



NODES

European Marketplace for Decentralised Flexibility

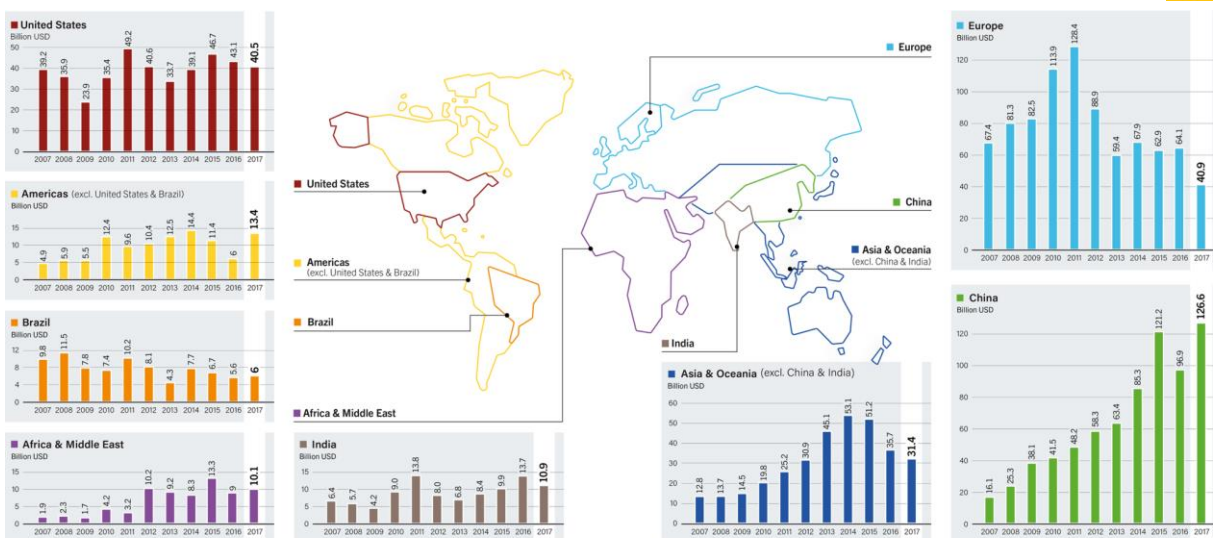
Electricity networks and their operators in a time of change

