NODES

European Marketplace
for Decentral Flexibility

NODES established

Creating the marketplace of the future supporting the drive to an emission free society

Facilitating optimal use of flexibility in the grid by offering an open, integrated marketplace to all flexibility provides and grid operators.

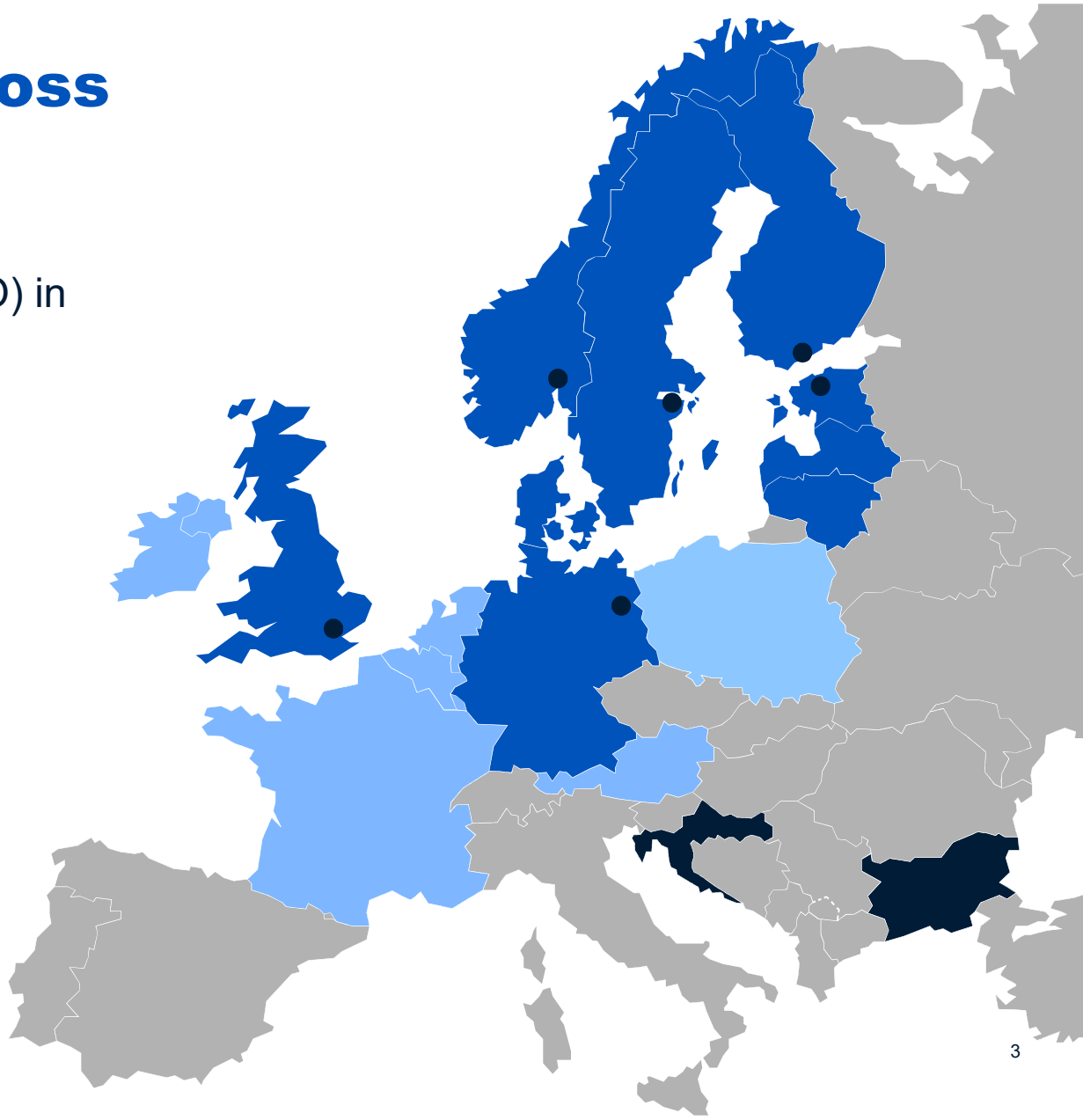
Nord Pool expanding across Europe

Nominated Electricity Market Operator (NEMO) in **15 European countries**

Delivering systems and operations to Power Exchanges – Bulgaria and Croatia

Tailored services to TSOs

Offices in Oslo, Helsinki, Stockholm, Tallinn, London and Berlin



NORD POOL

Total traded volume in 2016

≈500 TWh

European intraday:	**5 TWh**
UK day-ahead:	**109 TWh**
Nordic Baltic day-ahead:	**391 TWh**

