European grid development and future challenges

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Developing transmission electricity grids, protecting our seas
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Reliable Sustainable Connected

WHO WE ARE

43 TSOs in
36 countries

300 000 km of
transmission lines

7 times the earth's unconference

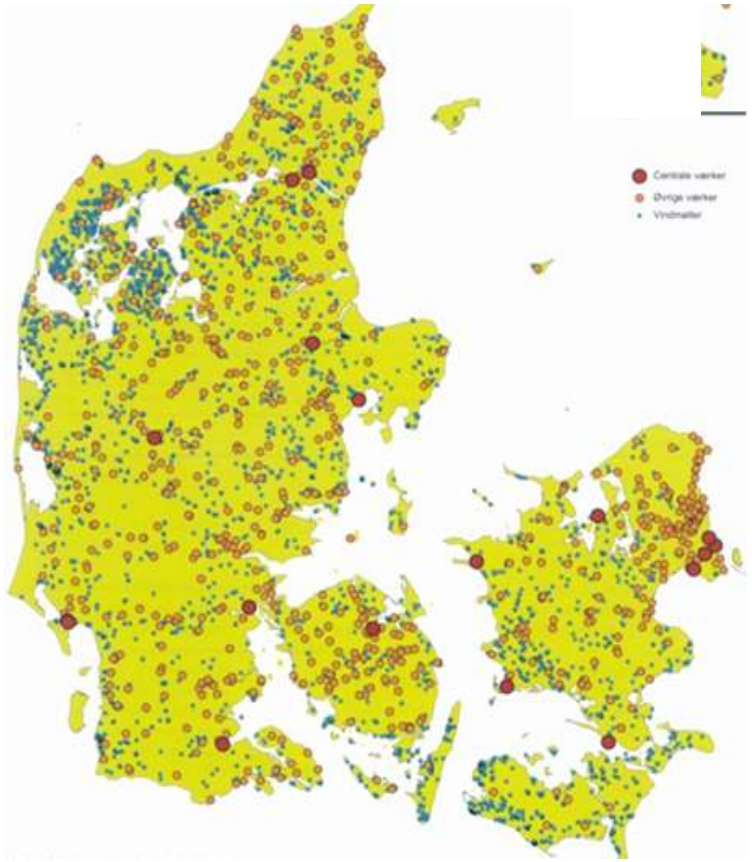
3300 TWh electricity
consumption

of the global
electricity
consumption

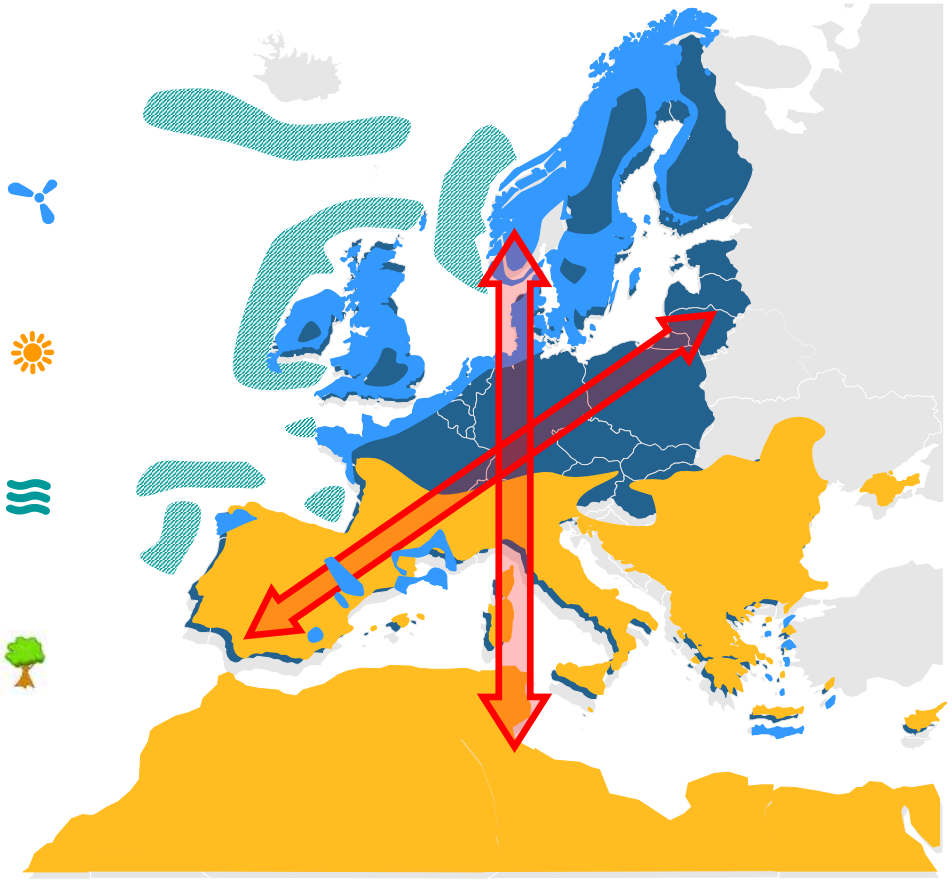
over 500 million
customers served

New complexity

THOUSANDS OF SMALL UNITS



LARGE FLOWS ALL OVER EUROPE



Planning renewable energy

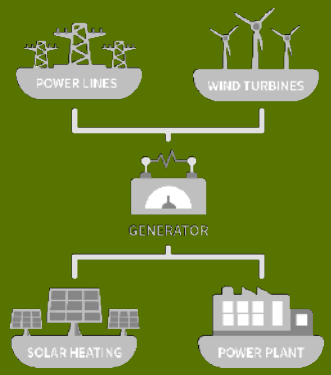
- Electricity saves energy + CO_2 in heating, transport
- But solar/wind volatile, low capacity factor; behind-meter PV affects system planning also
- Needs strong continental grid + smart local markets and grids to control technical problems

Markets

- Generation no longer a natural monopoly
- Wholesale markets dispatch generation well, especially over multiple systems
- Investment in DG in reach of retail customers

Microgrids

- For distribution reliability, price control, local market
- Normally grid-connected
- Good electrification option



Continental grids/HVDC

- Reliability and trading benefits from large inter-connections
- Transport RE surpluses often cheaper than storing or curtailing

HOW TO TACKLE COMPLEXITY?

