A National action plan for smart grid – summary of recommendations and proposals

The action plan in brief
The Coordination Council’s Action Plan for Smart Grids spans the time period 2015-2030 and is based on a broad definition of smart grids. As a result, the plan covers many areas of activity and actors that are perhaps not primarily associated with the development of smart grids, but will nevertheless be affected in the long term. The recommendations and proposals in the action plan have been divided into three main areas (4.2 – 4.31), each of which corresponds directly to the Coordination Council’s wording of its objectives.

- Political framework and market terms and conditions (4.2)
- Customer participation and societal aspects (4.3)
- R&D, innovation and growth (4.4)

Within each area the action plan consists of a number of fundamental objectives and recommendations, which are its long-term basis. Attached to some of the recommendations are proposals for concrete measures that need to be implemented as soon as possible. As far as other recommendations are concerned, there is above all a need for further initiatives that can lead to rule changes, clearer accountability, greater knowledge, etc., in the longer term. The results of such initiatives help to improve our readiness for future changes in the world around us that will require new measures and adjustment to the action plan. Finally, there are also examples of recommendations where there is clear accountability and where efforts are already being made. No proposals are given in the action plan in these cases; instead the Coordination Council presents its overall assessment of how the work should be taken forward. Recommendations where only assessments are presented are, however, just as meaningful for the long-term development of smart grids as recommendations linked to concrete proposals in the short-term perspective.

1 The figures refers to the sections in the Councils final report “Planera för effekt!” SOU 2014:84
Broad cooperation on smart grids will be needed to realise the action plan. The Coordination Council therefore proposes the establishment of a National Smart Grid Forum with the task of following up and further developing the action plan and the knowledge platform in broad cooperation with the relevant agencies, industries and consumer representatives.

### 4.2 Political framework and market conditions
As the proportion of intermittent electricity generation increases, challenges will emerge on several levels in the electricity system. Each of these challenges may require changes to market conditions and the political framework. Major, unpredictable variations in electricity generation create new demands for balance in the system. Rapid fluctuations in generation can also cause voltage problems on both the transmission and the distribution level. The expansion of intermittent generation may also require grids to be significantly strengthened. At least some of these demands can, however, be mitigated or delayed with the help of smart grid technology.

The future challenges facing the electricity system can to a certain extent be met by encouraging customers to be more flexible in their demand for electricity. Flexibility in demand can be further strengthened by utilising different energy storage technologies. The market ground rules and design will need to be developed in order to meet the future challenges facing the electricity system.

#### 4.2.1 Ground rules on the electricity market - market design
**Objective:** To develop a market design that copes with new system and market conditions.

**Recommendation:** Develop market ground rules in order to be able to balance the system, cope with output variations and solve grid capacity problems by means of better incentives for electricity users and producers to help create greater flexibility in the system.

**Motivation:** The overarching electricity market solution being developed shall make it possible to balance the system and cope with grid capacity problems with the support of new resources that are available in the form of demand flexibility and at generation facilities. The incentives to contribute flexibility need to be strengthened and the practical design of the market solution must provide the right conditions for actors to utilise their flexible resources on the electricity market in order to benefit both the system and the grid itself.
4.2.2 Ground rules on the electricity market - energy storage

Objective: To develop a market design that copes with new system and market conditions.

Recommendation: Develop a market- and technology-neutral playing field where energy storage can help improve energy system efficiency.

Motivation: The regulatory framework needs to be in harmony with the new opportunities created by the development of storage technologies to enable the efficient use of energy storage in a broad sense.

Proposal: The Government should task the Energy Markets Inspectorate to analyse the opportunities and obstacles that affect the establishment and use of energy storage in the distribution grid. The Energy Markets Inspectorate should shed light on the opportunities there are based on the current regulatory framework and propose how any obstacles can be overcome.

4.2.3 New conditions for the electricity grids - grid investments

Objective: To create clear incentives for modernisation and efficiency improvements in the grids with tough safety and security demands.