CREE, UiO, Faculty of Law, Oslo – 04.04.2019

Enno Böttcher

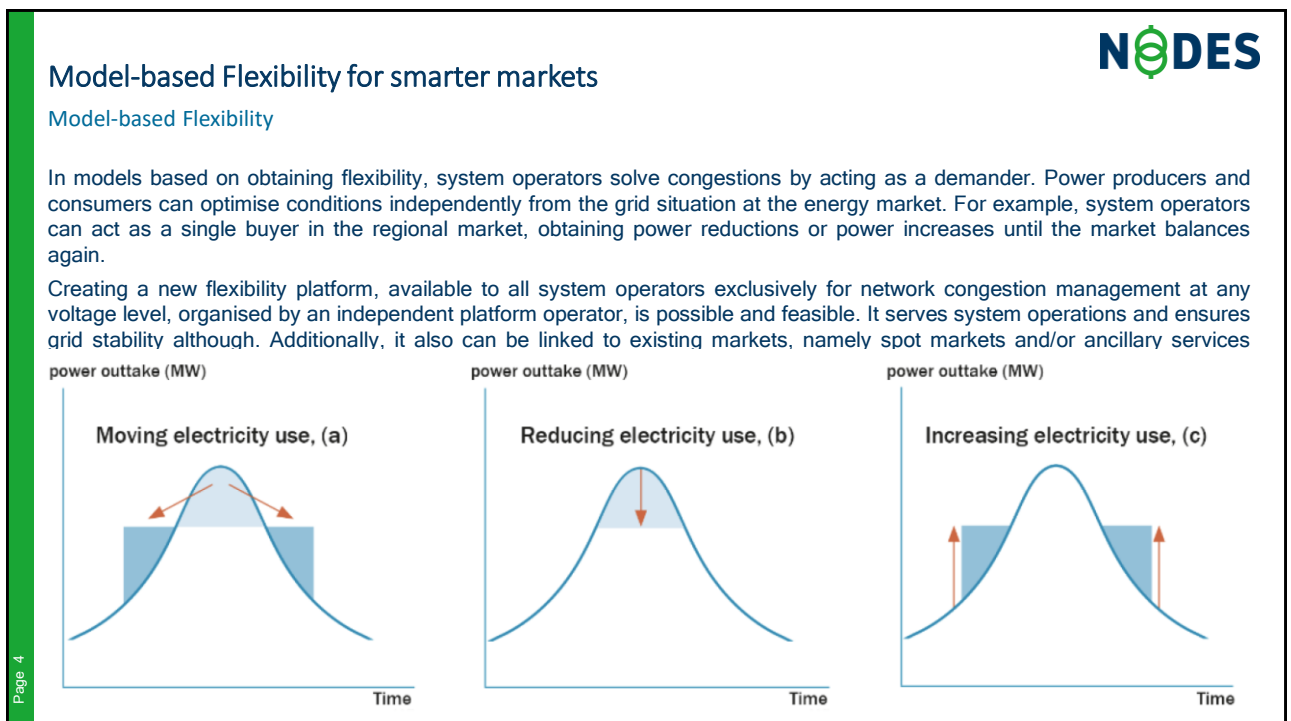
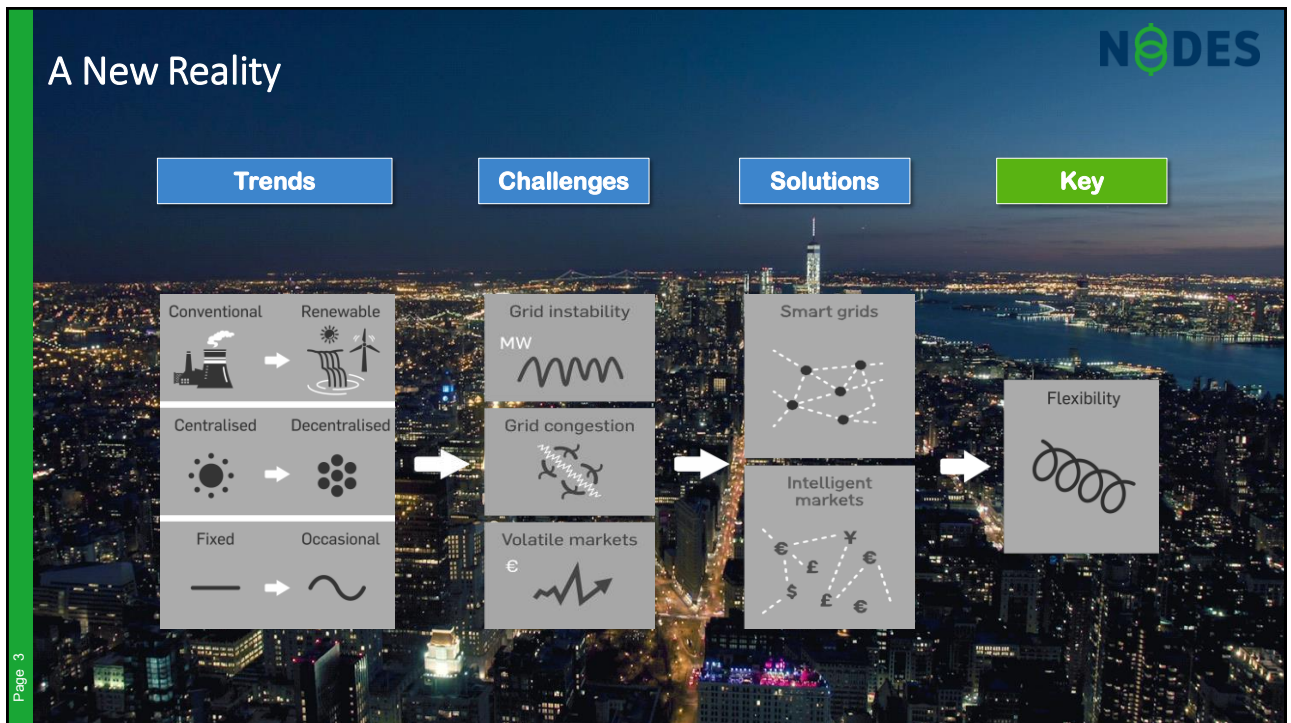
Transforming our world – investments in renewable energy

REN21 – 2018 Global Status Report: new investments in renewable power, by continent/region (2007–2017)



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Source: BNEF



Our approach

- Facilitate competition - in supply, generation and flexibility services
- Provide Neutral markets - for more efficient energy system operation
- Promote innovation, flexibility and non-network solution
- Managing the coordination - of services at the local level
- Maximizing utilization - of the electrical and communication network for the customers
- Fundamental changes - in current market design required to bring the DERs share beyond a 20-40% share of generation

Our approach



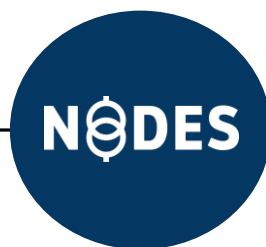
Bottom Up!
Distributed energy resources,
integrated market available to
both DSO & TSO
- let the market do the job!

