

## Summary of the consultation on the Nordic TSO strategy for wind and sector integration

The Nordic TSOs consulted stakeholders for five weeks, from 12 March 2021 until 16 April 2021, concerning the Nordic TSOs draft strategy to meet expectations for developments in wind power and sector integration.

The Nordic TSOs consulted stakeholders based on five questions in order to find the main challenges of wind and sector integration and how the Nordic TSOs should promote the development on both themes. The Nordic TSOs also asked for information of stakeholder plans to wind development and sector integration.

TSOs received 11 consultation responses and a lot of comments and questions from the Nordic TSOs strategy webinar 12.3. The responses are included in Annex 1 together with the TSOs comments. Consultation responses were gathered from following stakeholders:

- Ampner Oy
- EPEX Spot
- Finnish Wind Power Association
- Fortum
- Kemijoki
- Nord Pool
- Nordenergi
- Shell
- Statkraft Energi AS
- UPM
- Ørsted A/S

In general, the Nordic TSOs' draft strategy presentation for wind development and sector integration was well received and stakeholders highlighted that further communication and information of the strategy is needed in order to keep on track with the changes to infrastructure, markets, and operation. Stakeholders emphasised the importance of implementation of the current projects in short-term and how well the strategy support the current progress in long-term.

Stakeholders mentioned that the main challenge is how market participants can participate to electricity markets throughout the energy transition. The challenge is divided into market access and available transmission capacity. Stakeholders felt that uncertainties are now seen in building new infrastructure but also developing and implementing new market designs.

The Nordic TSOs are on the right track to promote wind development however, stakeholders wish to receive more information about the offshore wind development plans. The implementation of offshore wind to Nordic transmission system is linked to current TSOs implementation projects (i.e. 15 min ISP) but also future market design and integration. Fundamentally, to provide more capacity to the market.

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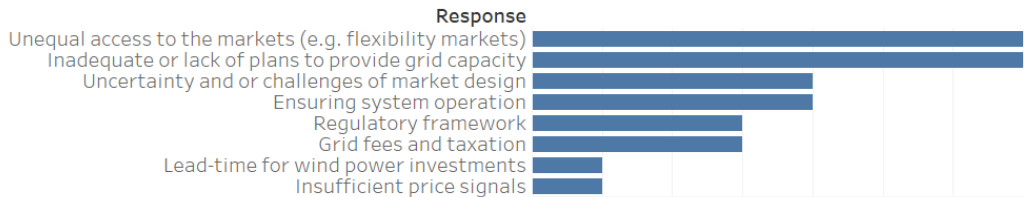
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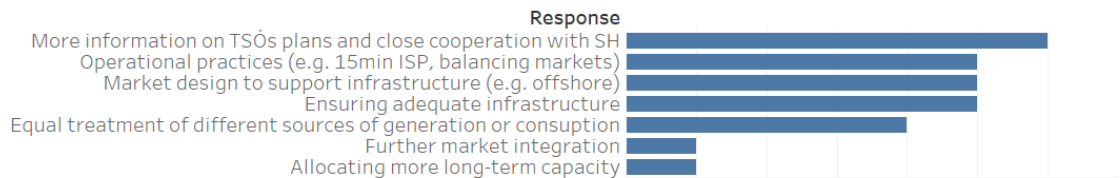
Stakeholders noted that there are a wide range of potential areas to promote in sector integration. Stakeholders felt that it is most important to focus on system level planning and to create a foundation for energy systems. In short-term, stakeholders emphasised equal and easier market access for all energy resources.

Please find more detailed answers below.

What are the key challenges to wind development and sector integration?



How should the Nordic TSOs promote wind development?



How should the Nordic TSOs promote sector integration?



What are the tasks the Nordic TSOs should prioritize in order to improve wind development and sector integration?



*Distribution of written responses.*

## Annex 1: stakeholders´ webinar and consultation responses to the Nordic TSOs strategy to wind development and sector integration

