Grid Development and offshore meshed Infrastructure: Outlook on the TYNDP

Baltic InteGrid Conference 27. February 2019

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27. February 2019

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Reliable Sustainable Connected

Drivers in European Grid Development

Objectives of EU networks :

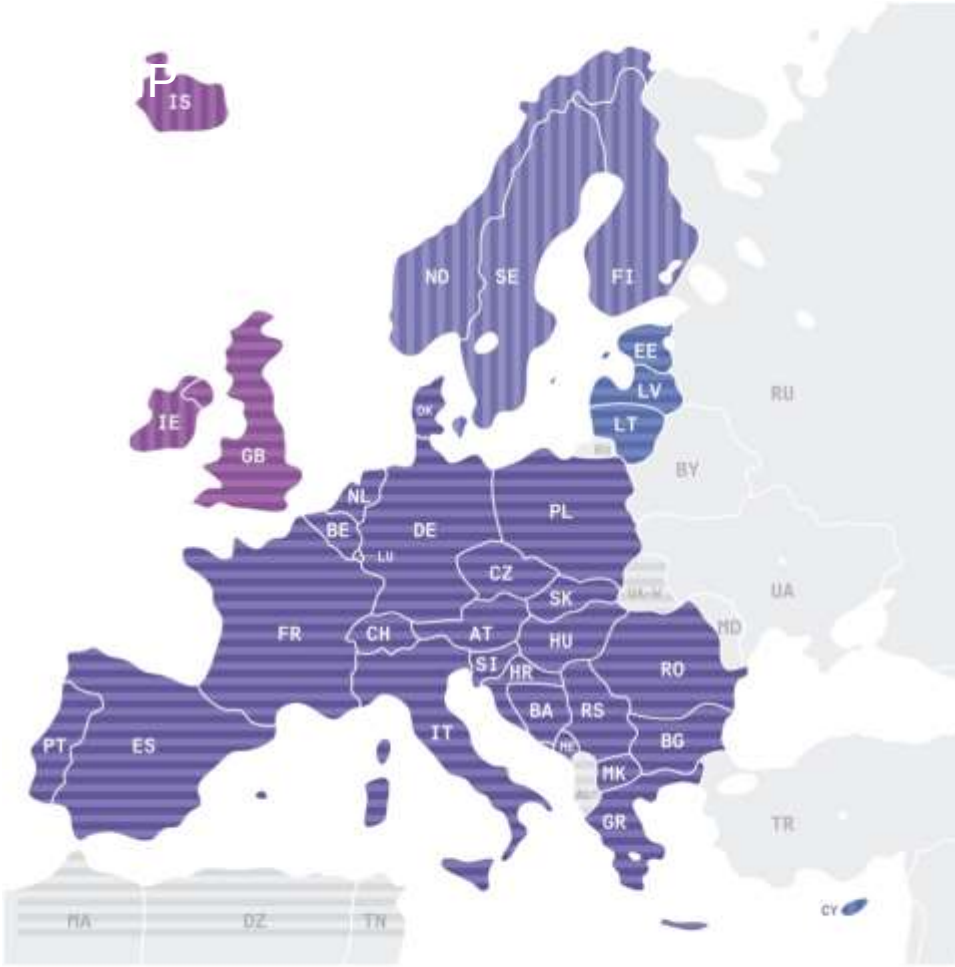
- ensuring the development of a European grid to permit the 20-20-20 and 2030 goals
- guaranteeing security of supply completing the internal energy market
- Integrate RES

The 2030 targets:

- 40% cut in greenhouse gas emissions (1990)
- at least a 27% share of renewable energy consumption
- at least 27% energy savings

Interconnection targets:

- 10% by 2020;
- 15% by 2030 (import cap/production-cap)



