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NRA toolbox to ease grid scarcity: from easy fixes to long-term solutions

Electrification Academy

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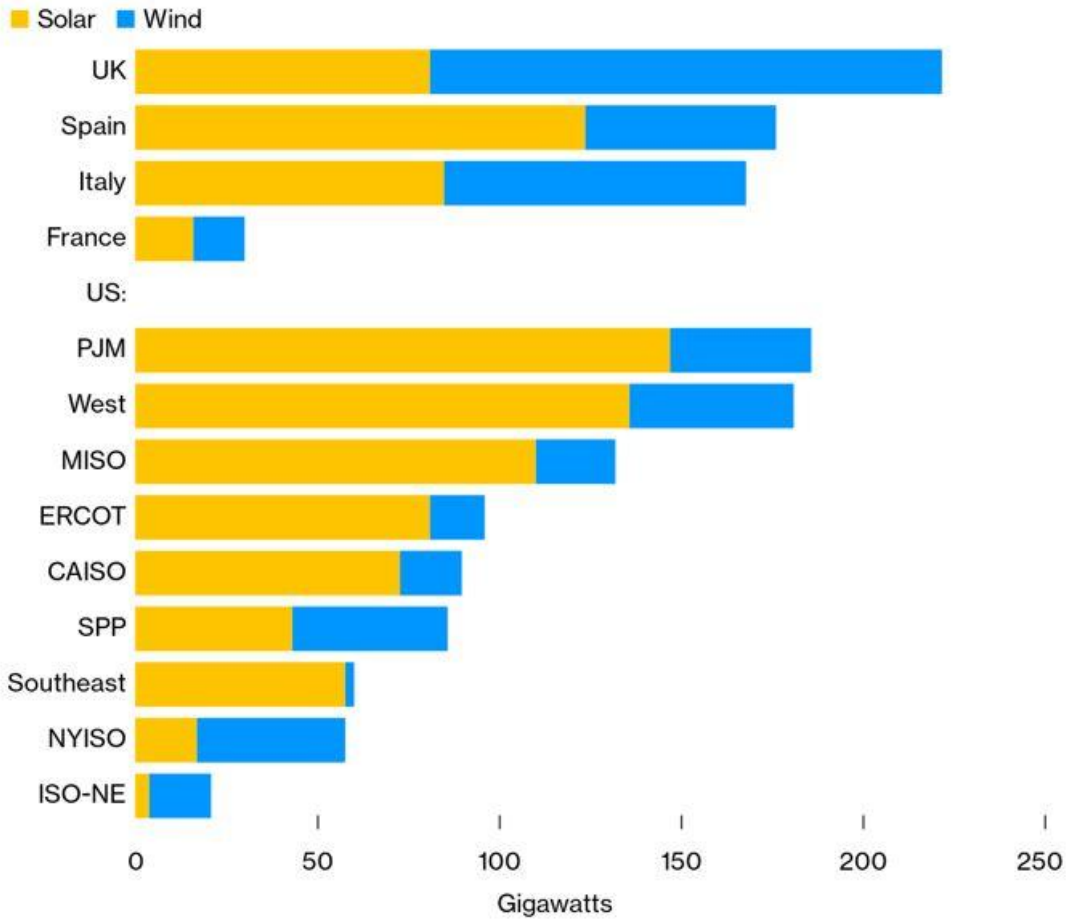
RAP

Gridlock

Over 1,500 gigawatts of wind and solar projects are waiting to be connected to the grid in Europe and the US



