Market-based flexibility procurement for Nordic DSOs

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INTRODUCTION

AFRY report for Nordic Energy Research: Market design options for procurement of flexibility

- Report is available at https://pub.norden.org/nordicenergyresearch2021-04/
- Project team involving consultants from Finland, Norway, Sweden and the UK
- Main authors:
  - Stian Hackett (Oslo)
  - Heidi Ahoniemi (Vantaa)
  - Hanne Goldstein (Oslo)
  - Espen Døvle (Oslo)
- Many others have also contributed

The EU Electricity Market Directive (2019)* sets the stage

"Distribution system operators shall procure such [flexibility] services in accordance with transparent, non-discriminatory and market-based procedures unless the regulatory authorities have established that the procurement of such services is not economically efficient or that such procurement would lead to severe market distortions or to higher congestion." (L158/159).

"Distribution system operators shall cooperate with transmission system operators for the effective participation of market participants connected to their grid in retail, wholesale and balancing markets" (L158/159).

*EU (2019): Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU (text with EEA relevance). ELI: http://data.europa.eu/eli/dir/2019/944/oj

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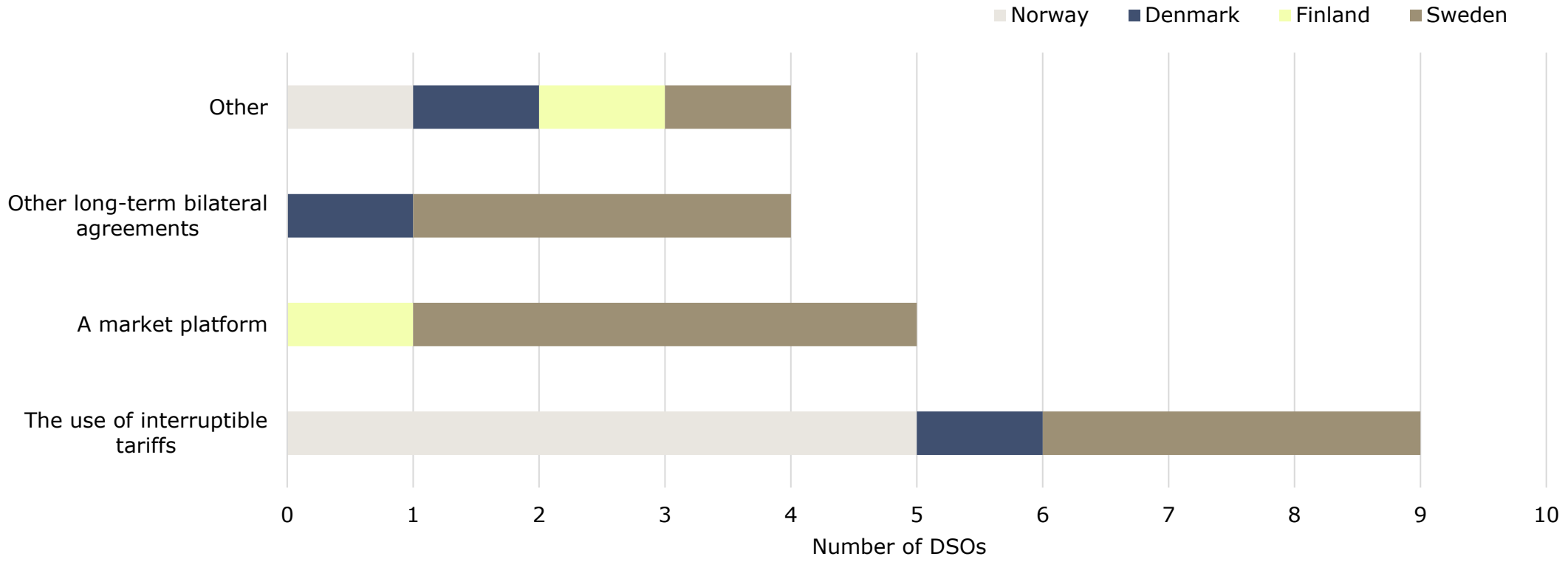
Objectives