No.	Consultation or webinar response	TSOs´ comments to responses
1	Can we have an overview of all cables, wind farms, battery factories, nuclear power sites and so on in the Nordics. A complete map, year by year to get a picture of the future?	Nordic TSOs will create "state of the art" as part of the final strategy which clarifies current situation of the Nordic clean energy transition. However, future scenario will be provided in the Nordic Grid Development Perspective 2021 report
2	How does the Nordic TSOs consider the integration and development of storage possibilities? How do you rate the role of hydrogen in this respect? Which position take the consenting entities of the individual countries and to which extent do they support a harmonized approach?	The future electricity market needs widely different storage solutions in order to balance weather dependent production. We see hydrogen as a one pillar of long-term storages mix which has great potential in system balancing.  European- or Nordic-wide harmonisation support energy system optimisation which is a one key aspect of the system-level planning. EU has made first roadmaps and plans that guides different nations to support sector integration. Also, up-coming European wide regulation for sector coupling creates foundation for harmonisation between National entities.
3	You told that you will be looking the Nordics in a holistic way, does this mean that you will be looking the Nordics grid investments as one forgetting the borders?	The goal is to develop grid planning towards holistic planning of energy sectors e.g., power and gas systems. Related to only grid investments, Nordic TSOs will depend on the coordination of the grid investments within Nordic TSOs area and other neighboring countries.
4	Have you identified where the strategy requires help from Nordic governments providing common Nordic policies, for example for promoting grid investments important for the whole Nordic area?	The work on national legislations focusses on different areas of energy transition. So far, Nordic TSOs have found that offshore grid infrastructure needs common practices among different countries. Also, providing new type of flexibility may not be economically feasible for the owners due to barriers from legislation.
5	Have you had any discussions on how to remove barriers to service providers to help energy market players increase flexibility in Nordic level?	Nordic TSOs will identify barriers through a study – level of ambition can vary from bottom - up identification to literature study.
6	Does easy access overrule level playing field? Also, wind power is expected to be the biggest contributor to new Nordic generation, but it should not be treated differently from other generation forms.	The Nordic TSOs are technology neutral and have the aim to ensure that all technologies have equal opportunities. This means also that TSOs would like to ensure the access of new potential flexibility, coming also from different energy sectors, to the markets when needed.
7	I thought the mission of the TSOs was to operate and build a secure electricity system, irrespective of the technology used, and not speculating in the potential of different business cases.	The Nordic TSOs have used different scenarios including different business cases as a tool to evaluate and time grid reinforcements. These scenarios open reasoning of the Nordic TSOs investment decisions to public.
8	which challenges do you predict in the electrification of specific industries like transportation (both public and private) and steel production industry (H2 Green Steel was announced last week to be built in Lulea region in Sweden)?	Electrification of transportation may challenge congestion management at local level. The challenge is more related to provide peak power rather than energy. The green steel production, however, may come faster than expected and creating a risk that the grid is not adequate for time being.

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9	Our key concerns relates to security of supply. How is this considered in the Nordic TSOs strategy?	In short-term, current implementation projects supports security of supply. In long-term, strategy will consider current measures in addition to coordinated flexibility, available non-grid solutions and providing adequate transmission capacity.
10	How Nordic TSOs can facilitate easy access to the markets for all flexible resources? When designing reserve markets, bid sizes and technical parameters must be such that different sources of flexibility can enter the market. Grid fees can also hinder large industrial consumption from offering its flexibility, if designed inappropriately.	New type of flexibility resources and its access to the markets are one of the key interests in the strategy and requires further assessment.
11	How other challenges to sector integration (e.g. taxation and grid fees) are taken into account?	Taxation and grid fees require further assessment from the Nordic TSOs
12	The strategy should consider the role that increased digitalization may play in further enabling demand and distributed energy resources to compete in markets on a level playing field, as well as improving the forecasting and monitoring of the integrated Nordic energy system.	Energy system integration indeed requires digitalization which works as a one tool to integrate different sectors. Those are taken into account in updated strategy
13	Nordic TSOs should actively participate in the development of a European hydrogen backbone.	Initial plans of European hydrogen backbone include the Nordic countries. Nordic electricity TSOs supports Nordic gas TSOs in the work.
14	There is no mentioning of DSOs in the report, but coordination between TSO(s) and DSOs is important for facilitation of well-functioning flexibility markets. DSOs' active role is required for efficient facilitation of DER services.	The Nordic TSOs wind development and sector integration strategy points out the topics that requires Nordic TSOs coordination. DSO have a great role essentially with congestion management and sector integration in future. However, most of the actions include TSOs coordination with corresponding DSOs.
15	Will you also pinpoint challenges to building out the grids at sufficient speed, such as long permitting processes, coexistence/acceptance challenges, not being allowed to make anticipatory investments etc.?	<p>The topic is addressed on a high level in the strategy and roadmaps out of several aspects.</p> <ol style="list-style-type: none"> <li>1) optimizing the use of the current network in order to free more capacity on a short term</li> <li>2) the TSO:s to optimize the internal efficiency concerning lead time, decision processes, implementation projects</li> <li>3) the TSO:s influence national government in order to shorten long permitting processes or to adjust working processes in adopting to legislation more efficiently</li> <li>4) support sector coupling, the development of smart demand, etc</li> </ol>
16	The "old" question was how big share of intermittent production technically can be integrated in the system, but without support system, how much investments in intermittent capacity is possible in a competitive market. e.g. taken into account cannibalization?	<ol style="list-style-type: none"> <li>1) From an economical view - The TSO:s are not investing in production so it is up to the producers to draw conclusion on the business case</li> <li>2) From a technical view - we do currently not know and the share of possible intermittent production depends on the circumstances. This will need further investigations and analysis.</li> <li>3) Flexibility in consumption (in larger quantities) is one common solution that can allow a bigger share of intermittent production</li> <li>4) Grid planning perspective – depending on where in the system intermittent production is connected the possible share can vary. Therefore, a map over where producers can connect within a reasonable timeframe would be a support for optimizing the share.</li> </ol>
17	to eliminate the effect of weather dependancies; do you expect the actual development of more direct HDVC connectors like Vikinglink	The topic is addressed in the TSOs system development plans.

