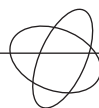


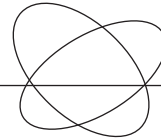
Smart Grids Austria Technology Roadmap



Implementation Steps for the Transformation of the Power System up to 2020

Management Summary





Smart Grids Austria Technology Roadmap

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Implementation Steps for the Transformation of the Power System up to 2020

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Management Summary



Goals of the Smart Grid Technology Roadmap

This technology roadmap is a key contribution to the Smart Grids 2.0 strategy process, which was initiated by the federal ministry for transport, innovation and technology (bmvit). It covers the short- and medium-term stages of development for the implementation of smart grids up to and including the development and implementation of marketable products and services, with a focus on the period from 2015 to 2020. Austria's industry, energy sector and research community expect the implementation of this national technology roadmap to result in end-to-end smart grid solutions and tremendous opportunities for Austria to secure global technology leadership, while also strengthening Austria as a business location.

Challenges in the energy system

As the share of renewable energies in overall energy supply increases, the planning and operation of the power grid – and especially the necessary task of balancing production and consumption – are becoming more and more difficult. In many cases, a conventional expansion of the existing grids is necessary. The smart grid approach is aimed at an increasingly decentralised, regional load balance. This is achieved by establishing communications networks between individual components such as decentralised power generation units, decentralised storage systems, flexible consumers, and intelligent buildings.

Individual technologies for smart grid solutions are already available today. Now these technologies have to be more widely integrated into distribution grids, systematically linked together and optimised.

Benefits of smart grid technologies and solutions

The roadmap examines the development towards smart grids from an economic perspective. By boosting the share of renewable energy in final energy consumption, smart grids help to increase the country's energy independence. The reduction of fossil fuel imports leads to a reduction of carbon dioxide emissions. In addition, smart grids contribute to increase the energy efficiency and security of supply of the power grid.

Development axes of the technology roadmap

The path towards the widespread implementation of smart grid solutions up to 2020 shown in the technology roadmap focuses on the following steps: working on the framework conditions, the large-scale system

validation of technologies that have already been developed, applied research and further development and the implementation phase. With this in mind, the implementation and the migration processes must be properly coordinated from a strategic perspective. This coordination will occur along three development axes (grid, system, and end customers) and in an overall ICT architecture.

The **network development axis** is targeting towards a cost-effective increase the distribution grids hosting capacity for decentralised power generation, flexible consumers, storage systems, and electro mobility. The focus here is on solutions and technologies for distribution grid monitoring, R&D testing infrastructure, and the operation and planning of electricity distribution grids.

The **system development axis** is aimed at the utilisation of flexibility for all market participants. Consideration must be given to the various needs relating to the smart grid and to ensuring the compatibility of the flexibility requirements on the market side and on the grid side.

The **end customer development axis** deals with the integration of the end customer – the prosumer (market participants who are both producers and consumers of electricity) – into the market and the operation of the system.

The **overall ICT architecture** serves as the central technical foundation for the technologies and solutions in all three development axes. It describes the architecture of the central IT environment and the communication infrastructure based on the operational processes specific to the distribution grid operators.

Key steps for the implementation of smart grids

The following issues were identified as the most important results that must be achieved together by the stakeholders:

Clarification of the framework conditions, roles, and responsibilities

In the first step, the requirements with regard to the technical and organisational framework conditions and the various possible roles and responsibilities within the smart grid (e.g. rights of access to flexibility in the context of a free market and a regulated grid) must be

clarified based on the previous experiences in individual projects and the discussions at the international level. In order to facilitate this, a process for dialogue between the involved stakeholders must be initiated.

Development of an overall ICT architecture and a smart grid migration path

Starting from the current state of the ICT infrastructure and the depicted development of an overall ICT architecture that will be required in the future, the next necessary steps are as follows:

- Expansion/adaptation of the existing operating processes of the distribution grid operators in order to be able to meet the new market and system requirements
- Description of the system interfaces with other market participants and internal system interfaces with consideration of the existing infrastructure
- Definition of the requirements for an optimal overall ICT architecture including possible synergies with existing systems

On the basis of these steps, a migration path will be developed in order to initiate a gradual convergence of the various technology generations to the common target architecture. Consideration for international standardisation will play a key role in this process. The path towards a standardised, scalable, and efficient solution necessitates the clarification

