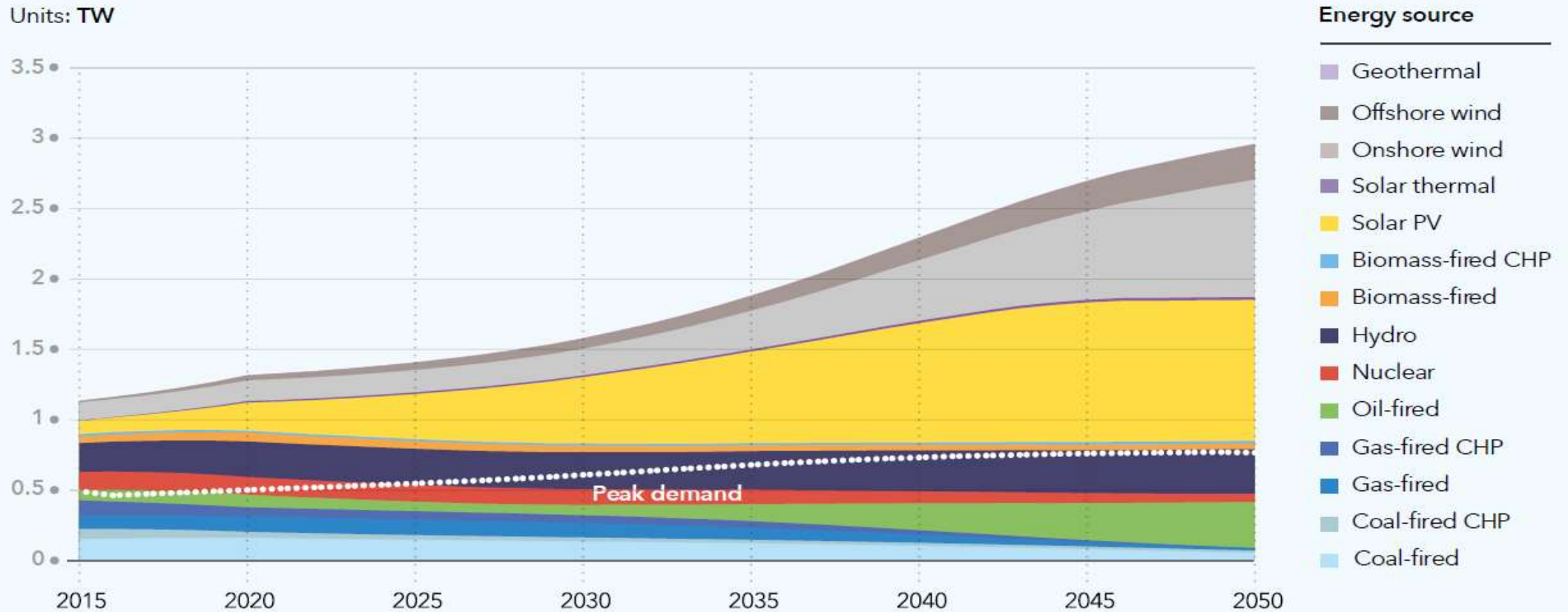
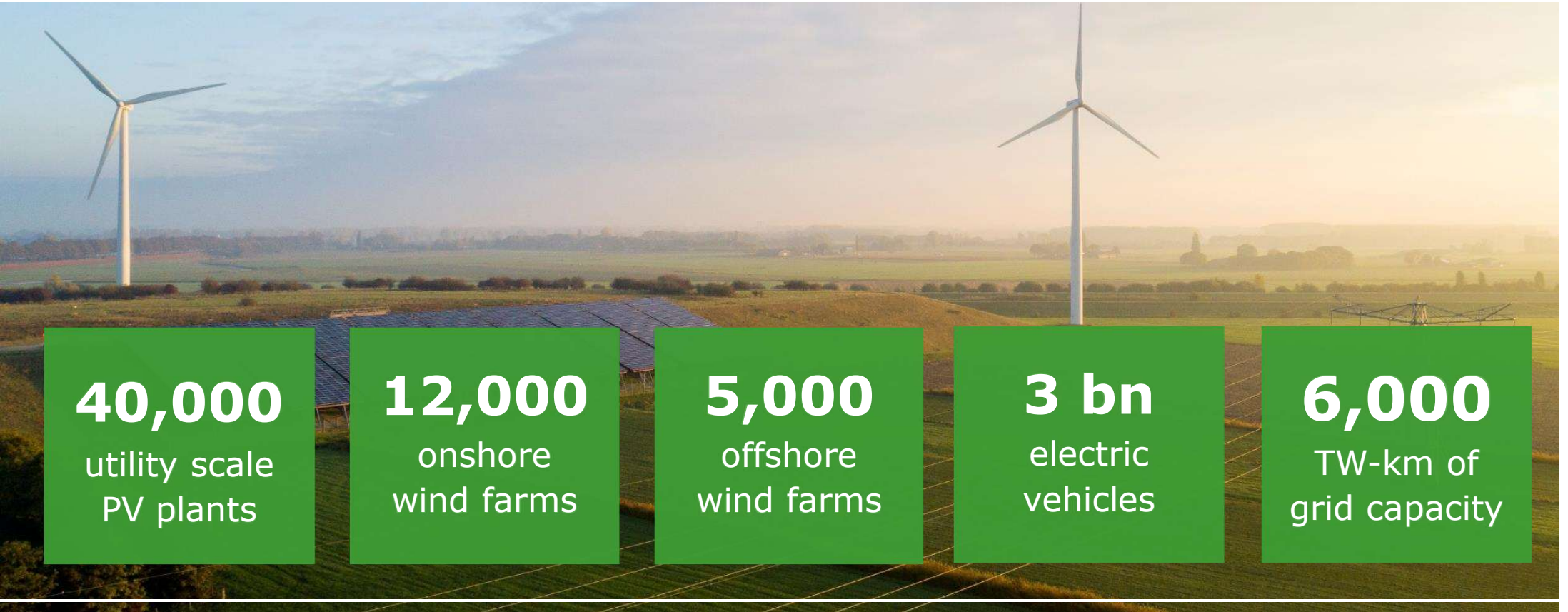


