids context increases with the growth of grid extension, ICT, Smart Meters and electricity storage capacities (with-out power electronics) from the current 99 bn Euro to around 263 bn Euro in 2030 (see Figure 4).

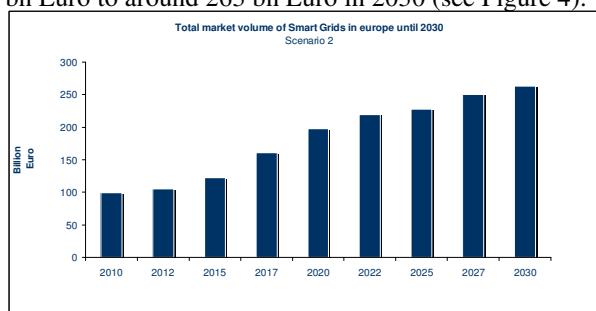


Figure 4: Total Market Volume of Smart Grids in Europe until 2030

Due to high installation costs the extension of the transport- and distribution grids is the biggest part with an overall increase of approximately 115 bn Euro. The transport grids account for 41 bn Euro while the remainder is generated by the distribution grids.

The market volume for information and communication technology almost doubles; it has increased from 27 bn Euro to 46 bn Euro.

The market is experiencing significant growth in the forecast before 2020 by a first wave of investment in Smart Metering, supported by a statutory introduction of Smart Meters, followed by the increased integration of decentralized generation systems. The effects of processes in metering, meter reading and billing towards Smart Metering as a key element of Smart Grids, are evident in this scenario and lead to changed requirements, for example at the level of processes, IT systems and services. The acceptance of consumers for Smart Metering, load variable tariffs and control of consumption increases in this scenario in medium-term. In the reference scenario, dissemination

proceeds of distributed systems (e. g. heat pumps, solar systems, etc.) and technological development in the area of networking of plant go ahead to ensure the stable grid operation.

The ICT is the interface between the physical infrastructure such as Smart Meters and applications for operational control. Information and communication-technologies already exist, but technical standards for interoperability and integration between different systems are not realized yet.

In regressive scenario "moderate proliferation of Smart Grids" developments in the market run more slowly, market and trade barriers are removed only with difficulty and the stimulation of the process is rather slow.

In the progressive scenario "rollout of Smart Metering and rapid dissemination of Smart Grids" the market is gaining faster than in the reference scenario. In total, it is about the competition, especially in the field of technology suppliers vendors establish a trend to mergers. Thus, cooperation between companies takes place in the information and communications sector with companies from the meter technology to develop solutions for Smart Grid concepts. In addition, some large, global technology companies, seen mainly in the field of information and communication technologies, recognize the potential of Smart Grid market and try hard to position itself in this area. According to the participants, the intensity of competition will already increase in the medium term.

In the context of growing power feed-in of decentralized power plants and the increasing cross-border power trading the European electricity grids within its infrastructure reaching their load limits more and more often. Planned projects like generating solar electricity in the south of Africa, hydroelectric power plants in Scandinavia or Offshore wind farms in the North Sea where the electricity will be transported across national borders show the basic necessity to develop a reliable and strong pan-European electricity grid. So Smart Grids are coming and the pivotal question is not when but who will participate. Whoever does not want to leave the field to only a few players has to deal with that subject to date. Therefore it is necessary to be clear about the companies' objectives to gain an initial position in the growing competition.