

ENERGINET

INTEGRATION OF OFFSHORE WIND IN THE ELECTRICITY GRID

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Energinet Associated Activities



ENERGINET

THE ENERGY BACKBONE

We operate and develop the transmission grids and gas pipelines in Denmark

ENSURE BALANCE

We have the day-to-day and long-term responsibility for the overall electricity and gas system in Denmark

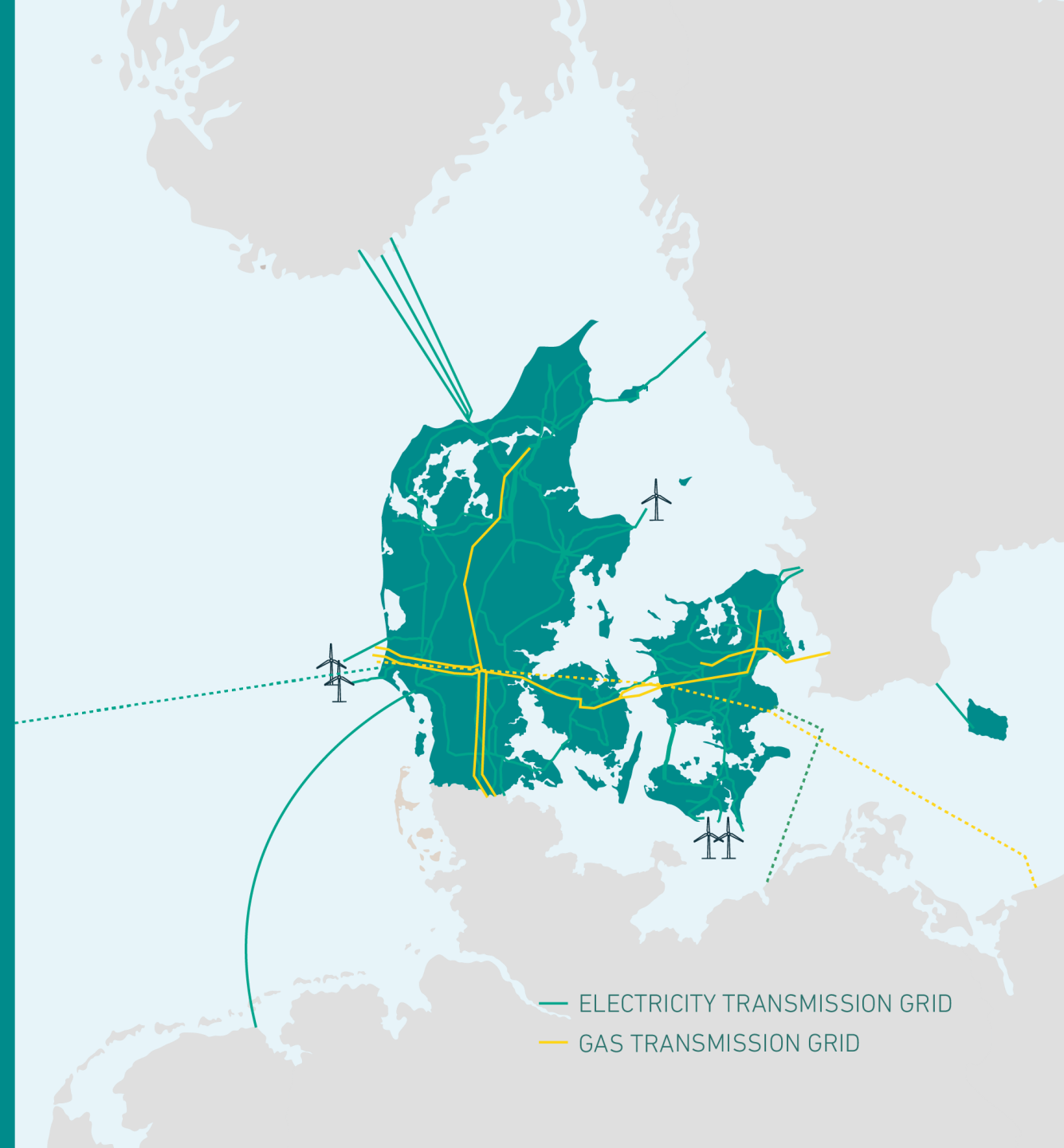
WORKING FOR THE SOCIETY

We are owned by the Danish Ministry of Climate, Energy and Utilities



VISION

GREEN ENERGY FOR A
BETTER WORLD



— ELECTRICITY TRANSMISSION GRID
— GAS TRANSMISSION GRID

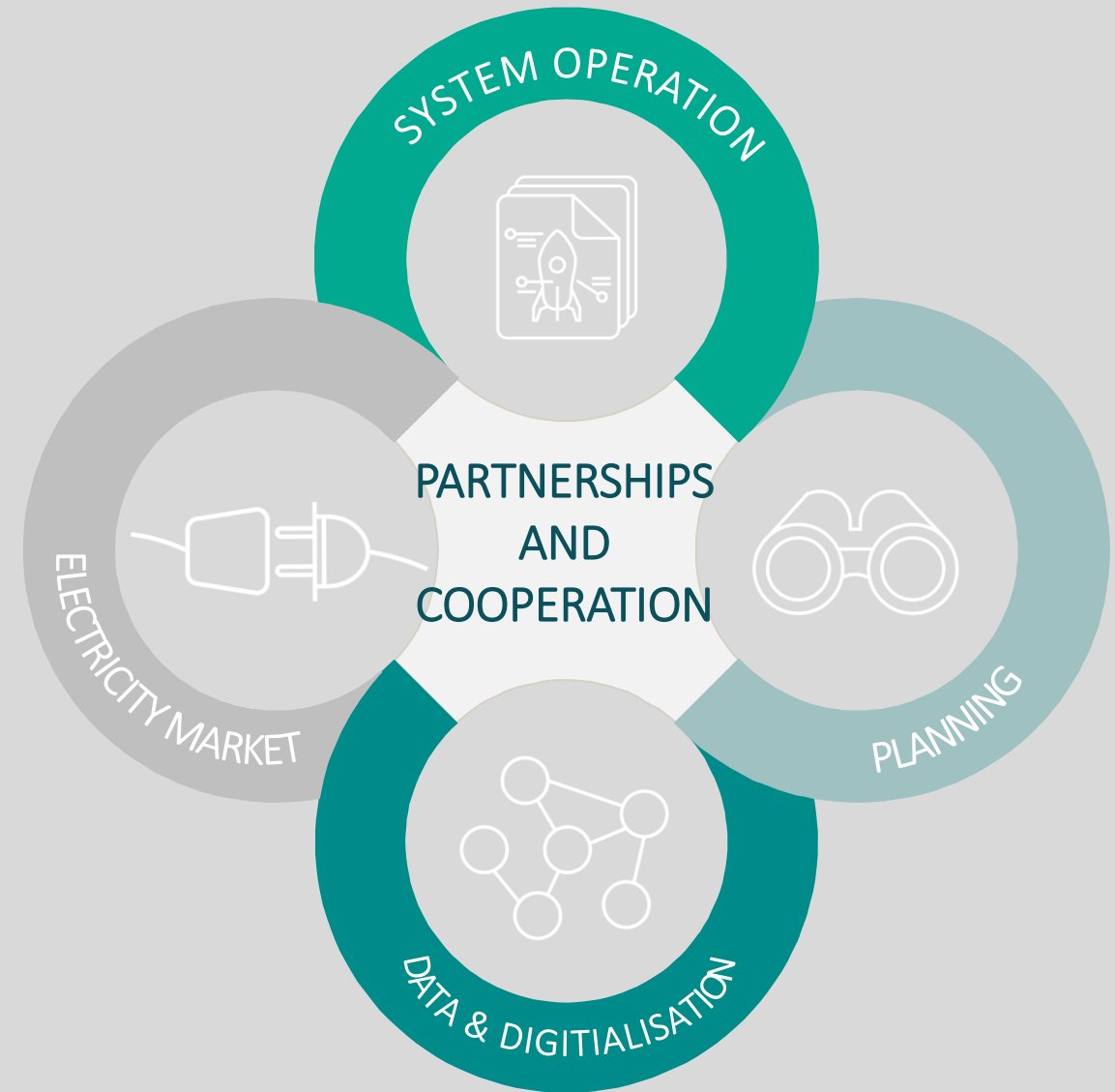
HOW TO INTEGRATE OFFSHORE WIND

ESTABLISHED TOOLS

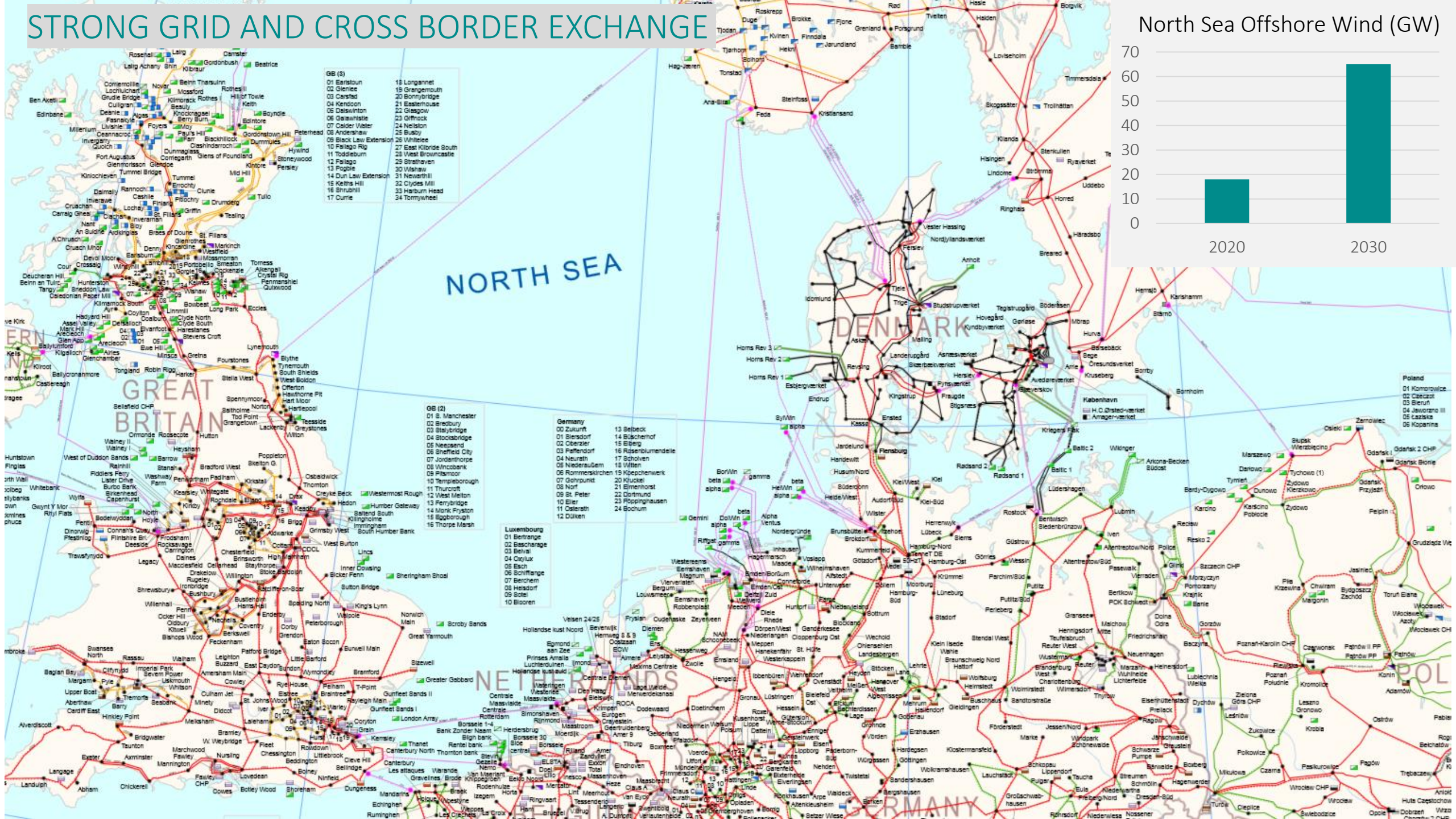