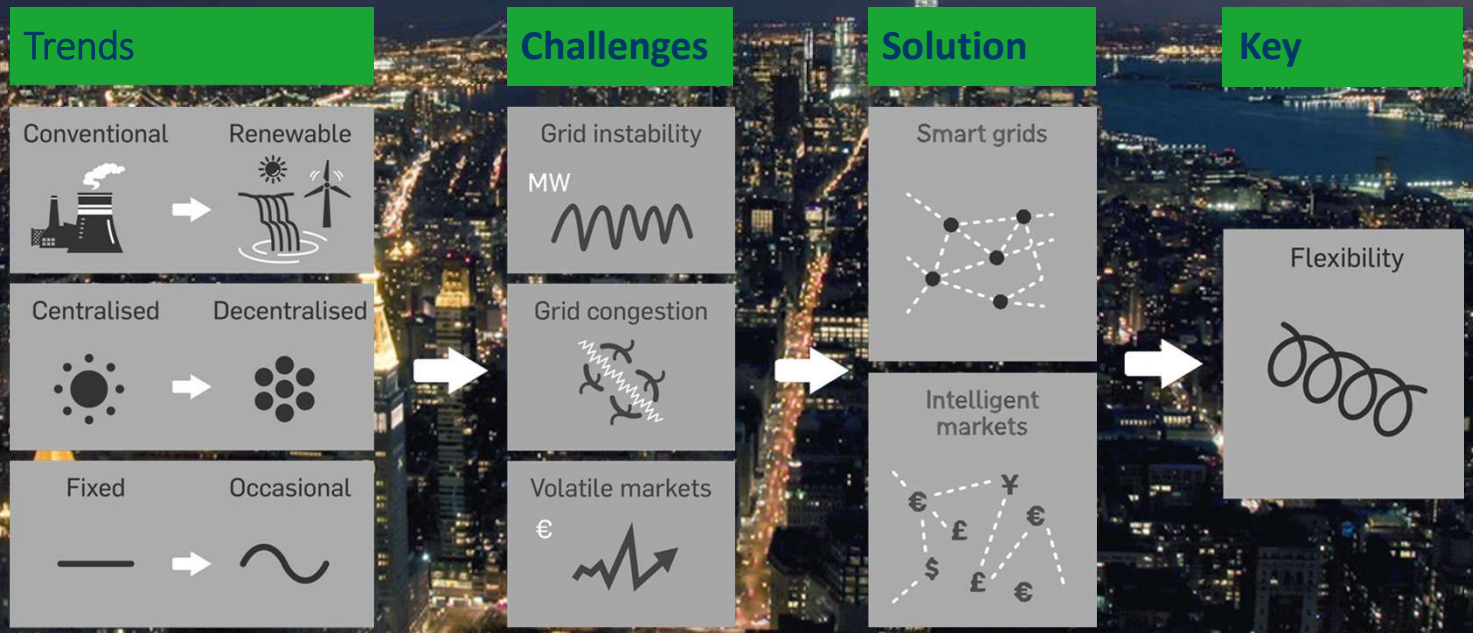
NORD POOL

Agder Energi AS

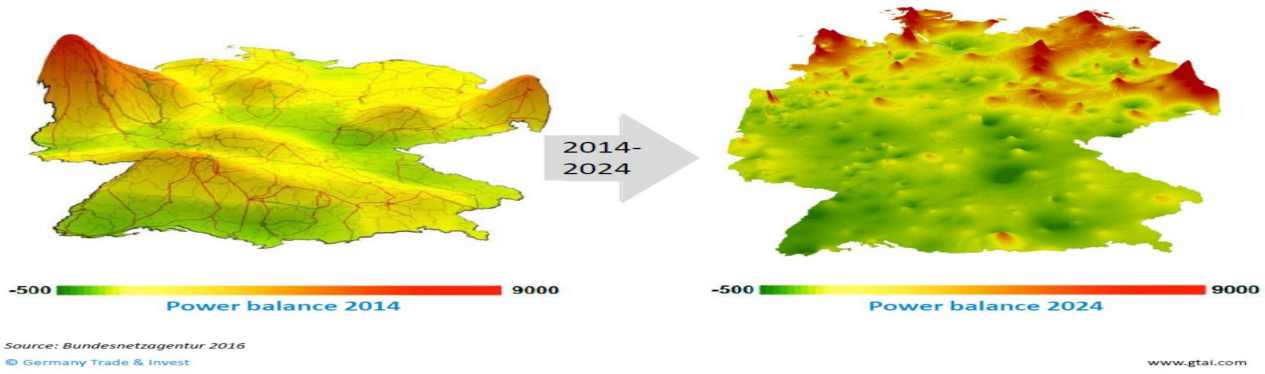
- Production, distribution and sale of renewable energy and related services
- 4th largest producer in Norway with 8.1 TWh in mean annual production
  - 49 power stations
- 4th largest DSO/grid operator
- Headquartered in Kristiansand

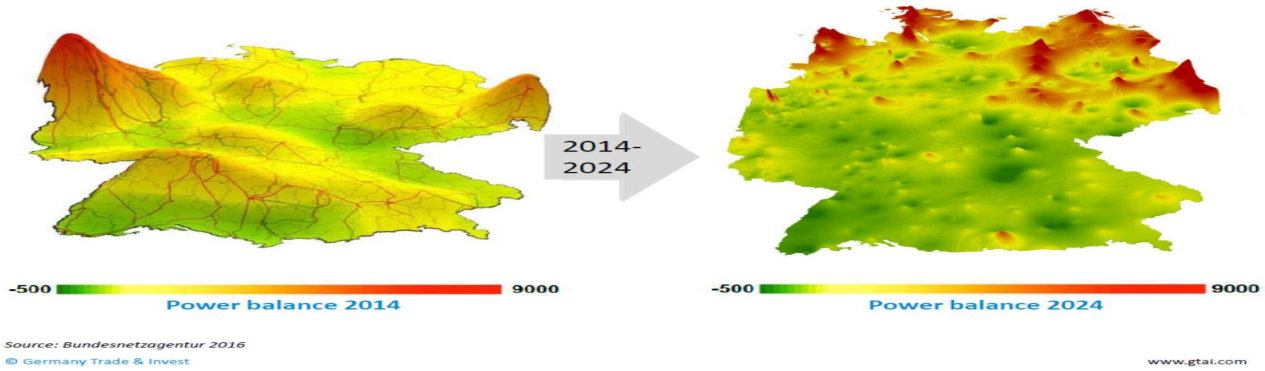
Agder Energi in Germany

A New Reality



Grid bottlenecks
generation units are geographically far from consumption





The costs of grid congestions are rising…

- 95% of RES are connected to the DSO grid

Source: BDEW „Redispatch in Deutschland“

The Changing Role of DSO

- Facilitate competition
  in supply, generation and flexibility services
- 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

- Tipping point
  20-40% Renewable share
- Fundamental changes
  in current market design required

Our approach

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

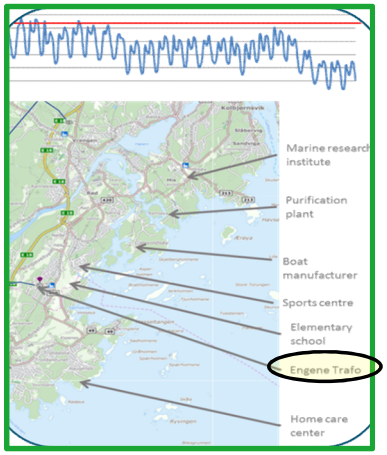
Live proof of concept demonstrated investment deferral at Engene substation in Norway

