Statnett

INVITATION TO TENDER

R&D-projects Statnett 2022

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1. INTRODUCTION

1.1 About Statnett SF

Statnett SF is the owner and operator of the Norwegian main power transmission system. This implies construction and operation of high voltage power lines and substations.

Statnett SF is operating about 11 000 km of high voltage power lines, 150 substations, and the interconnections to Sweden, Finland, Russia, Denmark and the Netherlands.

Statnett SF has approximately 1,600 employees and has operations across Norway. The headquarter is located at Nydalen alle' 33, 0484 Oslo.

For more information about Statnett, see https://www.statnett.no/en/

For more information about R&D in Statnett, see https://www.statnett.no/en/about-statnett/research-and-development/

This procurement process will follow the Public Procurement Act no. 73 of June 17th, 2016 (the Procurement Act), and the Procurement regulations for the utilities sector no. 975 of August 12th, 2016 (the Utility Regulation) according to §2.5 for R&D projects.

For KPN/KSP and IPN projects, Statnett refers to contract templates issued by the Norwegian Council of Research (NCR).

Statnett refers to our R&D Contract template for other projects. The general terms and conditions are the basis for all our contracts.

1.2 R&D financing options

Statnett is primarily interested in proposals that might fall into financing options, such as:

- RCN – The Research Council of Norway
- Enova - Enova.no (only available in Norwegian)
- Pilot E - https://www.enova.no/pilot-e/information-in-english/
- Innovasjon Norge - https://www.innovasjonnorge.no/en/start-page/
- Various EU financing opportunities, e.g., the Horizon program

Your proposals shall be submitted via Statnett's homepage, see

Do you have a project proposal? | Statnett

1.3 Rights to project results and contract award

As a partner, Statnett shall have user rights to all project results. Please note that any background information is not included in the user rights.

The Contract shall be signed no later than three – 3 – months after all Parties have agreed that the project shall commence. No projects shall commence until the contract is signed by all Parties.

2 STATNETT'S R&D FOCUS AREAS

2.1 Introduction

The green shift and the goal of sustainable value creation entails electrification of industry, transport, offshore platforms and other emission sources. The focus is on research and more concrete solutions that increase the pace of innovation of the green shift. The new design of the power system must be reflected in both planning and operation and supported by connection requirements and market solutions. Faster dynamic incidents in an inverter dominated power system requires new technology in substations and system operation. In addition new system services will be needed to support operations in the future power system with high shares of renewable energy.

Statnett's activity within innovation and technology development shall be long-term and business-driven, with a focus on the business' goal achievement and facilitation of the green shift through research, technology development, knowledge and insight. This transformation creates an increasing need for new solutions and new competencies within all core areas of Statnett.

2.2 Automation and control in systems operation

The development of the power system will lead to more frequent and major changes in production, consumption and power flow. In order to utilize the power system of the future in the best possible way, it will be necessary to increase the requirements for observability, monitoring and control, which in turn requires the collection of more data over large geographical areas and with finer time resolution. New market solutions for various system services used for balancing must be developed and automated.

In order to meet increasing variability, finer time resolution is introduced in the power markets and the activation of reserve power will be integrated with European platforms. In order to make better use of the transmission capacity and predict the power flow in the market clearing, flow-based market coupling is introduced. New methods are being introduced for balancing the power system in real time, where the power balance within an area is monitored together with the frequency in the network.

Transformation towards a cyber-physical power system will enable more automation and coordination of operations in the transmission network/power system and will provide increased opportunities for interaction and integration within and between network companies. Automation of decision support and management in system operation will entail a large increase in the use of sensors, measuring instruments, other instrumentation, real-time communication within and between stations, as well as to the control centers. It will be important to provide adequate and efficient solutions for system and data integrity, availability and confidentiality. Automated control rooms require good visual overviews and carefully thought-out interaction between man and machine.

