

SMART GRID ROADMAP FOR AUSTRIA

Andreas Lugmaier
Siemens AG - Austria
andreas.lugmaier@siemens.com

Helfried Brunner
Austrian Institute of Technology - Austria
helfried.brunner@ait.ac.at

Hubert Fechner
FH Technikum Wien - Austria
hubert.fechner@technikum-wien.at

Friederich Kupzog
ICT, TU Vienna – Austria
kupzog@ict.tuwien.ac.at

Andreas Abart
Energie AG Netz - Austria
andreas.abart@netzgmbh.at

ABSTRACT

Within the paper the background and follow up activities of the “Smart Grid Technology Roadmap for Austria” are described and presented in detail. The most important results of the Roadmap Smart Grids Austria, the R&D implementation strategy as well as the Austrian definition of a Smart Grid are presented. Finally an overview of the Austrian R&D focuses in the area of Smart Grids is given.

BACKGROUND

By implementing the European Smart Grid Technology Platform (ETP) in 2005 the European Commission brought all relevant stakeholders together to create a flexible efficient and reliable transmission as well as distribution system for the 21st century. The ETP created a common vision, and further defined the Strategic Research Agenda (SRA, [1]). At present the Smart Grid Strategic Deployment Document (SDD) [2] is finalised, including the timeline and related actions to reach the common goals agreed on. Furthermore, preparatory steps for market implementation are described.

An important recommendation of the SDD is to create encourage and strengthen facilitation groups in member states to serve as competent discussion and implementation partners.

Within the scope of Smart Grids, Austria already disposes:

- an industry with high-tech know-how, approved products and innovations,
- well established and complementary research and development (R&D) institutions in a broad range, actively participating in the “electricity network” part of the national energy research program, which was already established in 2007
- innovative grid operators and energy suppliers
- as well as a proactive policy concerning R&D stimulation in general.

Nevertheless in Austria there was a lack in overall cross-linking of relevant stakeholders (e.g. component developers, power industry, energy suppliers, grid operators, research institutions) as well as a missing focused coordination among several R&D projects related to Smart Grids.

In order to utilize upcoming economic opportunities in Smart Grid technologies most efficiently, the strategy process “e2050”, initialized by the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Economics and Labour (BMWA) in 2007, enables the implementation of an adequate Austrian cooperation basis in the sector of Smart Grids. This is why the “National Technology Platform – Smart Grids Austria” was raised on a common strategic basis.

The process of setting up the National Technology Platform (NTP) Smart Grids Austria was started in spring 2008, bringing together more than 60 experts from industry, utilities, research and administration. This process also supports the federal energy research program management, which shall lead finally to an ongoing and enhanced strong national research activity in “Smart Grids”. Meanwhile, not only several national R&D projects were successfully performed also internationally the Austrian Smart Grids research is aiming at collaborations like the formal established research cooperation with Germany and Switzerland in Smart Energy Systems, or the active role of Austria in the EU Smart Grid ERA Net Program as well as the leadership of Tasks within Implementing Agreements of the International Energy Agency (IEA – ENARD [3], IEA-PVPS).

Finally the NTP Smart Grids Austria – by enabling synergies between stakeholders from industry, energy sector and research institutions – bundles the strength for smarter electricity grids in the future for energy efficient and cost effective power system operation. The underlying Smart Grids vision of the NTP Smart Grids Austria is:

Smart Grids – Key for a secure and sustainable energy supply of tomorrow!

The key issues behind this definition are the following:

- access to a secure, cost efficient and ecological electricity supply for all consumers
- supporting a competitive, sustainable and efficient electricity market place
- positioning of Austrian companies in the area of Smart Grid as technological leaders in the global market

The most important result of the Technology Platform Smart Grids Austria is the Smart Grid Technology Roadmap including an Austrian research, development and demonstration implementation strategy for Smart Grids as well as a common definition of Smart Grids [4].