- Strong grid and interconnections
- International electricity and gas markets
- Specialised analyses and models
- Long-term planning

NEW TOOLS

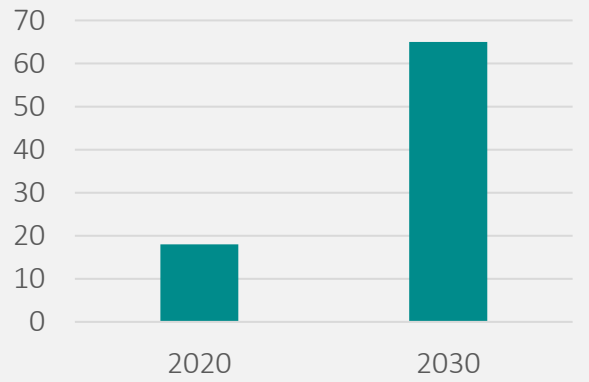
- Connected system development
- Sector coupling (electricity, gas, heating, transport, ptx)
- Market incentives and operational optimisation
- New players and partnerships



STRONG GRID AND CROSS BORDER EXCHANGE



North Sea Offshore Wind (GW)



- GB (8)
- 01 Easton
 - 02 Glenelg
 - 03 Cersted
 - 04 Kendon
 - 05 Deaswilton
 - 06 Gaswell
 - 07 Calder Water
 - 08 Andershaw
 - 09 Black Law Extension
 - 10 Faring Rg
 - 11 Toddeburn
 - 12 Falago
 - 13 Papple
 - 14 Dun Law Extension
 - 15 Keiths Hill
 - 16 Struthill
 - 17 Currie
 - 18 Langannet
 - 19 Grangemouth
 - 20 Bonnybridge
 - 21 Easterhouse