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	and Nordlink (with a feedin to Suedlink in Germany). Or/and the development of an offshore grid to bridge the distance between the place of generation and consumption of the energy produced? With regard to such an offshore grid, which decisions have to be made on an European scale?	Standardization and interoperability between vendors and their equipment is a condition for (last question) for an effective use of offshore wind power and needs to be addressed on a European level.
18	As the TSO's are mainly responsible for the distribution networks onshore, should any developer or investor not contribute to the upgrade of this onshore transmission network - so all plays together and the burden for the TSO's is reduced.	The transmission network is of common interest and therefore the TSO are responsible for it. EU law points to that the TSO own the grid and therefore are responsible for the investments. Who and how the investments in the grid are financed is regulated. Any changes are therefore a government matter.
19	how will you decide where to plan the massive amount of on/offshore wind farms needed? This considering the phase out of nuclear/fossil fueled powerplants across the Nordics?	This is not within the scope of the TSOs responsibility. Where wind farms will be placed will depend on national conditions, politics and producers ideas of profitable investments. The TSOs need to know where the projects are planned and are responsible for providing connection points and grid capacity to handle the production.  The TSOs plans for and actual development of the grid indirectly affects the plans for where wind power is built. The TSOs have the intention to proactive in pointing out where the conditions for connecting to the grid are more optimal than others.
20	Are you planning to look into frameworks for hybrid offshore wind power (connecting wind farms to several markets)? Are you also working together with other TSOs around the Baltic Sea on offshore wind power?	The legal framework is dependent on the situation in each country. There are however several initiatives ongoing both on a national, Nordic and European level. For example Denmark is looking into this topic in respect to the energy island concept. There is a cooperation around the North and Baltic Sea as part of ENTSO-E initiatives as well as via the TYNDP (Ten Year Network Development Plan). There is also a Nordic ad-hoc group addressing this specific topic.
21	Nordic TSOs should develop offshore network plans in close cooperation with other European TSOs and contribute to development of clear market rules for offshore generation, not only for offshore hybrid assets but also for offshore meshed grids.	The Nordic TSOs are working on and cooperation with other TSOs on this topic. There are joint statements for how the market rules could be formulates, meshed grid is under discussion and there are discussion ongoing on a EU level. However the TSO:s have to act under the national regulations and it is therefore not up to the TSO:s to define their role in offshore networks.
22	What is your understanding, when wind production will be able to participate itself to reserve markets. When wind is managed in near real time and not create need for flexibility anymore but instead wind would be flexible resource itself? Utopia?	The Nordic TSOs objective is to make the reserve markets technically independent and the TSOs would welcome wind power operators to contribute. There are currently quite significant differences between the Nordic countries with regards to how active wind power is. There is however a strong growing interest from the wind industry to take part in these markets, and for the TSOs this is prioritized. Technically many solutions already exist. We believe that especially down regulation is the first most promising opportunity.
23	Who will bear the cost of grid reinforcement triggered by increasing wind share? Who will pay for the interconnectors for off-shore wind?	National legislation regulates which party is to bear the cost of the whole or part of the cost for each grid reinforcement. Also, national legislation regulates how cost is split between different parts. Varies between the different countries.
24	Several words on climate and clean energy, but also the environmental aspects need to be considered - where windpower may have a significant impact on the local environment. I think it would be valuable to illustrate that also climate is considered in the strategy.	Environmental aspects are considered with a Nordic TSOs vision of climate neutral energy system. Wind power is an important contributor for clean energy, extensive electrification of society and industry and achieving the climate goals. It is the TSOs responsibility that wind power can be connected to the grid and that the energy can be transported in the grid. The TSOs are