Set up regulations and a proper business environment

Enabling more RES & demand response connections

flow based

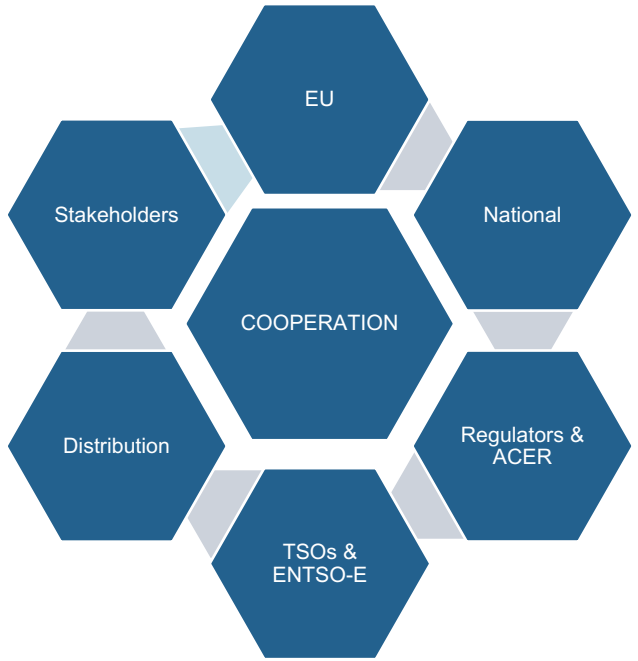
bidding zones review

Regional security coordinators

Strengthen the grid

Including links inside countries

Enhance existing cooperation at all levels



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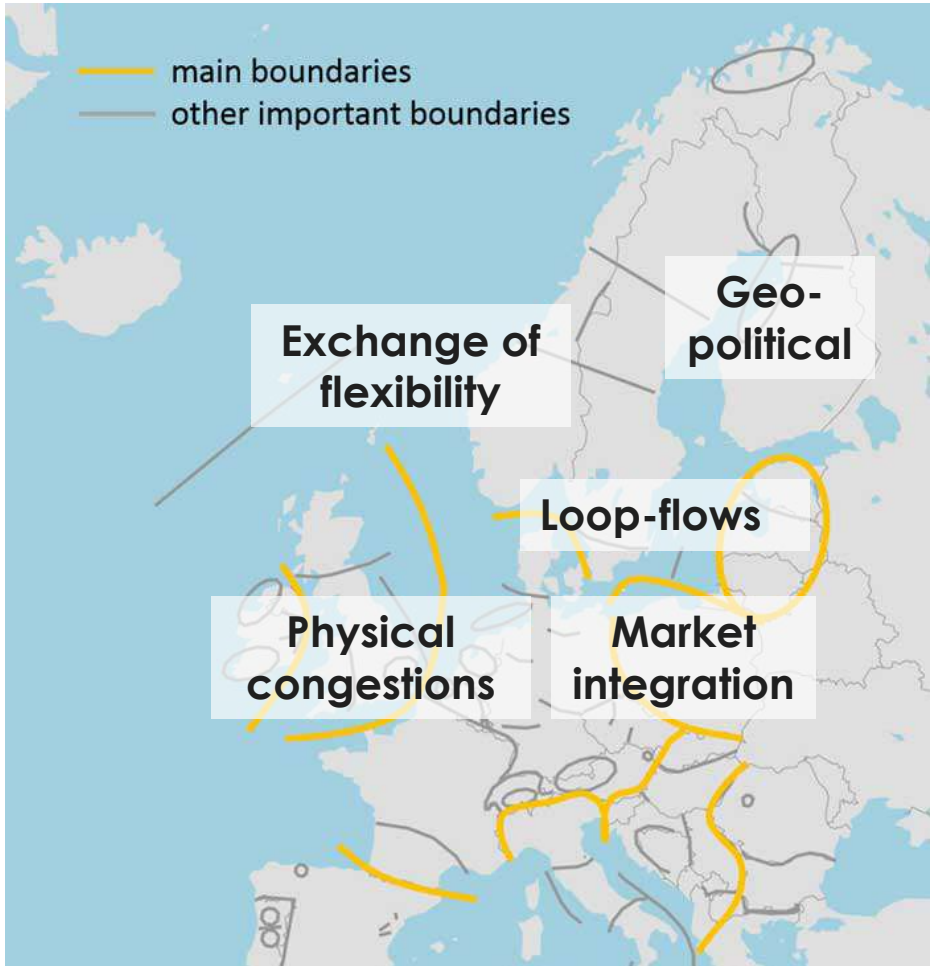
BUILD GRIDS FOR THE FUTURE

Barriers identified in TYNDP 2016



Grid investments by 2030

150 b€

→ Connect new entrants

→ Allow energy transition

THE 10-YEAR NETWORK DEVELOPMENT PLAN

1. Explores the future
2. Shows where the infrastructure needs are
3. Provides data for additional studies
4. Assesses +/- 200 pan-European projects