In the coming years, Statnett will put a lot of effort into meeting the needs for more automated system operation and structured information management. We therefore want project proposals that contribute to basic research which supports long-term needs:

- The intelligent and automated power system of the future can be based on more autonomous solutions for monitoring, control and protection.
- Robust solutions for real-time communication and data exchange between companies and countries, that ensures security of supply and provides for cost-effective operations.
- Nordic and European co-operation in the development of comprehensive solutions for system operation, system services and market operations.
- Development of operational solutions for the integrated and automated control rooms of the future within risk management and reliability-based operations.
- Methods where we can use artificial intelligence and machine learning as a contribution to increased automation of operations.
- User interface for operators that provides better and faster understanding of the situation, and a basis for better decision support in a more automated power system. The user interface must provide improved visualization of the operating state - preferably in combination with GIS solutions and constitute an integrated interface for functions in both planning, - operation and analysis. In addition to providing precise information about bottlenecks and critical incidents in the network, the

visualization should e.g., also provide information on recommended regulatory interventions, and where measures are placed in the network.

- Methods for ongoing qualification and follow-up of the quality of system services, as well as analyses of the data needed for this. For example, by automating the process of prequalification of reserve power supply and making this process continuous.

2.3 Communication, data management and cyber security

Technologies such as artificial intelligence, machine learning, the use of digital twins, IoT, sensors and 5G will be "game-changers" in research and development of the power grid in the future. Cyber security is a prerequisite, and it is essential with targeted and efficient mechanisms for detection, incident management and repair that cover all relevant digital and physical systems. It is therefore important to ensure adequate and efficient solutions for system and data integrity, accessibility and confidentiality. This means that cyber security protection and robustness must be built into everything from sensors to communication, and it is important that research and development in digital solutions is in line with the need for cyber security. It is important to work with national and international players to establish robust and comprehensive solutions for the industry.

We would like project proposals that contribute to:

- Research on how to build cybersecurity into the digital power grid, including sensor data, sensors, communications and protocols, as well as artificial intelligence and machine learning-based decisions.
- Development of technologies suitable for targeted and efficient detection, management and mitigation of cyber threats and incidents
- Development of expertise and solutions to utilize the new 5G (6G) network for communication and data transmission in an efficient, stable and secure manner.

2.4 Capacity increase of the power grid

The capacity of the power grid must be increased through both upgrading of existing grid and in the form of new facilities. Through the collection of data and the use of new technology, we must operate larger parts of the network closer to its capacity limits and for longer periods. The number of faults and disconnections as well as transmission losses must be reduced. New assets must be built with sufficient capacity and with the ability to be upgraded more efficiently.

We would like project proposals that contribute to:

- Technology that reduces losses on transformers, power lines and cables
- Technology for new facilities that support efficient future upgrades
- Technology that can be installed in existing facilities and increase capacity
- Knowledge of weather-related influences and technologies that enables us to predict errors before they occur
- Technology that enables us to perform inspection, repair and installation without disconnection
- Technology that can control the power flow so that we can utilize the entire capacity of the network
- Competence that enables us to challenge the limits that currently limit capacity
- Technology that can give us information about the assets so that they can be operated closer to the capacity limits

2.5 TSO-DSO collaboration, electrification and flexibility

Electrification in various sectors will lead to increased utilization of both the transmission and distribution networks. Increased utilization of flexibility in the distribution network will be important to maintain the security of power supply. Since most of the customers are connected to the DSO's network, a new approach to cooperation, the distribution of responsibilities and the exchange of information between TSO and DSO is necessary. New solutions must be developed, for example efficient market solutions for the purchase and sale of distributed flexibility that must also work together with our balancing markets.

A simplified value chain for increased use of distributed flexibility will contain several new roles and concepts.

We would like project proposals that contribute to:

- Knowledge/competence about how aggregators that manage the capacity of many small players will be able to offer this in relevant flexibility markets and handle signals for switching on and off.
- Development of methodology for prequalification of suppliers and verification of the deliveries for which payment is made.
- Development and/or testing of concepts for flexibility markets where both TSO and DSO have access to the same resources that must be offered and used in the way that is best for the overall power system. Such local markets must be compatible with the TSO's national balancing markets, and rules must be made for who can activate which resources, where and in what order. These rules can be integrated into the flexibility market as a form of bid filtering.
- Knowledge of how a flexibility market can include several products or types of flexibility with different specifications and purposes (bottleneck management, balancing, etc.) This will also apply if several markets are established where aggregators or resource owners can choose where they want to participate..