- Assess the current and future potential and need for explicit flexibility for Nordic DSOs
- Explore existing solutions for flexibility procurement
- Assess market design options

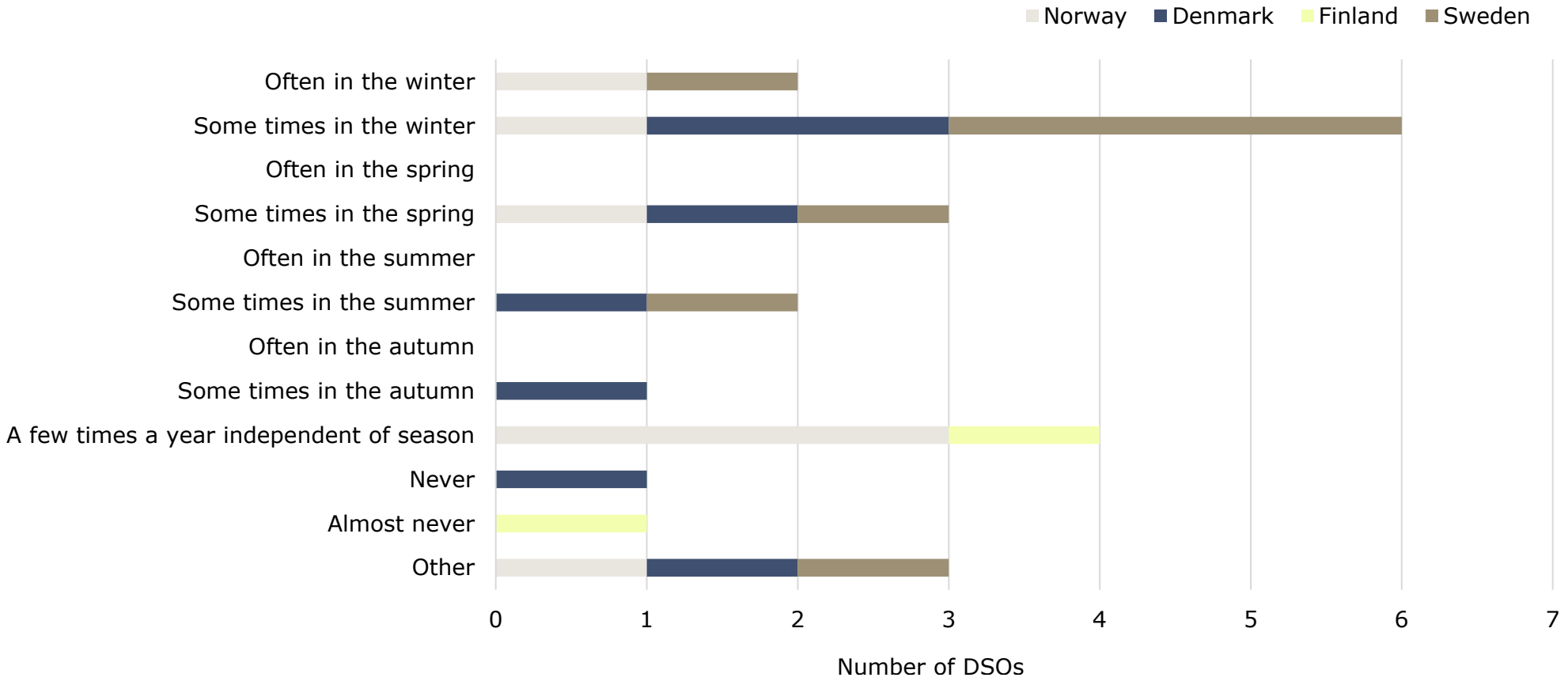
Methods

- Interviews with stakeholders (DSOs, flexibility service providers, regulators, flexibility marketplaces/pilots)
- Literature review
- Survey of major DSOs in the Nordic countries (14 respondents)