NTP SMART GRIDS AUSTRIA DEFINITION OF SMART GRIDS

The Austrian definition of Smart Grids is the following [5]: *Smart Grids are power grids, with a coordinated management based on bi-directional communication between grid components, generators, energy storages and consumers to enable an energy-efficient and cost-effective system operation that is ready for future challenges of the energy system.*

SMART GRID TECHNOLOGY ROADMAP

To pave the way for Smart Grids and to bring the Smart Grid vision into reality in Austria, the Roadmap Smart Grids Austria was developed as a joint process, by bringing together the most relevant stakeholder in industry, utilities, research and administration, in order to:

- address relevant Smart Grid related trends and describe the most important key aspects for the future development of electricity grids.
- identify Austrian paths enabling future intelligent electricity supply.
- specify the chances, challenges and implications resulting from possible R&D in the Smart Grids technology sector.
- supply a profound decision basis to national decision makers from politics, ministries and research institutions.

R&D FOCUSES OF THE ROADMAP

The NTP Smart Grids Austria analyzed the focuses and objectives of already ongoing Austrian R&D projects in the area of Smart Grids, as well as the future expectations of all contributing NTP members. Out of this process the platform defined four R&D topics, which are in the Austrians scope:

Customer and market / regulation

The topic “customer and market / regulation” focuses on two fields. On one hand on new business models for the electricity market with an integration of all Smart Grids players and on the other hand on legal and regulatory basic conditions, which implicates planning security and legislation security for the Smart Grids players.

System operation & management

This topic includes all aspects of a systematic development of planning and operation approaches (especially network management) for Smart Grids with integration of generation, customers, markets, information and communication infrastructure and intelligent components into existing electricity network infrastructure. In particular the interfaces

between all network participants are getting important in a more and more complex system.

Communication & infrastructure

A key factor for Smart Grids is the synergetic coordination of grid components by means of information and communication technologies. This implies information generation (by additional sensors), distribution of information to multiple stakeholders (accordant management systems, intelligent components, service providers etc) and agreed standards for this task. A further important aspect is privacy and data security.

Intelligent components

From the systemic view there are different requirements for the components in the current network to enable the integration into a Smart Grid operation. These components include in particular network assets, generation units, loads, storage technologies and measurement systems.

From a system point of view of course the four R&D topics can not be seen independently from each other. The system design for operation and management of a Smart Grids is influenced by operation-technical demands as well as customer and market-side demands. Therefore especially adapted interfaces and the information exchange within a Smart Grids have to be realized in order to enable new market applications and the interaction of all players in the energy system. For information exchange another important factor is data security.

Enhanced planning tools are necessary to integrate future system operation developments into the decision-making process in long term network planning.

As soon as operation concepts considering specifications from costumers, market, regulator, data security, as well as safety and security are available, specifications for a certain information and communication technology (ICT) and for the development of network components (e.g. network protection) can be derived.

CORE CONCLUSIONS OF THE AUSTRIAN SMART GRIDS IMPLEMENTATION STRATEGY

Key messages and R&D and D topics

In order to prioritize the Smart Grid implementation strategy on distribution network level for the four R&D topics, they were divided into sub-categories. A questionnaire including these sub-topics was sent out to the NTP Smart Grid members. Basis for the implementation strategy are 1337 concrete entries for the sub-topics, which are presented as aggregated results for the 4 R&D topics. Figure 1 summarizes the thematic priorities for Smart Grid technology development in Austria. Following aspects within the single topics were considered:

- The time frame of implementation: short term (2010-2012), medium term (2013-2015), long term (2016 – 2020) and beyond (>2020)
- Differentiation between research and development (r) and demonstration (d)
- Weighted focus on sub-categories of the 4 Smart Grid topics

