



Statnett

Innovation and
Technology Development

Tender Presentation 2022

Statnett

Agenda

- 1. Welcome, information about the process
- 2. Short introduction to the call
- 3. Presentation – R&D focus areas
- 4. Summary



Statnett

Innovation and
Technology Development

Welcome, information about the process

Ellen Sande

Senior advisor, Procurement Department, Statnett

Statnett

Presentation of this competition

- Invitation to Tenderer – there is a lot of important information in this document. Please read it carefully.
- All documents are published on Statnetts [homepage](#).
- All proposals shall be submitted via the PORTAL

Answering the tender

- Project proposals shall be submitted via the R&D portal
 - [Norsk: https://www.statnett.no/om-statnett/fou-og-teknologiutvikling/forslag-til-prosjekter/](https://www.statnett.no/om-statnett/fou-og-teknologiutvikling/forslag-til-prosjekter/)
 - [English: https://www.statnett.no/en/about-statnett/research-and-development/do-you-have-a-project-proposal/](https://www.statnett.no/en/about-statnett/research-and-development/do-you-have-a-project-proposal/)

IPR

- As a minimum, Statnett shall have user rights to all project results where Statnett participates.
 - Please note that background information is not part of user rights.
- For projects MAINLY financed by Statnett, Statnett shall have full IPR (owner rights) to the results if Statnett so wishes.
 - Please note that background information is not part of IPR.

Deadlines

- **Tender due date/deadline to submit proposals:**
 - 1. Nov 23:59 (CET)
- **Questions and answers will be published on Statnetts [homepage](#)**
 - Deadline for questions is 15.10.2022
- **All questions must be posted through email**
 - Ellen.sande@statnett.no
 - fou@statnett.no
- **Statnett will not discuss any project proposals in advance of the due date. Please refer to the information about the process.**

Process after November 1st.

Phase 1

- Evaluation and primary sorting
- Feedback

Phase 2

- Prioritization
- Technical and financial clarification
- Consortium
- Complete evaluation

Phase 3

- Contract negotiations
- Financial completion
- Contract signing

Evaluation and contract requirement

- The project proposal shall show the relevance for Statnett. Does the project fit into Statnett's strategy as described in the invitation to tender?
- Delivery plan and organization of the project. Is the plan for implementation, including available expertise, realistic? Is the timing of the project right in relation to other activities or ventures?
- Cost and Contract terms and conditions. Evaluate whether Financial terms, In-kind contribution (from all participants), and the budget proposal are realistic. Evaluate if any deviations to Statnett Contract terms and conditions are hindering a potential contract.

Phase 1 - Evaluation

- 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.
- If YES, you will receive a notice with information about the next step.
- If NO, you will get a notice with a short explanation.



Phase 2 – Evaluation/prioritization

- Statnett will evaluate the project ideas further and in more detail
- 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's priorities?
 - Have important clarifications been done, such as immaterial property rights (IPR)?
 - Will a good use case 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 the Statnett R&D budget or an increase to allow for more/other R&D partners.



Phase 3 Evaluation/consideration – finalize contract

- Agree on financial support from invited R&D partners
- 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 on terms and conditions
- Sign contract(s)

We wish to point out that even if the project is qualified for the final phase, Statnett may choose not to proceed with the project.