Recommendation: Stimulate investment and efficient use of the grids.

Motivation: Cost-effective investment and efficient use of the grids can provide stimuli in two fundamental ways: firstly by the creation of greater incentive in the financial regulations for electricity grid companies to invest in smart grid functions, move towards solutions other than simply increasing capacity and reducing transmission and distribution losses; and secondly, by creating greater interest in testing new smart grid solutions in other ways rather than via financial regulation.

Proposals:

• The Government should take the initiative to evaluate how financial regulation affects the will of electricity grid companies to invest in technical innovation. This evaluation can be implemented in two stages: firstly, in the short term, focusing on the electricity companies’ investment plans; and secondly, in a longer term perspective, focusing on the outcome of implemented measures. The evaluations are to be implemented by the end of 2018.

• Special support should be introduced aimed at mitigating risk when investing in commercial but as yet partly unproven smart grid solutions that are of socio-economic interest. The Government should task the Swedish Energy Agency to develop, in cooperation with the Energy Markets Inspectorate, the specific terms and conditions that should dictate the design and funding of the support. The support shall pay particular
attention to the conditions in the financial regulations so that they don’t counteract the purpose of the support. This task should be reported to the Government before the end of 2016.

4.2.4 New conditions for the electricity grids - safety and security

Objective: To create clear incentives for modernisation and efficiency improvements in the grids with tough demands on safety and security.

Recommendation: Increase awareness of safety, security and integrity issues and clarify the limits of responsibility when developing smart grids.

Motivation: This recommendation aims to bridge the knowledge gap and remove the ambiguity that has emerged as a result of the rapid ICT development in the electricity system, in which safety and security aspects have not been followed up systematically.

Proposals:

• The Government should task Svenska kraftnät (Swedish National Grid) to work together with the relevant agencies and actors to clarify who is to establish safety and security requirements in smart grids and monitor their compliance.

• The Government should task Svenska kraftnät to work together with the relevant agencies and actors to implement a comprehensive analysis of the current situation as regards safety and security in the electricity system. This analysis should cover the entire value chain from generation sites to the users’ smart meters.

• ICT and control systems should be included in the risk and vulnerability analyses established in accordance with applicable provisions in the electricity sector. Svenska kraftnät and the Energy Markets Inspectorate should be given the task of drafting provisions to this end within the framework for their respective remits (SvKFS 2013:2 and Chapter 3, Section 9 of the Electricity Act (1997:857).

4.2.5 Cooperation with other energy market constituents - energy carriers

Objective: To stimulate a systems approach which makes full use of cooperation with other energy system constituents.

Recommendation: Stimulate greater integration between the electricity system and other energy carriers.

Motivation: Barriers to cooperation between different energy carriers need to be highlighted and eliminated. This is true both of the current market and in the future where effects and advantages that may emerge as a result of e.g. more decentralised electricity generation need to be elucidated.
4.2.6 Cooperation with other part energy market constituents - the transport sector

**Objective:** To stimulate a systems approach which makes full use of cooperation with other energy system constituents.

**Recommendation:** Strengthen coordination between the transport and power sectors prior to a future electrification of road transport.

**Motivation:** Development of smart grids and electrification of the transport sector should be coordinated. Coordination between the transport and the energy sectors should be strengthened to meet future challenges. The potential demands on and opportunities for the power sector in the event of an electrification of road transport need to be identified and the aspects that are important for the development of smart grids need to be clarified.

**Proposal:** The Government should task the Swedish Energy Agency to take responsibility for coordinating the transport and energy sectors, e.g. regarding issues such as charging infrastructure and the electrification of road transport. This responsibility is to include the effects electrification may have on the power system.

4.2.7 Cooperation with other energy market constituents - improvements in energy efficiency

**Objective:** To increase knowledge regarding the consequences of the long-term development of the electricity and energy system in order to cope with future challenges.

**Recommendation:** Ensure that the incentives created for energy efficiency improvements take the changed conditions of the energy system into consideration.