 - 22 Glasgow
 - 23 Giffnock
 - 24 Neilson
 - 25 Busby
 - 26 Whitelee
 - 27 East Kilbride South
 - 28 Glasgow
 - 29 Strathaven
 - 30 Wishaw
 - 31 Newarthill
 - 32 Clyde Mill
 - 33 Harburn Head
 - 34 Torrywheel

- Germany
- 00 Zukunft
 - 01 Biersdorf
 - 02 Oberzier
 - 03 Paffendorf
 - 04 Neurath
 - 05 Niederauem
 - 06 Rommerskirchen
 - 07 Gompund
 - 08 Norf
 - 09 St. Peter
 - 10 Elter
 - 11 Osterath
 - 12 Dulken
 - 13 Seibbeck
 - 14 Bischenhof
 - 15 Elberg
 - 16 Rosenblumendele
 - 17 Scholven
 - 18 Wilfen
 - 19 Keeschenwerk
 - 20 Klucel
 - 21 Elmhorst
 - 22 Dortmund
 - 23 Rippinghausen
 - 24 Bockum

- Luxembourg
- 01 Bertrange
 - 02 Besenange
 - 03 Belval
 - 04 OxyLux
 - 05 Each
 - 06 Schifflange
 - 07 Berchem
 - 08 Hoesdorf
 - 09 Solel
 - 10 Bloeren

