



How can the distribution grid be adapted to facilitate a large-scale electrification of the society?

Online
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How can the flexibility market contribute to the electrification?



Hallstein Hagen

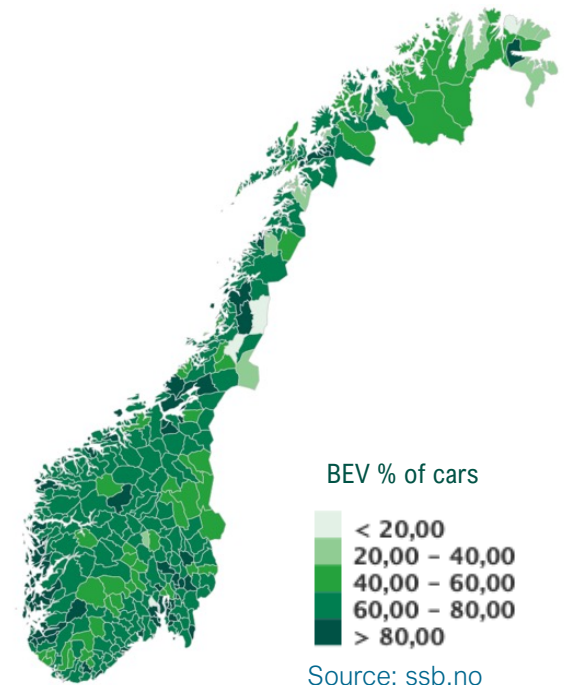
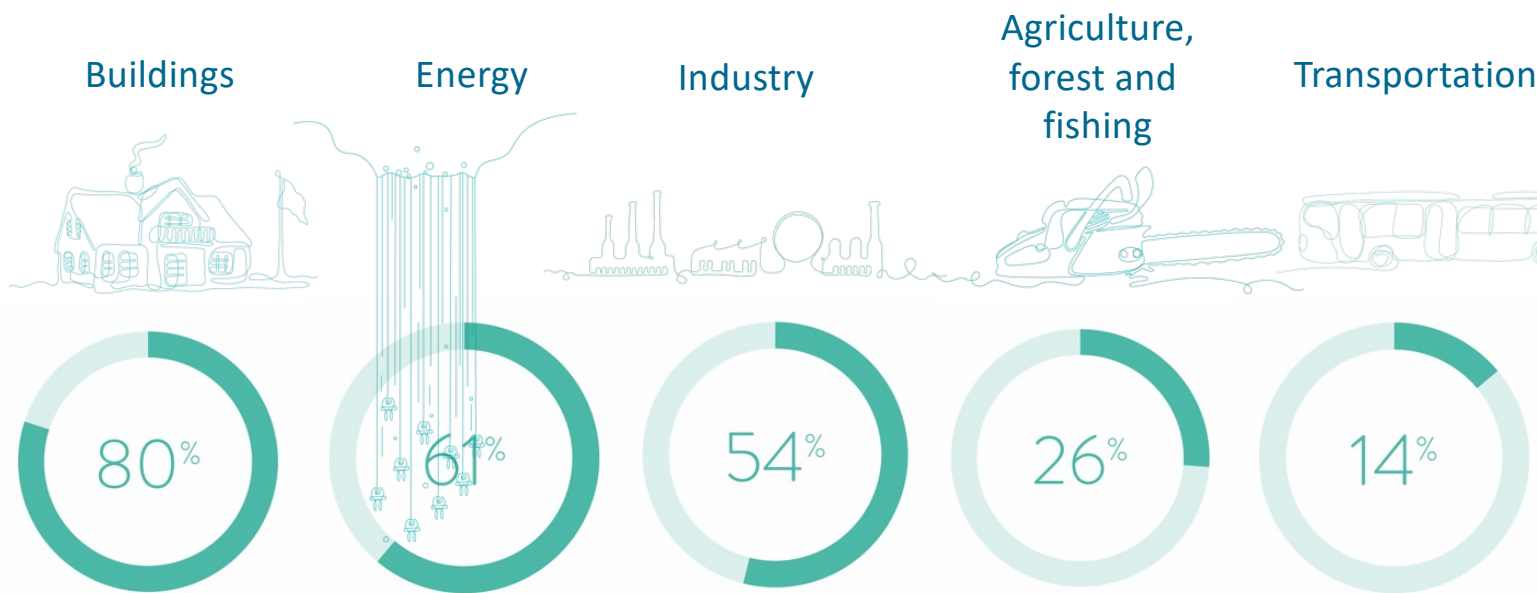
NODES AS

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Electric share of Norway's energy consumption was at 53% in 2021



In 2021 **65%** of all new cars registered were **BEV**



Source: www.elbarometer.no

Source: ssb.no

Will there be enough production?