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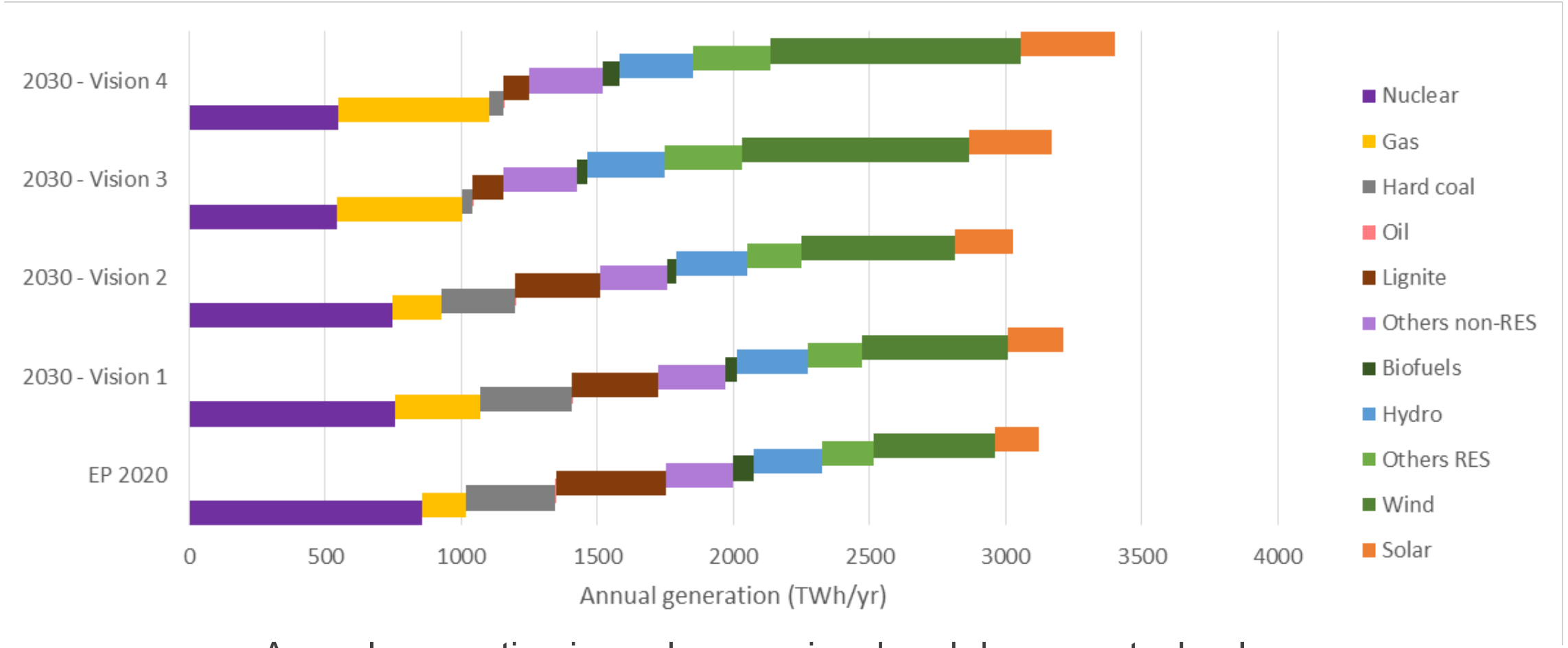
TYNDP SCENARIOS: A WIDE RANGE OF PLAUSIBLE FUTURES