Massive scale and Massive overcapacity at certain time stamps

EUROPE ELECTRICITY CAPACITY (FIGURE 3-5)



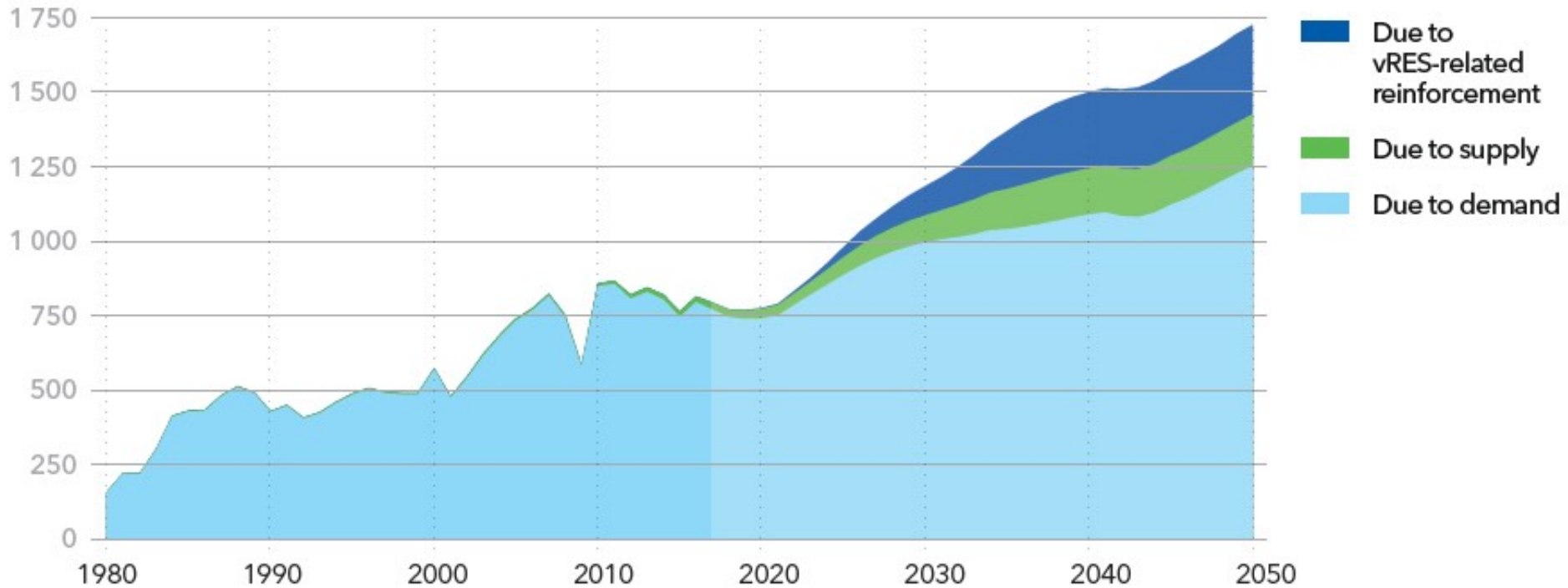
The power grid will almost triple in size by 2050