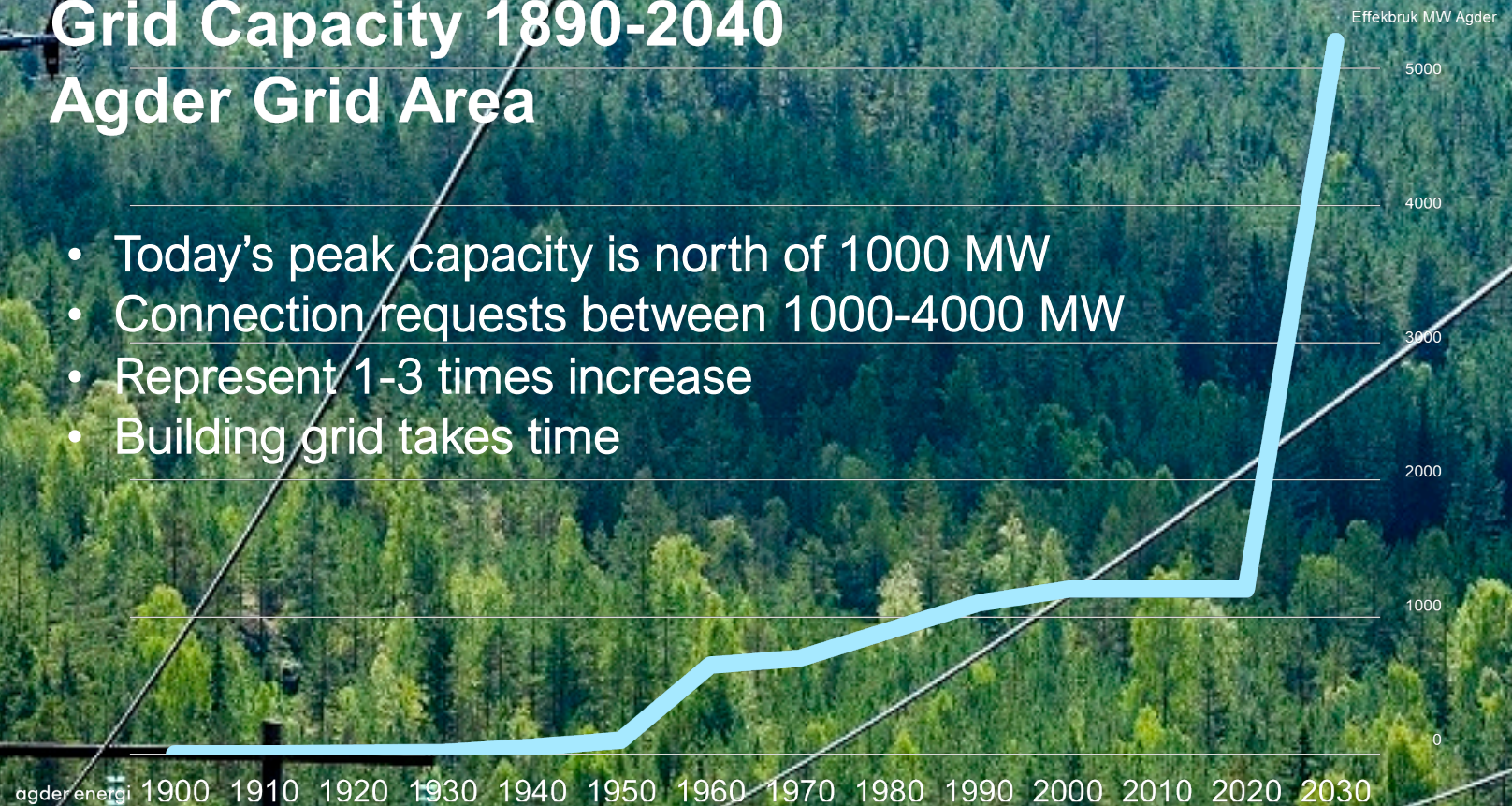


And can it be transported?