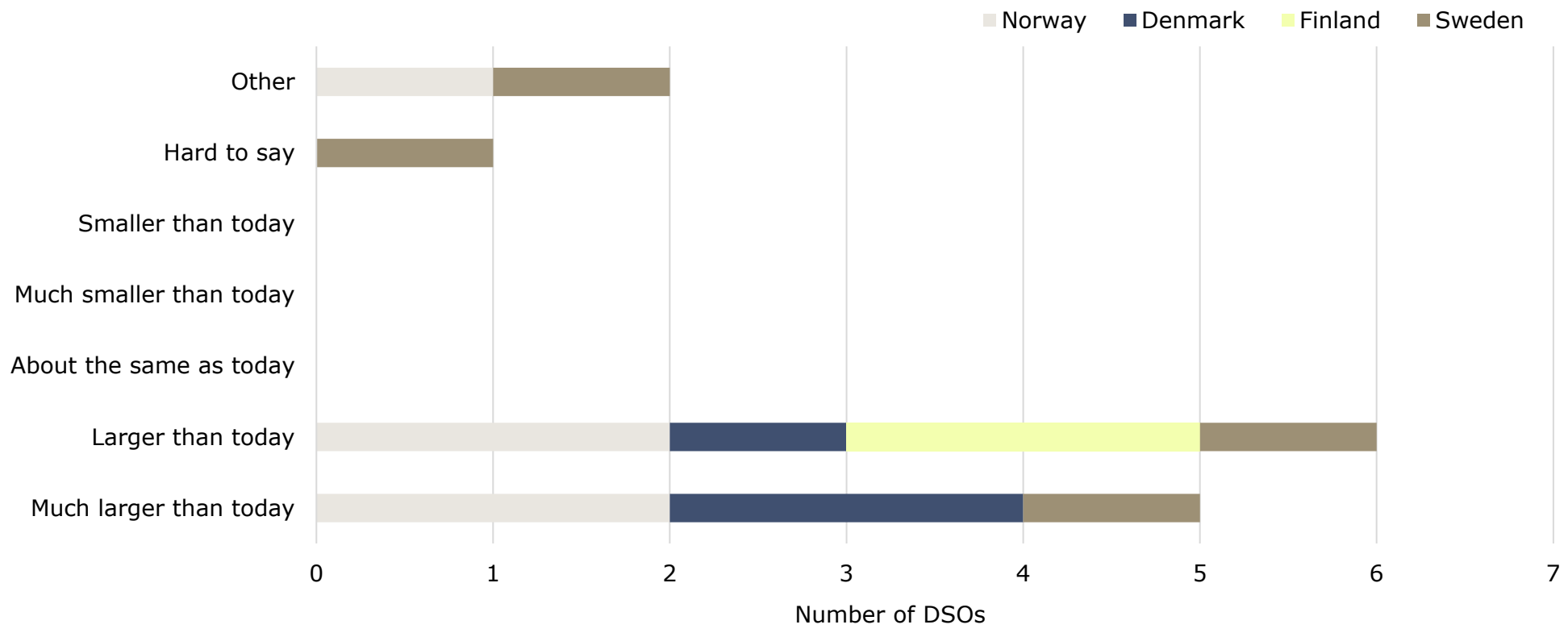
Survey answers to question 4: “Distributed flexibility is currently procured in my company through…”



Survey responses to question 6: “The current need to procure distributed flexibility, as reported in the previous questions, appears:”



Survey answers to question 10: “Given an optimal split (in a societal perspective) between grid investments, implicit flexibility (stimulated by tariffs and other price signals) and explicit flexibility procurement, the FUTURE (2030 and beyond) use of flexibility procurement is likely to be:”



Comparison: the need to procure distributed flexibility arises:	6. Today (number of DSOs):	11. Expectation in "optimal" future (number of DSOs):
Often in the winter	2	5
Sometimes in the winter	6	7
Often in the spring	-	-
Sometimes in the spring	3	6
Often in the summer	-	1
Sometimes in the summer	2	6
Often in the autumn	-	1
Sometimes in the autumn	1	4
A few times a year, independent of season	4	2
Never	1	-
Almost never	1	-
Hard to say	NA	2
Other (free text allowed)	3	2