sum of main categories		research & development					demonstration				
		sum	short term	medium term	long term	>2020	sum	short term	medium term	long term	>2020
18%	customers & market / regulation	9%	6.7%	2.6%	0.2%	9%	1.8%	5.1%	1.6%	0.3%	
6%	customer acceptance, customer consumption behavior and new products & services	4%	2.2%	1.2%	0.2%	3%	0.5%	1.6%	0.4%	0.2%	
5%	market development	3%	2.1%	1.0%		2%	0.3%	1.4%	0.3%	0.1%	
2%	fitting of the regulatory and legal framework to the market requirements	1%	0.6%			1%	0.3%	0.6%	0.2%		
5%	business cases	2%	1.7%	0.4%		3%	0.7%	1.5%	0.6%		
44%	system operation and management	22%	13.6%	6.7%	1.3%	0.7%	22%	3.6%	10.9%	6.2%	1.5%
18%	tools for planning and simulation	9%	5.7%	2.6%	0.4%	0.4%	9%	1.5%	4.7%	2.4%	0.3%
8%	managementsystem for operation	4%	2.5%	0.8%	0.2%		4%	0.9%	2.0%	0.8%	0.2%
19%	system operation	9%	5.2%	3.2%	0.7%	0.2%	9%	1.1%	4.2%	3.0%	1.0%
12%	ICT-infrastructure	6%	4.0%	1.6%	0.4%		6%	0.9%	3.4%	1.3%	0.7%
4%	infrastructure: smart services in smart grids	2%	1.1%	0.4%			2%	0.4%	1.3%	0.3%	0.1%
3%	communication in smart grids	1%	1.0%	0.3%			2%	0.3%	0.7%	0.4%	0.2%
2%	data management and computing in smart	1%	0.7%	0.3%	0.1%		1%	0.1%	0.5%	0.1%	0.1%
3%	decentralized intelligent control systems	2%	1.1%	0.5%	0.3%		1%	0.1%	0.7%	0.4%	0.2%
25%	intelligent components	12%	8.0%	3.1%	0.4%	0.2%	14%	1.6%	6.2%	4.6%	1.3%
5%	general issues	2%	1.3%	0.6%	0.1%	0.1%	3%	0.4%	1.3%	1.0%	0.1%
3%	grid components	1%	0.9%	0.4%			2%	0.4%	0.9%	0.7%	
2%	generation technologies	1%	0.9%	0.1%			1%	0.1%	0.9%	0.2%	0.1%
11%	demand technologies	5%	3.7%	1.0%	0.2%		6%	0.6%	2.6%	1.7%	0.7%
4%	storage technologies	2%	1.2%	1.0%	0.1%	0.1%	2%	0.1%	0.4%	0.9%	0.4%

Figure 1: Implementation Strategy Smart Grids Austria: Analysis of the ascertainment - all research, development and demonstration entries over the entire time scale results in 100%

The key messages of the Austrian implementation strategy for smart grids are the following:

- All 4 Smart Grid R&D topics are relevant for the Austrian technology development in the field of intelligent distribution networks. However single topics are considered differently. This leads to different focal points, which should be considered in the budgets of future research and demonstration programs. The timely optimized interaction and the integration of all four Smart Grid R&D topics is essential. On one hand the actual strength of Austrian companies and institutions and on the other hand the identified potentials in research, development and demonstration should be utilized as best as possible.
- The focus of interest in the field of Smart Distribution Grids is in system operation and management (especially planning and simulation tools, system operation, followed by operation management systems) and intelligent components. The area of consumer technologies came to the fore due to the closeness to the here integrated smart metering and electro-mobility thematic. coordination with electro-mobility activities is important, whereas solutions for Smart Grids with or without a fast penetration of e-mobility is necessary.
- In short term research and development will dominate, but in medium term demonstration interests will come to the fore. Until 2020 and beyond, a decrease of research and demonstration interests is expected. For this date market entries of several developments are estimated. Actually there is too little information for an exact conclusion. The

short term focus is strongly influenced by raising questions out of the operational environment, current challenges, supporting or even hindering framework conditions and innovation incentives in the regulatory system.

Cost out of the implementation strategy

Based on the thematic feedback to the implementation strategy, the costs for research, development and demonstration projects until 2020 were estimated. Concerning the cost the key messages are the following:

- The implementation of the strategy through research and demonstration project will generate costs of about 290 Million Euro.
- The in house effort by relevant players (technology ventures and energy industry) is in a range of about 140 Million Euro (about 50% of total costs). To assure the companies to spent this money a long term stable R&D framework is required
- Funding agencies need to contribute with about 150 Million Euro until 2020. More as half of this costs will occur before 2015
- According to this estimation until 2020 annually about 14 Million Euro of subsidies for R&D and demonstration in the area of Smart Grid are required. Due to the expected allocation in the first years a higher amount will be necessary (up to 20 Mio. Euros a year). 20 Million Euros represents 0.4 percent of the annual investments in R&D in Austria (6.87 billion Euros in 2008). Currently in the area of Smart Grids about 5-10 Million Euros of annually capital for R& D and demonstration projects is allocated.