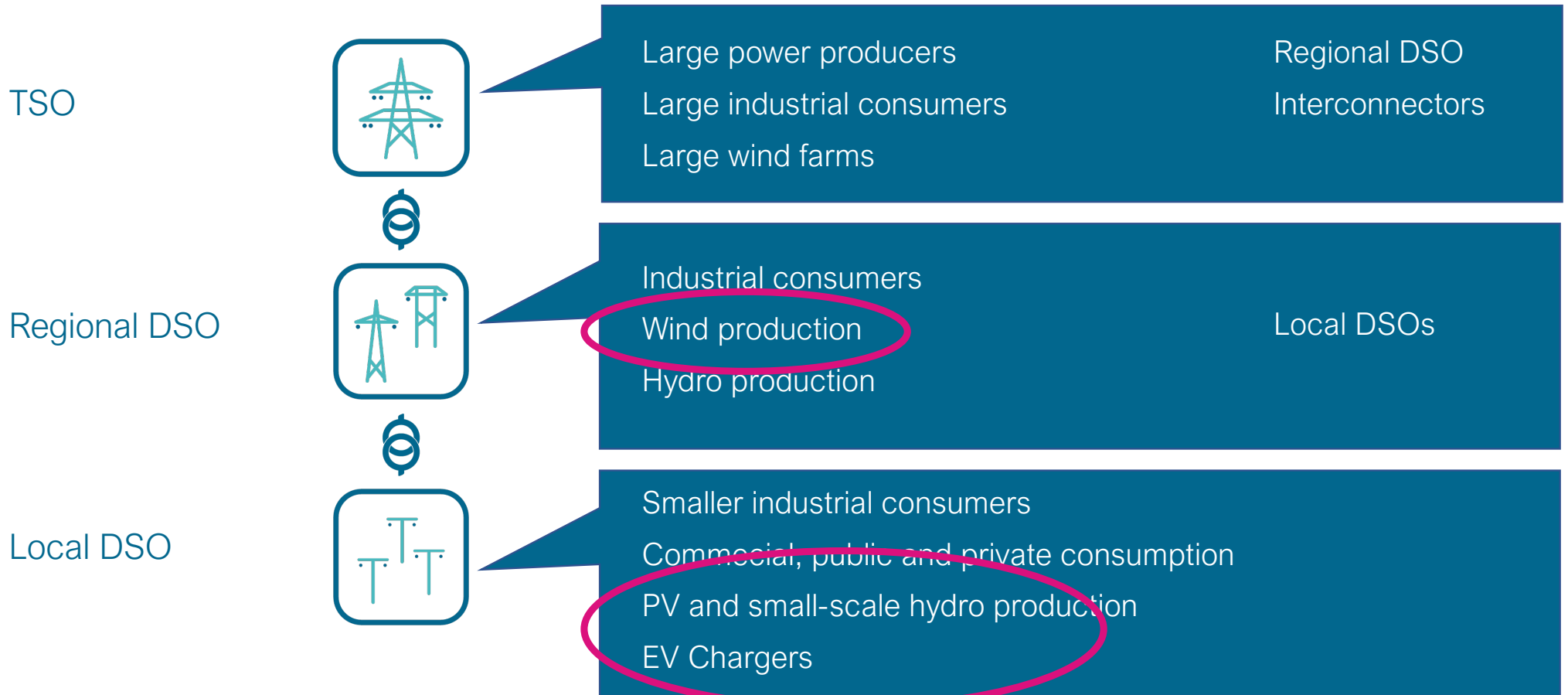


Grid Capacity 1890-2040 Agder Grid Area

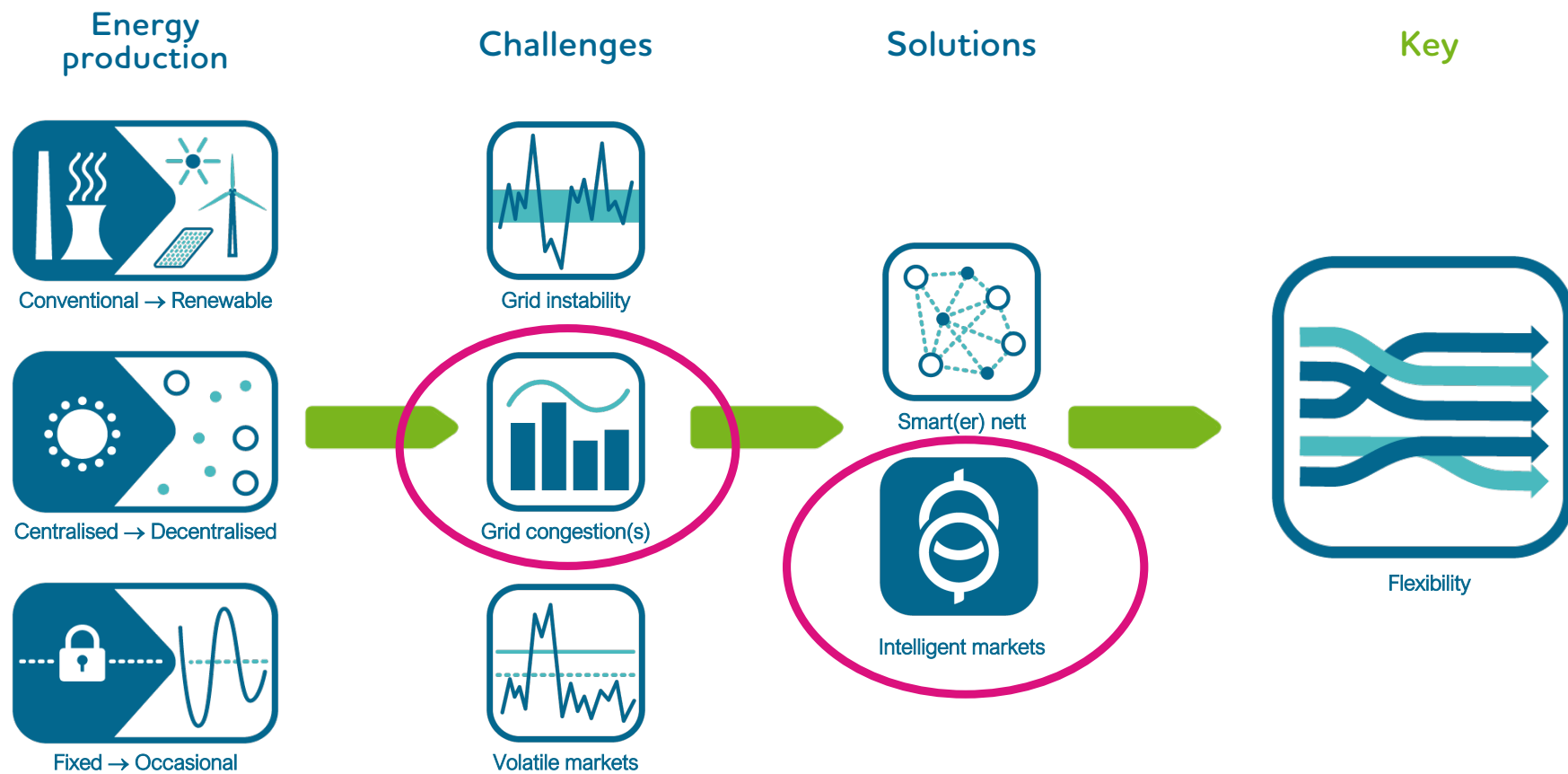
- Today's peak capacity is north of 1000 MW
- Connection requests between 1000-4000 MW
- Represent 1-3 times increase
- Building grid takes time