Business model options

Central control (e.g. DERMS)



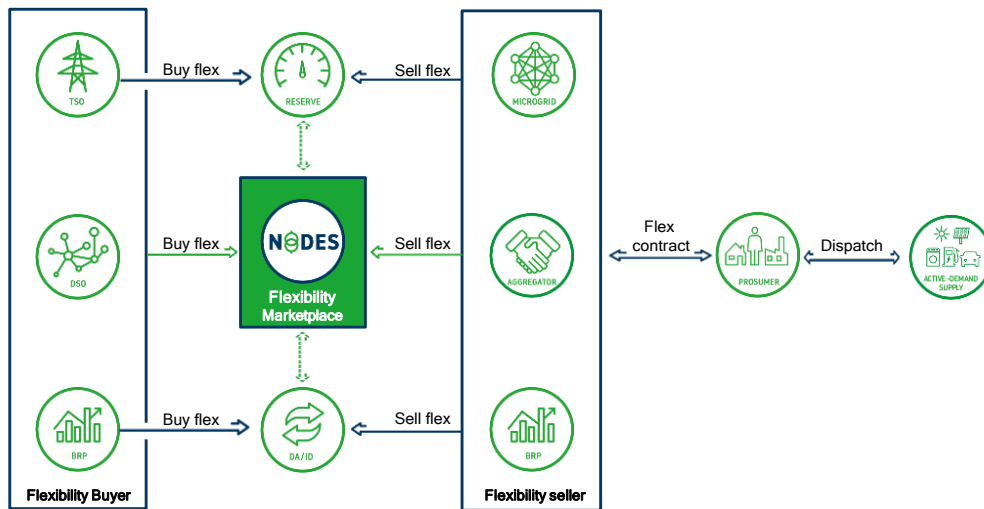
Independent market operator



Peer to peer (e.g. blockchain)



NODES – a fully-fledged market design



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Stakeholders of Flexibility



Buyers' need Flexibility to be available ...

- when there is *too much production*
- when there is *too much consumption*
- for *long term planning*
- in *N-1 situations*
- to *help operations* in near real-time situation
- in a *specific location*
- for *frequency balancing*
- for *balancing of portfolios*



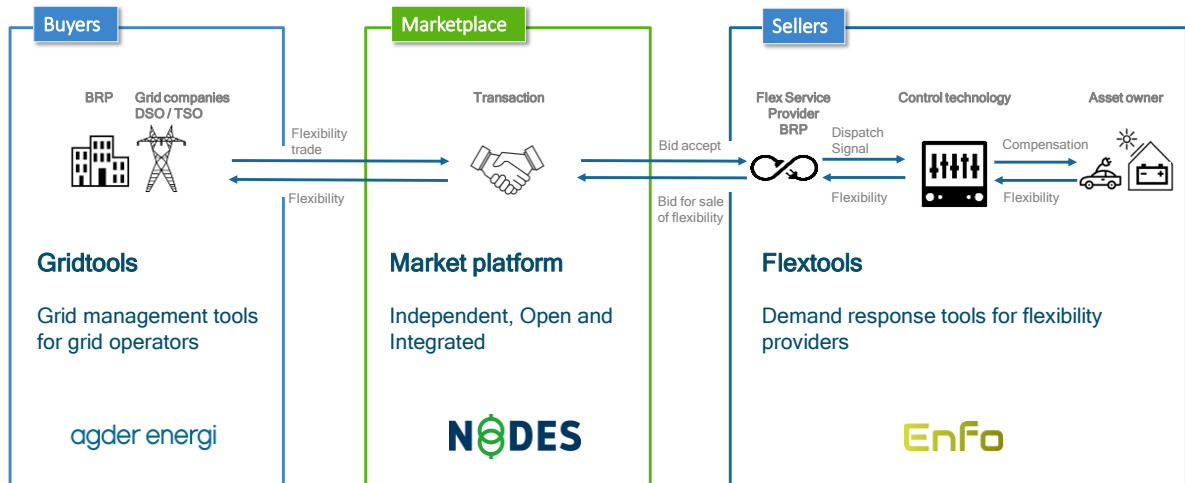
Sellers' need ...