Grid investments will outgrow demand growth

World electricity grid expenditures by driver

Units: Billion USD/yr

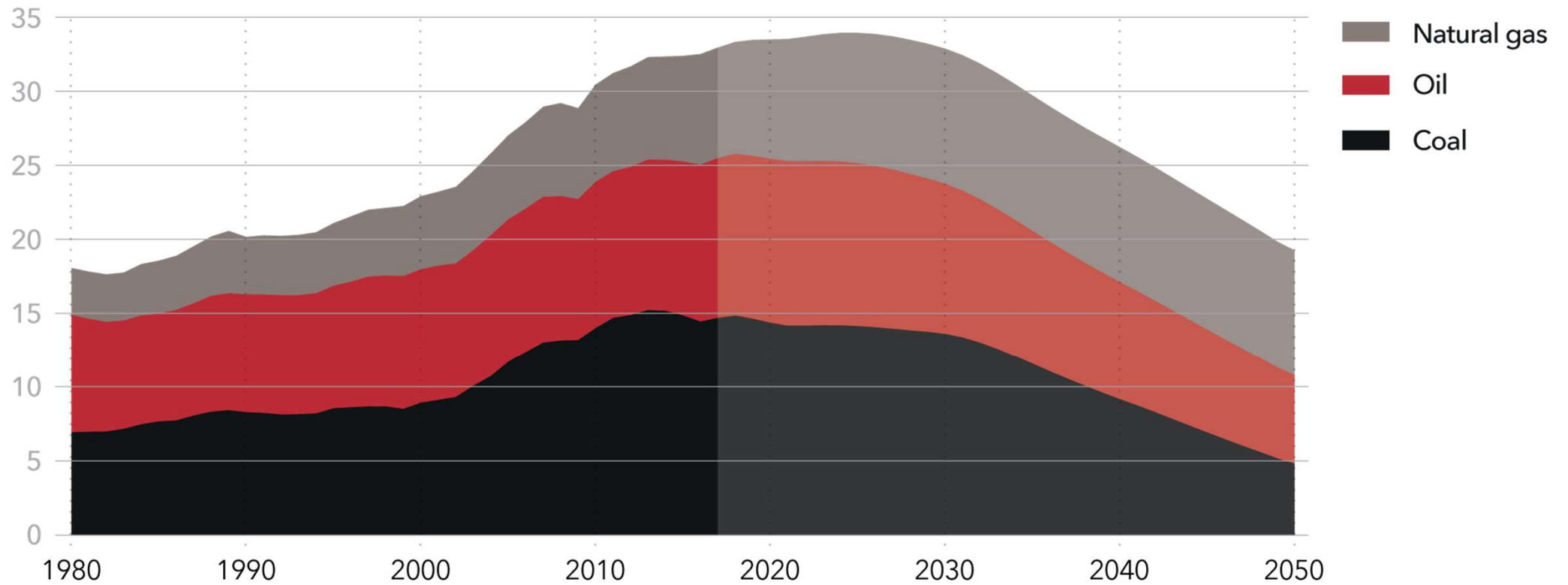




FAST, BUT NOT FAST ENOUGH

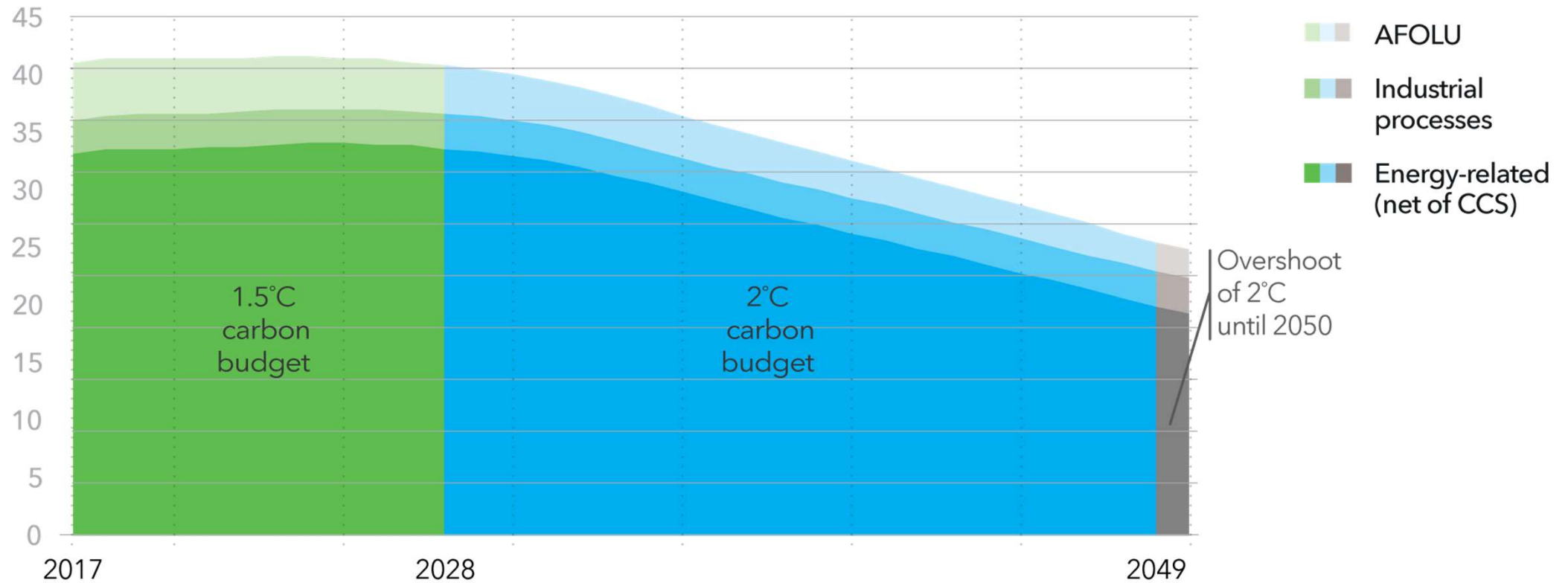
Emissions by fossil fuel

Units: GtCO₂/yr



Carbon emissions and carbon budget

Units: GtCO₂/yr



What can be done to close the gap?

**Electricity
from renewables**

**Reduced energy
intensity**

**CCS for power
and industry**

One such combination that could get us there includes:



Grow solar power by >10 times to 5 TW and wind by 5 times to 3 TW by 2030



50-fold increase in production of batteries for the 50 million electric vehicles needed per year by 2030



Invest more than \$1.5 trillion annually in the expansion and reinforcement of power grids by 2030



Create new infrastructure for charging electric vehicles on a large scale



Increase global energy efficiency improvements by 3.5% per year within the next decade

One such combination that could get us there includes:



Improved and cheaper heat-pump technologies and improved insulation



Green hydrogen to heat buildings and industry, fuel transport and make use of excess renewable energy in the power grid



For the heavy industry sector: increased electrification of manufacturing processes, including electrical heating



Massive rail expansion both for city commuting and long-distance passenger and cargo transport



Rapid and wide deployment of carbon capture, utilization and storage installations



“*Time is against us. We need extraordinary policy action now: policies that advance renewables, new decarbonization technologies, EVs and energy efficiency*