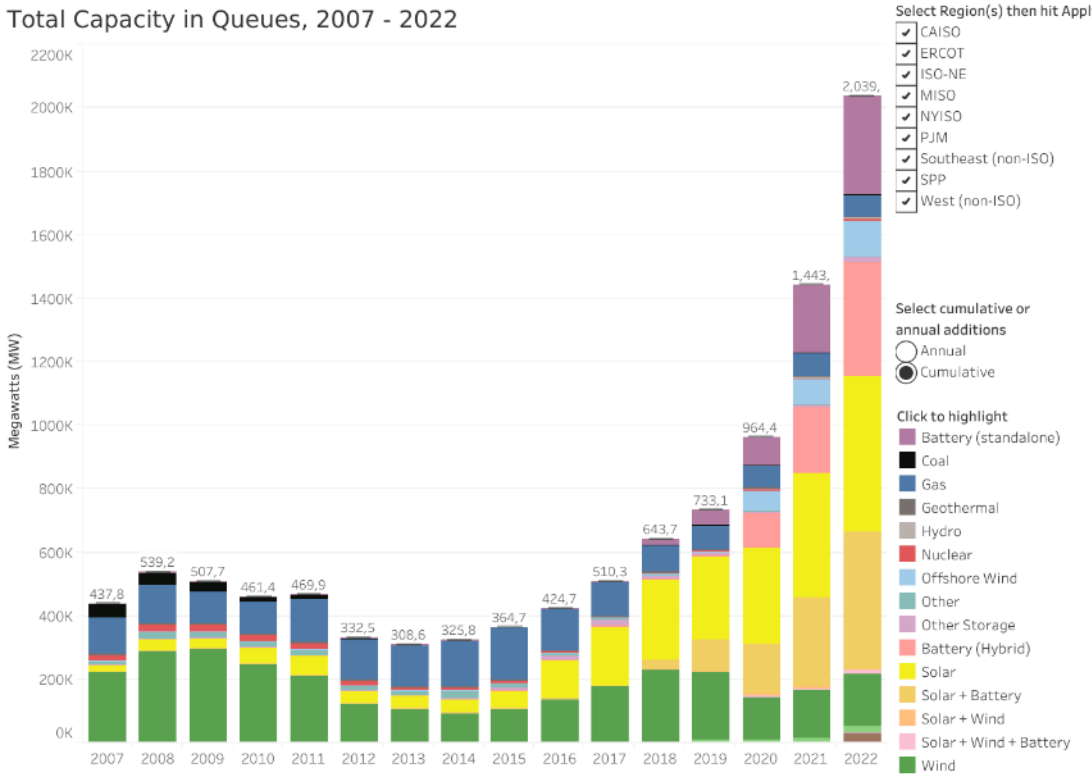
Source: BloombergNEF, Lawrence Berkeley National Laboratory, National Grid, Electricity Northwest, Northern Powergrid, SSE Networks, Scottish Power Energy Networks, UK Power Networks, Terna, Red Electrica, French Ministry of Ecological Transition.
Note: UK data as of December 2022, Spain as of August 2022, Italy as of the end of 2021, France as of October 2022 and the US as of the end of 2021. Battery hybrid projects are included. Wind includes both onshore and offshore sites.

BloombergNEF

Generation, Storage, and Hybrid Capacity in Interconnection Queues

Introduction | Regional queues | Hybrids only | Western non-ISO | Southeast non-ISO | Existing vs. queues | **Trends**

Total Capacity in Queues, 2007 - 2022



Select Region(s) then hit Apply
- ☑ CAISO
- ☑ ERCOT
- ☑ ISO-NE
- ☑ MISO
- ☑ NYISO
- ☑ PJM
- ☑ Southeast (non-ISO)
- ☑ SPP
- ☑ West (non-ISO)