- A place to trade their flexibility - *access to markets*
- Someone to *aggregate small flexibility* to enable market access
- A *fair* and *independent market price*
- A *market* all year round
- *Service providers* that can connect up and *manage flexibility automatically*



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Flexibility value chain



Use cases

	High Voltage	Medium Voltage	Low Voltage
Generation (congestion)	<i>Flexibility as alternative to traditional redispatch (EinsMan)</i>	<i>aggregation small scale generation units</i>	<i>PV</i>
Load (congestion)	<i>Disproportionately high costs if annual peak load is exceeded</i>	<i>Defer grid investment</i>	<i>E-Mobility</i>
Balancing (TSO/DSO coordination)	<i>Activation of assets in congested DSO areas</i>	<i>Aggregation of assets for balancing purpose</i>	<i>Aggregated storage</i>

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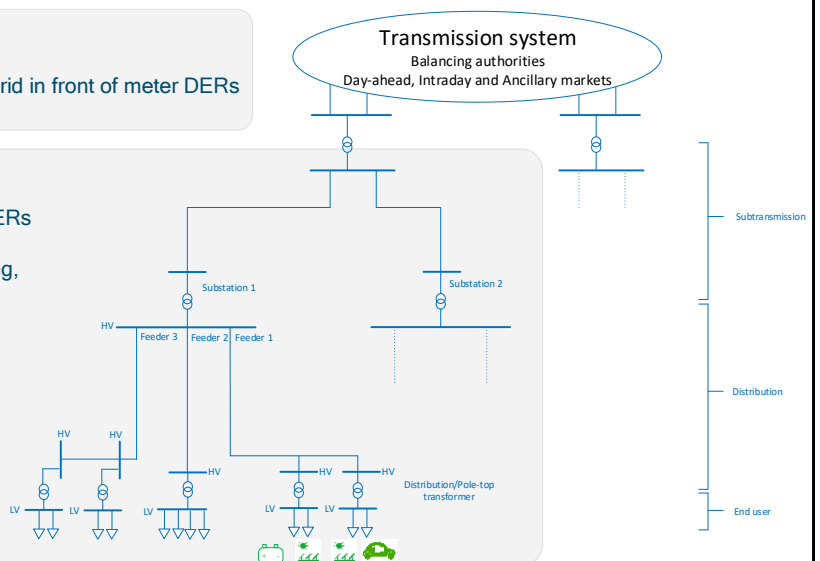
Optimisation before and behind the meter

Current optimization

Optimize sub-transmission and distribution grid in front of meter DERs in existing solutions

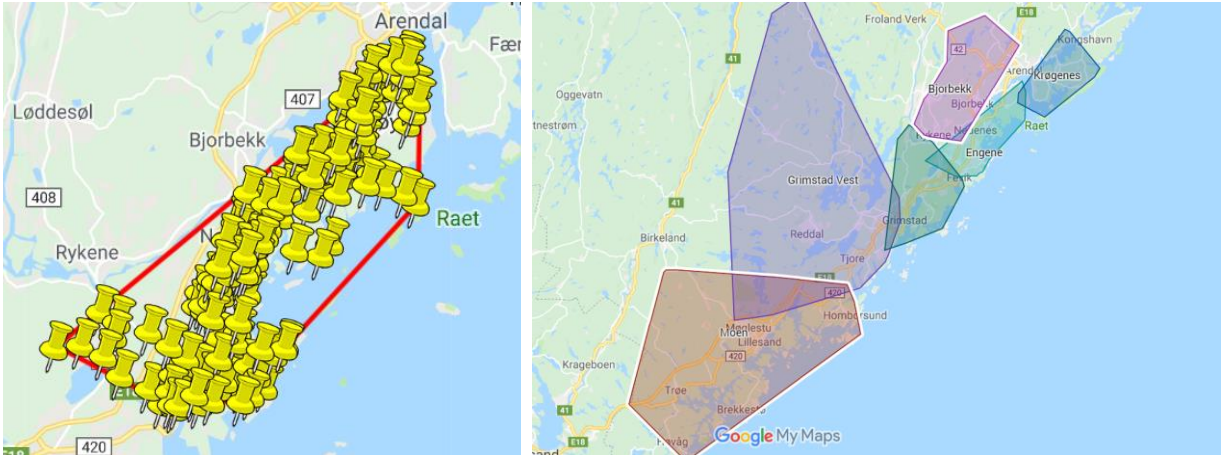
Behind the meter optimization

Enables behind the meter allows/enables DERs to participate and be optimized (e.g. EVs, home storage, heat pumps, cooling, Power-2-X, roof-top solar, wind)