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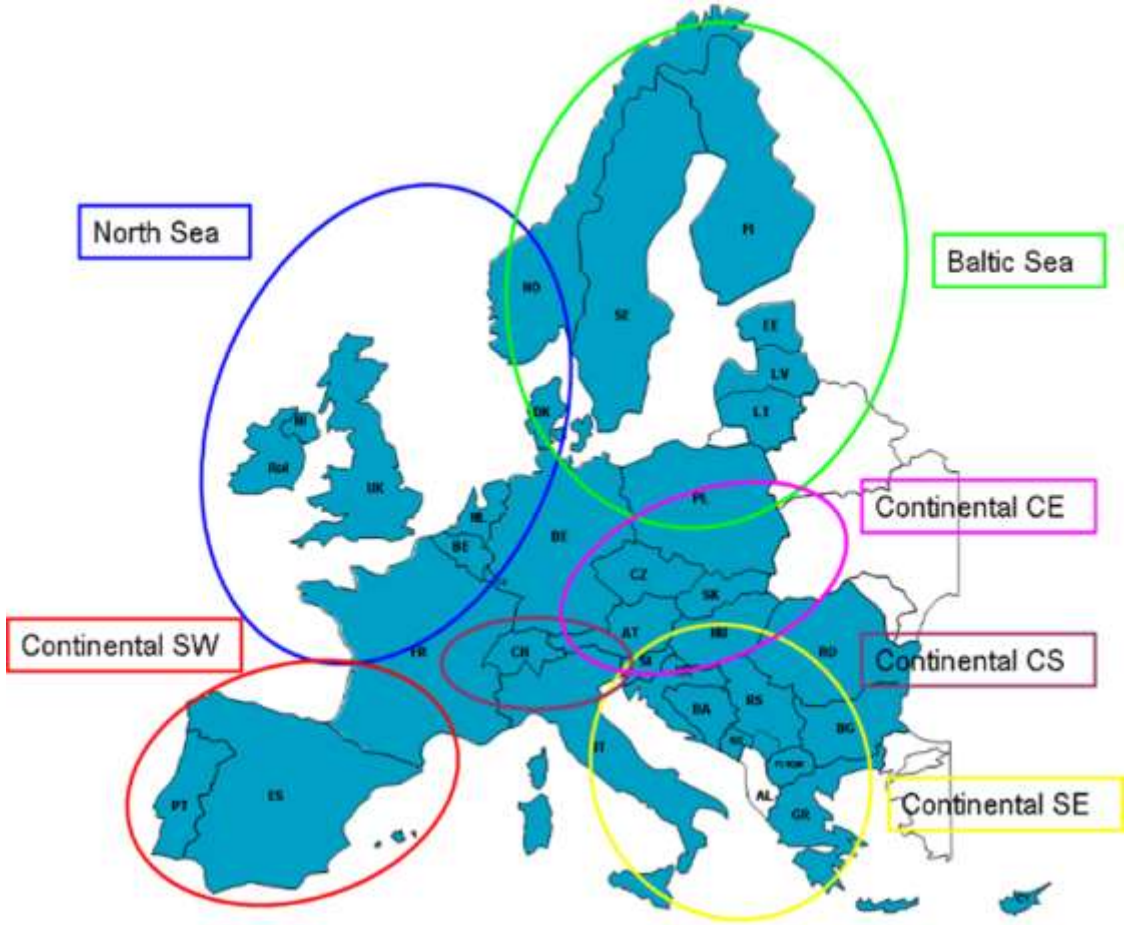
Europe is divided into 6 Planning Regions



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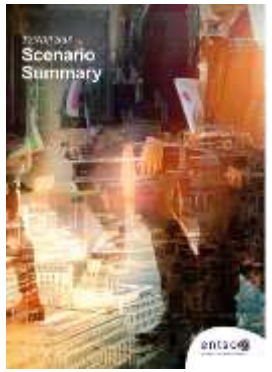
Transmission Planning in Europe