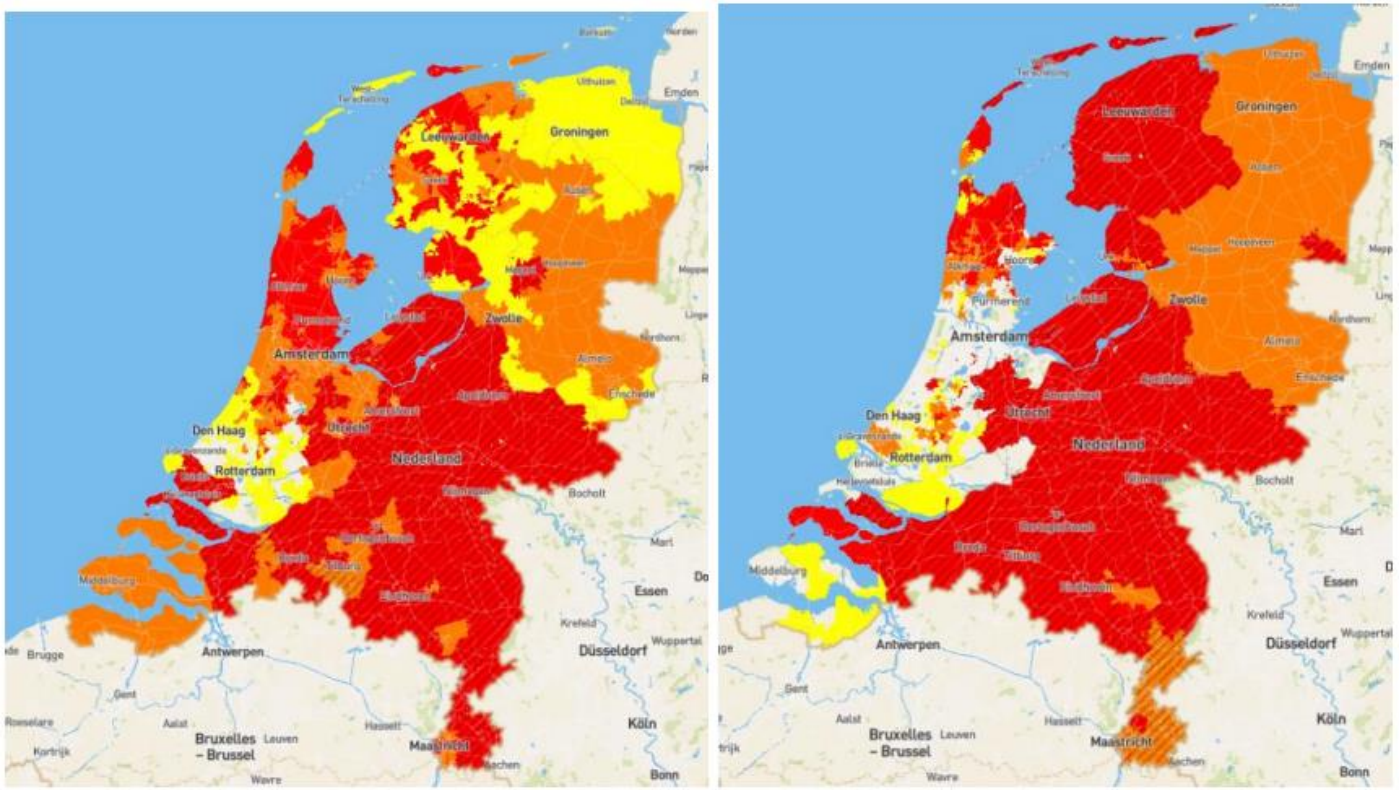
Select cumulative or annual additions
- ○ Annual
- ◉ Cumulative

Click to highlight
- Battery (standalone)
- Coal
- Gas
- Geothermal
- Hydro
- Nuclear
- Offshore Wind
- Other
- Other Storage
- Battery (Hybrid)
- Solar
- Solar + Battery
- Solar + Wind
- Solar + Wind + Battery
- Wind
- Wind + Battery
- Unknown
- Other Hybrids

Notes:
- Hybrid storage capacity is estimated for some projects.
- Battery storage and all hybrid categories data is from 2018 through 2022.
- Reforms in PJM and CAISO paused or slowed new interconnection requests in 2022.
- ERCOT queue data includes only projects that have requested a full interconnection study (FIS).
- For details on methodology see https://emp.lbl.gov/queues .

