DEMAND SIDE FLEXIBILITY FROM A NORDIC DISTRIBUTION SYSTEM OPERATOR PERSPECTIVE

NordREG workshop on flexibility

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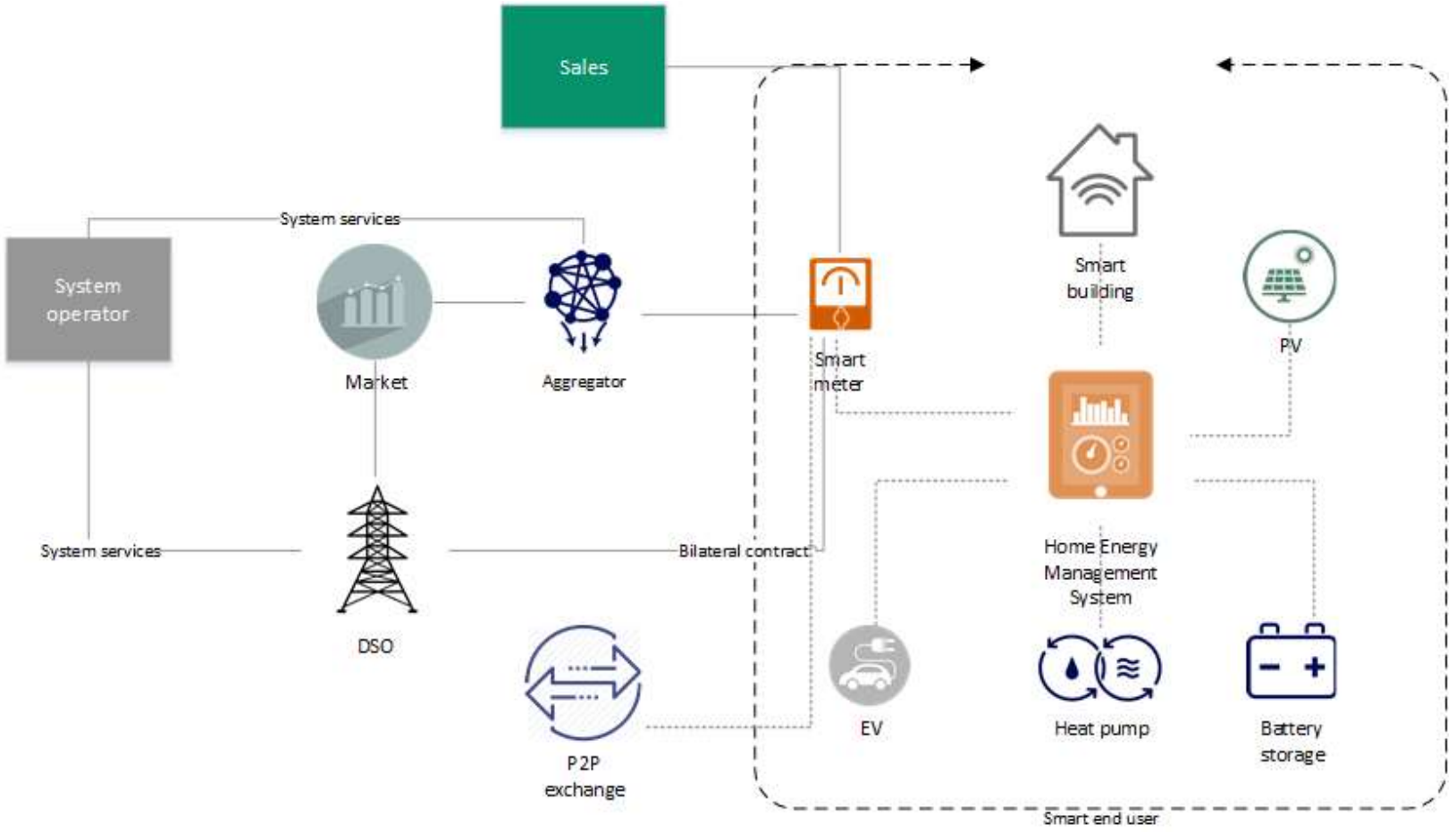
1. CONCEPT STUDY