2 yrs

Scenario building



1 yr

Screening

2040

Projects

TSO

3PP

TSO

3PP

TSO

3PP

0,75 yr

CBA

2030

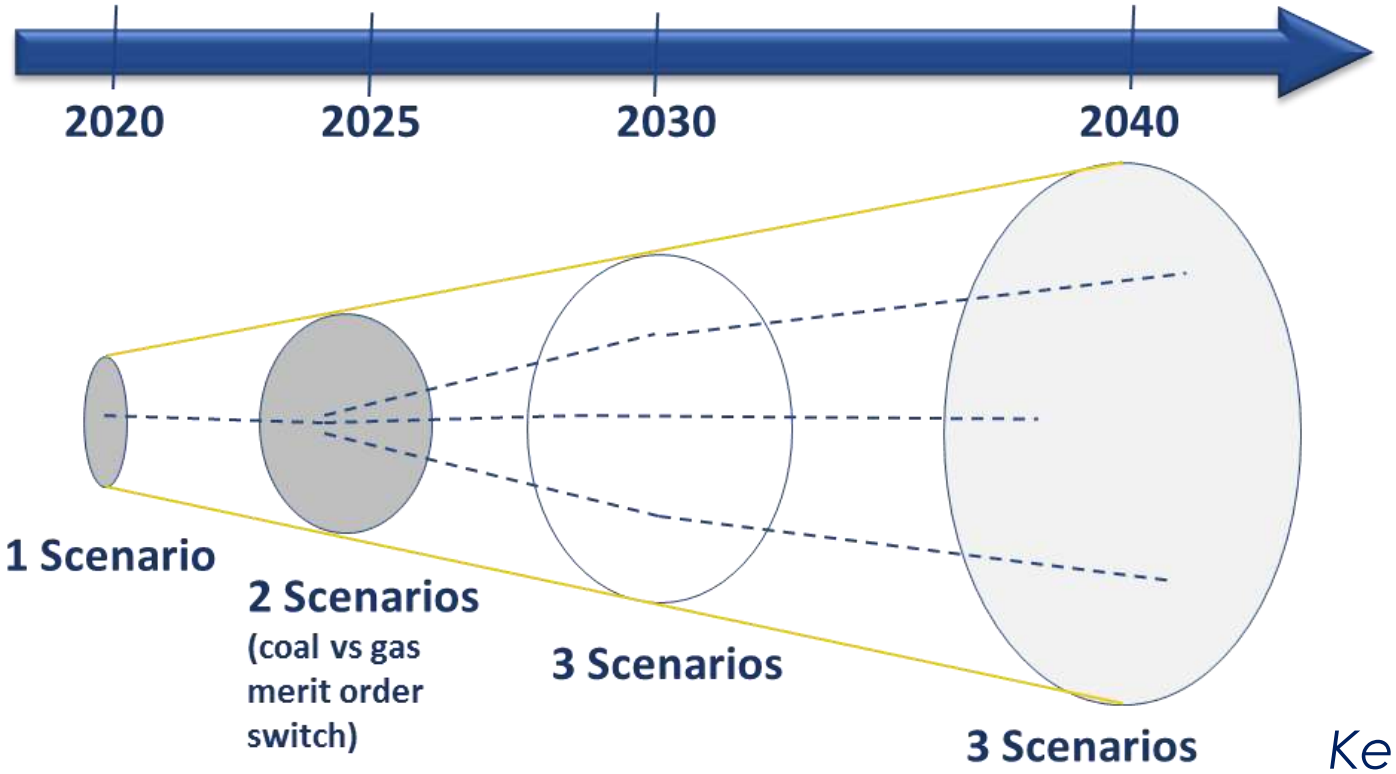
- Scenarios describe key factors of potential development in technology, economic growth, generation, demand, …..
- across several time horizons
- Combination of bottom-up and top-down scenarios

- Identification of system needs (IoSN): (focus on capacity increases in transmission system)
- Based on: Socioeconomic welfare (SEW), Integration of renewables (RES) & Security of supply (SoS)
- Based on long term scenarios for **2040**

- Cost Benefit Analyses (CBA) of individual projects on mid term time horizon 2025 and 2030
- Also additional studies on e.g. Interconnection Targets and Impact of “No-Grid development” study