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Short introduction

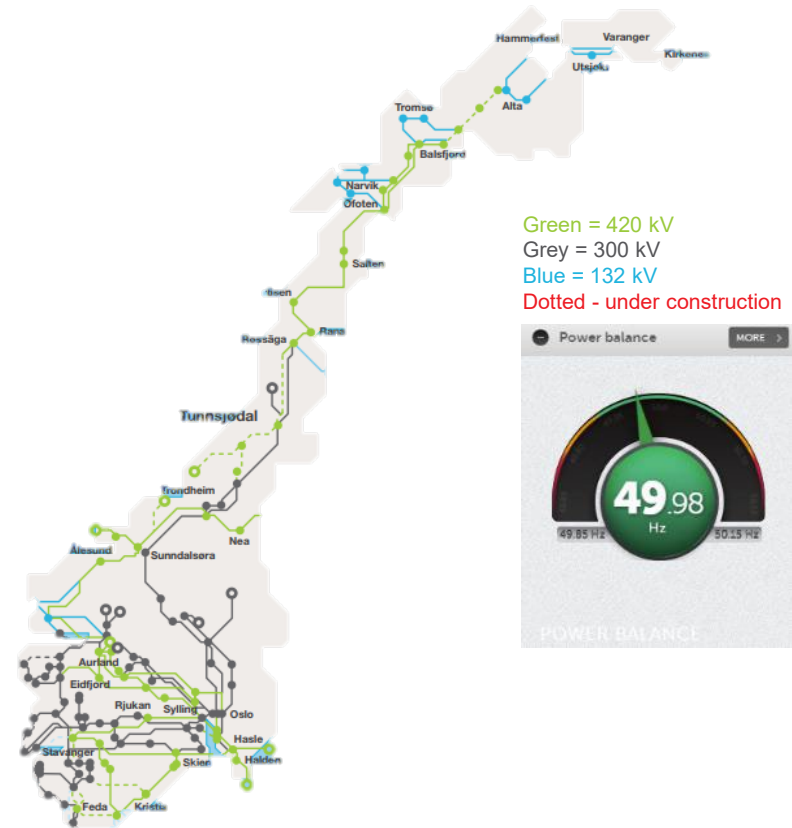
Rannveig Løken

Innovation & Technology development, Acting Director, Statnett

Statnett

This is Statnett

- Statnett is the **Transmission System Operator** in the Norwegian energy system
- Statnett operates around **11,500** km of high-voltage power lines and **2,500** km of subsea and land cables the length and breadth of Norway in addition to 170 substations.
- The National and Regional Control Centres continuously monitor the grid to ensure stable power supply.
- Statnett is also responsible for interconnectors to Sweden, Finland, Russia, Denmark, Germany, United Kingdom and the Netherlands.



Changes in the Power Grid



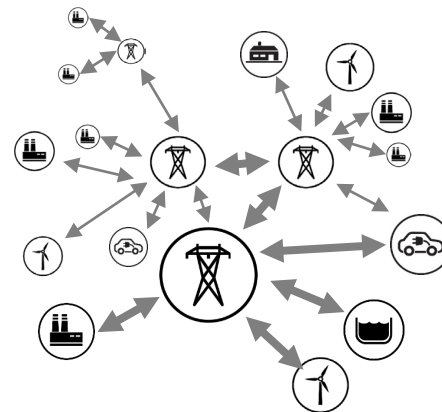
Zero emission in the energy system

Accelerated electrification and targeted innovation in Norway and Europe

Closer integration between onshore and offshore



New technology and digital solutions are enablers for the change



Co-operation is essential for R&D

- National level



Nordic level

Nordic R&D Group



European level



International level





Statnett

Innovation and
Technology Development

Presentation – R&D focus areas

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Innovation & Technology development, Section managers, Statnett

Statnett

Automation and control of the future power system

Intro

- The development of the power system will lead to more frequent and major changes in production, consumption and power flow.
- It will be necessary to increase the requirements for observability, monitoring and control
- Transformation towards a cyber-physical power system will enable more automation and coordination of operations -> increased opportunities for interaction and integration.
- Automated control rooms require good visual overviews and carefully thought-out interaction between man and machine.

Topics

- Autonomous solutions for monitoring, control, and protection.
- Robust solutions for real-time communication and data exchange
- Solutions for the integrated and automated control room (risk management and reliability-based operations)
- Artificial intelligence and machine learning as a contribution to increased automation
- User interface for operators that provides a better and faster understanding of the situation

Automation and control of power system operations

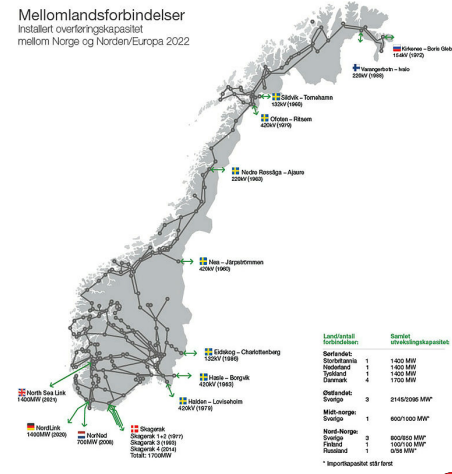
Integrated green energy wind and solar, flexible solutions in production and consumption



Automatically surveillance of the grid and handling of different market solutions.



European integrated solutions for grid monitoring and activation of electric energy reserves



Automation and control of power system operations

Today most of the surveillance and handling of different market solutions are treated manually in the control centre.