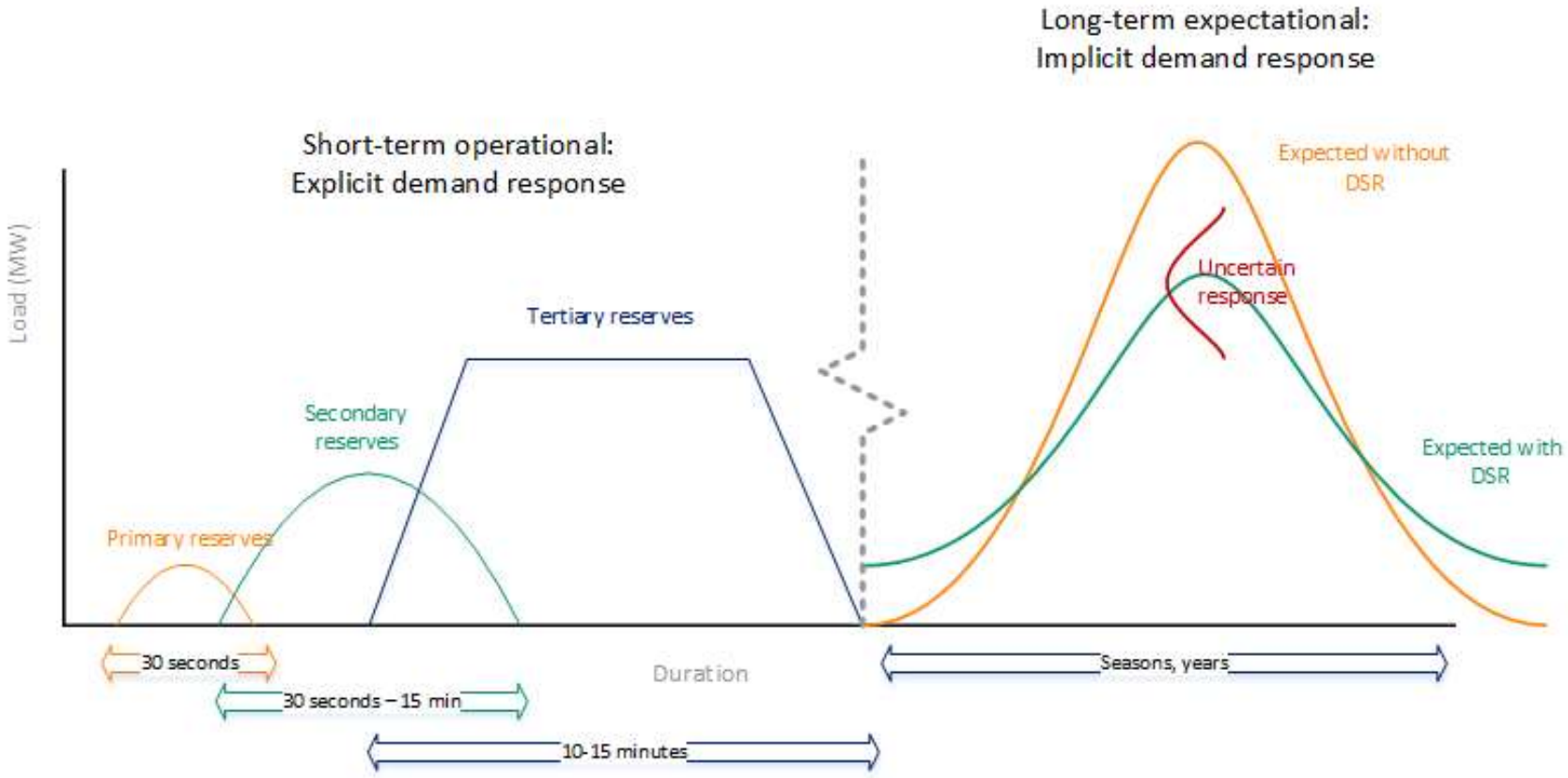
MAIN FINDINGS

DSR is a market-driven process with multiple new roles in the value chain



WHAT IS FLEXIBILITY?