Source: Laurence Berkeley Lab

Load

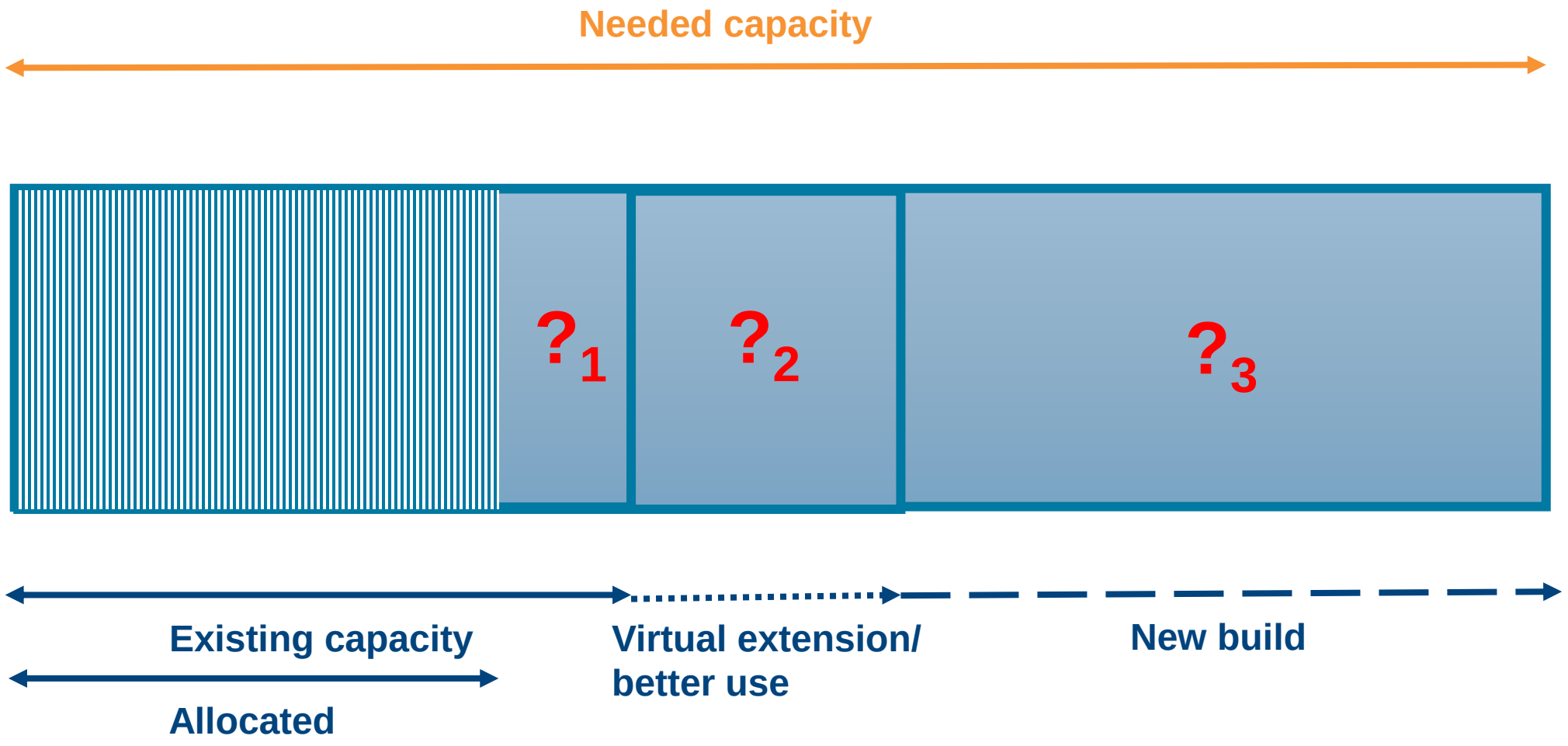


Feed-in

Transparent: Transport capacity available
Yellow: Limited transport capacity available
Orange: No transport capacity available for the time being pending the outcome of the congestion management study
Red: No transport capacity available: congestion management cannot be applied

Source: Pató: Gridlock in the Netherlands, 2023. RAP

How can you enhance grid capacity?