Identification of the System Needs - Scenarios

Scenario used in TYNDP18 process



Main update compared to TYNDP 2016

Cooperation with ENTSOG

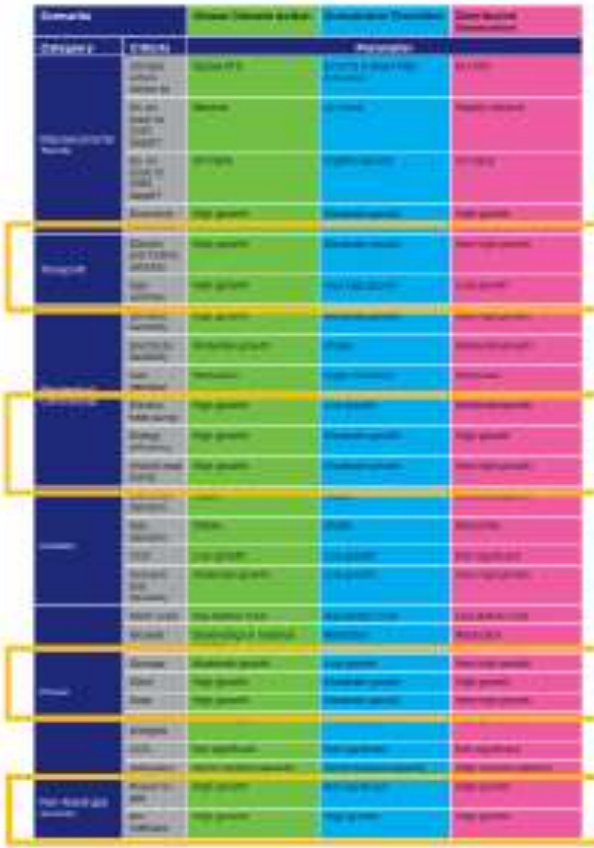
Publication of Clean Energy Package

Key factors:

- *Transport*
- *Heating*
- *Power*
- *Renewable Gases*

Identification of the System Needs - Scenarios

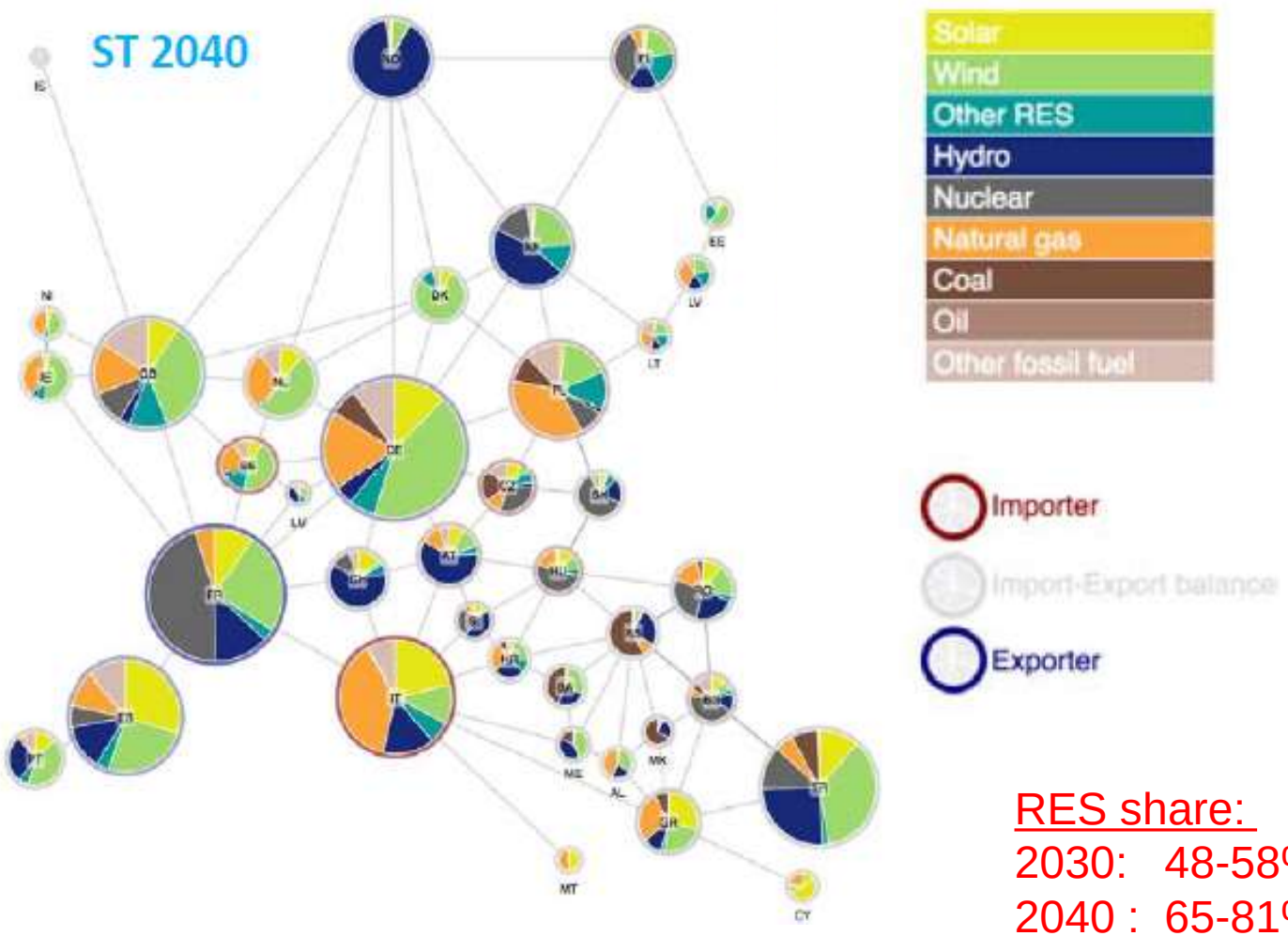
2040 scenarios – Key Indicators

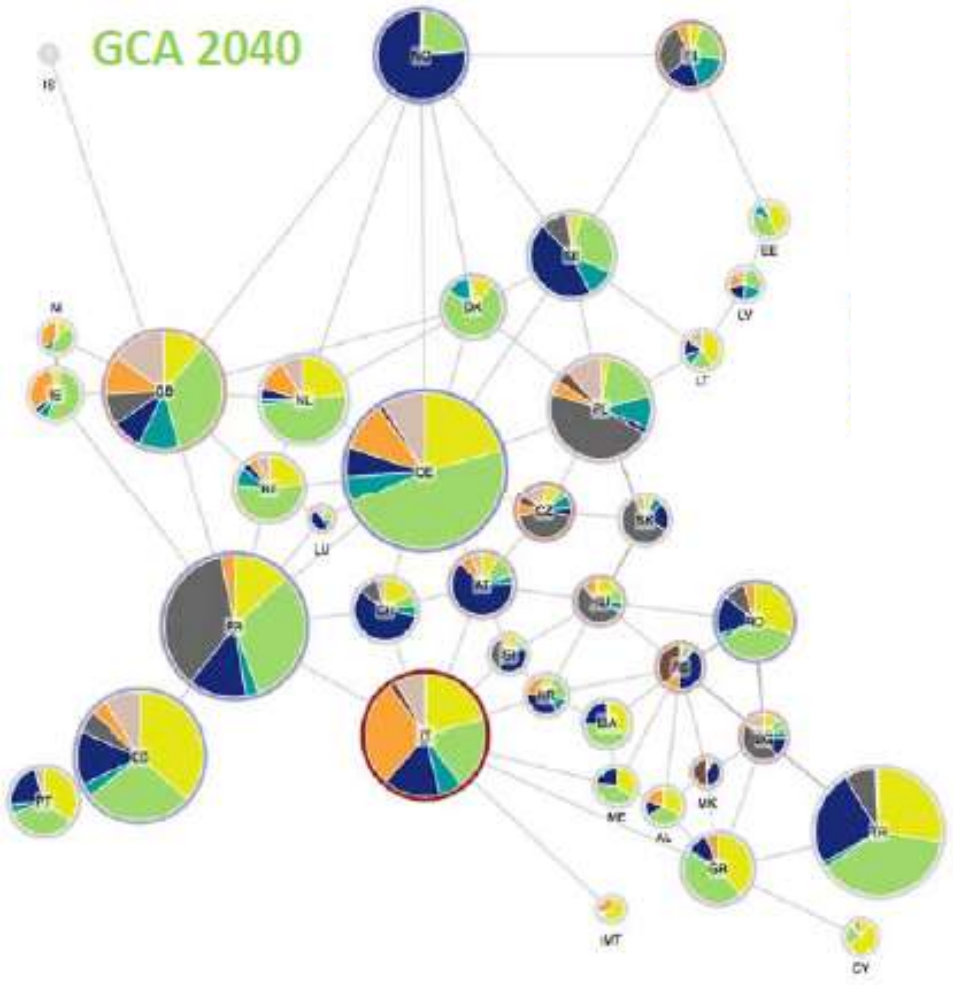


		GCA 2040 Global Climate Action	ST 2040 Sustainable Transition	DG 2040 Distributed Generation
Transport				
	Electric and hybrid vehicles	High growth	Moderate growth	Very high growth
	Gas vehicles	High growth	Very high growth	Low growth
Heating				
	Electric heat pump	High growth	Low growth	Moderate growth
	Hybrid heat pump	High growth	Moderate growth	Very high growth
Power				
	Storage	Moderate growth	Low growth	Very high growth
	Wind	High growth	Moderate growth	High growth
	Solar	High growth	Moderate growth	Very high growth
Renewable Gases				
	Power-to-gas	High growth	Not significant	High growth
	Bio-methane	High growth	High growth	High growth