Explicit and implicit felxibility with different usages and timeframes



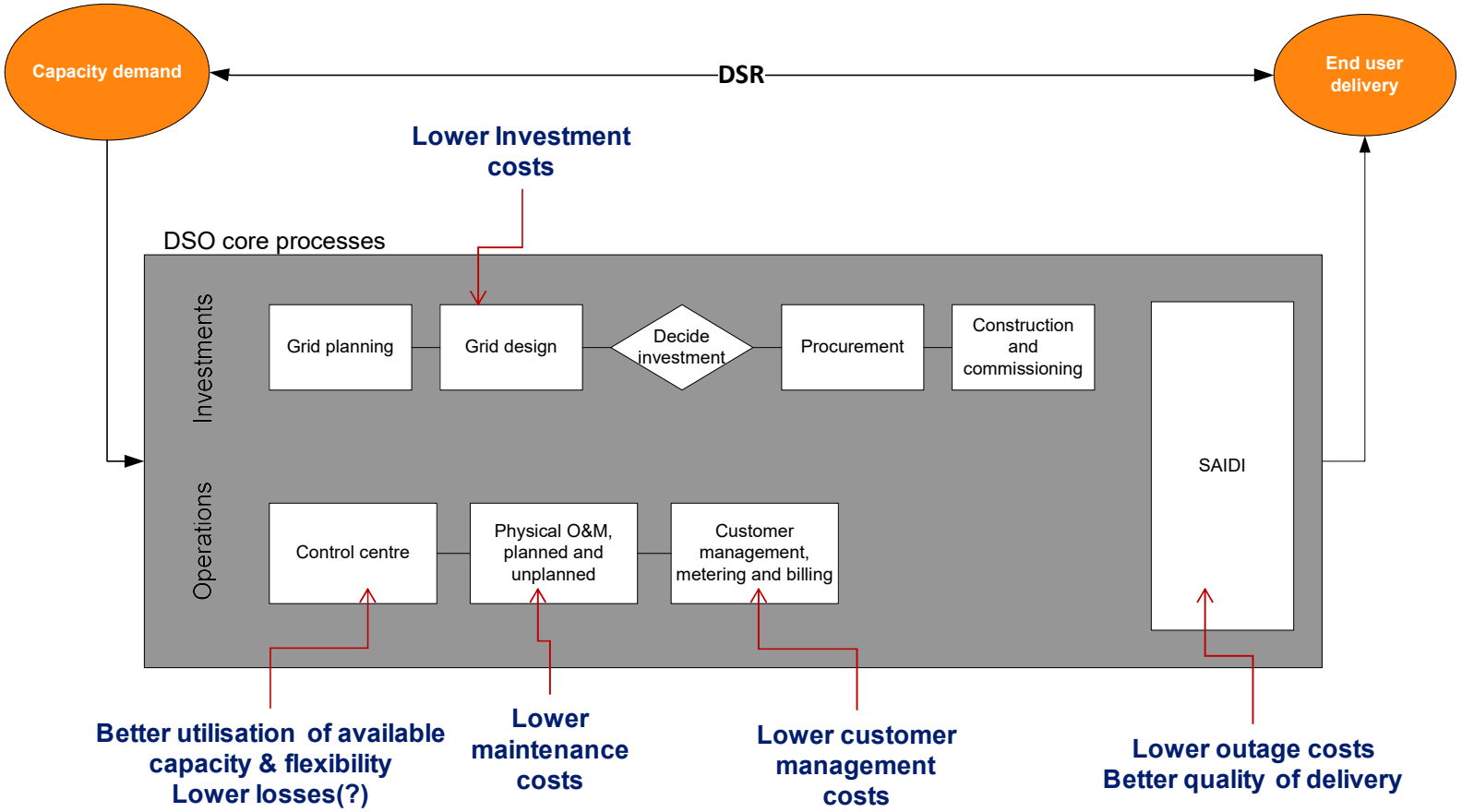
THE SOURCES: WHAT CAN END USERS DO?