In the future

- Processes in the control centre for grid operations and handling of the electricity energy market will be transformed to automatic processes.
- Processes for surveillance and handling of different market solutions will be more integrated on the Nordic and European levels.
- More flexible solutions on the consumer side will be more integrated in the grid and market solutions

Future operations will require:

- New type of user interface, to help operators to understand situations in the grid and the electric energy market.
- Need for artificial intelligence (AI) between processes to fully carry out the operation of the grid and handling of the electricity energy market.
- New tools to handle interfaces on a Nordic and European level for grid situations and the electric energy market.

*In the coming years, Statnett will put a lot of internal resources into meeting short-term needs for more automated system operation and structured information management. Therefore, we are looking for **proposals that contribute to research with a long-term perspective.***

Communication, data management and cyber security

Intro

- Technologies such as artificial intelligence, machine learning, the use of digital twins, IoT, sensors and 5G will be "game-changers"
- Cyber security is essential with targeted and efficient mechanisms for detection, incident management and repair
- Important to ensure adequate and efficient solutions for system and data integrity, accessibility and confidentiality.
- Both national and international players are important in order to establish robust and comprehensive solutions

Topics

- 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.
- Technologies suitable for targeted and efficient detection, management, and mitigation of cyber threats and incidents
- Expertise and solutions to utilize the new 5G (6G) network for communication and data transmission in an efficient, stable and secure manner.
- Insight and techniques against digital transformation

Capacity increase

Intro

- The capacity of the power grid must be increased through both upgrading of existing grid and in the form of new assets.
- 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.

Topics

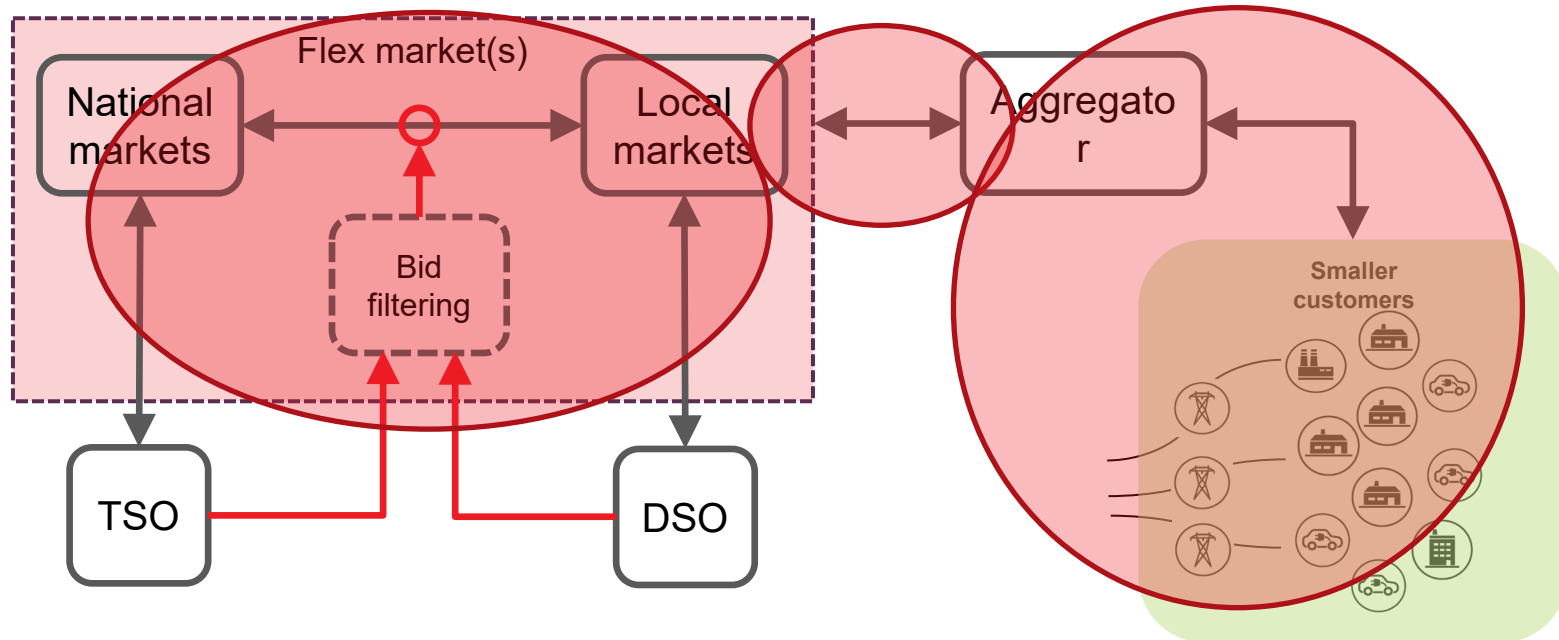
- Technology that reduces losses on transformers, power lines and cables
- Technology for new assets that support efficient future upgrades
- Technology that can be installed in existing grid and increase capacity
- Knowledge of weather-related influences and technologies that enables us to predict errors before they occur
- 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
- Technology that can control the power flow so that we can utilize the entire capacity of the grid