Focus is moving to the distribution grid



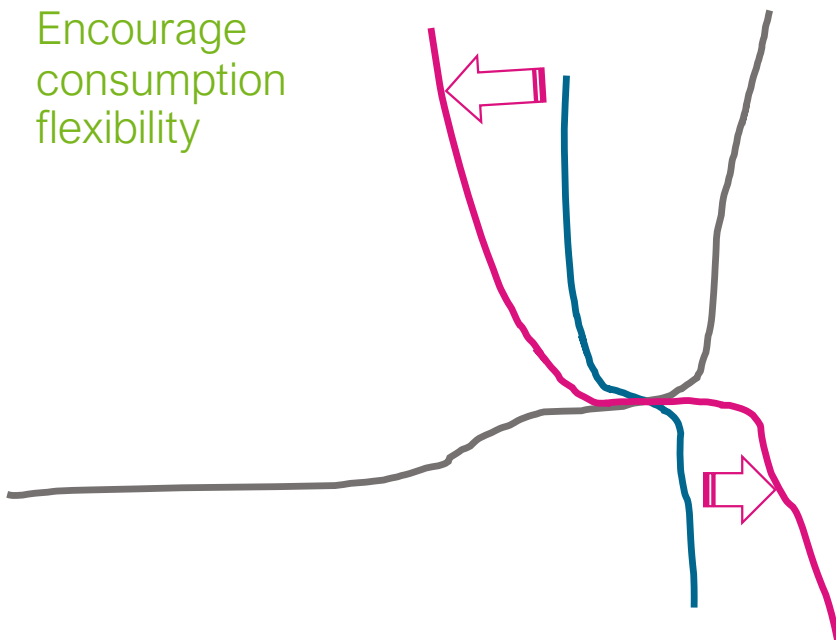
A new reality



Consumption must follow production.....



Encourage
consumption
flexibility



Consumers
need
price signals
& tools

In order to optimise:

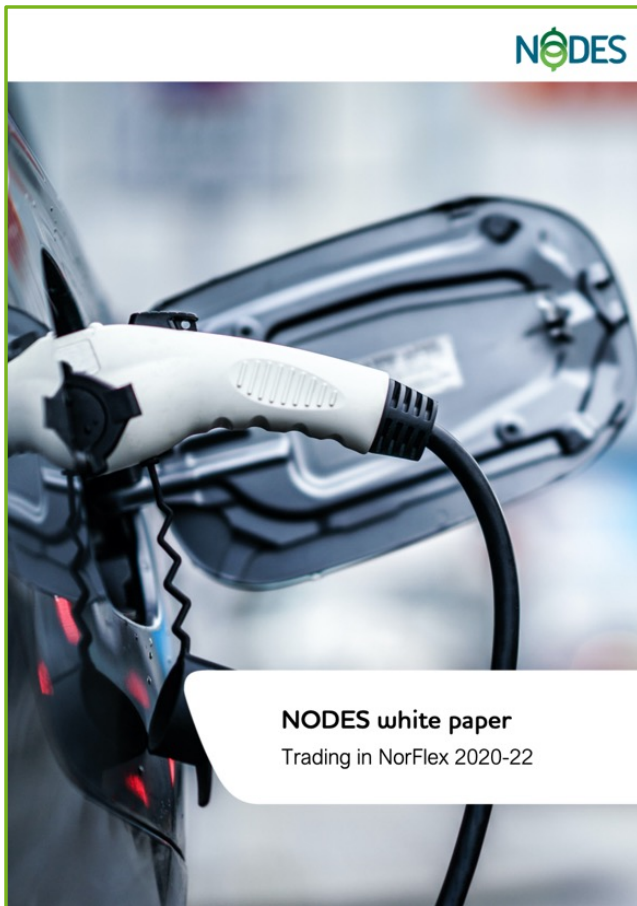
Behind the meter:

- ⌚ Energy efficiency
- ⌚ Move consumption to cheaper time slots
- ⌚ Reduce grid fees

Market based:




















- ⌚ Generate revenue of explicit flexibility

Unlocking demand flexibility in NorFlex



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and the other project we participate in....