2.6 Socio-economic methods in a time of rapid system changes

A central part of Statnett's mandate is to contribute to the socio-economical rational development and operation of the power system both onshore and offshore. Statnett obtain licenses based on the expected socio-economic profitability of the investments. The energy transition is also a societal process where societal acceptance, policy and political goals, framework conditions and demands are of great importance for what is a rational and coordinated development of both AC and DC transmission networks. We must understand how new challenges for the energy system may require a different distribution of roles and organization than we have today.

Rapid changes in the energy system and rapid growth in power demand and production create a need to further develop planning methods and socio-economic methods related to the operation of the power system and to the development of investments.

We would like project proposals that contribute to:

- Further develop methods for holistic planning and development of onshore and offshore transmission networks, in collaboration with other actors and with the authorities. The assessment must be compliant with EU's strategy for holistic planning of the energy system.
- Improve the understanding of how one should assess the socio-economic profitability of network investments in a time of great and increasing need for capacity
- Develop a better understanding of how the spot market and other sub-markets, tariffs and special agreements with network owners as well as general framework conditions, policies and support schemes, individually and collectively, can contribute to more efficient utilization of onshore and offshore power grids (greater value creation) and ensure the continued ability to balance the power system throughout the entire energy transition.

2.7 Digital substation

Introduction of Digital substation with digitization including the primary components in combination with IEC 61850 process bus, is one step closer to establish the next generation control system, including better and more flexible implementation of new functionality. This also provides the opportunity to retrieve data from the grid assets with finer real-time resolution. Continuous access to data provides a completely different control and a unique basis for developing insight into the lifespan of a digital substation and the individual components. Data in combination with machine learning can help predict malfunction allowing mitigation measures to be applied before a fault. Digitization of substations requires continuous improvement of cyber security.

The main driver for introducing the Digital substation with IEC 61850 process bus is the expectation that in the long-term perspective it will be possible to improve personal safety, e.g., using unconventional

measuring transformers (LPIT or optical). Reduction of total lifetime costs for the substations is also very important. Efficient working methods must be used for specification, installation and replacement, as well as testing and monitoring of protection and control systems.

We would like project proposals that contribute to:

- Technology for digitization including the primary components
- Expertise and experience that enables us to challenge requirements and reduce risk related to both construction and operation of digital substations
- Collaboration with universities and research institutes to establish and further develop a laboratory platform for digital substations
- Interoperability between different suppliers.

2.8 Interconnected AC / DC transmission systems

The transmission system of the future will be tightly integrated with an ocean grid that links offshore wind power production with consumption both on offshore platforms and several domestic onshore hubs. At the same time, there will be a large-scale development of onshore wind power throughout the Nordic synchronous power system. It is important to coordinate capacity development to handle the increased amounts of energy to be transmitted. An integrated offshore and onshore grid with interconnected AC and DC systems requires better monitoring and coordinated control throughout the synchronous area. New production sites are connected with converters with other characteristics than the traditional synchronous generators. Production fed from inverters will dominate much of the time and system stability will be challenged within time horizons down to milliseconds. In order to detect undesirable phenomena; new instrumentation, real-time data exchange and closely coordinated and automated measures that ensure system stability and security of supply are necessary.

In order to analyze a power system with many converters, it is necessary to develop new power system models and tools that can analyze new phenomena that occur, how it affects system stability and what measures must be applied to ensure stability and security of supply.

Project proposals can be in the form of participation in Nordic and European research and development projects.

We would like project proposals that contribute to:

- The development of measuring systems for real-time monitoring with a high sampling frequency that can be used for automatic control in interconnected AC / DC systems.
- The development of new types of system services and solutions that include end-user flexibility to cover specific needs in the transmission and distribution grids.
- A Interoperability between large numbers of converters from different suppliers in the Nordic power system.
- The development of models and simulation tools for the analysis of the future's converter-dominated transmission systems.