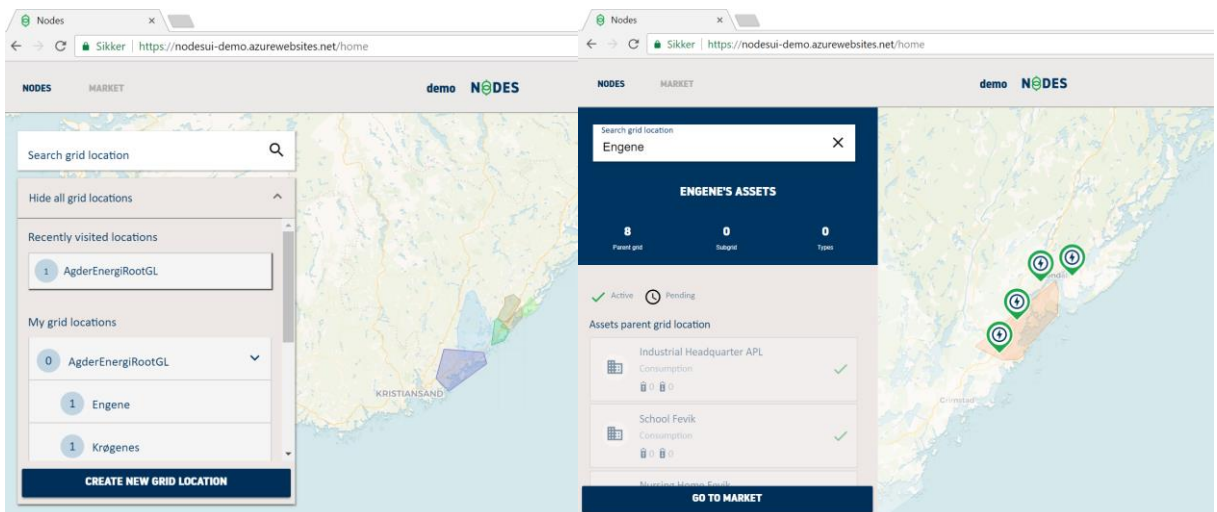
Location parameters

Using grid operator objects to define grid location polygons



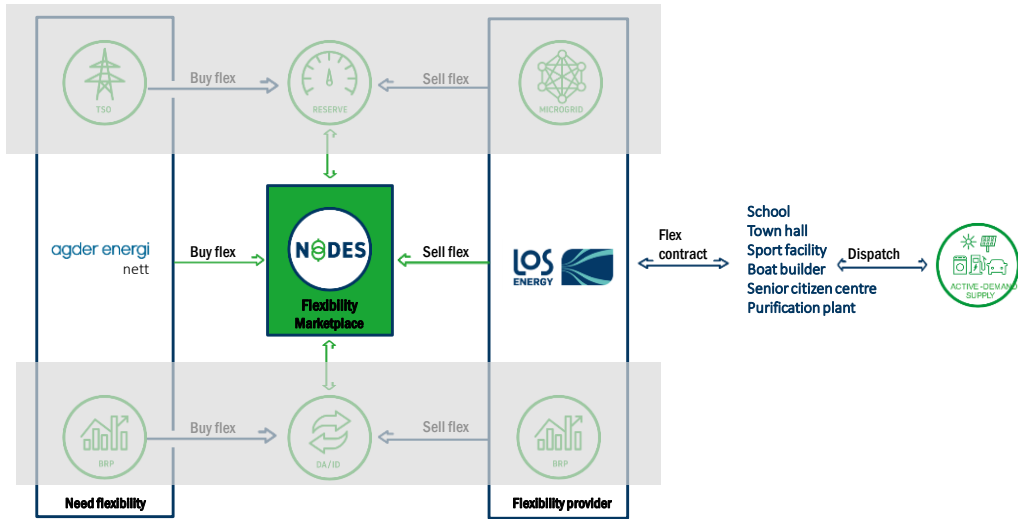
Location parameters - creation of Grid Locations