**Motivation:** The incentives created in the short and long term for energy efficiency improvements and smart grids should not counteract each other. More efficient energy use should take into account how renewable electricity generation varies so that use can be adapted to shortages and surpluses in the electricity system and where the opportunities for cooperation with other heat carriers and district air conditioning supply are fully exploited.

**Proposals:**

- The Government should task the Swedish Energy Agency to take responsibility for disseminating knowledge and information about how smart grids can play a part in energy efficiency measures.
- The Government should task the National Board of Housing, Building and Planning to include smart grids when designing energy efficiency measures in current regulations and general guidelines.
4.2.8 Long-term development of the political framework and market conditions - system responsibility

**Objective:** To increase knowledge about the consequences of the long-term development of the electricity and energy system in order to cope with future challenges.

**Recommendation:** Monitor new demands placed on system operators and grid companies as a result of increased intermittent electricity generation.

**Motivation:** The development of the demands that intermittent electricity generation may put on system operators needs to be monitored in order to identify potential new challenges and problems so that the necessary measures can be identified in time and changes can be implemented if need be.

4.2.9 Long-term development of the political framework and market conditions - system effects

**Objective:** To increase knowledge about the consequences of the long-term development of the electricity and energy system in order to cope with future challenges.

**Recommendation:** Increase understanding of the effects on the system level of more decentralised or large-scale intermittent electricity generation and micro-grids.

**Motivation:** Extensive expansion of intermittent electricity generation (both centralised and decentralised) requires an analysis of various system aspects and of the consequences and opportunities from a long-term planning perspective. For this to be possible, detailed analyses and research are required that provide a basis for future decisions.

4.3 Customer participation and societal aspects

Smart grids can create the conditions needed for customers to become more active on the market. The development of various smart services can make it easier for the customer to benefit from the opportunities created by a more dynamic electricity market. These services are often aimed at measuring, visualising and automatically controlling the customer’s electricity use, while there is nevertheless scope for the customer to choose based on their own preferences, such as environmental responsibility, independence, etc. Other products and services can be based on the customers’ interest in self-generated electricity or on synergies with solutions from other sectors.

As on all commercial markets, this development will primarily be driven forward by market actors and the customers’ experience of the benefit being offered will be pivotal to success. Within the framework of such a market-driven development, there are, however,
a number of issues in need of special attention regarding the customers' position on the market.

4.3.1 Smart grids from a customer perspective - protecting customers

**Objective:** To make it easier for customers to benefit from smart grid functions.

**Recommendation:** Protect the customers' interests on the electricity market when introducing smart grid functions.

**Motivation:** As a result of constant, long-term monitoring and regular evaluation of the development of smart grids from a customer perspective, needs for improvements and change can be identified. This can, for example, be monitoring the extent to which customers adapt their electricity use and how it works for the customer. Other important areas are evaluation of the development of user-friendliness and how services and products function, as well as the need for amended or extended consumer protection.

4.3.2 Smart grids from a customer perspective - protecting customer integrity

**Objective:** To make it easier for customers to benefit from smart grid functions.

**Recommendation:** Protect customer integrity when handling data and information.

**Motivation:** Greater knowledge is needed regarding the consequences for the customer when an ever-increasing amount of data on electricity use is being collected. As regards the interpretation and application of the rules regarding personal data protection, the need to clarify the more detailed design of the measurement infrastructure becomes clearer.

**Proposals:**

- The Government should task the Energy Markets Inspectorate to work together with the relevant agencies and actors to perform a legal analysis of how an infrastructure for measurement, data collection and data management on different levels can be designed. This is to include analysis of the consequences of an agency or juridical person being responsible for personal information in a future system in which large volumes of data are collected and processed.