- ⌘ NorFlex  
- ⌘ sthlmflex   
- ⌘ IntraFlex 
- ⌘ Mitnetz 
- ⌘ EUniversal   
- ⌘ SmartSenja 
- ⌘ CINELDI  
- ⌘ FlexLab 
- ⌘ Engene 
- ⌘ Ontario LEM  
- ⌘ Effekthandel Väst 
- ⌘ Essex PowerShare 

Large scale demonstration project 2019 - 2023



- New digital flexibility value chain
- Verification of market model
- Facilitating new business models
- Level playing field for all asset types
- Industrial, commercial and household assets
- Value stacking, aggregation DSO - TSO



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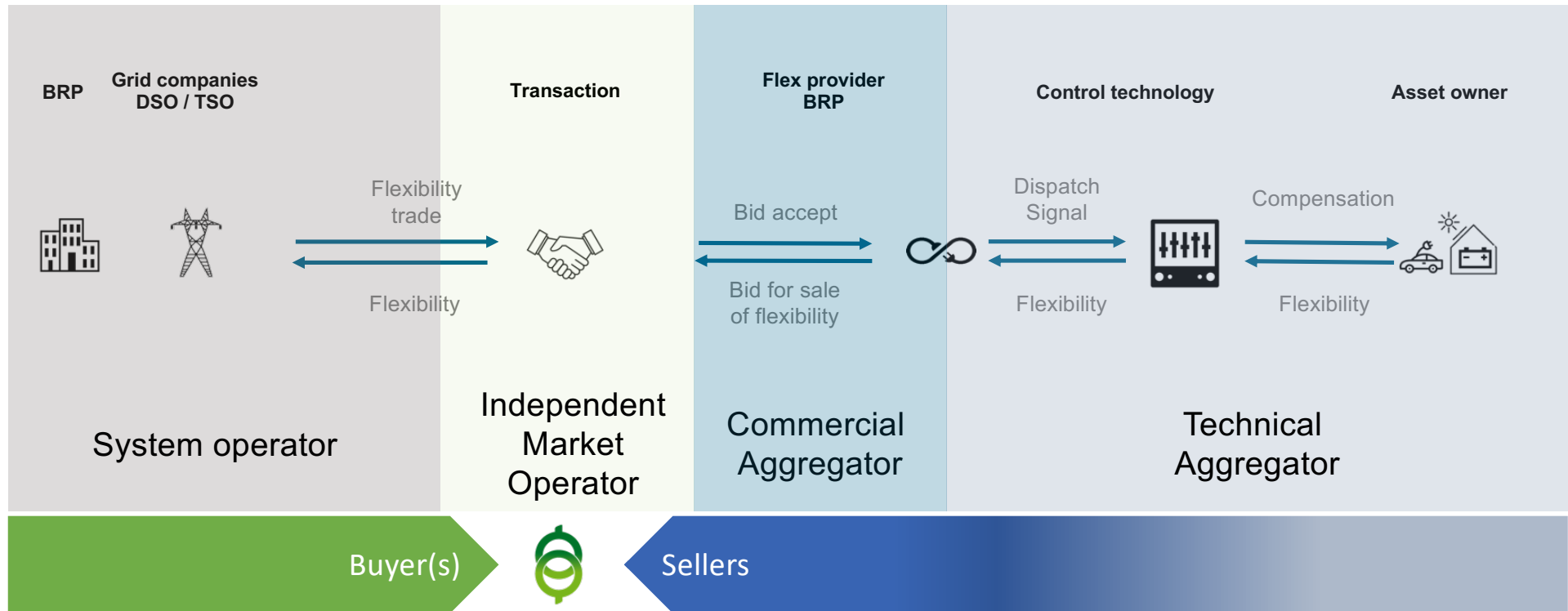
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New digital flexibility value chain