2.9 Efficient technologies and construction methods

Several thousand km of power lines and many new substations will be built in the years to come. New technologies and construction methods will be able to reduce construction time and / or reduce the costs of new assets including costs for maintenance, inspections and fixing of break downs due to e.g., extreme conditions. In addition, compact design, new materials, prefabricated components and testing at factory site could contribute to faster production, installation, lower weight and reduced maintenance from a life cycle perspective. Competence and technology for the construction of power lines/assets in the proximity of energized assets are necessary for efficient construction with reduced possibilities for disconnection.

We would like project proposals that contribute to:

- Interoperability and standardization of HVDC components

- Use of alternative building materials
- More compact design of assets in the power grid
- Increased use of prefabricated components
- Use of larger drones and unmanned helicopters during construction of new facilities
- Use of more efficient construction methods
- New energy-efficient methods for inspecting and laying submarine cable.
- Technology that enables us to correct errors faster
- Increased use of digitized construction control/checks (drones, handheld devices, etc.)
- Technology that enables us to perform inspection, repair and installation without disconnection

2.10 Digital twin and condition based asset management

In order to meet a growing and aging asset portfolio, there is a need for condition-based management. By introducing the use of digital twin and associated sensoring, real-time and automated condition monitoring will enable maintenance to be carried out when necessary as well as performing risk-based lifetime evaluations. This requires good data quality, methods and systems that provide a good basis for decision-making. This will result in efficient asset management, increased lifespan and reduced costs.

We would like project proposals that contribute to:

- Expertise and new technologies that can improve monitoring, estimation and prediction of condition of assets/components that will provide a better lifetime estimate, better insight into risk, targeted maintenance and increased asset life
- Automatic drone inspection of stations and power lines
- Technologies and methods for appropriate instrumentation of both new and existing assets
- Further development of probabilistic methods to be able to estimate and predict risk

2.11 Reduce greenhouse gas emissions and preserve biodiversity

The transition to a low-emission society will entail major changes that require broad social acceptance, a focus on comprehensive environmental responsibility and the preservation of biodiversity. Preservation of nature and landscape values, measures to reduce our own emissions and adaptation to climate change, will be crucial in order to implement the necessary changes in the power system. Through research and development, Statnett wants to reduce greenhouse gas emissions related to our use of steel, concrete and aluminum.

Reduction of leaks from existing assets and the development of environmentally friendly technologies such as alternatives to SF6 gas are measures that can contribute to Statnett being able to achieve its climate goals.

We would like project proposals that contribute to:

- Increase the knowledge base about Statnett's impact on biodiversity using digital solutions.
- Strengthen our efforts and to develop methodologies to promote comprehensive environmental responsibility and preserve biodiversity.
- Knowledge and technology development to develop climate-neutral facilities
- Development and application of environmentally friendly gases and liquids in components in our substations
- Collaboration with Norwegian and European suppliers on emission reduction measures
- Contribution to the development of methodologies for circular economy and life-cycle analyses
- To replace all components with SF6 gas

2.12 Safe and secure assets and safe working conditions

With our zero-injury philosophy, we are interested in technology, technical solutions and methods that can help make the workplace safer. New methods and digitization will be able to contribute to better HSE. The focus on HSE, including technical safety, will place different or new requirements on our facilities and working methods. Increased external threats place new demands on preparedness security, physical security and protection of the facilities.

We would like project proposals that contribute to:

- New working methods that increase personal safety
- Reduce the amount of work at height
- Secure our assets against external threats, both physical and digital

3 THE EVALUATION PROCESS

Statnett will only evaluate RnD project proposals that meet the requirements for the RnD deviations to the Public Procurement Act as described in the Norwegian Public procurement Act with the relevant regulations FYF §2.5.

Assessments will be done in phases, see detailed description below.

For Statnett to evaluate your proposal, it must substantiate one or more of the following points:

- Includes or proposes the formation of a consortium consisting of several organizations across academia, research and industry. Preferably also across national borders.
- Spans over several TRL levels. (Technology Readiness Level)
- Includes several external participants with funding
- Encourages new thinking and promotes innovation towards the green shift
- Encourages solutions that develop expertise both internally and externally
- Facilitates future competence building by projects including, senior and junior resources across gender and ethnic background.