Annual generation in each scenario – breakdown per technology

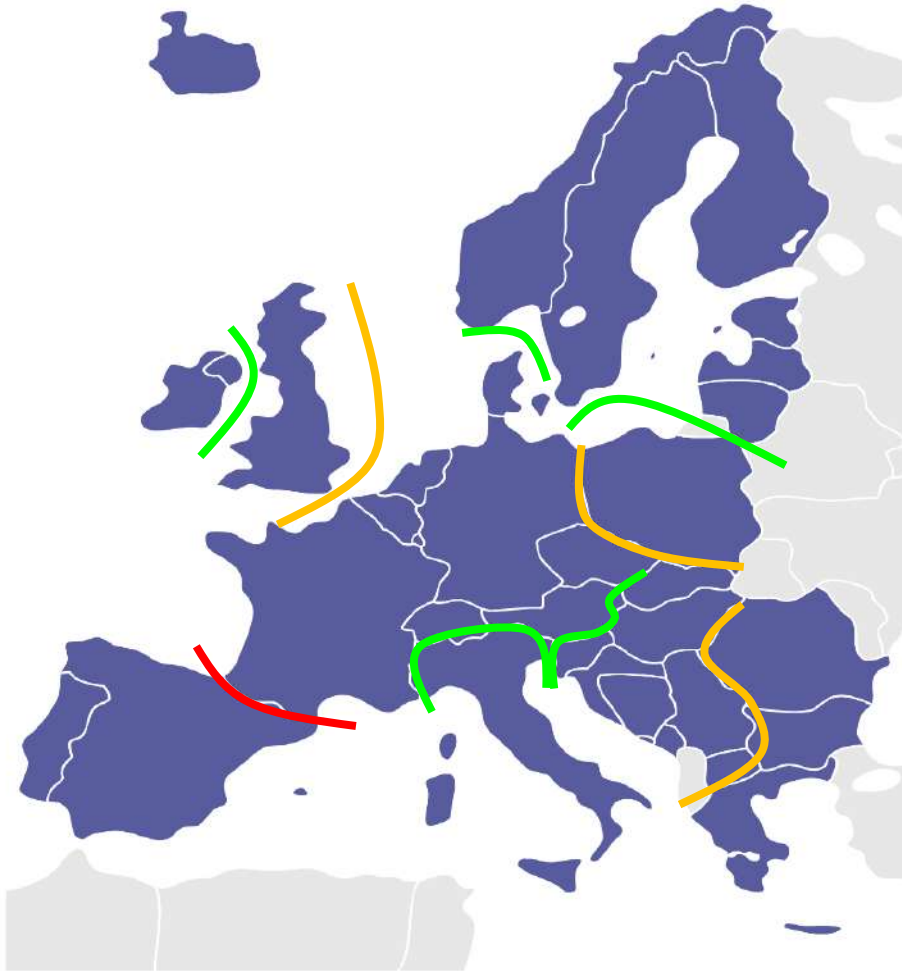
EP= Expected Progress scenario

TYNDP PROJECTS – EUROPE NEEDS THEM BUILT

2x more interconnection capacities by 2030

Integrating up to 60% renewable energy sources

Up to 5 €/Megawatt hour reduction on bulk power prices



1% increase in the total consumer bill

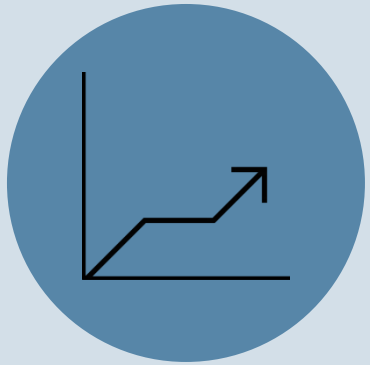
€150 billion investment

Proper return for investors

Gain support from local communities

BUILDING GRIDS AND CREATING VALUE (TYNDP 2016)