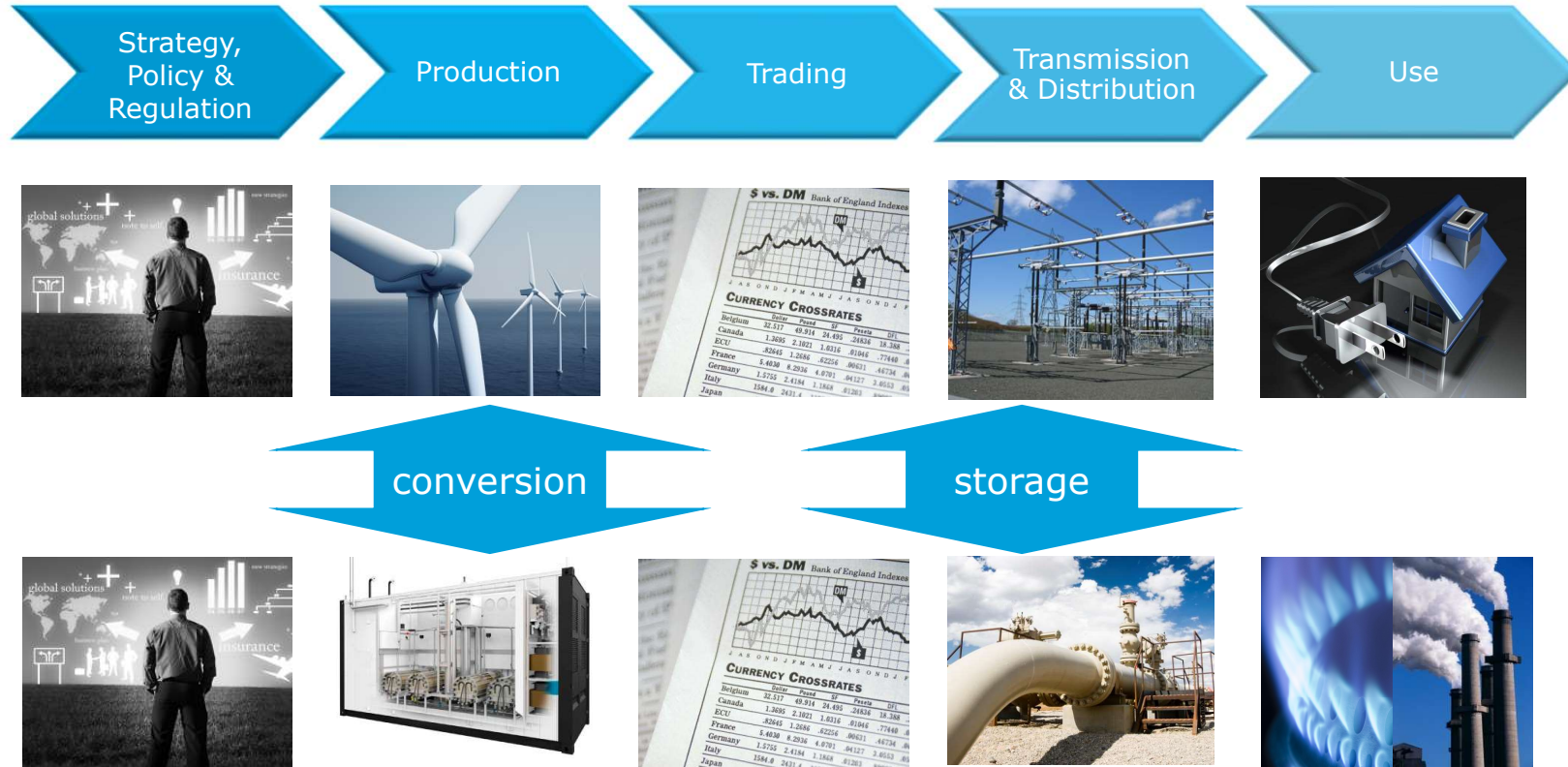
Ditlev Engel, CEO DNV GL - Energy

Energy System Framework – verbinden van bronnen