3.1 Deadlines and evaluation phases

Deadline

The deadline for R&D proposals is **01.11.2022**.

The process after receiving of proposals is as follows:

Phase 1

Statnett will evaluate the project proposals to determine whether the project idea is qualified for further evaluation. The evaluation will be done with reference to the described areas of interest and the award criteria in chapter 4 below.

Phase 2

Statnett will evaluate the project ideas further and in more detail according to the award criteria.

If necessary, Statnett will clarify with the tenderer and among other things consider if and how the project could fit better to Statnett' s R&D needs. Statnett will consider the following:

- Does the project have the best R&D partners, or could it be strengthened by inviting others?
- Could – or should there be revisions to make the project more relevant to fit in with Statnett priorities.
- Have important clarifications been done, such as immaterial property rights (IPR).
- If a good case can strengthen the project, including the following implementation of the R&D results.
- Does the budget need to be revised? This could be both a downscaling to meet Statnett R&D budget or an increase to allow for more/other R&D partners.

Phase 3

The target for phase 3 is to finalize the contract documents, which includes:

- Get financial support from invited R&D partners outside Statnett.
- Create a more detailed project plan with work packages, milestones, performance goals, routines for reporting etc.
- Establish an agreement between Statnett and the project partners
- Agree terms and conditions and finally signing of the contract

We point out that even if the project is qualified for the final phase, it may happen that Statnett chooses not to proceed with the project. The reasons may be several; unforeseen changes in the project along the way, changes in Statnett's framework conditions or budgetary reasons. There may also be events that are outside of Statnett's control, but which may nevertheless have an impact on the R&D project.

Everyone who submits a project proposal will receive feedback. Further feedback can be given if contact is made with the contact person in this document.

Beyond this, Statnett incurs no obligations by receiving project proposals.

3.2 Tendering costs

Statnett will not reimburse costs incurred by the proposer in connection with the preparation, delivery and follow-up of the proposal.

3.3 Confidentiality

Statnett is subject to the Freedom of Information Act § 23. We will exempt business secrets from the public, including sensitive parts of project proposals submitted to us. We reserve the right to discuss proposals internally at Statnett and with relevant partners among the Nordic network operators who will be subject to confidentiality. If we need further third-party opinions/expert assessment in order to take a position on the proposal, the proposer will be given the opportunity to provide input on this. Beyond this, Statnett incurs no obligations by receiving project proposals.

4 REQUIREMENTS AND EVALUATION CRITERIA

Statnett reserves the right to evaluate the Tenderers financial capacity.

For projects that intends to qualify for support from NRC or other financial support, the tenderer must fulfill the requirements given by these.

Statnett has the following additional requirements:

Qualification criteria	**Documentation**
The project proposal must be within Statnett's line of business	The project description shall show the relevance for Statnett
Legally established enterprise	Company certificate
Taxes etc. paid in full	Certificate for tax and VAT. Not older than 6 – six – months from deadline for this announcement.
Confidential information	A security agreement and confidentiality declarations are mandatory when confidential information is involved.

Statnett will evaluate the suitability of the project idea according to the award criteria given below:

Award criteria	**Documentation requirement**
1. The suitability of the project idea as documented in the project description Including, but not limited to: Does the project fit into Statnett's' strategy	• Project-/problem-description • Presentation of Consortium or cooperating parties • Present the benefit/value for Statnett, including cost benefit estimates
2. Delivery plan and organization of project Including, but not limited to: • Realistic plan for implementation including available expertise • Whether the timing of the project is right in relation to other activities or ventures	• Organization of project • Delivery plan/work plan/project plan • short CV (max 1 page) for the planned and available key resources for the project
3. Cost and Terms & Conditions • Financial terms • In-kind contribution • Is the budget realistic? • Contract Terms & Conditions	• Hourly rates for the relevant resource-categories including an estimated share for each of the categories. • Total cost estimate in given currency, including proposed Statnett part of the costs and any In-kind contribution • Any deviations to terms and conditions