?$_1$: (Re)allocation of remaining grid capacities

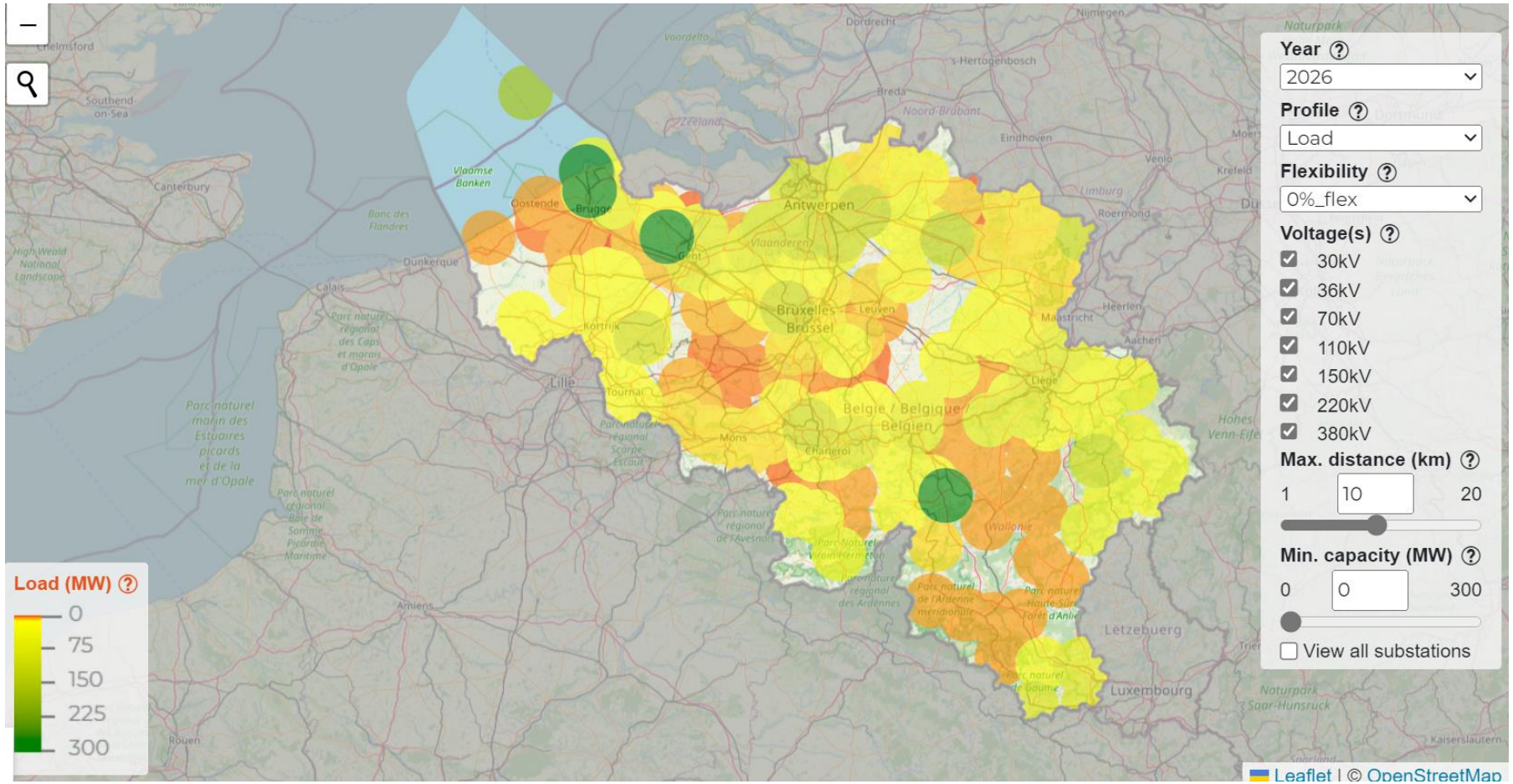
- Managing ‘contractual congestion’
- Priority lanes
- Cleaning the queue
- More transparency on the available capacities
- Better governance
- Competitive allocation of grid capacities
- Trading of allocated grid capacities

Time horizon of implementation - legend:

(Re)allocation of remaining grid capacities: examples

- "use-it-or-lose-it": NL
- "shovel-ready": South-Africa
- "triage" process: UK
- Revoking grid permit if milestones not met: UK, ES
- Amnesty to leave the grid queue: UK, BR
- Financial penalty on grid operators not meeting study deadlines: US
- Cluster approach: NL, US
- Auctioning grid capacities: TR, PT, ES