met gebruikers

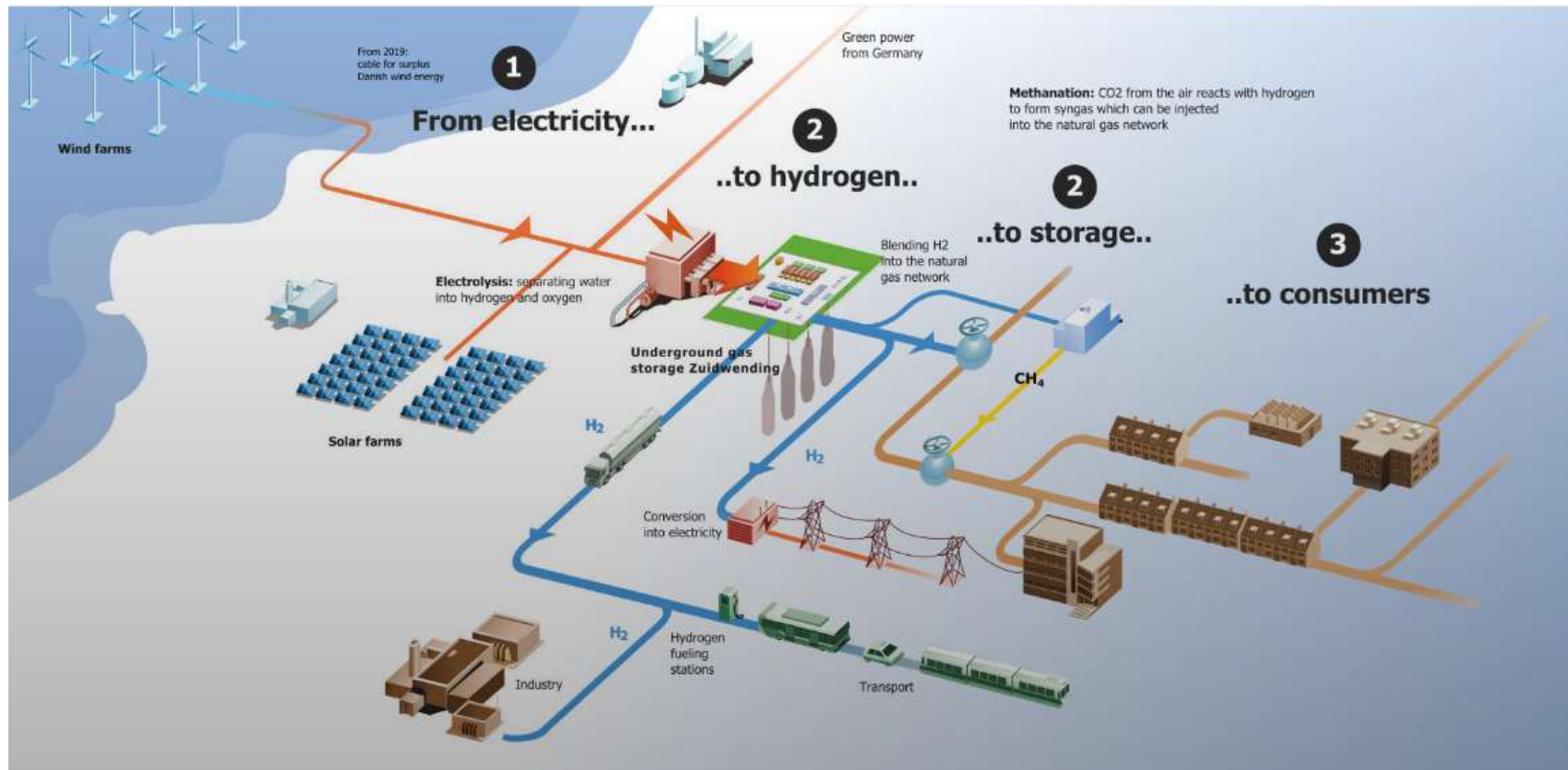
bouwblokken voor waardeketensns



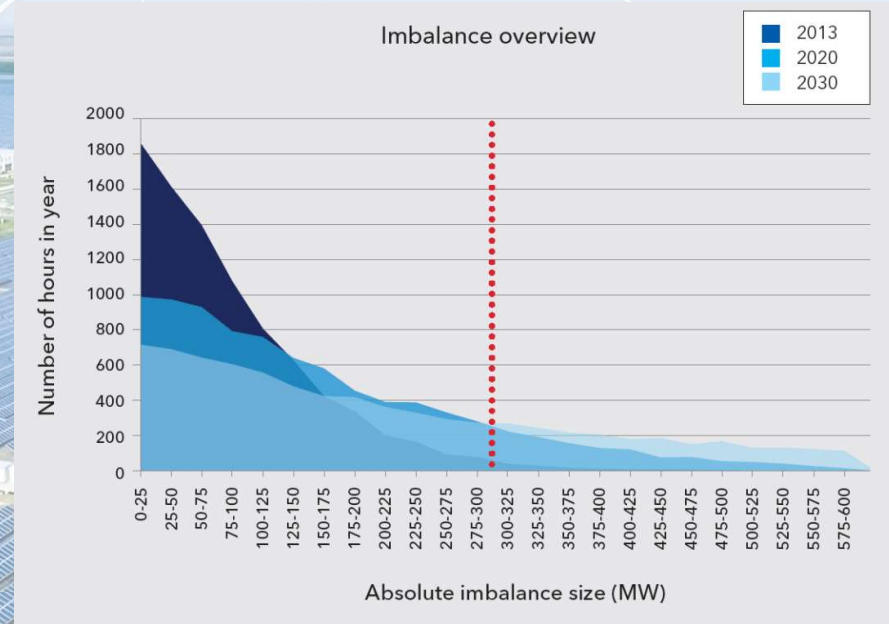