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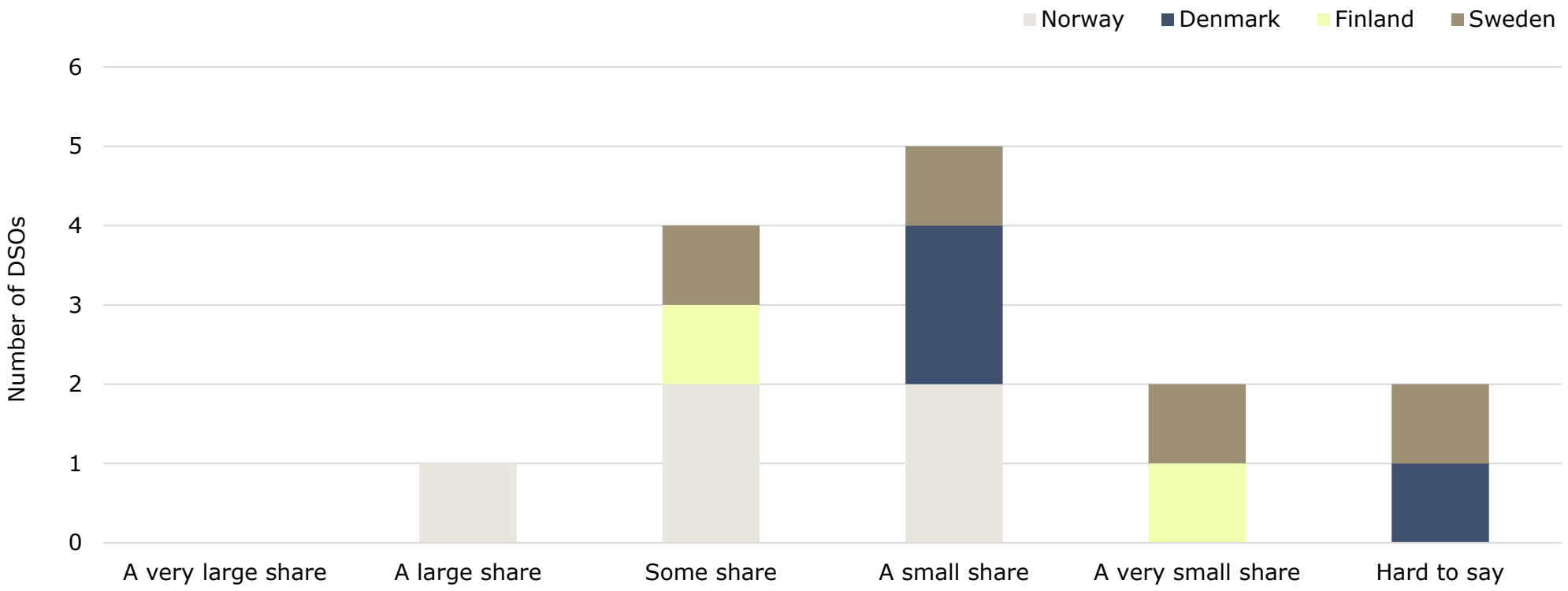
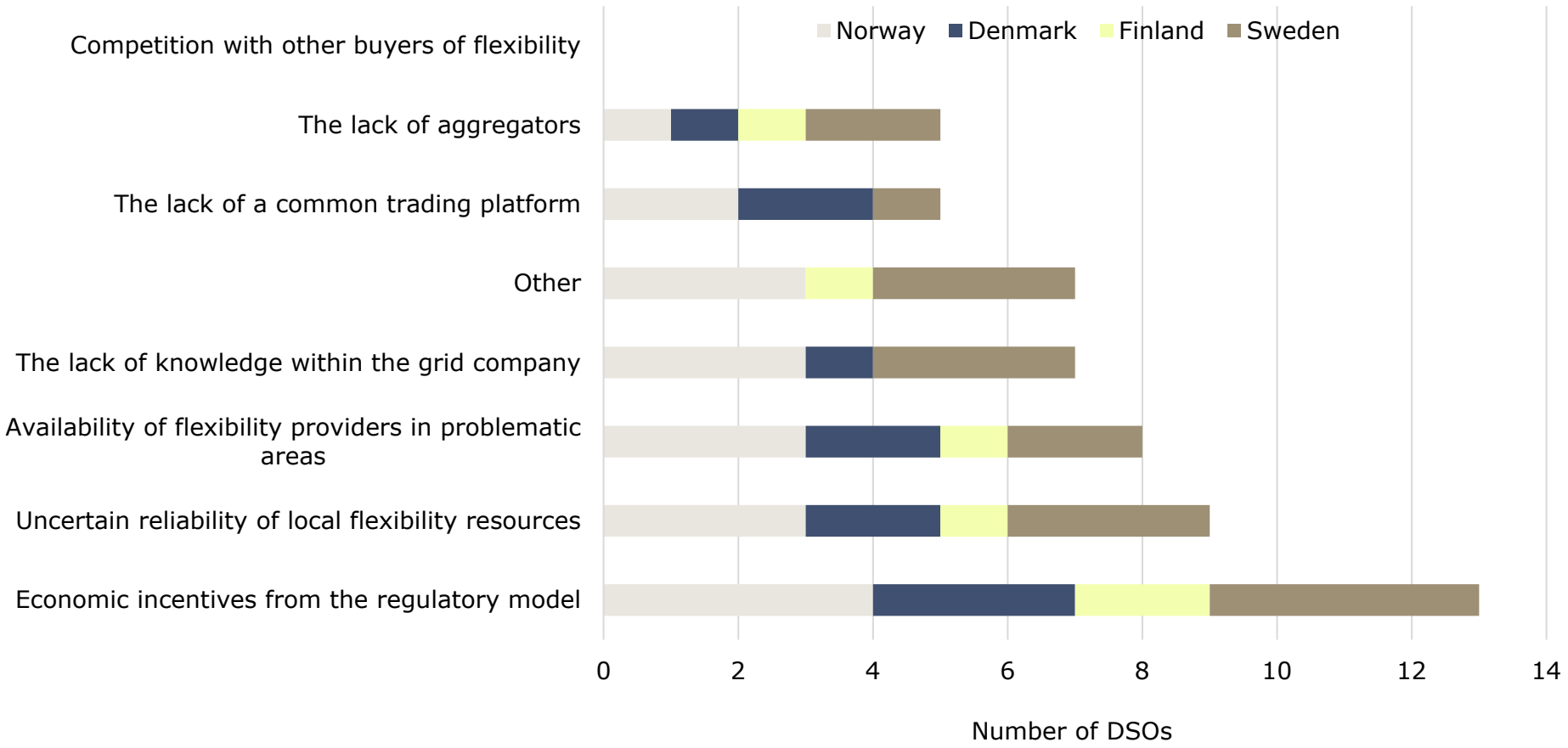
Survey answers to question 14: “Over the next 10-20 years, approximately how much network capacity expansion would you say could be meaningfully reduced or postponed by procuring flexibility, if government regulatory policy provided neutral (socioeconomically optimal) incentives between capacity expansion and all alternatives to it?”