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		however not responsible for or have no opinion on where wind power is implemented and how and where it effects local environment. The TSOs focus and mission is to support electrification.
25	The biggest current challenge is caused by the inadequate grid capacity. How and when this is taken into account?	All TSO:s have coordinated plans for the expansion of the Nordic grid that are more ambitious than for many decades. The primary issues are knowing what and where the upcoming demands are and what then would be an adequate grid. To some extent CAPEX is a limited resource and needs to be spent wisely therefore expanding the grid on confirmed on demands. Other issues are the long permitting processes that challenge time from plan to actual implementation as well as the implementation capacity for delivering to the number and size of investments projects.
26	TSOs to consider the benefits of allocating long-term capacity, specifically annual capacity, on the interconnectors	From time to time, Nordic TSOs evaluate some interconnectors to allocate long-term capacity to support financial hedging market.
27	The work on investigating offshore market design should be considered as a short-term milestone, and not a long-term milestone. The timescales for offshore wind and interconnector development and construction are significant.	Work on offshore market design is ongoing on the European level, both through ENTSO-E and other cooperation. We agree that the fundamental design needs to be clarified short-term, but there might be additional design issues that comes up over time, so it is also a continuous process.
28	On wind strategy: will proactive balancing reduce market participants' possibilities to do self-balancing and hence reduce need for pro-active and reactive balancing by TSOs	Self-balancing is a complicated issue, particular in situations with congestions within bidding zones. Self-balancing may then lead to actions that are counter to the system needs and then lead to security of supply risks.
29	In Sweden, the winter has been challenging regarding operational security. You did not mention operational security in relation to your 2030 vision, however that is the main mission of the TSOs. Please comment on this in relation to the upcoming norm on electricity adequacy.	Nordic TSOs share you concern, the vision includes secure system operation as a part of the harmonized market and secure power system.
30	It can be observed that new technology to control the power flow is developed with the American company Smart Wires in the lead. With this technology the TSO can route the flow from overloaded transmission lines to transmission lines with unused capacity instantly and continuously. Due restrictions related to stability and security issues, transmission lines are hardly used up their thermal capacity (normally below 50%). How do you assess how this new technology can support the challenges you now face from increased demand for transmission capacity from both producers and consumers?	This is so far a R&D topic in the TSOs but it will be looked deeper into. More efficient utilization of the (existing) grid is one of our main concerns.
31	Will all the new wind power result in even lower capacities between Swedeish areas? Have the congestions in transmission grid (within SE and between SE-FI) affected wind power building	<p>Wind power added to the grid only to a small extent affects the actual transmission capacity in the transmission network. However, if wind power contributes to displace other power production that contributes with rotation energy and/or voltage support, the capacity between the Swedish areas may decrease as an indirect consequence of wind power.</p> <p>Wind power (or other production or consumption) that is planned is affected by the expected electricity price in the area to which they intend to connect. To what extent temporary bottlenecks and the then lower/higher electricity prices this leads to in each electricity area on either side of</p>