Identification of the System Needs - Scenarios

2040 scenarios – Electricity: Energy Mix





RES share:
2030: 48-58%
2040 : 65-81%

Scenarios create contrasted Country level results

from: Scenario Report for Consultation, Oct 2017

Identification of the System Needs - Methodology

Main steps of the approach

Main update compared to TYNDP 2016

Better balance between overall EU view and RGs specificity

Market studies

- Identification of potential needs based on: marginal costs diff. and CAPEX of capacity incr.
- Check of economic efficiency

Network studies

- Identification of cross border and internal bottlenecks
- Update of costs of capacity increase

Regional expert check

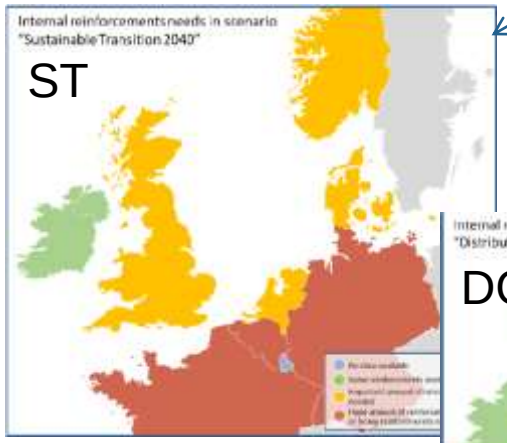
- Integration of renewable generation **(RES)**
- Reduction of risk of SoS issue **(SoS)**
- Check of interconnection targets

Additional capacity increases don't necessarily result in new infrastructure projects in TYNDP 2018

Many investments needed..