Consumers



Higher grid cost:
1,5 – 2 €/MWh

but…

Lower wholesale prices:
1,5 – 5 €/MWh

Society/Climate

Emissions down by:
50 – 80%

Emissions reduction only due to grid:
8%

Reduced spillage of renewable energy by:
30 – 90 TWh

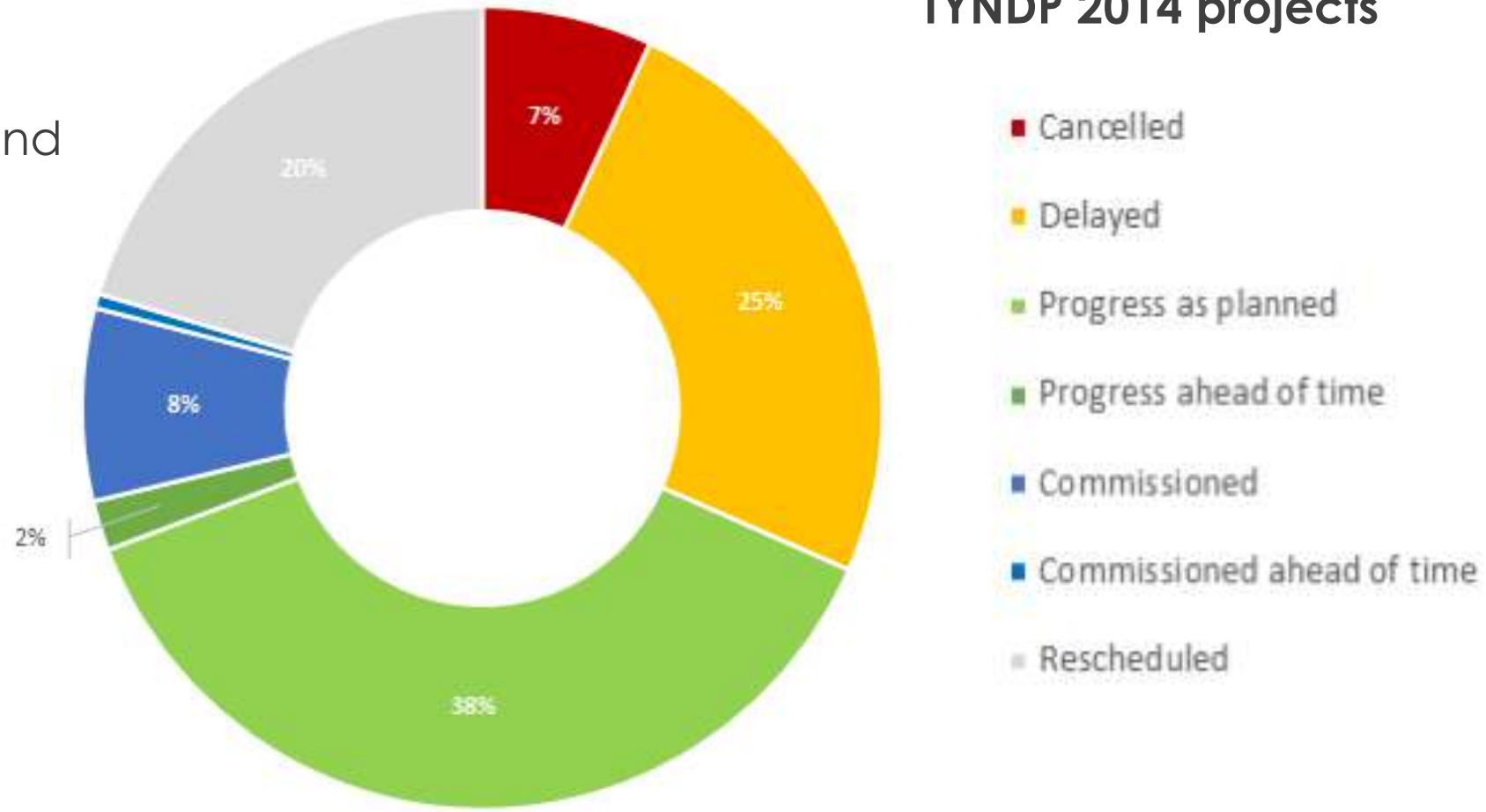
BUILDING THE GRID FOR THE ENERGY TRANSITION
EVERYONE'S BUSINESS

Involve local citizens more and early on

Need support from policy-makers on all levels

Need this conference!