NODES

Phase 1

Alternative to grid investment

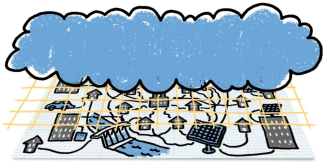
- Developed a cloud based solution to avoid overload in short periods
- Accessed available flexibility in distribution grid
- Optimised load based on available flexibility, price weather data and production in the area
- All data delivered in real time by use of advanced analytics and machine learning

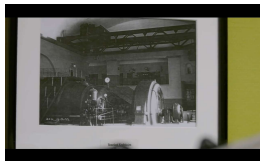


Phase 2

Develop a marketplace concept

- Prototype for a marketplace for decentral flexibility
- Developed concept for business models and roles for the flexibility market
- Alignment to EU winter package and dialog with Norwegian regulator
- Deferred grid investment of approx. EUR 4,5 M





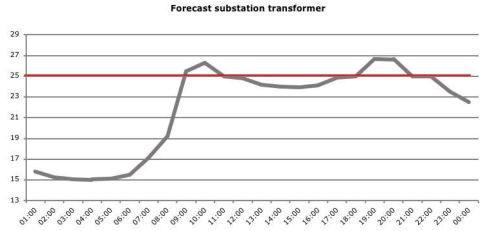
Microsoft

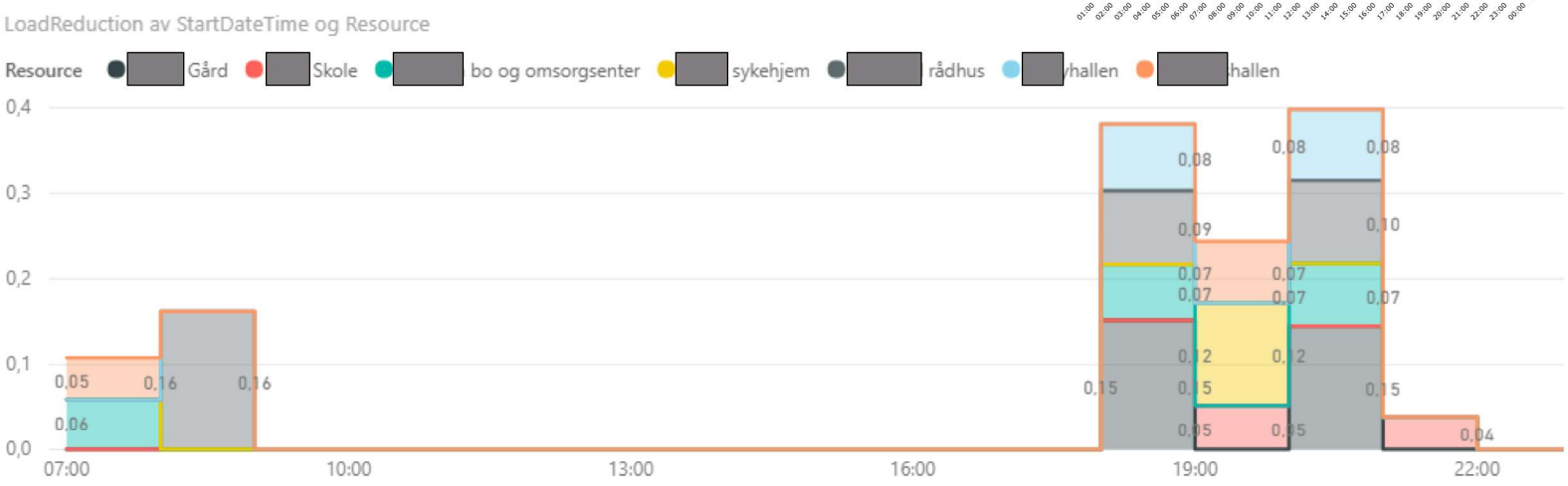
agder energi

ENGENE SUBSTATION

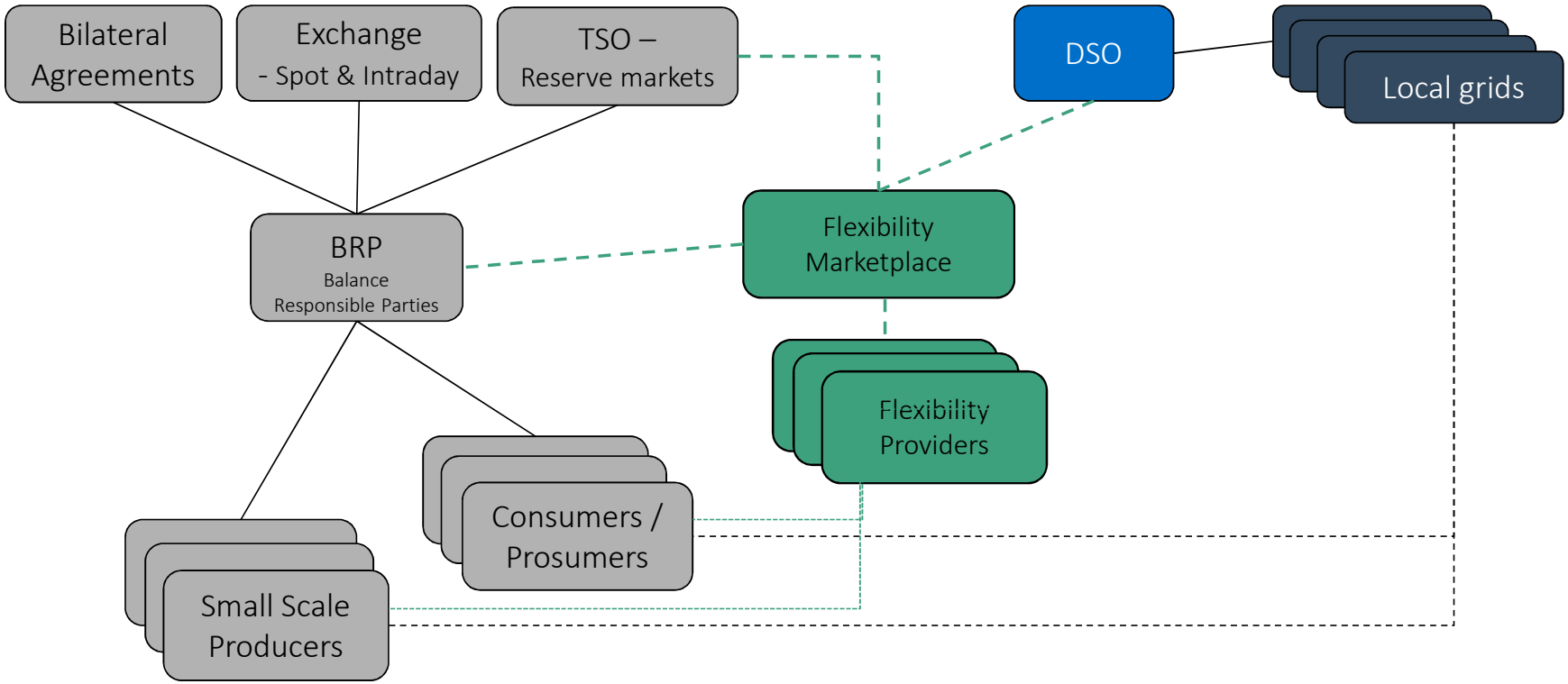
Live proof of concept

28. Februar 2018