- Poland
- 01 Komornice
 - 02 Czacok
 - 03 Bierut
 - 04 Jaworzno III
 - 05 Laskowice
 - 06 Kozanina

COMMON EUROPEAN ELECTRICITY MARKET

1999: Scandinavian markets coupled

2006: Market Coupling Belgium, Netherlands, France

2008: Coupling Central West Europe, Central Eastern Europe

2008: Coupling Central Western Europe and Nordics

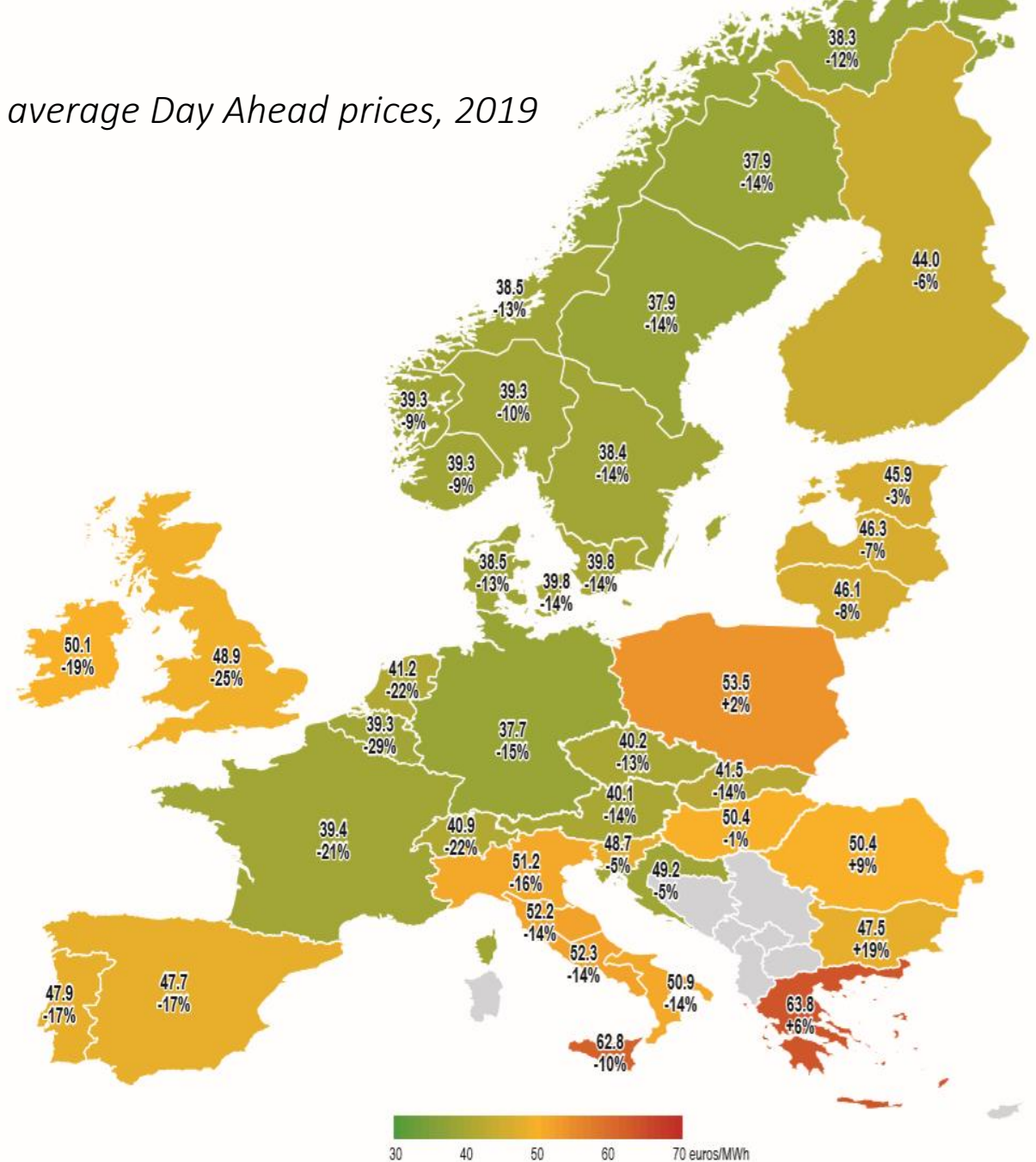
2011: UK coupling

2014: Coupling North West Europe

2015: Full European Market Coupling