Monitoring of the TYNDP 2014 projects

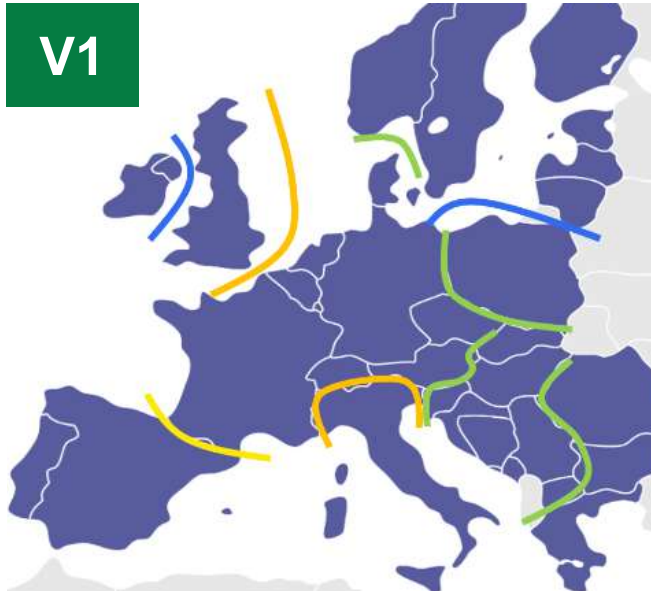


TYNDP PORTFOLIO: OVERVIEW OF MAIN ELEMENTS

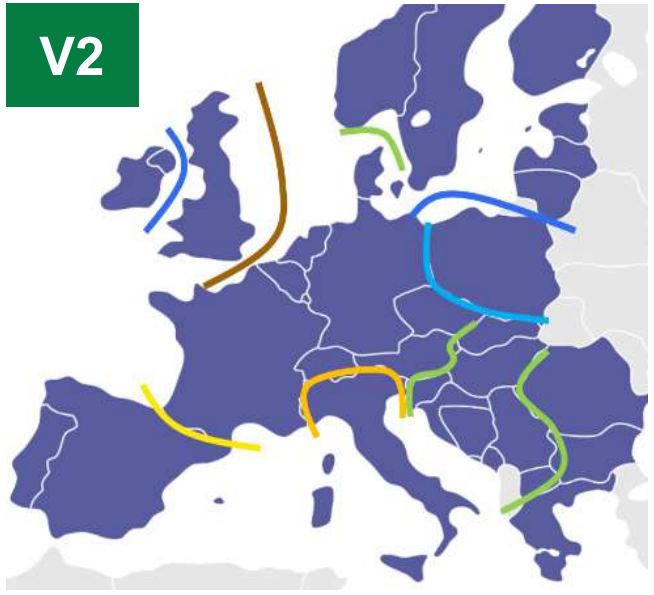
Type	Total	New compared to TYNDP 2014
Overhead Line	248	159
Underground Cable	15	15
Subsea Cable	49	45
Phase Shift Transformer	7	5
Substation (incl. converters)	57	33

2030 TARGETS FOR INTERCONNECTION CAPACITIES

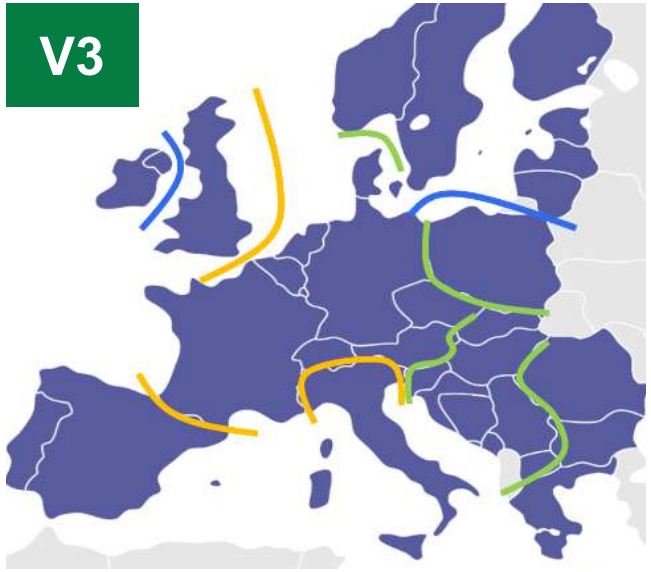
V1



V2



V3



V4