- The Government should task the Energy Markets Inspectorate to work with the relevant agencies and actors to draft proposals as to how information security and integrity protection technology can be introduced by incorporating the protection into the infrastructure.
4.3.3 Smart grids from a customer perspective -- attitudes and behaviours

**Objective:** To make it easier for customers to benefit from smart grid functions.

**Recommendation:** Ensure a clear customer perspective by transferring knowledge from marketing and behavioural science research and performing knowledge and public opinion surveys when developing smart grids.

**Motivation:** Knowledge from marketing and behavioural science research can provide a better insight into how people interact with technology, etc. It can be utilised when designing market functions, regulatory frameworks, etc., and hence contribute to greater customer benefit. Furthermore, knowledge about people’s behaviour and preferences should be used when communicating with different target groups about the potential of smart grids. One specific occasion when this principle can be used is in conjunction with the introduction of tax reductions for micro-generated electricity as the effects of this should be followed up from a behaviour perspective.

**Proposals:**

- The Government should assign the Swedish Energy Agency a coordinator role and make it responsible for utilising and disseminating knowledge about marketing and behavioural science research in the energy field.
- The Government should also task the Swedish Energy Agency to conduct a knowledge and public opinion survey in connection with or shortly after the introduction of tax reductions for micro-generated electricity, and a follow-up to improve knowledge about the effects of active customer participation.
- The Government should also task the proposed Smart Grid Forum with constantly identifying the areas in which knowledge and public opinion surveys are needed. It should also identify in which issues pre- and post-studies that are important for the development of smart grids should be conducted.

4.3.4 Customers’ access to measurement data and information - measurement data

**Objective:** To make it easier for customers to access measurement data and information.

**Recommendation:** Stimulate development towards greater empowerment of customers and other electricity users by strengthening their rights and access to measurement data.

**Motivation:** The knowledge that historical hourly measurement values, and in the longer term even more precise data, can provide about electricity use makes it easier for customers to evaluate measures and contract and service offers that can change and vary their own consumption, improve energy efficiency and help reduce electricity costs.
Proposal: The Council proposes that the present regulatory framework be supplemented to give customers the right to hourly measurement values when they ask for them without the current requirement for an electricity contract and at no extra cost. This proposal does not specify how the information is to be provided, however. The aim should be to bring the regulatory amendment into force in 1 July 2016. The Council does not submit a proposal regarding real-time data but does present its assessment.

4.3.5 Customers’ access to measurement data and information - information
Objective: To make it easier for customers to access measurement data and information.
Recommendation: Secure access to price- and cost-related information that enables active customer participation on the electricity market.
Motivation: The recommendation is aimed at making electronic price information from Nord Pool Spot available in a format that can be used by electricity users to benefit from equipment that automatically controls electricity use based on the electricity price. Furthermore, the recommendation aims to make it easier for customers to assess what e.g. an hourly contract or power tariff involves and whether these contracts affect costs.
Proposal: The Government should task the Energy Markets Inspectorate to draw up recommendations on the design of information and electricity grid tariffs. The information issues that should be included are the effects on costs of a tariff change and the development of electricity grid costs. If the recommendations fail to have an impact, mandatory requirements should be considered, e.g. by supplementing Chapter 4, Section 11 of the Electricity Act (1997:857) with a relevant provision giving the Energy Markets Inspectorate jurisdiction over such matters.

4.3.6 Customers’ access to measurement data and information - functional requirements
Objective: To make it easier for customers to access measurement data and information.
Recommendation: Introduce functional requirements on information management for next-generation smart meters.
Motivation: The recommendation aims to ensure that functional requirements are developed that enable access to measurement values and other functionality that contributes to the development of smart grid functions.
4.3.7 Synergies between smart grids and other societal development - community planning

**Objective:** To increase knowledge about how community planning can affect the potential of smart grids in different sectors.

**Recommendation:** Clarify the influence and potential of community planning in the event of a long-term development of smart grids within different sectors.

**Motivation:** Knowledge transfer between community planning and the energy sector needs to be strengthened in order to contribute to development in each sector respectively. The potential of community planning to support the development of smart grids needs to be clarified and the relevant actors need to be involved so that the energy sector can utilise this potential.