2018: Intraday Central Western Europe/Nordic Market Coupling

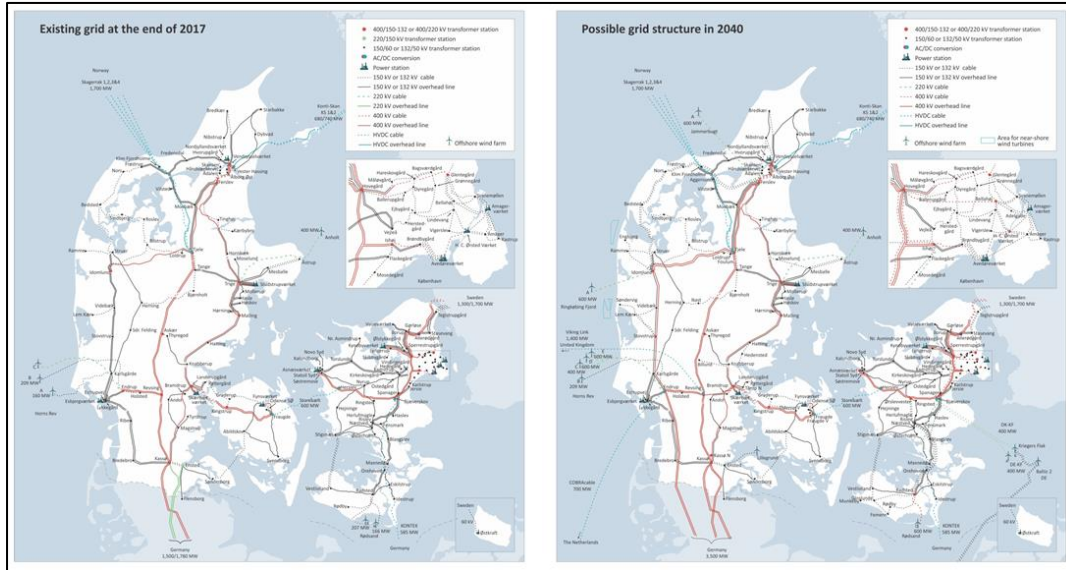
Annual average Day Ahead prices, 2019



Source: ACER calculations based on data by the European Network of Transmission System Operators for Electricity (ENTSO-E).

LONG TERM NATIONAL AND EUROPEAN PLANNING

National development plans

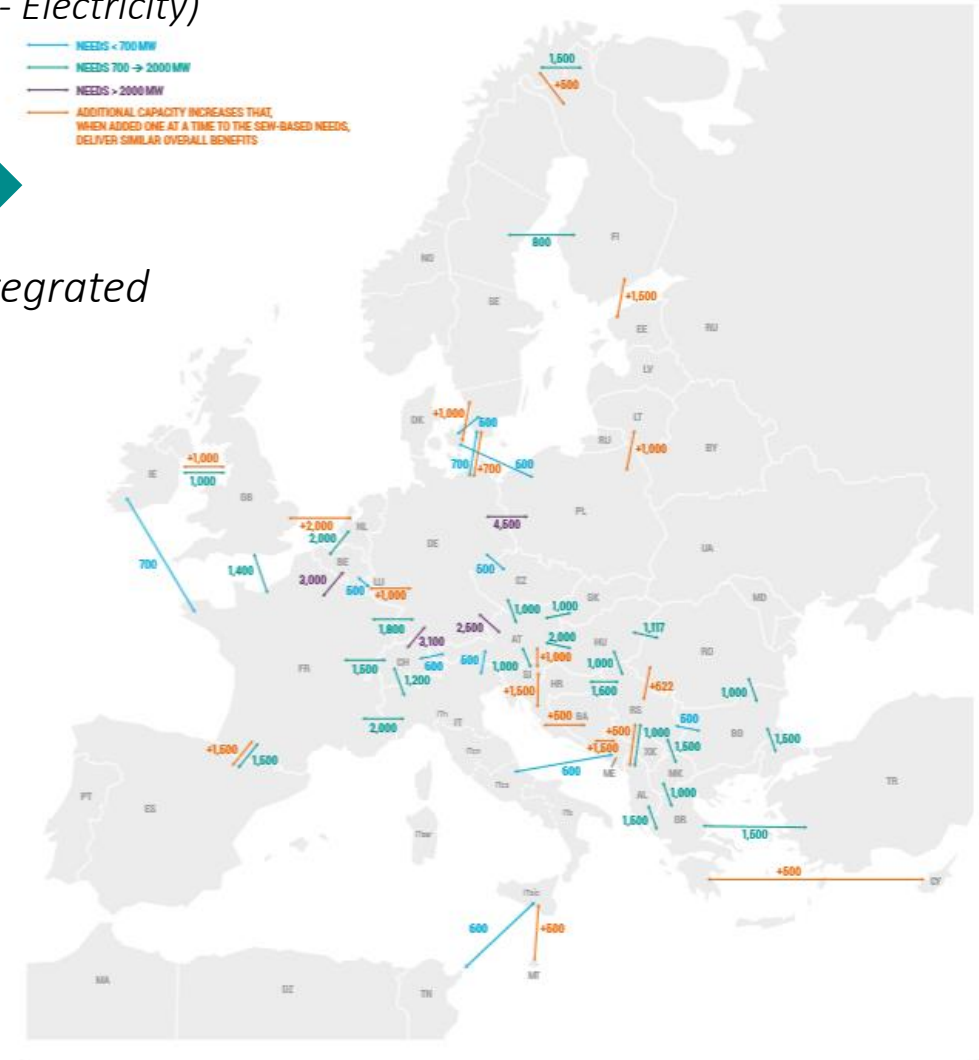


European Ten Year Network Development Plan, TYND-P (facilitated by ENTSO-E, European Network Transmission System Operators- Electricity)