(Re)allocation of remaining grid capacities: examples



Source: Elia

$?_2$:Utilization of existing grid capacities

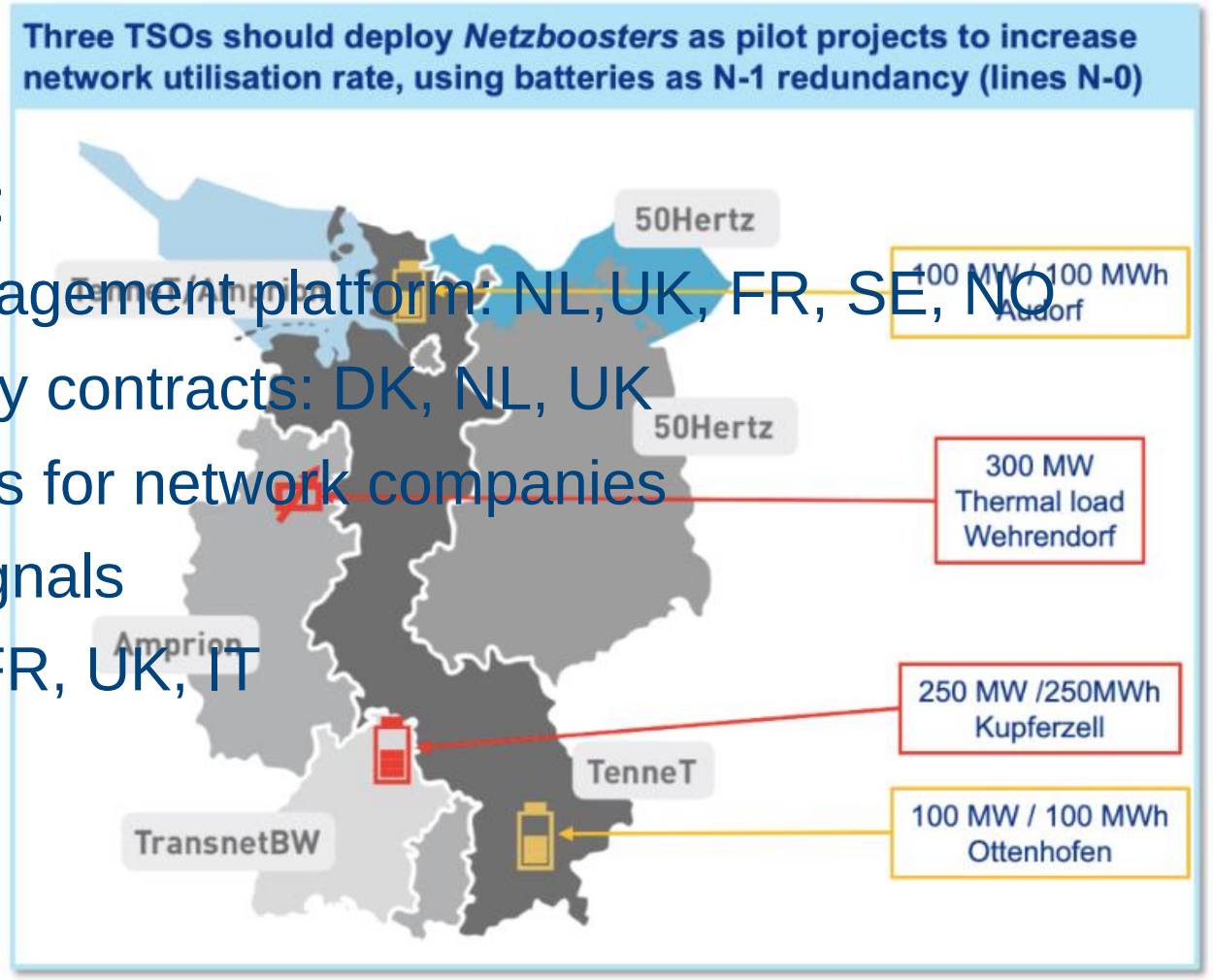
- Shared connection/pooling
- Setting up a congestion management platform
- Mobilising participation in congestion management
- Flexible connection contracts
- Rethinking grid assessment
- Grid enhancing technologies (GETs)
- Incentives for network operators
- Better scarcity signals for grid users
- ISO