DSO accepting Assets in Grid Location – Flexibility Service Provider (FSP) is notified



Too much demand in the Medium-Voltage grid

Engene Substation in, Norway



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Enova large-scale demonstration pilots

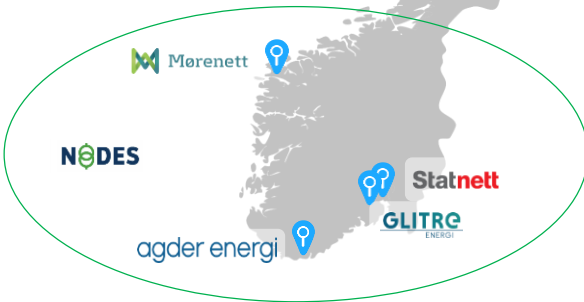
Smart Infrastruktur på Nord Serja

38,7 MNOK funding

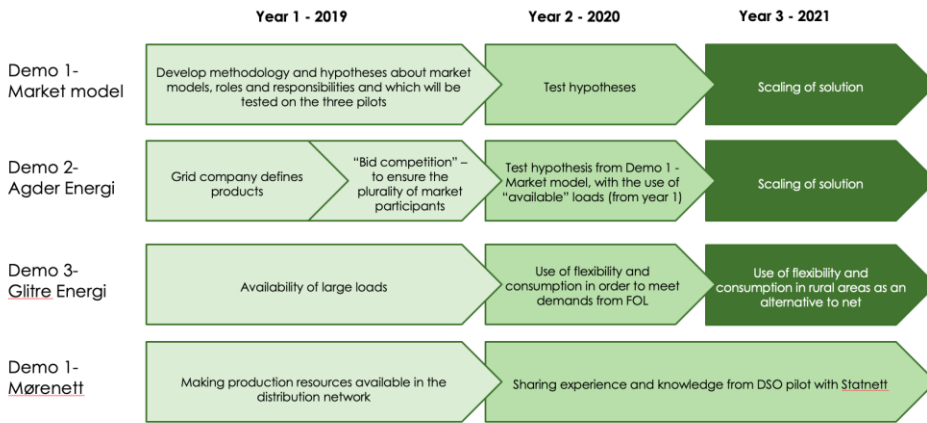


NOR FLEX

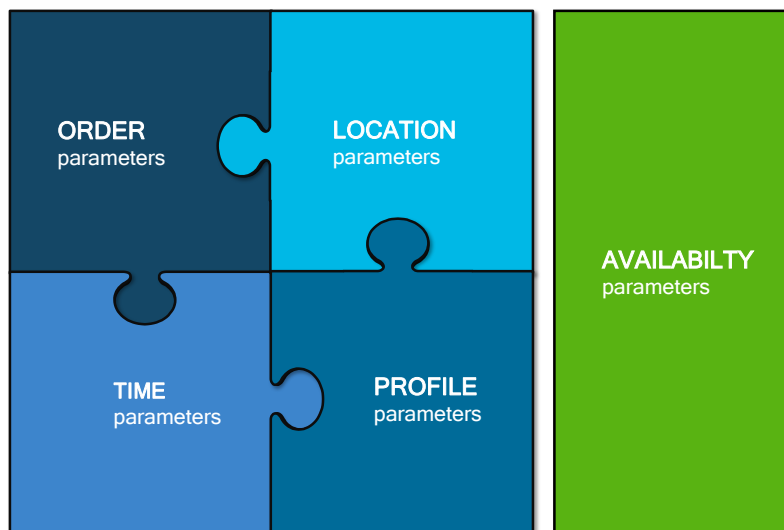
22 MNOK funding



Timeline for activities in NorFLEX



Product Parameter Categories instead of fixed Products




NODES – an Independent Flexibility Market Operator in Europe


A platform open to all participant systems



Grid Companies



TSO



DSO

- Simulation
- Grid analysis
- Forecasting
- Optimisation
- Congestion management
- Buy flexibility



- Open, transparent and independent
- Provide visibility and matching
- Be cost effective and automatic
- Connect to other markets
- Not owned by a dominant market participant
- Not offering grid- or flextools