A limited number of physical measures

Source	Explicit flexibility	Implicit flexibility
Heating (and cooling) system	Suitable for down-regulation for shorter periods, up to hours	Price signal to trigger substitution with other energ carriers, or to flatten deman curve over the day.
Household appliances	Limited flexibility, except refrigeration that can provide down-regulation	Flatten demand curve with systematic shift in time-of-use of wet appliances
Local generation of electricity, like PV systems	Limited capability, may down-regulate generation	May increase need for flexibility, but also reduce long-term need for capacity depending on technology
Local storage, hot water or electricity (batteries)	May shift load from hours up to days. May provide both up- and downregulation	Flatten demand curve for all usages (el or heating hot water)
Transportation, i.e. electrical vehicle (EV) charging)	Suitable for down-regulation, may provide up-regulation (cost issue)	Flatten demand curve with controlled charging behaviour

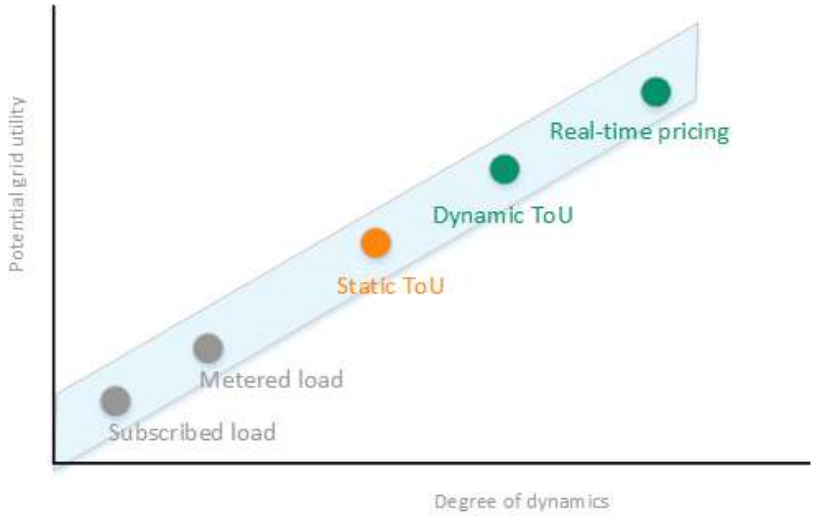
DSO VALUE AND BENEFIT FROM DSR

Both direct and indirect benefits for DSR and automation



END USER INCENTIVES