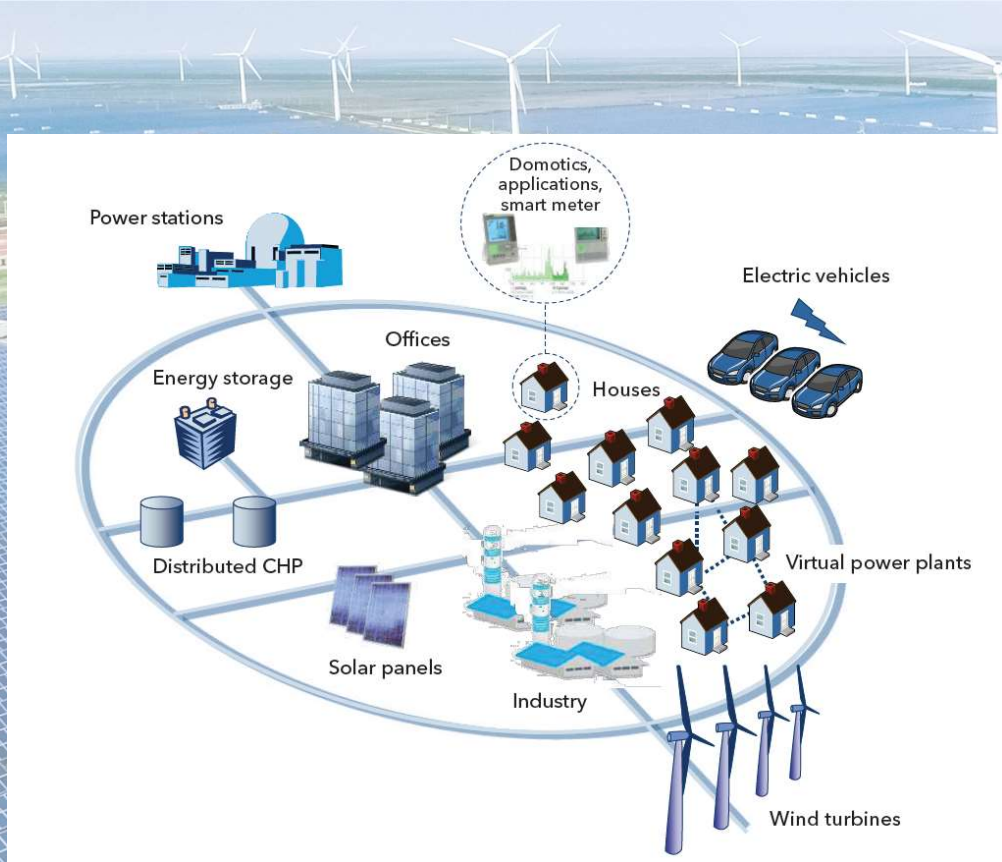
De Energie Waardeketen: flexibiliteit door systeemintegratie