Flexibility Service Provider



AGGREGATOR



BRP

- Forecasting
- Optimisation
- Aggregation
- Activation
- Verification
- Re-balancing
- Portfolio optimisation

In summary



- Grid companies will be *able to buy* the flexibility they need on NODES to perform their new role as DSO
- The *value* of flexibility will be visible on NODES
- NODES *integrates* with existing markets so that all (DSO/TSO and BRPs) can buy the available local flexibility
- The *value* of flexible assets *increase* because NODES will connect to existing markets so that it can be traded any time, not only when the DSO needs it locally (which may only be 3-4 times on e.g. cold winter days)
- NODES facilitates the *use of flexibility* (OPEX) as an *alternative* to grid investment (CAPEX)
- NODES believe that more flexibility will be *available* because of facilitated market access
- Market participants are invited and *encouraged* to test use cases based on NODES



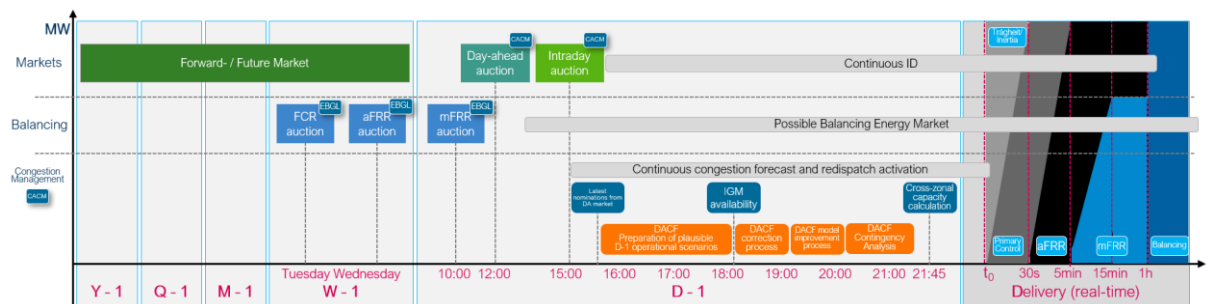
enno.boettcher@nodesmarket.com

Market Segment Integration and Timelines



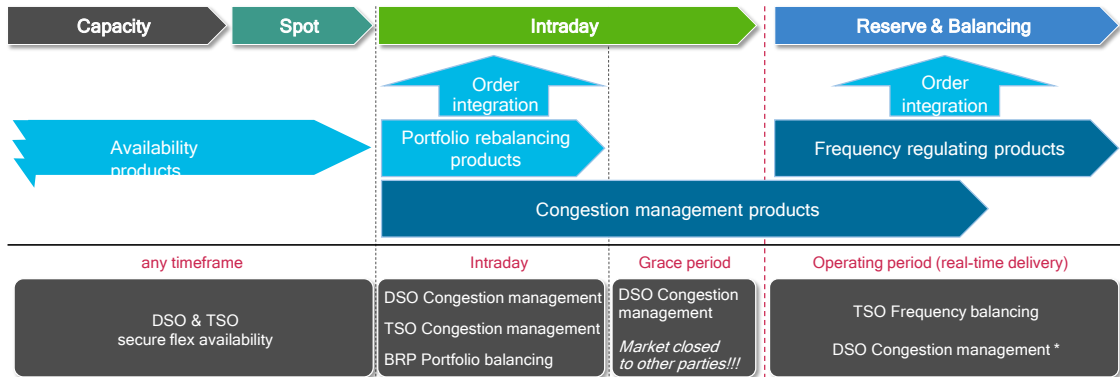
MSI regarding wholesale, balancing and congestion management

Even without any integration, there are interdependencies between market segments. **Market segment integration** is defined as the interaction between and possible combination of market segments, i.e. intraday market, congestion management and balancing market.



Trading timeline

Physical products



* Subject to regulatory framework

ENTSO-E European Network Codes

Facilitating the harmonisation, integration and efficiency of the European electricity market

Network codes are a set of rules drafted by ENTSO-E, with guidance from the Agency for the Cooperation of Energy Regulators (ACER), to facilitate the harmonisation, integration and efficiency of the European electricity market.

Each network code is an integral part of the drive towards completion of the internal energy market, and achieving the European Union's 20-20-20 energy objectives of:

- at least 40% cut in greenhouse gas emissions compared to 1990 levels.
- at least a 27% share of renewable energy consumption.
- at least 27% energy savings compared with the business-as-usual scenario.