**Proposal:** The Government should task the National Board of Housing, Building and Planning to analyse the need for information and knowledge exchange regarding the potential of smart grids linked to sustainable community planning and for knowledge dissemination about these issues.

4.3.8 Synergies between smart grids and other societal development - development of products and services

**Objective:** To make use of the development of services in adjacent areas as catalysts for smart grid customer solutions.

**Recommendation:** Ensure greater knowledge about the potential of smart services and synergy effects between products in the energy sector and adjacent areas.

**Motivation:** The development of smart services and products is primarily driven by commercial actors to meet the needs of and demand from customers. As a complement to this commercial development, more knowledge needs to be disseminated about the potential of smart grids not only to consumers but also to public actors. Better scope for the energy sector to utilise synergies with service development in other sectors is also needed.

**Proposals:**

- The Government should include in its task to the proposed Smart Grid Forum a responsibility for analysing the need for information and knowledge exchange regarding the purchase of smart services and products and for disseminating knowledge about these issues.
- The Government should task the National Property Board and other government-owned property companies to take joint responsibility for analysing the need for information and
knowledge exchange regarding the purchase of smart products and services in the area of property administration and management and for disseminating knowledge about these issues.

4.4 R&D, innovation and growth
Sweden has a long and successful tradition of research and development projects in the field of electrical power technology and ICT. It is the basis of Sweden’s prominent position in the field of smart grids. A decisive factor in the country’s continued success is its ability to retain and further develop its cutting-edge skills in these areas. Another important success factor is well-functioning cooperation between higher education, business and the public sector. To maintain its competitiveness in the area, Sweden needs to take a cohesive approach to skills development, R&D, innovation and promotion measures. This is particularly important bearing in mind the interdisciplinary and cross-sectoral nature of smart grids.

4.4.1 Knowledge and skills development
Objective: To develop knowledge and skills to meet future demands related to the development of smart grids.

Recommendation: Ensure that the new skill sets needed for the development of smart grids are taken into account when reviewing educational programmes in technical and other relevant subjects.

Recommendation: Increase the attractiveness of energy technology education programmes by highlighting smart grids as a future industry and use new ways of transferring knowledge for skills development.

Motivation: The interdisciplinary nature of the subject requires a holistic approach to be taken to future skill needs related to smart grids. The recommendations aim to meet the changing needs of the future on all levels of education regarding smart grids and to benefit from the measures being implemented to attract new students to energy technology studies and where necessary supplement these initiatives with special measures. The potential for skills transfer between relevant areas, e.g. power technology and ICT for professional practitioners, should be given special attention.
4.4.2 Research priorities and cooperation

**Objective:** To promote research and development by allocating clear priorities and increasing cooperation.

**Recommendation:** Promote research and development in smart grids by means of a thematic research plan that also strengthens existing research environments, cross-sectoral cooperation and network building.

**Motivation:** Research linked to smart grids and by extension smart energy systems spans several disciplines. In order to improve the coordination of research initiatives, be more efficient as regards funding, promote knowledge exchange and ensure high international quality, an integrated thematic plan for smart grid research is needed.

**Proposals:**

- In its assignment to the proposed Smart Grid Forum, the Government should include the task of drawing up and further developing the thematic research plan drafted by the Council. This is to be done in cooperation with the Swedish Energy Agency along with other relevant research funders and business sector and academia representatives. The aim should be for the resulting plan to be included as a priority area in the Government’s next research bill.

- The Government should task Vinnova to work together with the Swedish Energy Agency to formulate proposals for research programmes in the interface between ICT and energy. Within the framework of existing research funding, the option of designing national research programmes in this interface should be considered. These should be based on cooperation between several higher education institutions, the business sector and the rest of society.

- The Government should task Vinnova to, in consultation with the Swedish Energy Agency, draw up proposals for support to interdisciplinary smart grid research networks in order to strengthen research across scientific disciplines, technologies and industries.