Time horizon of implementation - legend:

≤2 year	2-3 years	≥3 years

Utilization of existing grid capacities: examples

- Shared connecti
- Congestion management platform: NL,UK, FR, SE, NO
- Non-firm capacity contracts: DK, NL, UK
- Proper incentives for network companies
- Price/scarcity signals
- GETs: US, DE, FR, UK, IT



Source

?$_3$:Creating new grid capacities

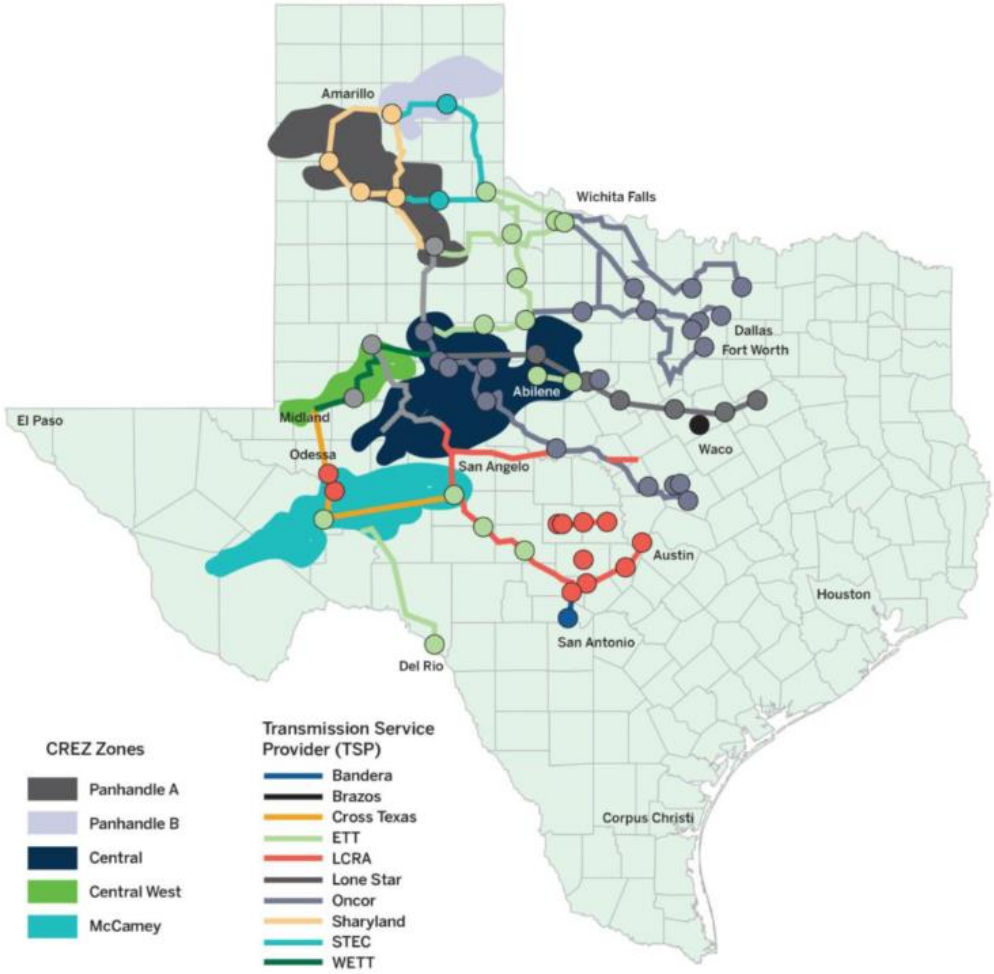
- Contestable built
- Anticipatory planning/RES zones
- Co-opting/buying-in of local communities
- Locational marginal pricing

Time horizon of implementation - legend:

≤2 year	2-3 years	≥3 years

Creating new grid capacities: examples

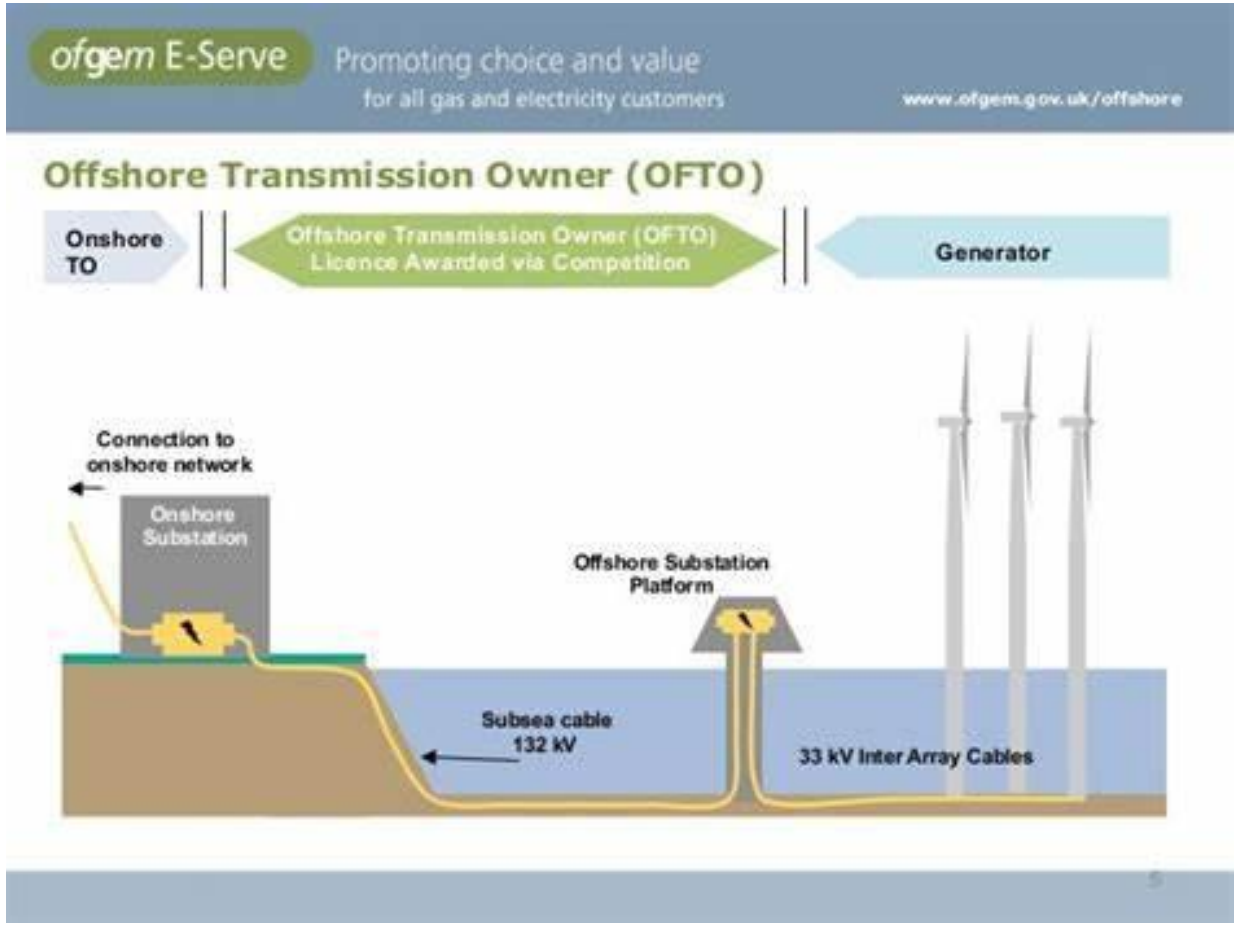
CREZ



Source: Lasher, W. (2014). The competitive renewable energy zones process

Creating new grid capacities: examples

OFTO



Source: OFGEM

Key takeaways

- Grids are imminent barriers to the energy transition
- Many short and longer term options
- Balance welfare loss: delayed grid buildout vs underutilised new grids
- Incentive for SOs to be innovative