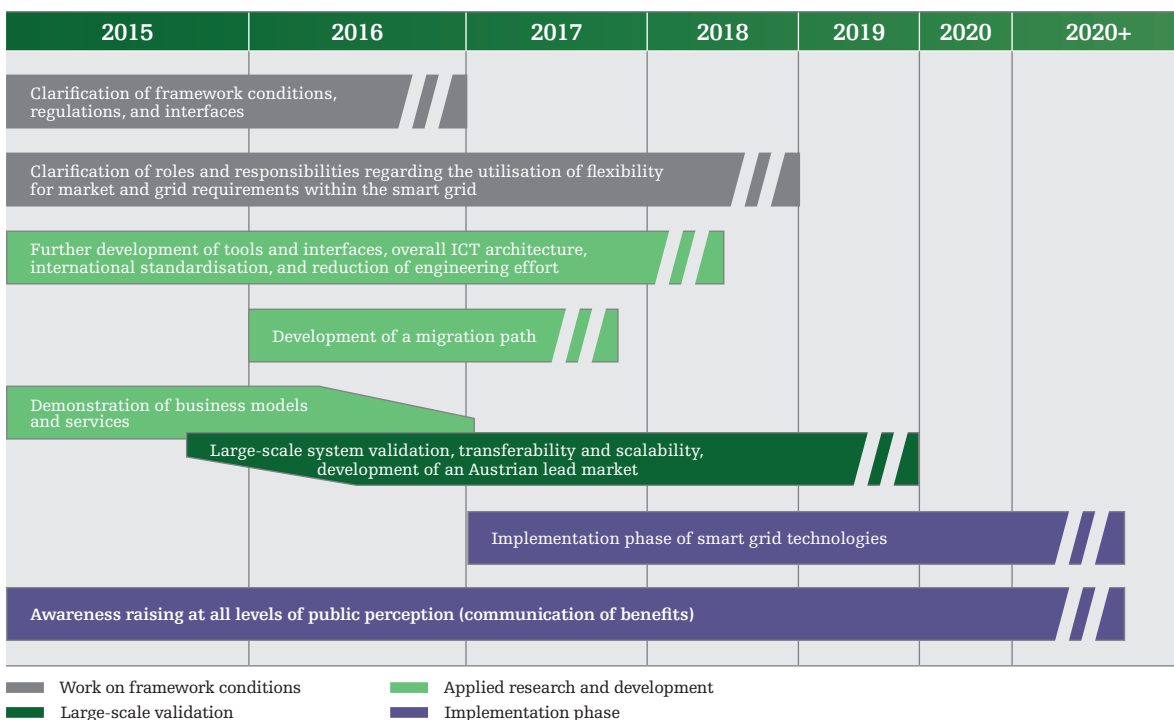
and optimisation of process questions through the large-scale system validation described above.

Demonstration of new business models and services

New business models in the smart grid determine the framework conditions for the processes involved with the technological solutions. Therefore, the development of new services must occur within the context of the technological requirements, and their real-world implementation must be demonstrated.

Large-scale validation projects in Austria

Extensive system tests are required in order to be able to test the smart grid solutions that have been developed thus far in a real-world environment, optimise them, and apply them more efficiently. For the validation and field testing of system approaches, entire distribution grid sections must be fully equipped with the appropriate technology in the course of large-scale implementation projects. Validation should be performed for at least one urban, one rural, and one mixed grid and should encompass the areas of infrastructure for monitoring operating conditions, systems for active grid management and an ICT migration path (including new functions for individual IT components). The interaction of the many new processes, components and functions required for smart grids can only be tested under real conditions and their functionality and economic viability optimised in large-scale validation projects.



Key steps for the implementation of smart grids

The implementation of such validation projects should be supported through the Austrian subsidy landscape.

Development of a lead market for Austria

If Austria successfully implements end-to-end, integrated smart grid solutions, it can position itself as a lead market for smart grids. This will serve Austrian companies as an internationally visible reference for the system expertise they have gained. Application-oriented R&D funding is an important aid for boosting the expertise of Austrian technology providers so that they can position themselves well in international competition.

Awareness raising

Awareness raising measures aiming at the general public will be necessary in parallel to the migration towards smart grids on the basis of the technical, economic and legal framework conditions. For this, experts and decision makers must present an aligned view of the benefits of smart grids and discuss this in public. Active communication about risks and how to minimise them, but also about the benefits and opportunities, is urgently needed.

Identified need for action on the part of the individual smart grid stakeholders

The roadmap describes the need for action on the part of the key stakeholders such as public authorities, grid operators, technology providers, and research institutes in detail. In the interests of the successful joint implementation of smart grids, all stakeholders should be involved in support measures. A permanent process of dialogue between the involved stakeholders must be established in order to improve the associated tasks and fields of action and, in turn, to enhance the stakeholders' understanding of one another.

The most important areas in which there is a need for action are summarised for each individual stakeholder below:

Need for action on the part of public authorities

In Austria, the responsibility for the topics associated with the field of smart grids, such as energy, research, safety and security, and economy, is distributed among several different ministries and authorities. The co-ordination between the affected authorities must be strengthened so that the necessary framework conditions for innovations in industry, the energy sector,

and research can be created through a joint strategy.

Need for action in the regulatory environment

In many cases, smart grid solutions lead to a reduction or delay of investment costs, but also often result in increased personnel expenses for operations. The recognition of these costs incurred by the grid operators must be ensured on a long-term basis, with consideration being given to the overall optimum. In order to ensure innovation over the long term, the approval of the costs for validation projects must be taken into consideration.

The utilisation of flexibility ranging all the way down to prosumers and consumers in the household segment offers many possibilities for marketing. The framework conditions with regard to the rights of access to flexibility must be clarified in order to regulate the divergent requirements of the involved stakeholders (e.g. using the traffic signal model).