Samengaan van systemen (TSO 2020)



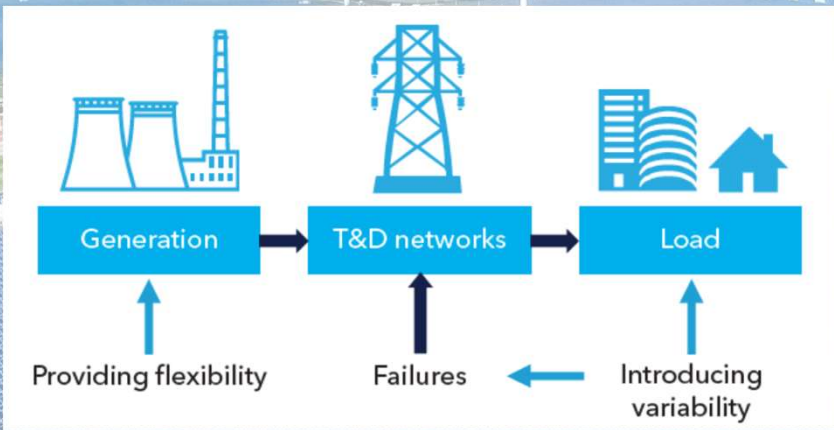
Consequences of high RES



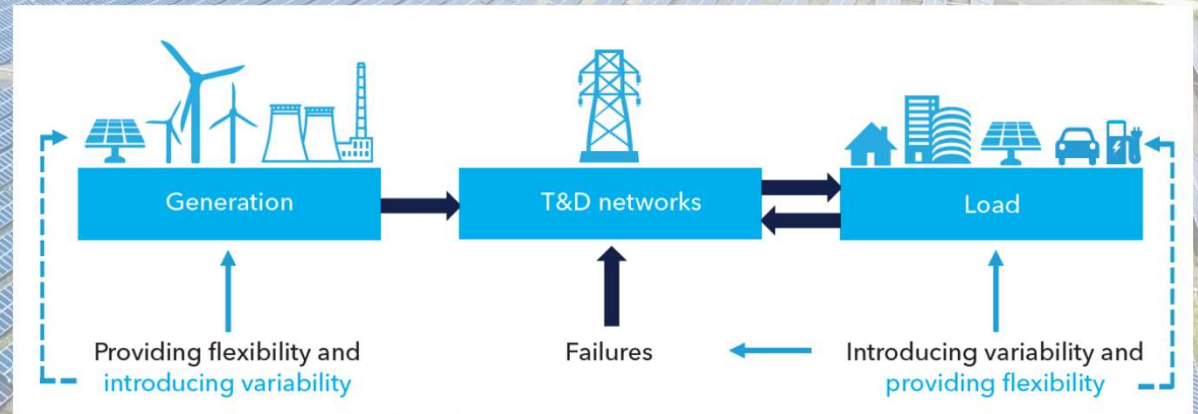
EXCITING TIMES FOR THE DUTCH GRID
 Creating a healthy electricity market for a new energy landscape
SAFER. SMARTER. GREENER.