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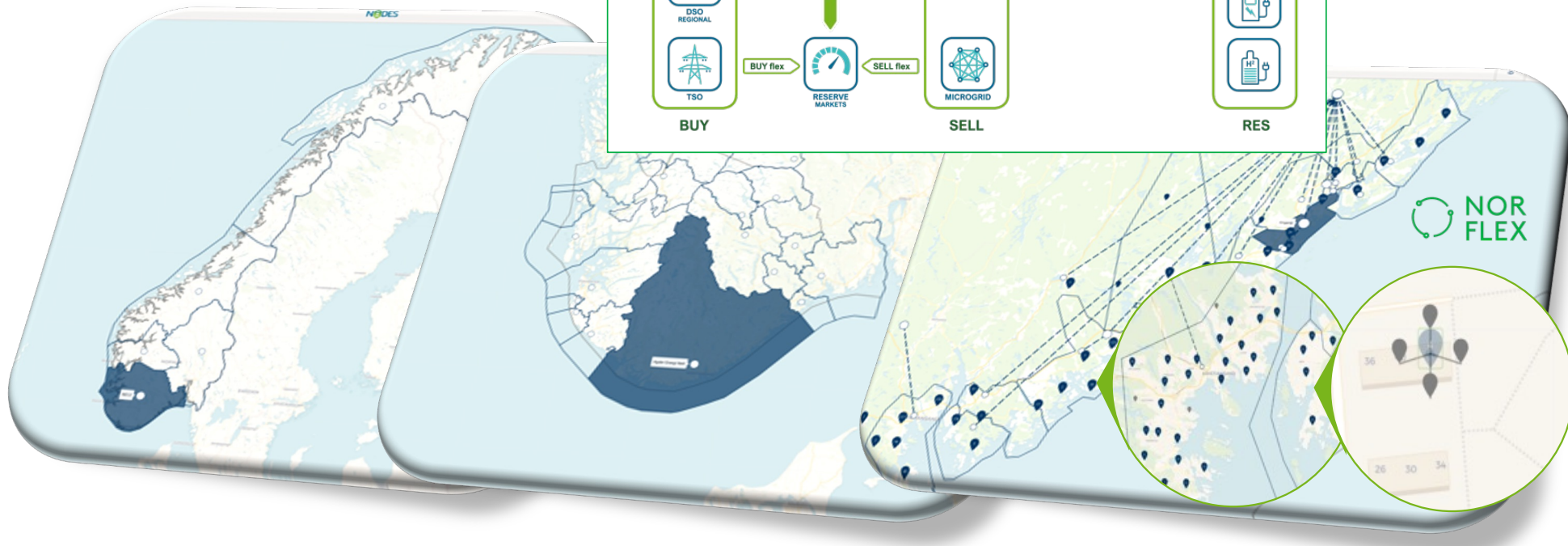
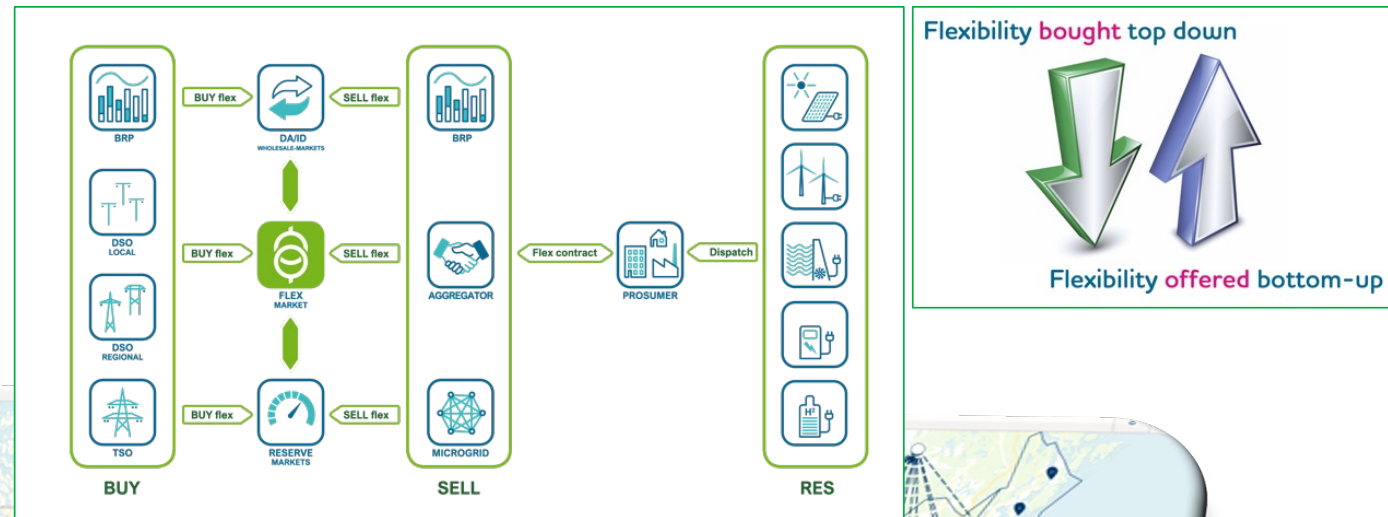
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Integrated Market Design



- Unlocking the value of flexibility
- Flexibility at all levels of the grid
- Equal access to flexibility
- Competition on a level playing field
- Price signals from the grid



Facilitating new business models - sellers



- New opportunities for flexibility providers
- Example: Tibber (CIRED paper #1316, 2022)

CIRED workshop on E-mobility and power distribution systems Porto, 23 June 2022 Paper 1316

NORFLEX: ACCOMMODATING E-MOBILITY IN THE DISTRIBUTION GRID. UTILISING A FLEXIBILITY MARKET TO MANAGE GRID CONGESTION

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ABSTRACT

In Norway more than 64% of all new car registrations in 2021 were electric vehicles (EVs). We have investigated the opportunities, challenges, and potential value of E-mobility as part of a flexible energy system. This paper provides insight into how to accommodate E-mobility in the local distribution grid, in addition to functioning as an asset to manage grid congestion and system services with a market-based approach.

The project has developed and tested technology and business models enabling more efficient and sustainable power grid operations. This includes utilizing market-based flexibility from the growing number of domestic EV chargers, and hence accommodating E-mobility in the distribution grid.

Key to this project in NODES and its innovative approach is an integrated market design that allows for the reservation (LongFlex) and activation (ShortFlex) of local flexibility to be transacted between Flexibility Service Providers (FSPs) and the DSO & TSO.

Infrastructure: Today Norway has a network of fast chargers on the major corridors. The public fast (50kW) and ultrafast (>150kW) charging points are accessible 24/7 and open to all types of EVs. In addition to CPDs developing fast chargers, other companies are developing AC charging at home and building complexes.

We see new business models developing. CPOs are offering energy and energy companies are offering CPO services even with limited public funding.

Norway is the frontrunner in terms of EV adoption, boasting a 65% market share of new-sales last year, displayed in Figure 1 (Ebil.no, 2022).

Not charging

A car is connected, but it is not charging. Latest charging session was 28.31 kWh.