4.4.3 An integrated smart grid innovation strategy

**Objective:** To create growth and competitiveness by means of technological development and innovation.

**Recommendation:** To stimulate smart grid development and innovation by creating an integrated innovation strategy to make better use of existing structures and environments and to open up for alternative funding solutions.

**Motivation:** The aim of the recommendation is to ensure that existing structures can be utilised as effectively as possible in order to promote smart grids while at the same time
creating scope for considering the specific conditions that apply to smart grids in these contexts.

Proposals:

• In its assignment to the proposed Smart Grid Forum, the Government should include the task of developing an integrated smart grid innovation strategy in an international perspective with regard to policy, organisation and funding. The work is to be done in consultation with the Swedish Energy Agency, Vinnova and other expert agencies and in cooperation with industry representatives.

• The Government should also task the Energy Agency to work together with Vinnova to review and develop new and supplementary forms of funding within the framework of the innovation strategy described under the previous proposal. The proposals shall aim to promote smart grids all along the value chain and include small and large as well as new and established companies.

4.4.4 Conditions for pilot and demonstration projects

Objective: To adapt conditions for pilot and demonstration projects so that new technology and new market models can be developed.

Recommendation: To develop more effective funding models for pilot and demonstration projects that stimulate broad participation all along the value and innovation chain.

Recommendation: Adapt the demands on smart grid pilot and demonstration projects in order to utilise knowledge and stimulate development through cooperation.

Motivation: Pilot and demonstration projects facilitate interdisciplinary approaches. Different types of cooperation projects also lead to the more rapid development of different value chains, which in turn promotes the development of smart grids into a growth industry. The recommendation highlights the potential of pilot and demonstration projects as cooperation platforms for the development of smart grids as a result of greater knowledge exchange and knowledge development, broad participation and clear demands for knowledge dissemination and follow-up.

Proposals:

• The Government should task the Swedish Energy Agency to work together with Vinnova and analyse the funding support for different types of pilot and demonstration projects, with particular emphasis on a review of the requirements for counter funding.

• The Government should task the Swedish Energy Agency to, in cooperation with Vinnova, investigate the possibility of simplifying and adapting applications for different
forms of pilot and demonstration projects in order to shorten lead times from application to project start, which will make it easier for more actors to participate in the projects.

• The Government should also task the Swedish Energy Agency to analyse how the requirements placed on pilot and demonstration projects can be adapted to take into account the special needs relating to smart grids. The result of the task can be a set of guidelines on specific requirements within a number of well-defined areas.

4.4.5 Smart grids on a global market - a national promotion strategy

Objective: Work to ensure Sweden takes a prominent position in the international smart grid arena.

Recommendation: Strengthen and utilise international cooperation projects and bilateral contacts in order to promote smart grids as a growth industry on a global market.

Motivation: In order to ensure a long-term and holistic approach to the need for initiatives and cooperation projects, an integrated national strategy is needed with clear priorities for international projects. Positioning Sweden as a smart grid pioneer will strengthen the country's competitiveness.

Proposal: In its assignment to the proposed Smart Grid Forum, the Government should include the task of, in consultation with the relevant agencies and actors, developing a long-term strategy for strengthening Sweden’s position in smart grids on a global market.

4.4.6 Smart grids on a global market - standardisation and interoperability

Objective: To utilise standardisation and interoperability as promotional tools.

Recommendation: Promote standardisation and interoperability as tools for the development of smart grid products and services.

Motivation: Standardisation and interoperability strengthen Swedish competitiveness by stimulating and laying a foundation for new innovations. The possibility of developing Swedish ideas as proposals for global standards should be utilised in a strategic manner to increase Sweden’s influence in important smart grid-related areas.

Proposal: In its assignment to the proposed Smart Grid Forum, the Government should include the task of working together with the Swedish Association for Standardisation to develop a national strategy for how standardisation and interoperability can be utilised as tools to promote smart grids.