Sources of variability and flexibility

Conventional



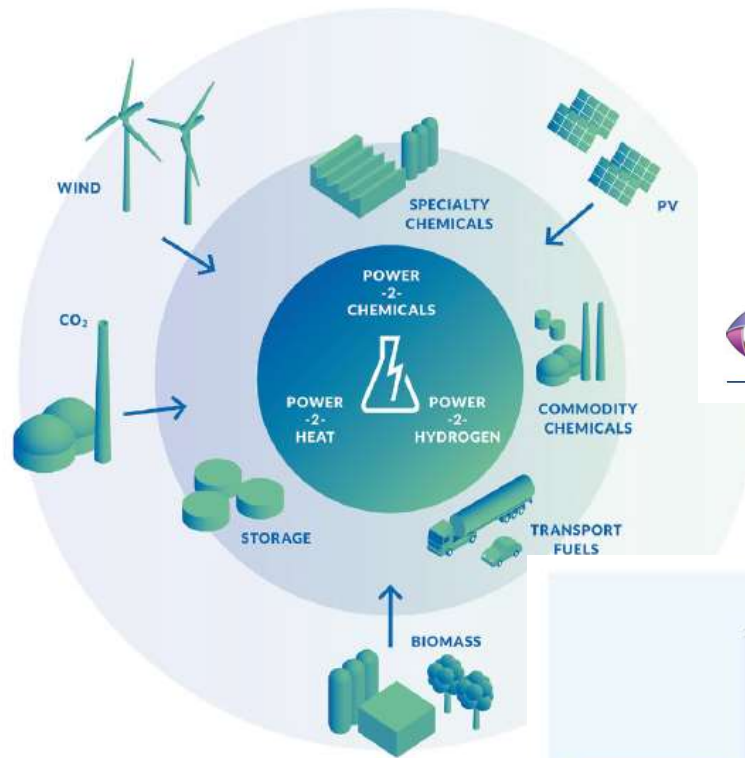
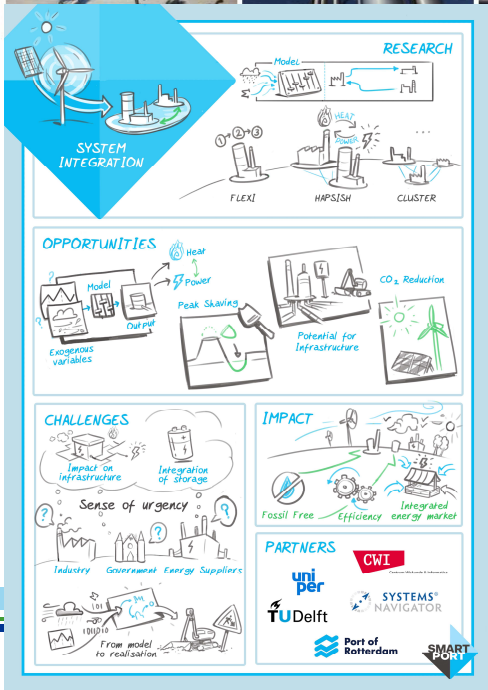
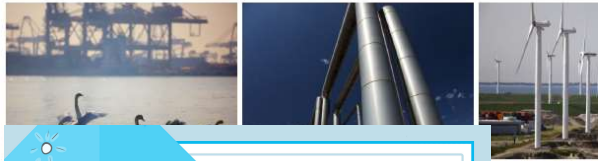
Future



En veel partijen zijn al druk bezig

FINAL REPORT

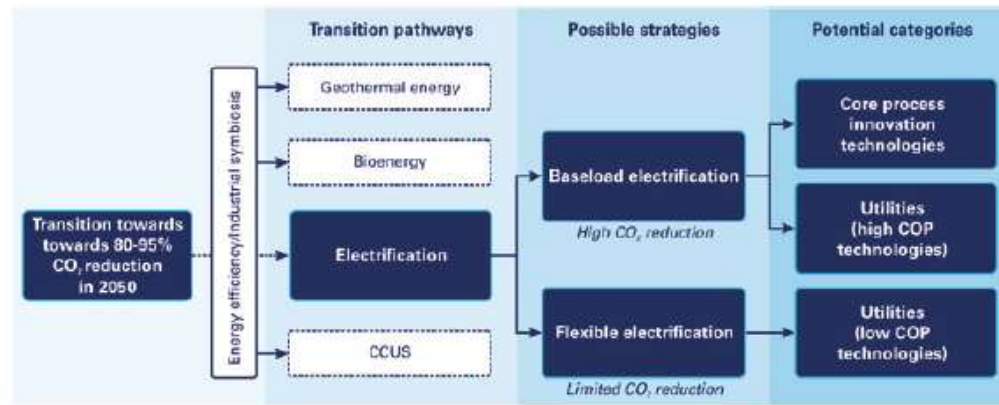
Decarbonization Pathways for the Industrial Cluster of the Port of Rotterdam



Electrification in the Dutch process industry

In-depth study of promising transition pathways
and innovation opportunities for electrification
in the Dutch process industry

8 februari 2017



Kosten en kansen van de EnergieTransitie



Welke rol kan de gebouwde omgeving spelen in het faciliteren van de energietransitie?



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