Cooperation between TSO and DSO, electrification and flexibility

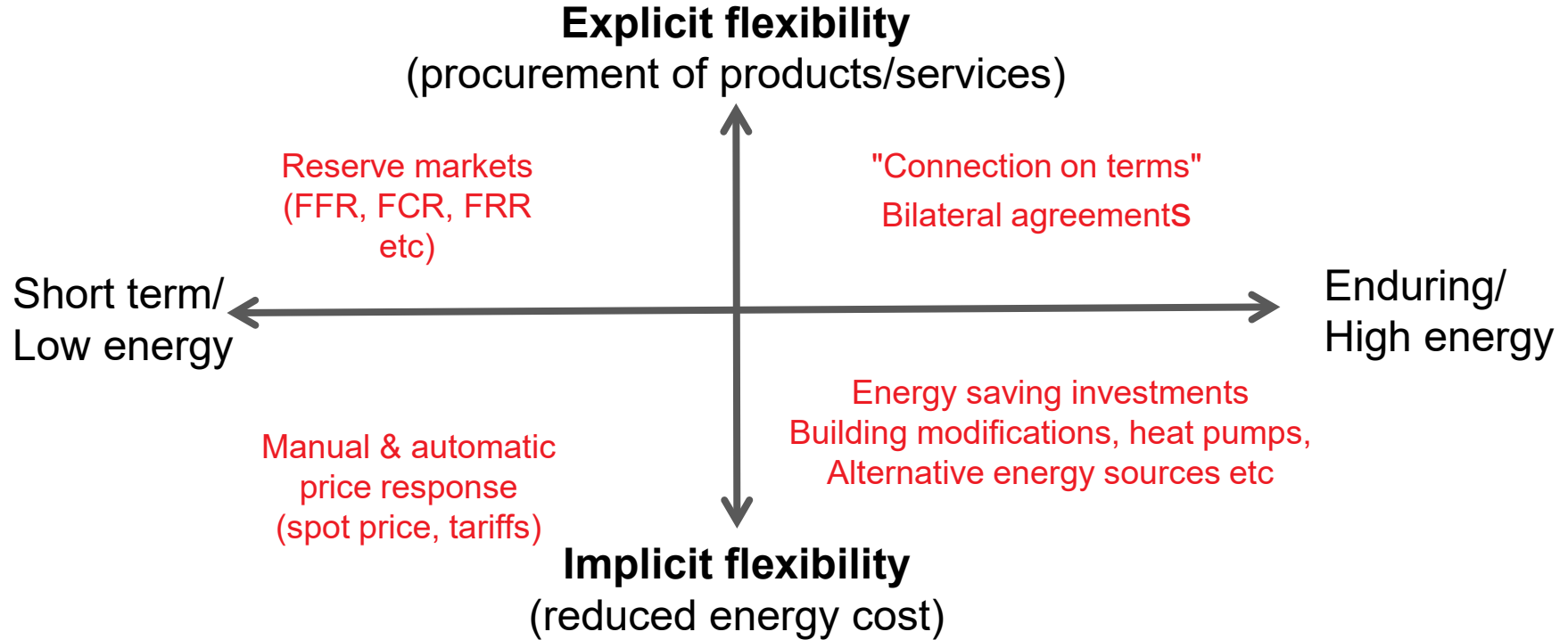
- Electrification in various sectors will lead to increased utilization of both the transmission and distribution networks.
- Since most of the customers are connected to the DSO's network, a new approach to cooperation, the distribution of responsibilities and the exchange of information between TSO and DSO is necessary
- A simplified value chain for increased use of distributed flexibility will contain several new roles and concepts.



High level concept for flex value chain



Flexibility categories



Cooperation between TSO and DSO, electrification and flexibility

Summary

- Electrification in various sectors will lead to increased utilization of both the transmission and distribution networks.
- 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
- A simplified value chain for increased use of distributed flexibility will contain several new roles and concepts.

Topics

- Knowledge/competence about how aggregators will be able to offer small-scale capacity in relevant flexibility markets
- Methodology for prequalification of suppliers and verification of the deliveries
- Concepts for flexibility markets where TSO/DSO optimize resources to the best for the overall power system
- Knowledge of how a flexibility market can include several products or types of flexibility with different specifications and purposes

Socio-economic methods in a time of rapid system changes

Intro

- The energy transition is a societal process where societal acceptance, policy and political goals, framework conditions, and demands are of great importance
- 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 the development of investments.