Survey responses to question 15: ”From your side, what are the main current barriers when it comes to procuring distributed flexibility (when flexibility would be useful)”



Insights from interviews and surveys

- DSOs see a growing importance of flexibility, but do not expect it to have a very large impact on the need for network investment
- DSOs emphasise the importance of long-term, reliable agreements
- With an optimal future use of flexibility, activations are not expected to be very frequent, and to be seasonally dependent
- Current regulatory incentives are identified as a barrier

Photo: Energifyn.dk

Market design options and dilemmas

BENEFITS OF MARKET-BASED SOLUTIONS

- Access the cheapest sources of flexibility
- Buy flexibility only where and when it is needed
- Elicit the real willingness to buy and sell flexibility, versus the alternatives

KEY CHARACTERISTICS FOR FUNCTIONAL MARKETS FOR DSOS

- Reliability and long-time assurance of availability: especially important for highly local problems
- High liquidity (where possible) – needs to be attractive for flexibility providers
- Options to buy availability on both longer and shorter time horizons when possible
- Regulatory incentives should enable DSOs to optimise the use of flexibility

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Current market initiatives: long-term and short-term market mechanisms

- **NODES:** combined long-term availability and short-term activation
- **PICLO FLEX:** long-term contracts
- **Enera:** short-term activation (intraday timeframe)
- **GOPACS/ETPA:** short-term - direct sourcing of bids from intraday market

However:

Piclo may add a market mechanism for short-term activation, while Enera and GOPACS may add market mechanisms for reservation*

*According to Schittekatte, T & Meeus, L (2020): Flexibility markets: Q&A with project pioneers. Utilities Policy, 63 (2020).

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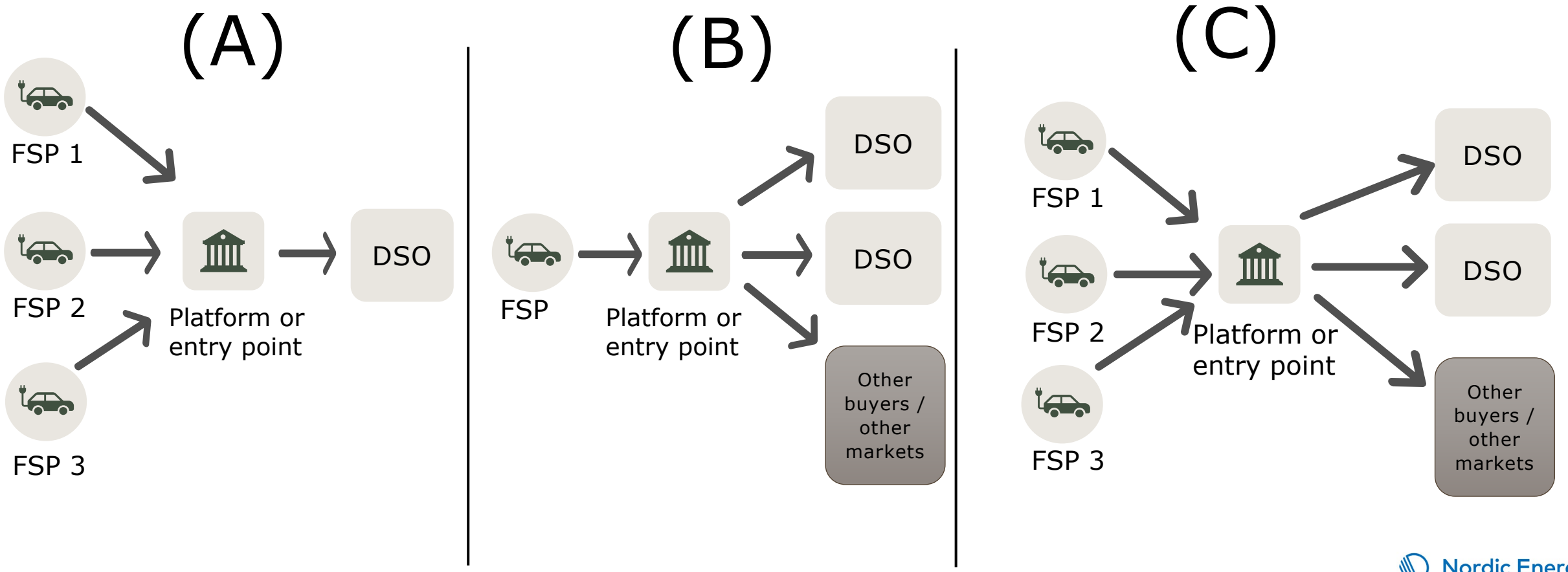
«Few» or «many» marketplaces