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		the bottleneck has led to plans being turned down or become more relevant, is hard to predict since the electricity price is only one of many factors that affect the investment's GO or NO GO.
32	What role will RSC play in this strategy?	RSC, and soon RCC, will improve the operational planning. Operational planning is challenged by more HVDC links and more renewables. RSC services will help utilizing the Nordic grid and help improving system security
33	How will the TSOs approach firm vs. non-firm (flexible) grid connections going forward?	Non-firm (flexible) grid connections will challenge system operation. Clear agreements must be made
34	What's the obstacle for a Nordic ISO/ITO?	The Nordic TSOs argues the TSOs solution is the preferred one
35	Are there specific solutions for grid losses to optimize the power delivery, especially in longer north-south connections?	There is software used for grid loss optimization in the TSO in different extent
36	For the integration of variable renewable electricity into the existing grid, dynamic line rating solutions advisable to consider. This allows for unused capacity to be identified which reduce the curtailment of renewable energy. Heimdall Power offer such a solution. Have any of participants considered or tried out this category of solutions?	Dynamic line rating is a topic considered and to some extent used by the TSOs
37	Do you see a model where government or TSOs determine a renewable energy zone (e.g. REZ in Australia, and offshore wind development model in many European countries) and build transmission infrastructure, and onshore wind projects bid for the access, work in the Nordics?	This question should be directed towards legislators rather than TSOs. There are national differences with regards to e.g. use of auctioning of offshore wind parks etc. There are currently no proposals that we are aware of to introduce similar models for onshore wind.
38	What is new here? The Electricity market directive and the network codes are already describing a big part of this. Why not focus on the implementation of existing legislation? Where do you find the need for this particular initiative? Is not the existing legislation satisfactory to the Nordic TSOs?	This strategy work is not primarily directed towards the European legislation. The Nordic TSOs are fully committed to the work of implementing existing legislation. However, in order to realize the ongoing transformation of the energy sector significant efforts are needed. The Nordic strategy work focuses on what we from the TSO side see as important and necessary steps.
39	Can a private company build a cable between two Nordic countries?	The European legislation does not prevent this. Note however, that the Swedish electricity act states that concessions for interconnectors only can be granted to transmission grid companies (defined as a company that has a concession for a line that is part of the transmission grid). The European legislation also put up requirements on how congestion income may be used, with a possibility for new DC interconnectors to be exempted from those rules for a limited period.
40	Don't the low area price reduce wind power investments' profitability in Northern Sweden?	It is market participants who make their investment decisions. Naturally the price level will impact profitability of investments.
41	Will there be incentives to ensure consumption increases where the production surplus is the highest? Currently it looks like datacenters are keen on developing in southern Norway and southern Sweden	There are many factors determining the localization of large consumption and we are well aware of the fact that the power system is not the only factor. We however believe that it is important that the right incentives are in place so that the needs of the power system are also taken into

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	(better internet connection) - increasing the supply/demand gap between North and South	account when localization is determined. This can be achieved both through connection fees and tariffs as well as the use of correctly configured bidding zones.
42	Do you see a need to harmonize transmission tariffs and/or implement stronger locational signals?	Tariffs are currently primarily a national issue. It should be taken into account that the countries have different structures of their grids and therefore it may be that the different countries need to focus on different aspects of the tariffs with regards to incentives. There is a common understanding that locational signals are and will be important going forward in order to create incentives for localization of production and consumption in the right places.
43	Self-balancing through real-time price signals would be a preferred option.	We are aware of the interest in self-balancing. While there could be potential benefits, self-balancing may also create difficulties and risks with regards to security of supply. Self-balancing would typically be more suitable for systems with limited intra-zonal congestions.
44	Do you include further integration and more interconnectors with other European regions into the strategy, with more possibilities for Nordic power exports and Nordic hydro flexibility value?	This strategy work focusses on the Nordics. However, the Nordic TSOs are also closely cooperating with neighbouring regions. For example, we have recently entered into a Memorandum of Understanding with regards to cooperation around offshore in the Baltics.
45	Would be good to have a bit more technology neutral starting point in this strategy.	The logic in the strategy is that electrification is a key part in reducing CO2-emissions and that wind power is likely to be a major contributing source of the electricity needed for this. Wind power is also changing the power system in many ways, and therefore the TSOs need to develop strategies to handle both positive and negative impacts of growing wind power.
46	Will the market be controlled by the TSO's or is there room for private energy companies and developers to invest and participate?	If the market refers to the transmission grid market, we believe that this is a natural monopoly where different measures in the system will impact the overall system. Therefore we typically do not see the benefits of e.g. individual lines or interconnectors with regards to the overall system efficiency.
47	how will transparency be optimized towards (private) stakeholders?	Transparency is very important, but it is difficult to say how it will be optimized. On the European level the TSOs have implemented the Transparency Platform, which will be further developed to be able to handle more information and make more user friendly. We also aim to be transparent with regards to upcoming changes in e.g. market design and plans for grid reinforcement.
48	what can be said about the economic benefits to the energy transition? to what extent will it contribute to Nordic economies?	It is not within the expertise of the TSOs to assess the overall economic benefits of the energy transition. The energy transition - both on consumption and production side - is a key part in meeting the climate targets and other policy objectives.
49	do you have strong opposition from public for new power line?	The opposition for new power lines varies from case to case. It is however not unusual that there are conflicts with regards to land-use or other aspects when new power lines are to be built. All the TSOs are heavily engaged in dialogues with stakeholders and the permitting process is often a major part in the lead time for new power lines.

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