Start

Charging at home in September: 66 kWh

Smart charging: On

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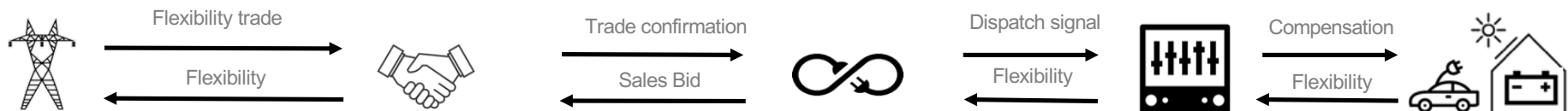
Grid companies
DSO / TSO

Transaction

Flex Service Provider
FSP/BRP

Control technology

Asset owner



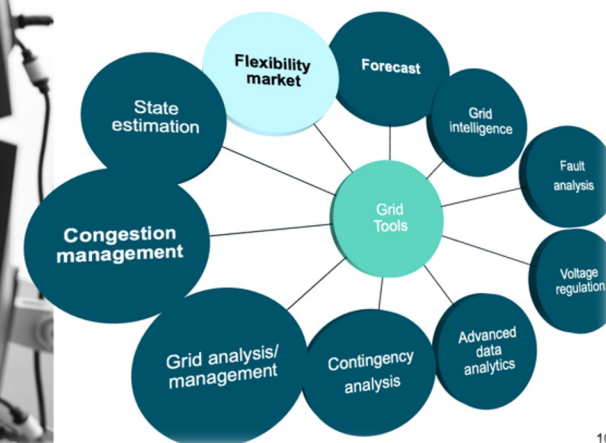
Facilitating new business model - buyers

- Different use cases tested
- Trading strategy to fulfil service needs
 - Reservation (LongFlex)
 - Activation (ShortFlex)
- Tested toolbox
 - Switching
 - Market based flexibility
 - Interruptible connection agreement
 - Flexible production

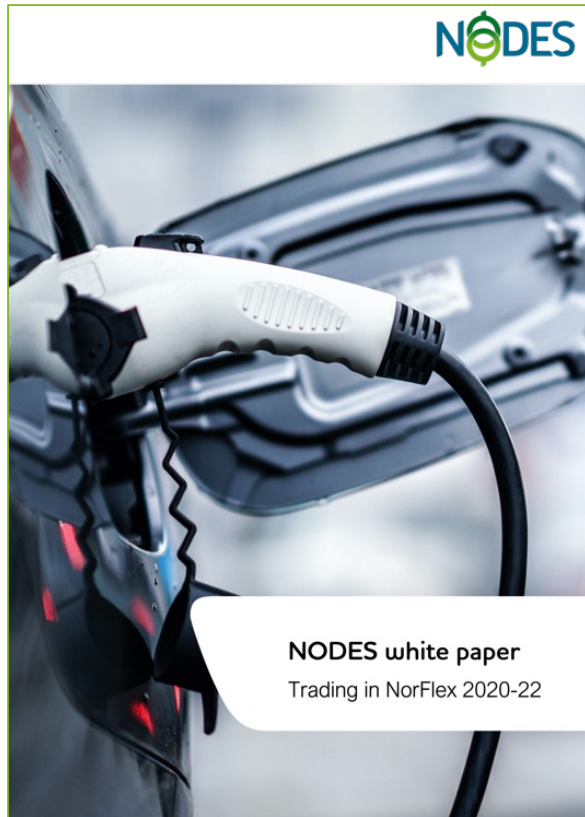


DSO role

Flexibility market is one of many tools



Results



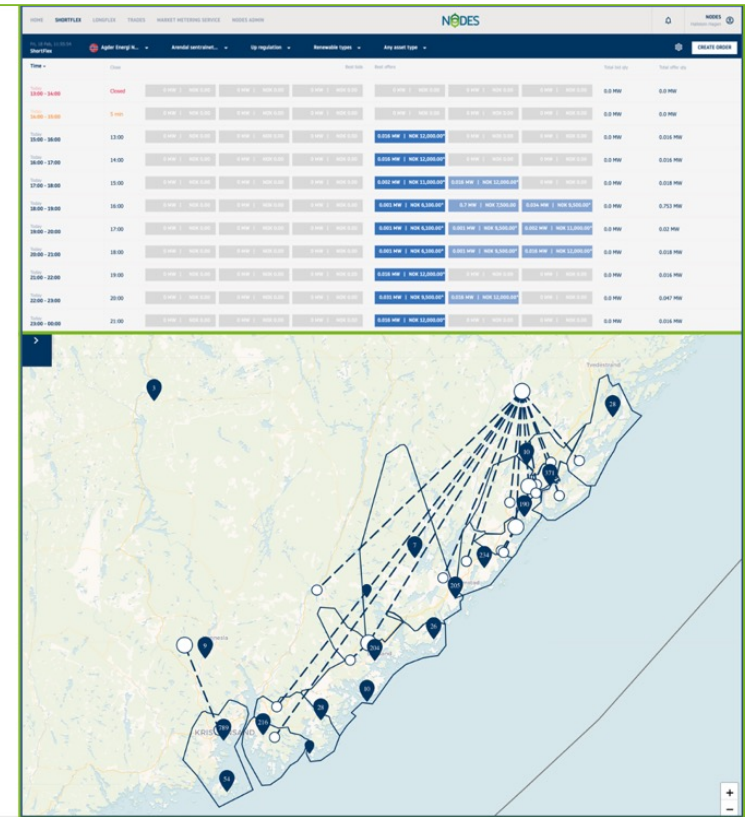
NODES white paper
Trading in NorFlex 2020-22