The various use cases described in the roadmap give rise to numerous requirements with regard to market design. As a result, the questions of whether new roles are necessary and which existing and/or new stakeholders could fill these roles must be clarified.

It is also necessary to define balanced requirements for security and privacy in line with the relevant potential risks.

Need for action on the part of technology providers

The need for action in terms of technology must be clarified by the technology providers in cooperation with the future users of the relevant technology – primarily grid operators and final energy customers. Points of emphasis include the technical and economic optimisation of the solutions for grid operators with due consideration being given to CAPEX (capital expenses) and OPEX (operational expenses) in light of the requirements for the overall energy system while simultaneously ensuring supply quality. At the same time, all of the requirements with regard to security, privacy, and safety must be taken into account, and “plug and automate” solutions must be developed in order to reduce the engineering effort and costs associated with smart grid solutions.

Need for action on the part of grid operators

Smart grid technologies offer grid operators new possibilities for the operation of the grid, innovative methods

for grid planning, and additional functions in order to be able to meet the new market requirements that are arising. Well-established processes often have to be redefined and implemented within the companies.

As a result, each grid operator must have a needs-based migration scenario for these new technologies and processes, which must be developed on an individual basis. The experience gained in the large-scale validation projects is crucial in this context.

With regard to the operation of the grid, the requirements related to the following issues, among others, must be clarified and appropriate solutions developed:

- Definition of functional requirements for distribution grid monitoring
- Integration of existing network assets into smart grid solutions
- Technical integration of end customers for grid-driven flexibility demand
- Validation of possibilities for decentralised control technology

Need for action in research and education

Research and education institutions must ensure the availability of the necessary expertise and the transfer of knowledge. In order to achieve this, they must continuously adapt to the current developments in order to ensure the high level of research quality in the field of smart grids and constantly advance the level of education.

In the interests of making the solutions developed in Austria transferable and scalable, collaborative European and international projects should be implemented.

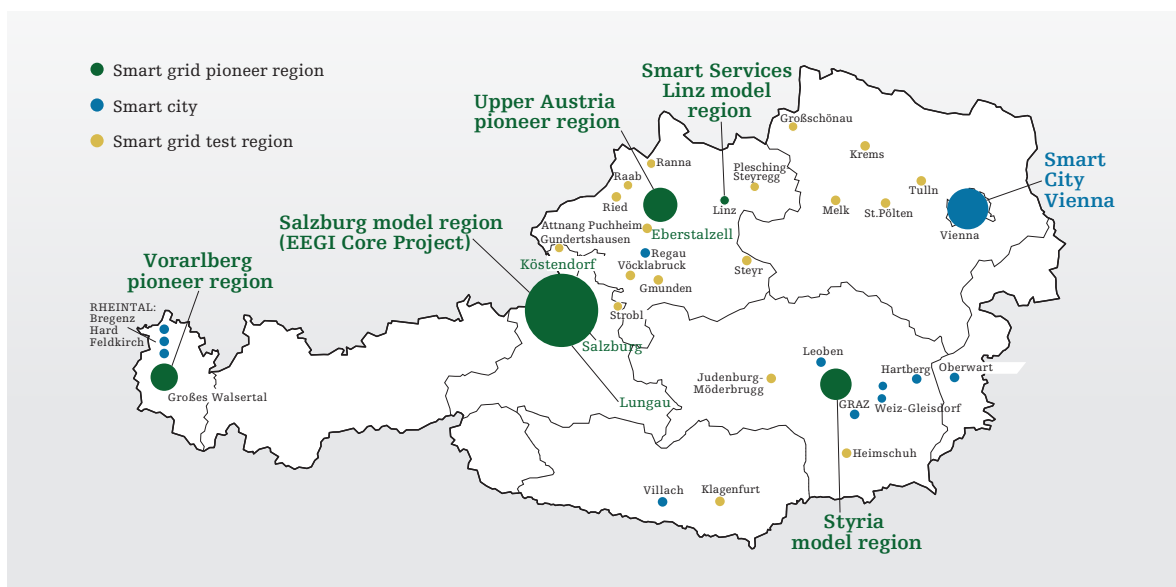
Need for action on the part of the Technology Platform Smart Grids Austria

The technology platform serves to network representatives of the energy sector, industry, and the research community within the platform and has been able to establish a good rapport with ministries, authorities, and international experts in recent years. Its task for the future is to establish and strengthen its contacts with stakeholders that are not yet involved in the current development of smart grids. In addition, it can facilitate the appropriate further development of the focuses in funding by continuously monitoring the topics that are emphasised.

Austrian model regions and pilot projects

Several model regions have been established in Austria in the course of the research activities being conducted here. The smart grid technologies that have been developed were field tested in these regions. The figure below shows the Austrian model regions and smart city projects. Descriptions of the projects can be found in the technology roadmap and on the web site of the Technology Platform Smart Grids Austria (www.smartgrids.at).

Download of the entire technology roadmap:
www.smartgrids.at



Smart grid pioneer and test regions in Austria
 As of 2014

Source: Climate and Energy Fund, bmvit

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