Two year integrated process

NEEDS < 700 MW
NEEDS 700 → 2000 MW
NEEDS > 2000 MW
ADDITIONAL CAPACITY INCREASES THAT WHEN ADDED ONE AT A TIME TO THE SEW-BASED NEEDS, DELIVER SIMILAR OVERALL BENEFITS

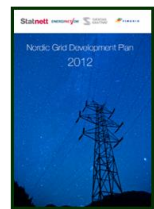


National plans



(EC) 72/2009
Law on Energinet

Nordic Plan



Nordic
Council of Ministers

2 Regional ENTSO-E Plans including Denmark (RGNS, RGS)



1 European TYNDP



ENERGINET EXPERIENCE WITH OFFSHORE WIND TOPOLOGIES

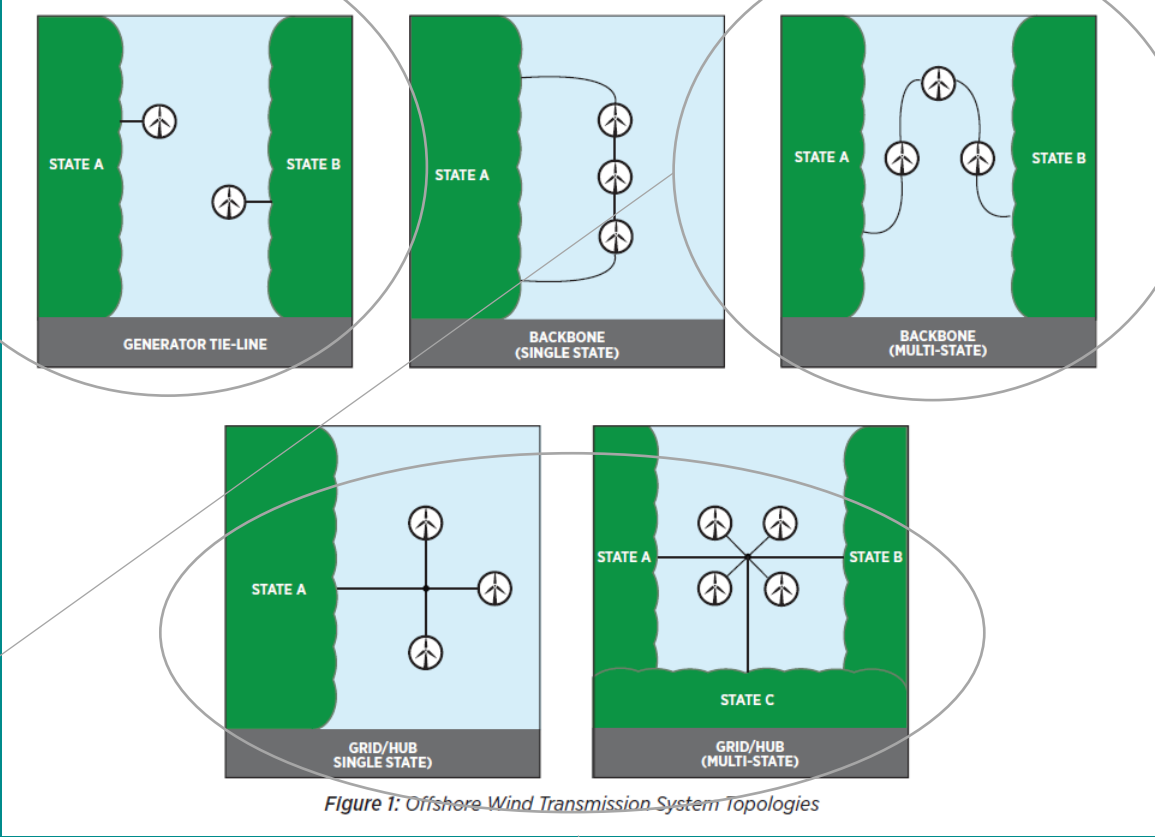
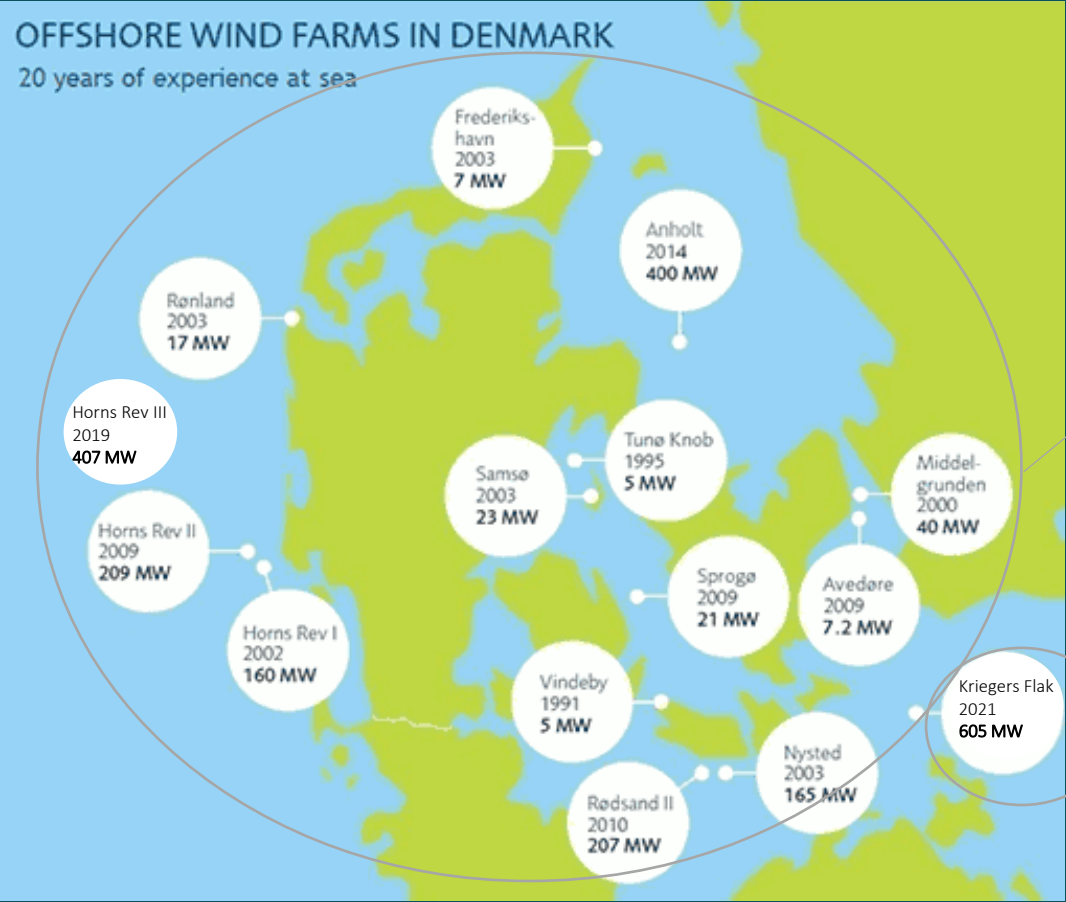