Price signals are important, but not the only incentive

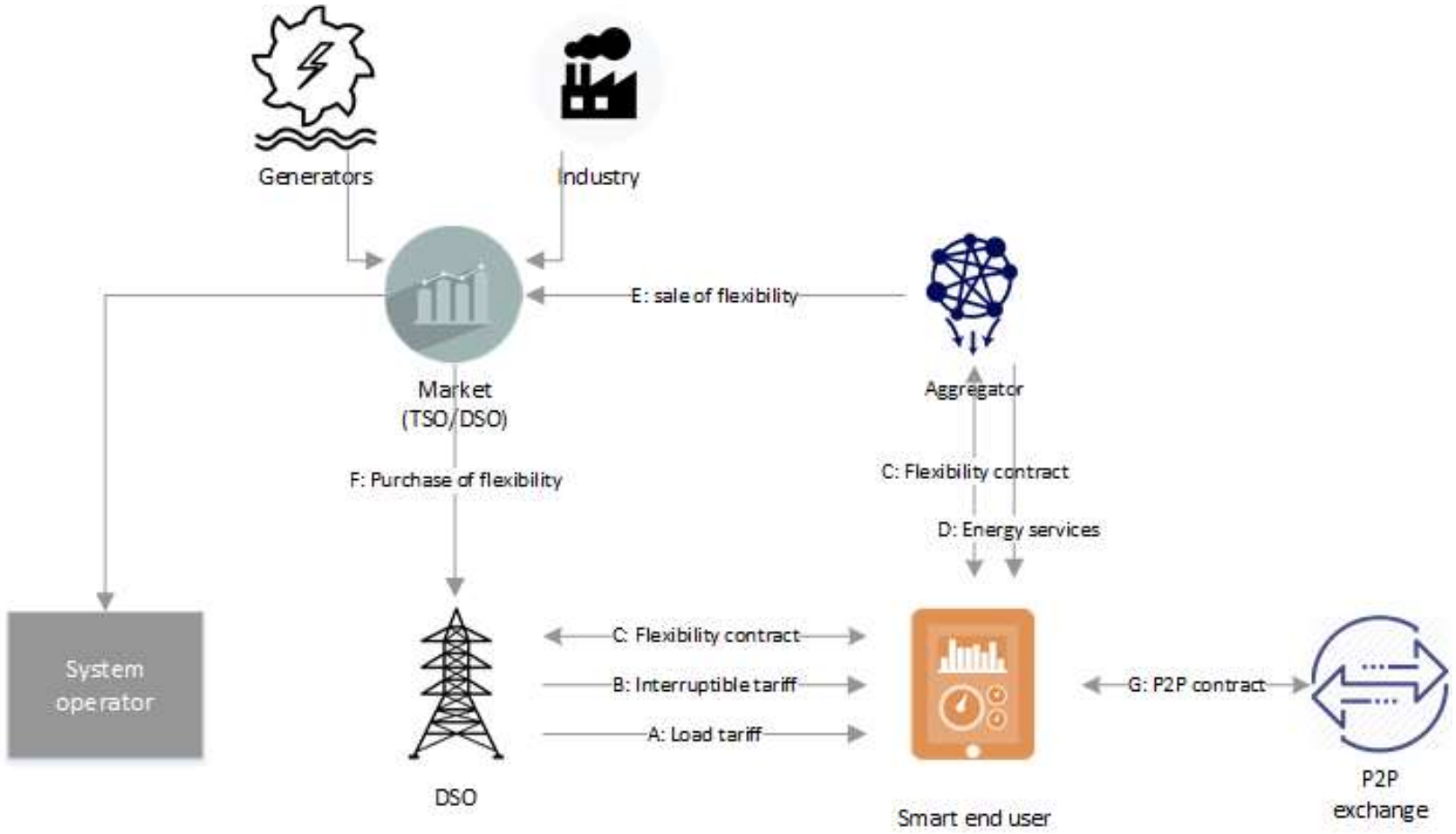


What are the benefits to the end user?

- Financially, in the form of direct payments or reduced costs, for example on grid tariffs or on reduced energy consumption
- Increased comfort, that are of subjective value to the end user in the form of a more well-functioning home
- Increased security, which could be alarms or surveillance, health monitoring etc.

NEW BUSINESS MODELS

DSOs play crucial role in creating the commercial basis for new business models



NEUTRALITY: WHAT CAN AND SHOULD DSOS ENGAGE IN?

Balance between principles, efficient markets and efficient mechanisms

Criteria

- Equal access to end user data to all relevant parties
- Equal access to DSO procurement of services from all qualified parties
- Level playing field between grid investments and flexibility mechanisms
- Non-discrimination between grid customers with regards to connection and tariff terms

Battery storage

- Network services
- Market services
- Well-functioning markets?

Bundled services

- DSO and aggregator part of same group
- Prioritisation between own investments and purchase services