Adapted from report, p.60

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Summary and steps forward

- Learning and innovation from new markets and pilot studies is currently going on. At least at the current moment, it seems risky to commit too strongly to one particular, very comprehensive and centralised architecture
- DSOs can learn from each other in the development of flexibility products
- Developing systems for information exchange between system operators
- Incentives for flexibility in the regulatory models may need review
- Regulators may also need to review the interplay between the development of markets, current non-market flexibility tools such as interruptible tariffs, and rules for who should pay for network capacity through e.g. connection fees and investment contributions

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CONCLUDING REMARKS

Contact us

- Reach out to us for more information:
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- More webinars will follow with relevant topics, and any update on the evolving situation.
- Next webinar:
  - **Engineering Demand Management: Supporting your company to manage future wind engineering growth**
  - Thursday 15 July
  - 14:00 BST / 15:00 CEST
  - **Sign up:** https://afry.com/en/events/engineering-demand-management

Q&A

Which countries of Nordics were covered?

Norway, Sweden, Denmark, and Finland.

How do you best allow flexibility to be used at different levels with very different geographic footprints - DSOs as well as e.g., TSOs and suppliers - without conflicts or unnecessary duplication of assets?

(and)

What is your advice on how this topic is connected to the development of DSO-TSO coordination methods?

That is an important topic which we describe in some detail in the report, but there is still a lot to be learned. It is quite often brought up that some level of coordination between system operators is needed, but there is not always agreement about how advanced it needs to be, and in some cases, there may be different ideas about which system operator should be responsible for what or whose needs have priority. Coordination between system operators, would at a minimum, involve some form of information exchange between them. That will probably be useful in any case, whether or not there is an advanced flexibility market. The same goes for allocation of responsibilities and priorities. Conceivably, coordination can also involve a more advanced 'traffic lights' system or having the system operators trade in the same marketplace with the same products. In the report we also describe DSO-TSO coordination platforms.

The process to define the coordination arrangements should begin with an understanding of the obligations and rights of each of the system operators towards its network users and each other. The coordination agreement needs to resolve circumstances in which the actions of one actor may impact costs for another actor, and the circumstances in which these costs must be taken into consideration and/or compensated. An ideal outcome would be that decisions are taken which consider the total system implications not just the costs to a single actor. Ultimately, such agreements need appropriate regulatory frameworks and incentives.

Q&A

What key differences are there amongst the different Nordic countries? How do the findings translate to different markets (NW-Europe)?

There are several differences, for example when it comes to regulation. Some differences are however more temporary than others, and regulation is often changed. When it comes to some of the more permanent or long-lasting differences, the natural resource endowment is one, especially Norway is a somewhat unique country because it has so much cheap hydropower and for that reason already a very high degree of electrification, for example in heating and increasingly also in transport. That has consequences for how the existing electricity network is built and operated. Denmark, on the other hand, is more similar to other (non-Nordic) European countries.

When it comes to transferability, many of the key features of flexibility market solutions for DSOs can be quite similar between different countries because the problems one is trying to solve are sometimes similar. But there can be quite large differences in the use cases for flexibility within countries, for example, whether flexibility is needed in a city or in a rural area, at which voltage level it is needed, whether it is needed to avoid curtailment of renewables or to reduce maximum demand, and so on. It can be productive to look to other countries to see if the particular problem that one is trying to solve has been addressed elsewhere. If we find that it seems problematic to implement good solutions used in other countries because of for example regulation, then maybe we need to look at the regulation.

We do see that the NODES platform is being used in several countries that are quite different (Norway, Germany, Sweden, UK). In part, this is because the platform itself is quite adaptable. The basic products that are traded there are also applicable to many contexts.

Q&A

On which time scale should DSOs procure flexibility? A long time scale gives DSOs more long-term security with respect to alternative network investments. But a short time scale would allow flexible demand, batteries and renewables to participate more.

It should probably be possible to procure it on multiple time scales, whatever fits the local situation. As the question says, DSOs will often want long-term reliability. Short-term activation markets can, however, enhance efficiency by using the flexibility that is cheapest at the time when it is needed. The NODES market has combined both approaches by having long-term contracts for availability but also have competition close to the activation phase. So one does not have to exclude the other; they can be a part of the same market.