Figure 1: Offshore Wind Transmission System Topologies

Future solutions

FUTURE SOLUTIONS FOR AFFORDABLE INTEGRATION

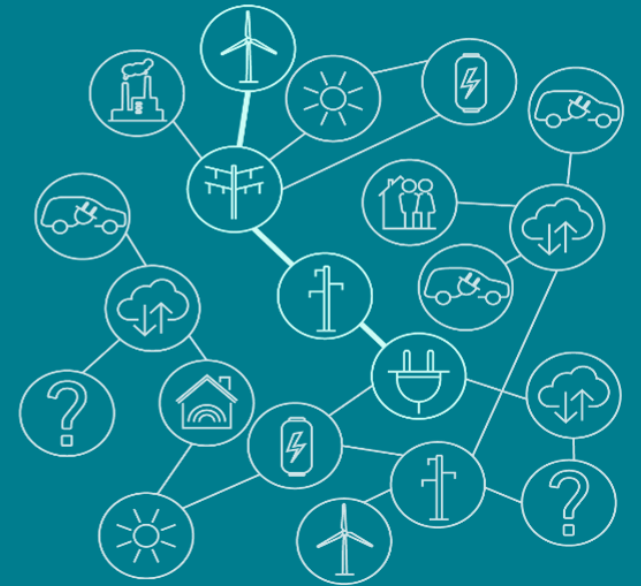
NORTH SEA WIND POWER HUB
- INTERNATIONAL COOPERATION