Tariff discrimination

- Effieciency of price signals
- Equal treatment of all grid customers

REGULATORY BARRIERS

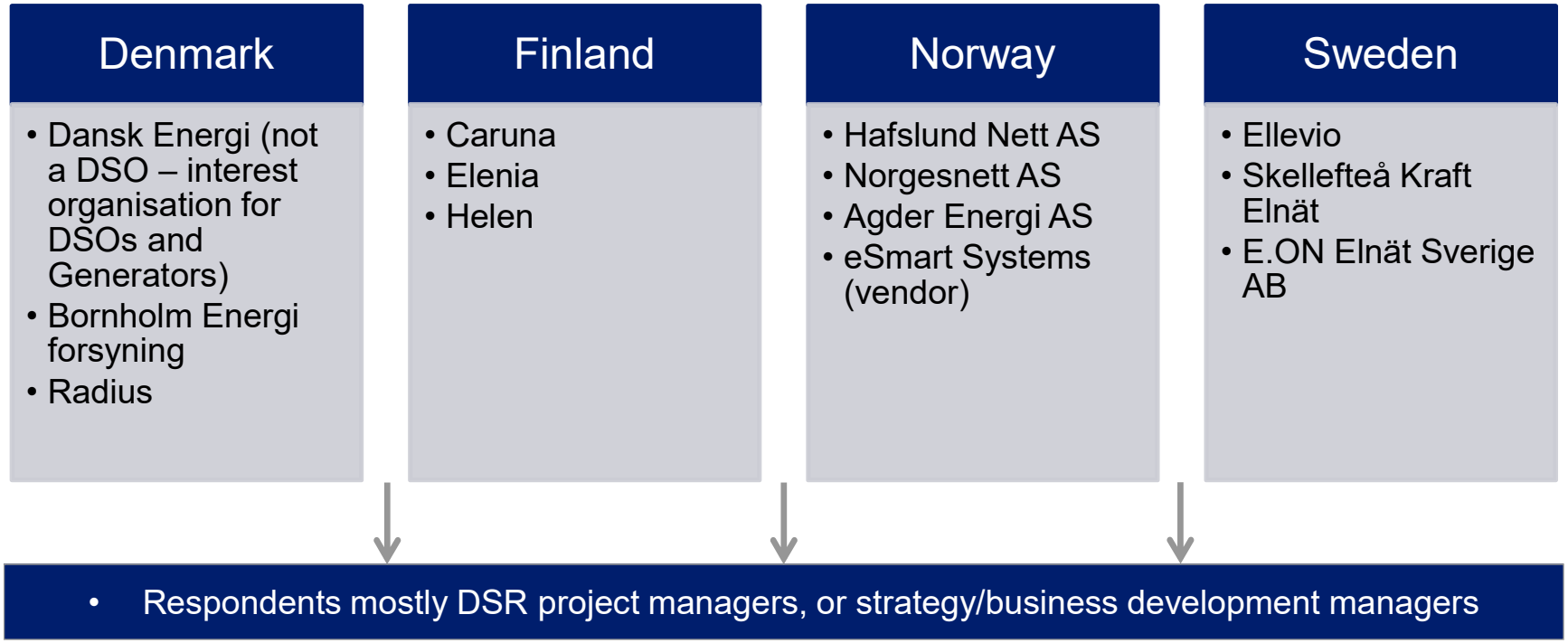
Main barriers linked to DSO role constraints and neutrality constraints

Area	Assessment
Tariff regime, with regards both to design and use of price signals, and possibility to discriminate between customers on network benefit grounds.	This is judged to be a crucial issue, where forthcoming tariff regulatory reform will significantly affect the possibilities to realise DSR benefits
Access to and DSO involvement in flexibility markets for end users	The main issue to consider is whether DSOs should be allowed to use bilateral flexibility contracts, to the possible detriment of aggregator and market-based models
Allowed DSO activities and roles, like ownership of certain assets and DSO involvement in flexibility markets.	We point to that there are very strong arguments in favour of allowing DSOs to own and operate batteries for grid support
Income or profit effects of buying flexibility, e.g. that certain uses of DSR is to detriment of DSO profitability due to income regulation models	We find this to be a problem of moderate importance in the current regulatory models in the Nordics
Access to and use of data from end users	This is not found to be a major challenge, as current regulations adequately balance data privacy and customer protection with commercial needs

2. INTERVIEW STUDY

INTERVIEW CANDIDATES

We interviewed companies that have shown activity or interest in the field



MAIN QUESTIONS

Interview study questions in 4 topics

1)	Current status	• DSOs use of flexibility today • DSO knowledge of network needs and potential costs or quality issues
2)	Value of flexibility	• What kinds of flexibility • Short-term value • Long-term value
3)	Barriers	• Technology, market, regulation, and user behaviour
4)	Planned actions	• DSOs planned actions, and outlook for the market

1) CURRENT STATUS

The DSOs grids are typically over-dimensioned, and DSR activity is – if any – at the R&D stage within the respondents' organisations