RECOMMENDATIONS FOR POLITICAL DECISION MAKERS, REGULATORY AUTHORITIES AND FUNDING AGENCIES

Following supporting measures for implementing research, development and demonstration in the area of Smart Grids in Austria are required by the NTP Smart Grids:

Clear energy policy in Austria and corresponding setting of priorities

For long term planning of future networks and smart grid operation approaches clear national and international energy strategies are required, considering security of supply (for long term grid and generation development). A clear commitment and vision for the future electricity mix (what amount of different energy resources) is needed. Out of that scenarios and clear requirements for future distribution networks can be identified. This strategies need to be coordinated between all ministries and the entire government, in order to reach the European energy goals (energy efficiency, CO₂ reduction and increasing share of renewables). Smart grids allow setting the course for a sustainable and cost efficient energy supply, but it is necessary to define a clear legal, economic and technical framework for all players in this area. Additionally it is required to evaluate the actual impact via scalable and alienable pilot projects. Thus

a further intensified cooperation between all stakeholders via platforms and working groups is essential.

Cooperation and position of emphasis in technology and research issues as crucial factor of success

To avoid doubling of activities a coordination and network between national, European and global Smart Grids initiatives is required (e.g. SET Plan, EU Framework programme). In the broad area of Smart Grids within a global market a clear focus for Austrian research and development is crucial. In view of the international positioning the Austrian focus is on intelligent distribution grids (Smart Distribution Grids) and this area should be further developed.

Expansion of competitive research framework

Following measures for Austrian research framework in the Area of Smart Grids are necessary:

- Continuity of research framework regarding program coordination, program administration and budget for research funding. For initializing of long term projects chains from research to development and demonstration this is essential.
- To ensure security in project planning the funding criteria need to be transparent and stable.
- An increase of public R&D funding is required.
- The administrative effort for long term projects should be marginal
- A full financing of Universities and research institution should still be ensured, whereas cooperative projects with industries should have high priority.
- For the development process of Smart Grid technologies appropriate research infrastructure with coupling of network simulations and experimental component development is necessary and should be supported. It is hardly possible to do experimental development of components in real networks.
- Demonstration of components as well as system solutions in the real network is finally required. Investments in lighthouse projects should be possible and supported in an adequately amount. Thus investment incentives for research and demonstration for network operators should be established.

Finally due to the increasing system complexity of future network operation DNOs, industries as well as education institutions need to build up new knowledge with a stronger focus on Smart Grids. A strong cooperation between Universities, research institutions and industries is essential to designs special courses on Smart Grids and by cooperation via dissertations, master thesis, internships and providing equipment for laboratories and teaching.

CONCLUSION AND OUTLOOK

The implementation document summarizes the different areas of research as well as the needed budget for performing R&D and demonstration activities. The key outcomes are:

- System operation and management needs the most effort, followed by the development and demonstration of new components. Moreover R&D in market and regulation is further seen as important field of R&D and D as well as ICT however with a little minor financial need.
- Generally, the research budget should come from public as well as from private money. The partnership of public authorities, industry, utilities and research institutes and universities in the development of energy and cost efficient electricity networks is crucial for the success.

The required supporting measures for implementing research, development and demonstration in the area of Smart Grids in Austria are:

- Clear energy policy in Austria and corresponding setting of priorities
- Cooperation and position of emphasis in technology and research issues as crucial factor of success
- Expansion of competitive research framework

To ensure the implementation of the Smart Grid Roadmap starting in 2010 the organizing institutions of the NTP Smart Grids Austria are the Association of the Austrian Electrical and Electronics Industries (FEEL) and the Association of Austrian Electricity Companies (VEÖ). The NTP Smart Grid with all members will guide the Austrian R&D and demonstration for the next decade.

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