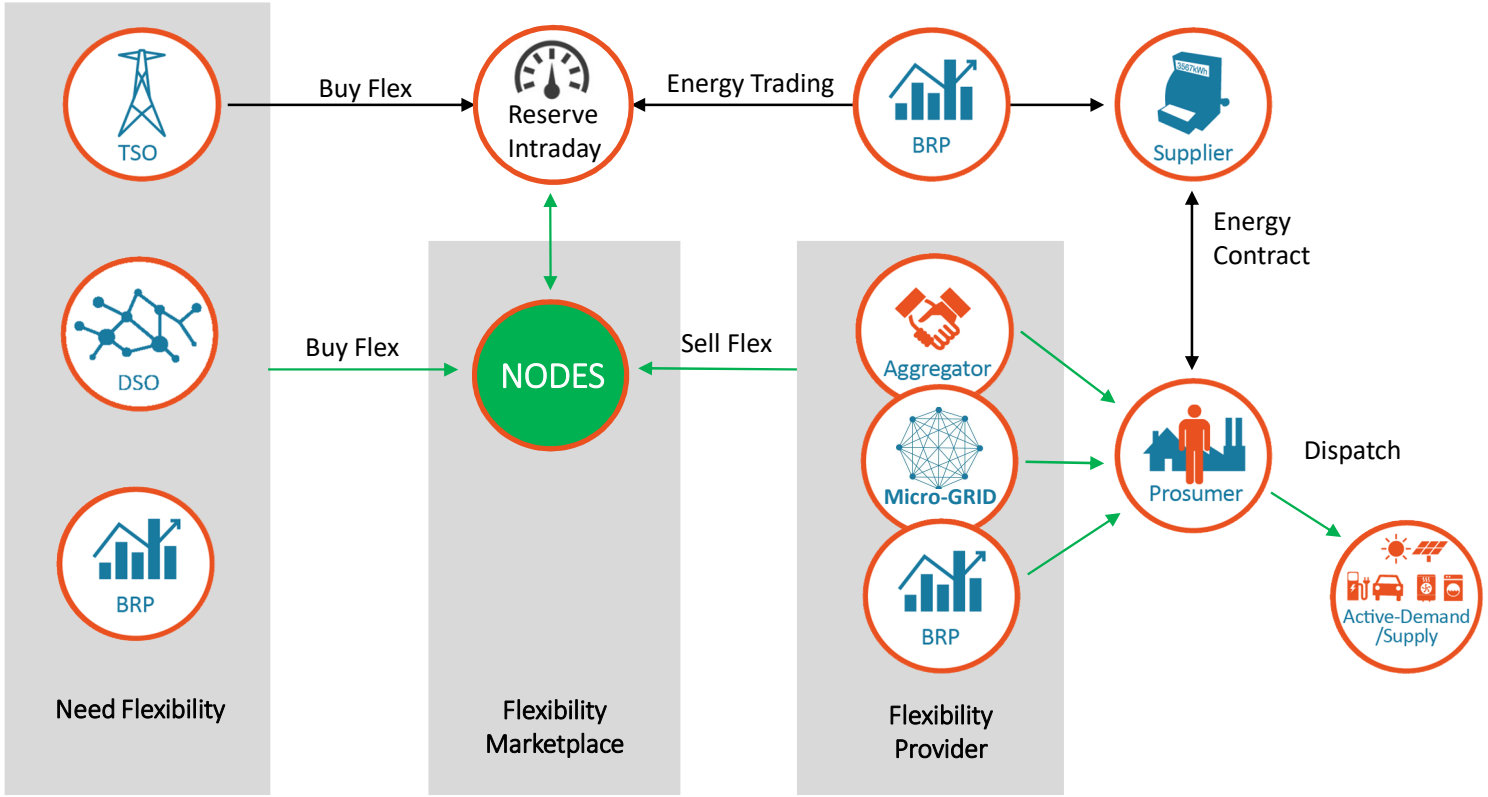
Integrated marketplace open to DSO, TSO and BRPs



Building a transparent marketplace for flexibility

- Tools to act in a commercial manner
- Attract and identify flexibility resources
- Social benefit using markets to provide alternative to grid investment
- Grid owners save money deferring investment
- Alternative to shutting down renewables
- Integrating various markets (e.g. intraday, reserve)

Roles - Decentralised Market




NODES
CONNECTING MARKETS