Issue	Norway – 3 DSOs	Sweden –3 DSOs	Denmark – 3 DSOs	Finland – 3 DSOs
Current DSR activities	Either commercial and/or pilot activities	No current activities	Research and demonstration activities	Limited
Current DSO information on capacity restraints within their network area	Limited information at distribution level.	Limited information on distribution level.	Limited information. No constraints. Some potential in DK2, which is not over-dimensioned	Good offline information. Online solutions are on the way
Sufficient systems to make use of available DSR flexibility	Not sufficient at distribution level	Not sufficient	Not sufficient, except new SCADA technology	Some DSOs have systems sufficient for predictive DSR, but not real-time
Third party interest in DSR	Few third party companies around	Only research organisations	Very few commercial third parties. Some more take part in research projects	Some interest, but very little activity

2) DSO VIEW ON VALUE OF FLEXIBILITY

The main value of DSR in the DSO business area is assumed to be long-term; to avoid/postpone investments in the grid. The respondents see digitalisation as a prerequisite for the sucess of demand flexibility.

Issue	Norway – 3 DSOs	Sweden – 3 DSOs	Denmark – 3 DSOs	Finland – 3 DSOs
Main drivers for DSR	Tight situations	Batteries, PV and tightened situations due to increased level of intermittent generation	Primarily wholesale level imbalances, and secondary local imbalances due to EV+battery	Flattening demand peaks. Voltage support from storage
Where in the DSO business process will DSR give most value	Operations and planning	Operations and planning	Operations and potentially planning	Planning
Main benefits to the grid	Buy regulating power instead of outage in tight situations	Lower costs	Buy regulating power instead of outage in tight situations. Lower costs	Stronger grid from lower dimensions
Short term vs long term benefits	Both	Long term but small potential	Short term and potentially long term	Long term
Main prerequisites for realizing value to the grid. Necessary work processes	Digitalization	Digitalization, automation and aggregators	Aggregators	Automation and change in regulation

3) BARRIERS

The regulation and end-user behaviour are mentioned as barriers to DSR development

Barrier		Current situation	Outlook
Technology		Technology generally exists on a research and demonstration stage. Standardization and robustness are challenges. **Not a barrier.**	R&D projects exists/are coming to test current/new technologies
Regulatory		For most countries, capacity tariff is not implemented. Further, the regulation needs to include *stronger* price signals to end-users, and promote classic grid investment vs more risk based (DSR) investments. **Barrier.**	For most countries – regulation is evolving and on the right track. Uncertainties still exist.
End user behaviour		End-users are unaware or uninterested regarding their flexibility, and does not have economic incentives to offer flexibility. Automation is needed. **Barrier.**	Uncertain, but regulatory changes are on the right track for most Nordic countries.
Market		No market present. **Currently a barrier, can change soon.**	Supply and demand changes, and regulation changes can create market.

4) PLANNED ACTIONS

Most DSOs positive towards the value of DSR activities in the DSO business areas, but other than in pilot projects – no concrete plans are mentioned by the DSOs

Issue	Norway – 3 DSOs	Sweden – 3 DSOs	Denmark – 3 DSOs	Finland – 3 DSOs
Price signals	One DSO has had a pilot on capacity tariffs	One DSO is trying new pricing models in a pilot project	Danish DSOs want capacity tariffs and regulation is on the way	Pilots on capacity tariffs
Communication platforms	At a pilot stage	One DSO develops platforms within current pilot projects	Aggregators should develop this	Some DSOs have plans
Bilateral agreements with end users	No concrete plans	No concrete plans	No concrete plans	No concrete plans
Procuring market solutions	Maybe within the next few years	No concrete plans	Maybe within the next few years	No concrete plans, but market is the only way longer term

INTERVIEW STUDY SUMMARY

DSR is currently not a necessary, and barriers exist for its development, but the DSOs see future potential in its business

1)	Current status	• The DSOs grids are typically over-dimensioned, and DSR activity is – if any – at the R&D stage within the respondents' organisations
2)	Value of flexibility	• The main value of DSR in the DSO business area is long-term; to avoid/postpone investments in the grid. The respondents see digitalisation as a prerequisite for the sucess of demand flexibility.
3)	Barriers	• The regulation and end-user behaviour are mentioned as barriers to DSR development
4)	Planned actions	• Most DSOs positive towards the value of DSR activities in the DSO business areas, but other than pilot projects – no concrete plans are mentioned by the DSOs

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