Trading statistics

Jan 2021 – Mar 2022



- # aggregators **8**
- # assets **> 2 400**
- traded volume **> 600** MW*h
- # trades **> 12 000**
- average price **850** EUR/MW*h
- total contracted value **> 510 000** EUR
- smallest order **1** KW*h
- largest order **5,4** MW*h
- highest volume pr hour **7** MW



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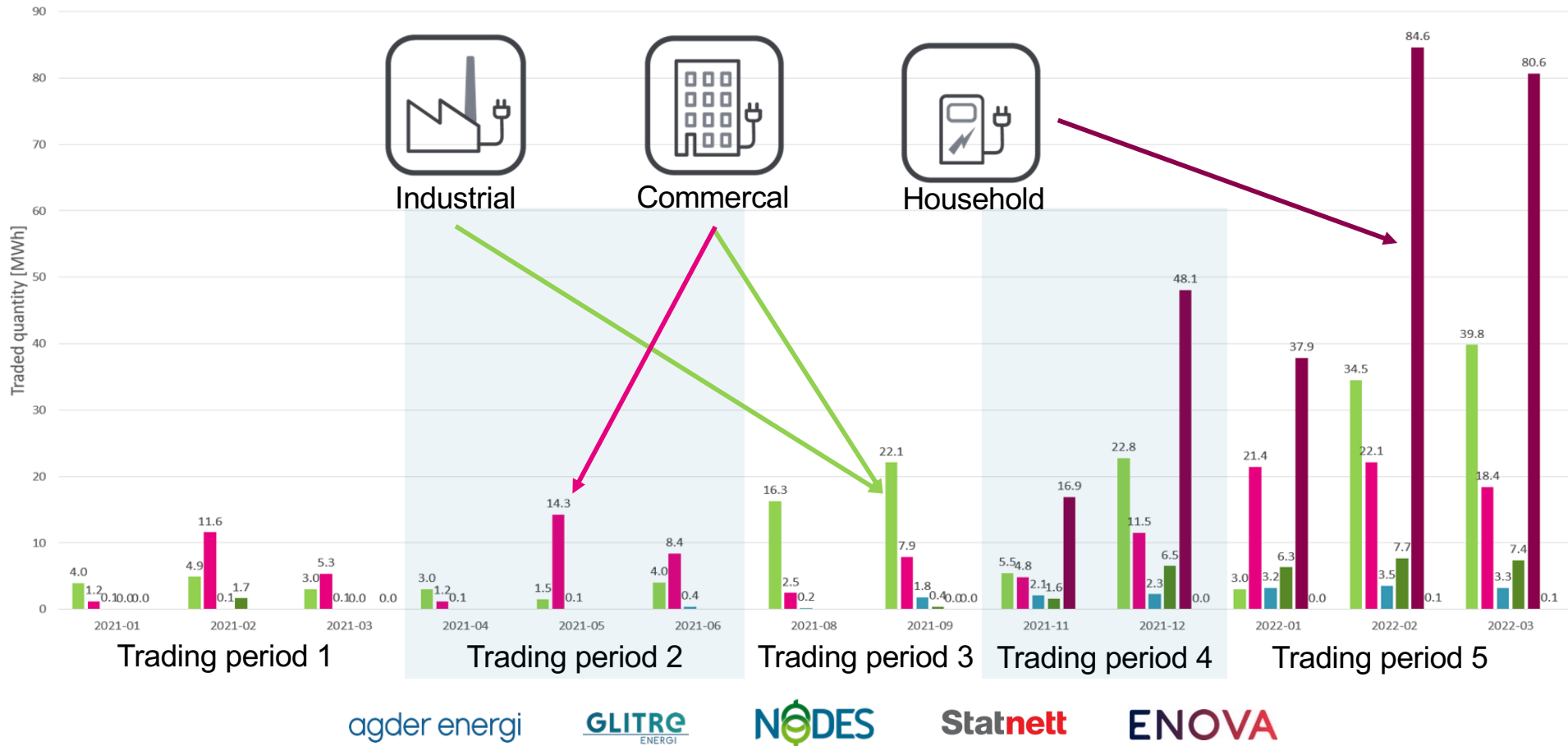
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Level playing field for all asset types



ShortFlex - Activation contracts



How can the flexibility market contribute to the electrification?

- € Enable a transparent **price formation**
- € Allow the grid to signal to the commercial market where there is **bottlenecks** in the grid
- € Allow the grid to provide **price signal**, bids, valuing their need for flexibility at a **specific location**
- € Allow the grid to **reserve flexibility** ahead of time through LongFlex contracts
- € Allow the grid to **manage activations**, close to real-time, through ShortFlex contracts
- € Provide a **level playing field** for all flexibility providers regardless of technology
- € Allow flexibility to be offered to **all levels** of the grid showing, volume, price and location of flexibility
- € Enable the grid to **operate with higher risk** “from N-1 to N-0,9” *
- € Reduce the impact of conditional grid connections by **coordinating flexibility activation** in the market
- € Provide **DSO/TSO coordination** by offering transparency of activations contracts

Allow more connections to the grid!

* Ref report from Aabø Powerconsulting 14. January 2022: “Det norske kraftsystemet i det grønne skiftet: Fra N-1 til N-0,9

Thank you!