The efficiency of dispatch can be enhanced further by market mechanisms in which the sellers may enter into secondary trading of long-term obligations for availability (while ensuring that the equivalent service is provided to the system operator by the replacement provider).

How can a centralised TSO be flexible enough to include and promote micro-producers?

If you have rooftop solar PV in mind, the impact of their unpredictability on the system balance would normally first be the responsibility of the balancing responsible parties (BRPs) of those prosumers. The BRPs (through intraday trading) and the TSO (through the balancing markets) can source flexible resources from a wide geographical area to counteract the intermittency and unpredictability of these resources. The more local impact of micro-producers / prosumers on the distribution grid is the domain of the DSOs.

Q&A

Although we are talking about Nordic countries, is Solar PV feedback a concern originating lack of capacity from DSO to absorb excess energy generated in rooftops and not consumed locally during summer?

We have not looked closely into this in this report. Currently and in the near future, our impression is that it may be a concern at lower voltage levels in the distribution grid. However, the further down in voltage levels you go, the more difficult is it to use market-based solutions due to the small number of possible flexibility providers. The main focus of most of the Nordic DSOs we have talked to or surveyed seems to be the winter season. Yet, the issue may need to be studied further as solar PV is growing quickly also in the Nordic countries.

Would you still not want to enable competing market places? FSPs would be free to select the marketplace, while all marketplaces should be connected to all flexibility buyers.

That kind of approach is described in the report and is something that is considered by for example GOPACS – it could connect to multiple intraday markets. It is also a part of the approach in the INTERRFACE project which the report references. The challenge of this approach is to develop a good system for interoperability. We discuss both pros and cons of this kind of approach in the report but do not take a strong stance on it; the need for innovation is still high.

What are the main flexibility providers?

For DSOs, technologies include management of distributed generation, distributed batteries and demand-side management from different sectors. Looking forward, with the electrification of heat and transport at low voltage levels, we would expect these to be important providers of flexibility. District heating can also be an important contributor in some cities.

Q&A

It is natural that if flexibility is used often, then it is better to reinforce the network.

The answer may be 'yes and no'. Some uses of flexibility are very low impact e.g. moderating the timing of (home) EV charging: this may be cheaper than building capacity to permit everyone to charge coincident with the natural system peak.

The trade-off will vary on a case by case basis: it depends on how inexpensive and reliable flexibility is compared with the cost of upgrading (or accelerating the upgrade of) the network. Flexibility can be used as a temporary solution, often to postpone an upgrade.

Is it hard to make the trade-off between market-based flex and network reinforcement, as the market-based process entails that the price will be revealed when it is too late to invest? How about reservation payments?

In our view long-term contracts for availability/reservation, as described in the report, can also be in the category of market-based procurement. For example, an auction for long-term availability/reservation contracts is also a market.

The challenge is to combine long term procurement and short term efficient dispatch. In long term procurement, the strategy between having a fixed or floating activation price is one of the subtle aspects of auction design: there is no 'right' answer. However, for any DSO to take the "flexibility/capital investment" tradeoff in a way that is optimal from a societal perspective, the incentive regime has to give neutrality between OPEX and CAPEX. The RIIO incentive regime in Britain is an example of an attempt to achieve this neutrality.

Q&A

In Denmark, there is a lot of talk about hydrogen production for electricity and biogas to provide flexibility, but how central is flexibility in a country like Denmark, which has so many connections, with both the Nordic connection, the German connection and soon the Viking line to the UK?

If flexible resources are connected to the distribution network, they can be useful to solve local congestion problems or reduce the need for network investments to accommodate them. For many cases of local congestion in the distribution network, interconnection at the transmission level will not help. Interconnection may reduce the need for flexibility at a system level, but it can also give flexibility resources in Denmark more work to do if the interconnection goes to countries where prices are more volatile than in Denmark and where imbalances are a more serious problem. So it depends on where the interconnection goes and what the situation is in that country.

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