Topics

- Methods for holistic planning and development of onshore and offshore transmission networks
- 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 markets, tariffs, and special agreements with network owners as well as general framework conditions, individually and collectively, can contribute to more efficient utilization of power grids

Digital substation

Intro

- Substation Control system today in Statnett is already digitalised - with ethernet based communication at the substation level and numerical protection and control units.
- Digital substation with process bus is the further step towards digitalisation, where digitalisation is done directly at the primary equipment level. It is expected that the substations will be smarter, smaller and safer.
- Process bus itself does have the very obvious advantages like personal, environmental and equipment safety, but it needs to be tested further for ensuring aspects like reliability, easy to extend, plug and play for faster building and replacement and not the least cyber security.
- Good business case from implementation of new technology is always a very important factor. So the focus is well to explore the added functionality and new possibilities which comes along with the process bus for building the control system of the future.

Topics

- 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. This will enable the testing to be performed in a control environment and not the least will help in building competence in control system of the future.
- Set ups and approaches to verify Interoperability between different suppliers at the greater extent.
- Contribution to the development of methodologies to verify the added functionality which comes along with the process bus.
- Developments of tools and methodologies for more or fully automated testings.
- Increase the knowledge base and strengthen the efforts in Digitalisation and Virtualisation concepts.

Interconnected AC/DC transmission systems

Intro

- 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.
- 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.

Topics

- 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.

Interconnected AC/DC transmission systems

Recommended Background information:

[Research, Development and Innovation Reports
\(entsoe.eu\)](#)

[ENTSO-E Position Paper on Stability Management in
Power Electronics Dominated Systems
\(azureedge.net\)](#)

Power System Stability Phenomena

Resonance
stability

Converter
driven
stability

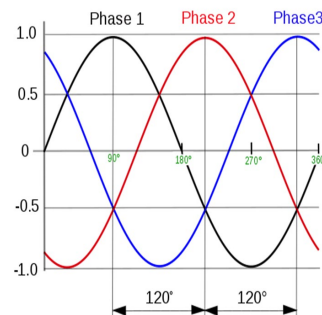
Rotor
angle
stability

Voltage
stability

Frequency
stability

New phenomena
Timeframe of milliseconds

Growing and changing phenomena
Timeframe of seconds



Efficient technologies and construction methods

Intro

- Need to build more assets faster than before to meet growing demands
 - New technologies and methods
 - Compact design, new materials, prefabricated components, testing at factory
 - Competencies and technologies for construction in the proximity of energized assets particularly where disconnection is not possible

Topics

- Interoperability and standardization of HVDC components
- Energy-efficient methods for inspecting and installing submarine cables
- 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
- Use of more efficient construction methods
- Increased use of digitized construction controls/checks (drones, handheld devices, etc.)
- Technology that enables correction of errors faster
- Technology that enables inspection, repair and installation without disconnecting energized assets

Digital twin and condition-based asset management

Intro

- By introducing the use of digital twin and associated sensing of assets/components, real-time and automated condition monitoring will enable maintenance to be carried out when necessary
- Sensing should also provide a basis for performing risk-based lifetime evaluations
- Good data quality, methods and systems that provide a good basis for decision-making is needed.
- The goal is to increase the lifespan/capacity of our assets and to obtain a more efficient asset maintenance process which in turn should contribute to lower LCC.

Topics

- Technologies that can improve monitoring, estimation and prediction of the condition of assets/components that will provide a better lifetime estimate, better insight into risk, maintenance needs and overall contribute to increased asset life
- Automatic inspection of stations and power lines (drones, sensors...)
- Technologies and methods for appropriate sensing of both new and existing assets
- Further development of probabilistic methods to enable better estimates of risk prediction of assets

Reduction of greenhouse gas emissions and preservation of nature- and bio-diversity

Intro

- 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.

Topics

- 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

Secure facilities and safety for employees

Intro

- 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.

Topics

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

Questions? Deadline October 15th



- Questions can be sent to fou@statnett.no
- ellen.sande@statnett.no
- Q&A will be published shortly after deadline for questions

Summary

- Important to send your R&D Project proposals within the deadline.
 - Read the invitation to tender carefully.
 - Any questions shall be raised via the email addresses given
 - Use the portal at the [homepage](#)
 - Deadline is 1. Nov 23:59 (CET)
- 