ENERGY ISLAND
- LARGE SCALE SOLUTIONS

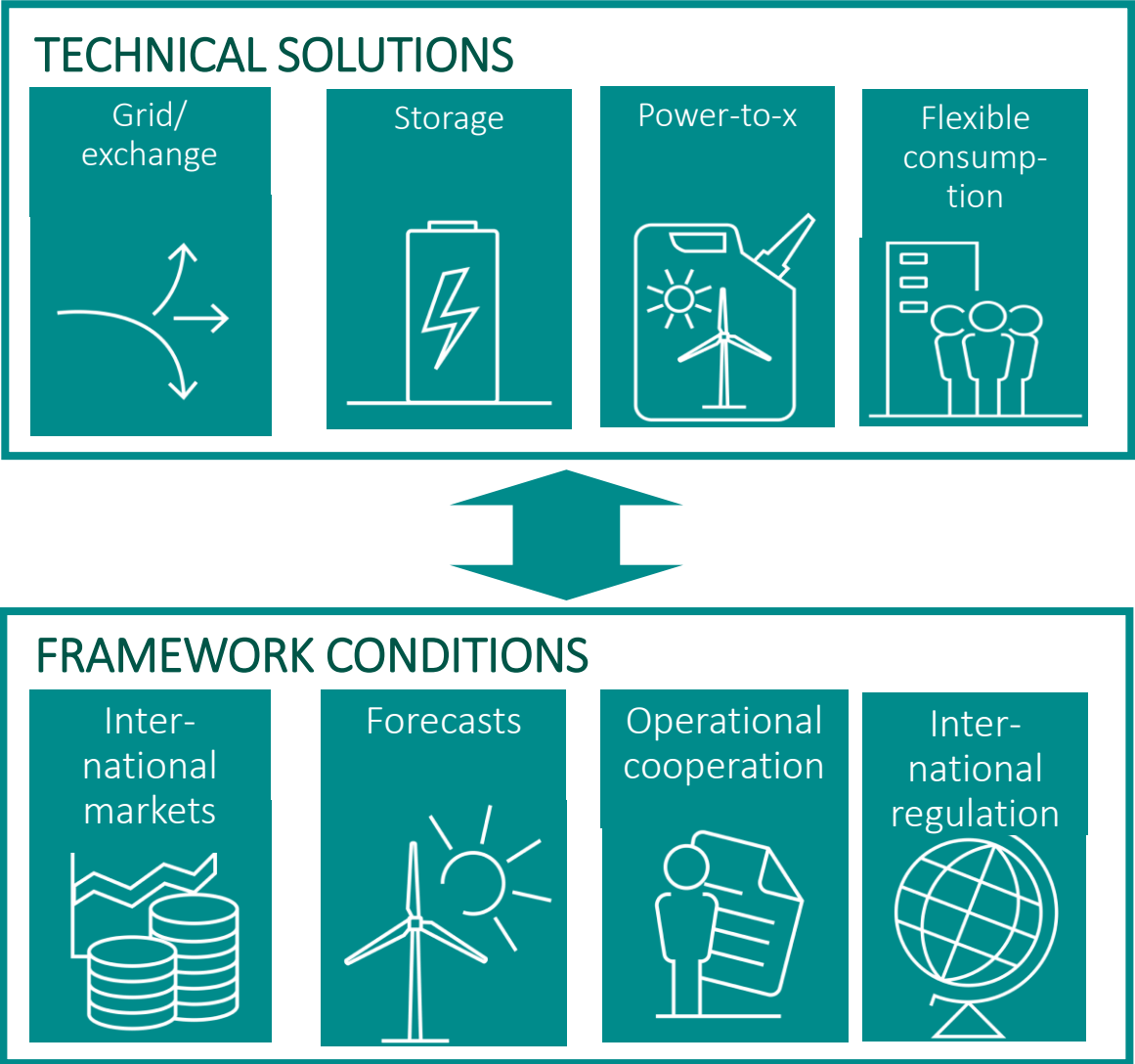
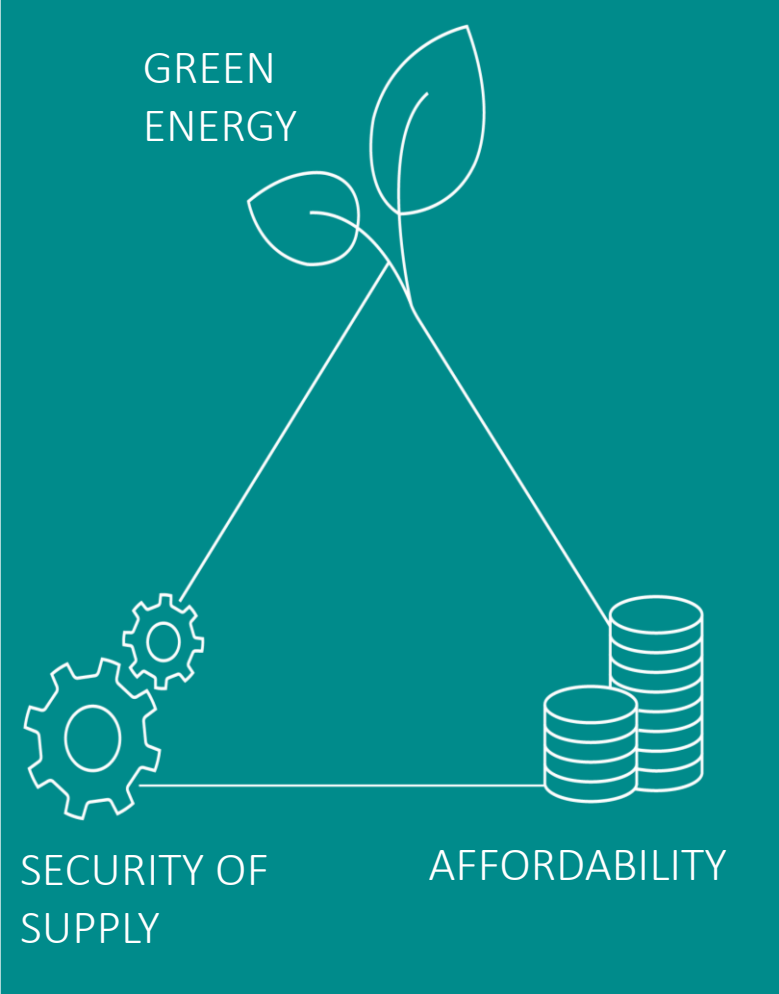


SECTOR COUPLING
- INCREASING VALUE FROM ELECTRIFICATION



ENERGINET

ALL SOLUTIONS NEEDED – AND FRAMEWORK FOR EFFICIENT EXECUTION



Thank you for
your attention



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Video [green energy for a better world](#)