2040

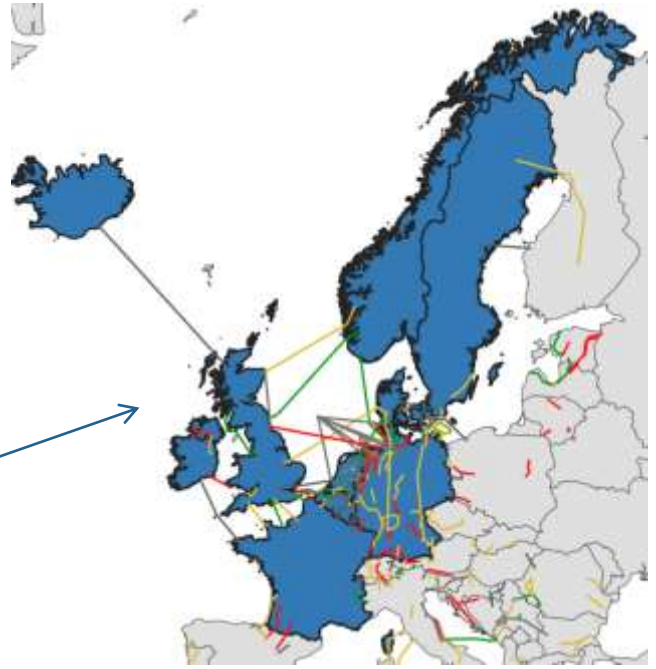
Internal reinforcement needs



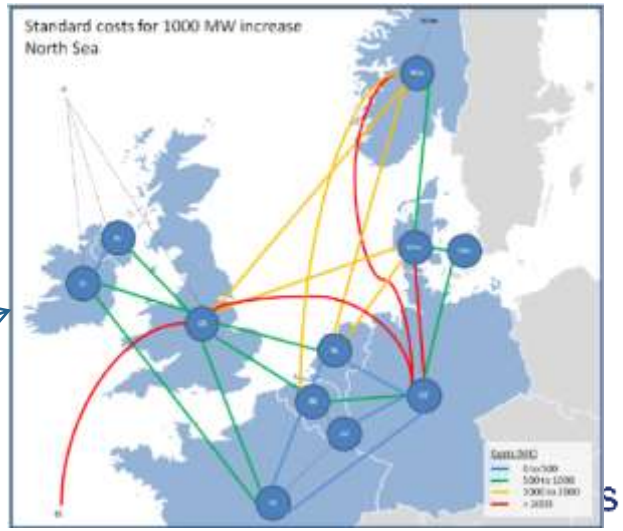
2040

Challenged AC borders

Submitted TYNDP18 projects



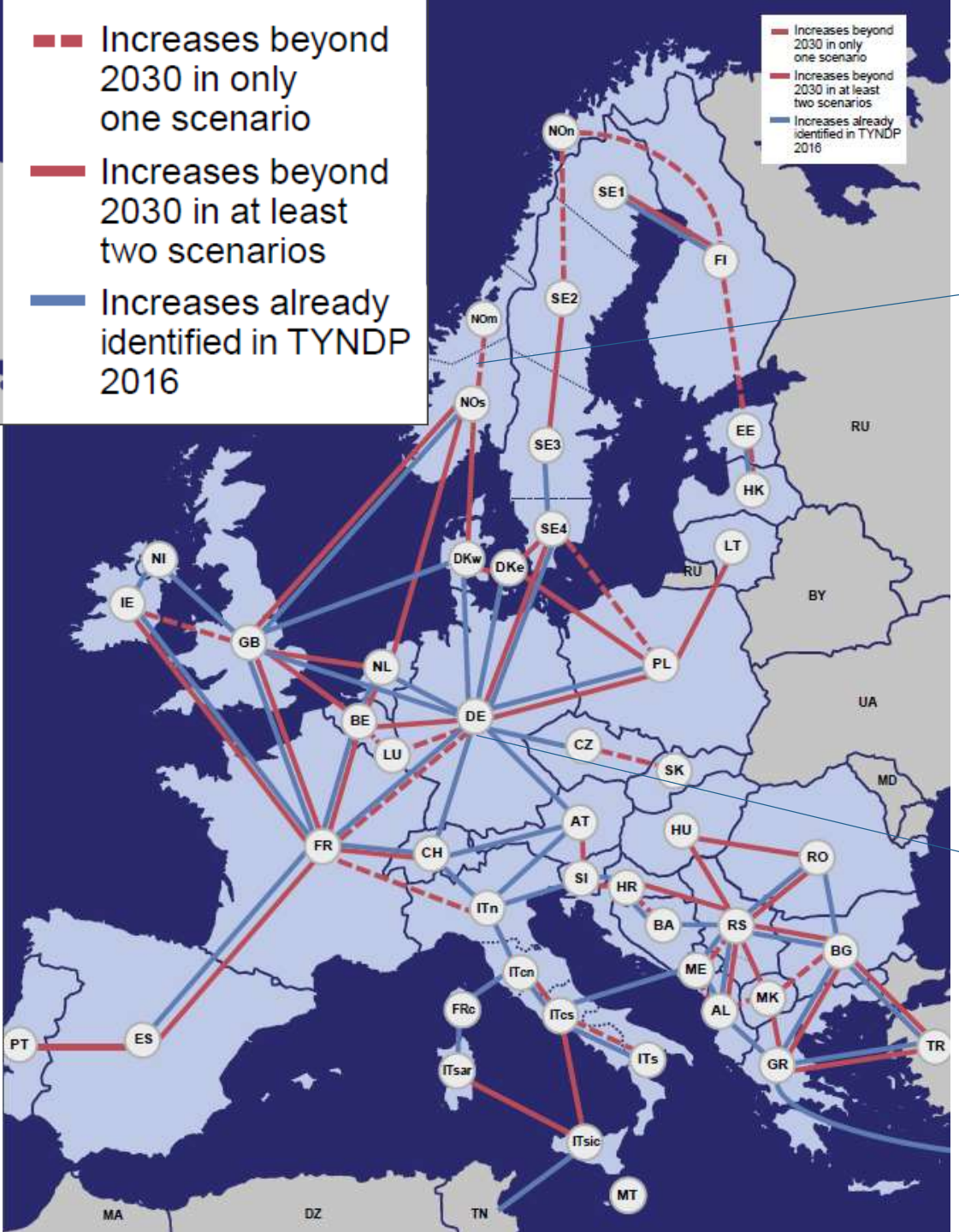
Standard costs per 1 GW

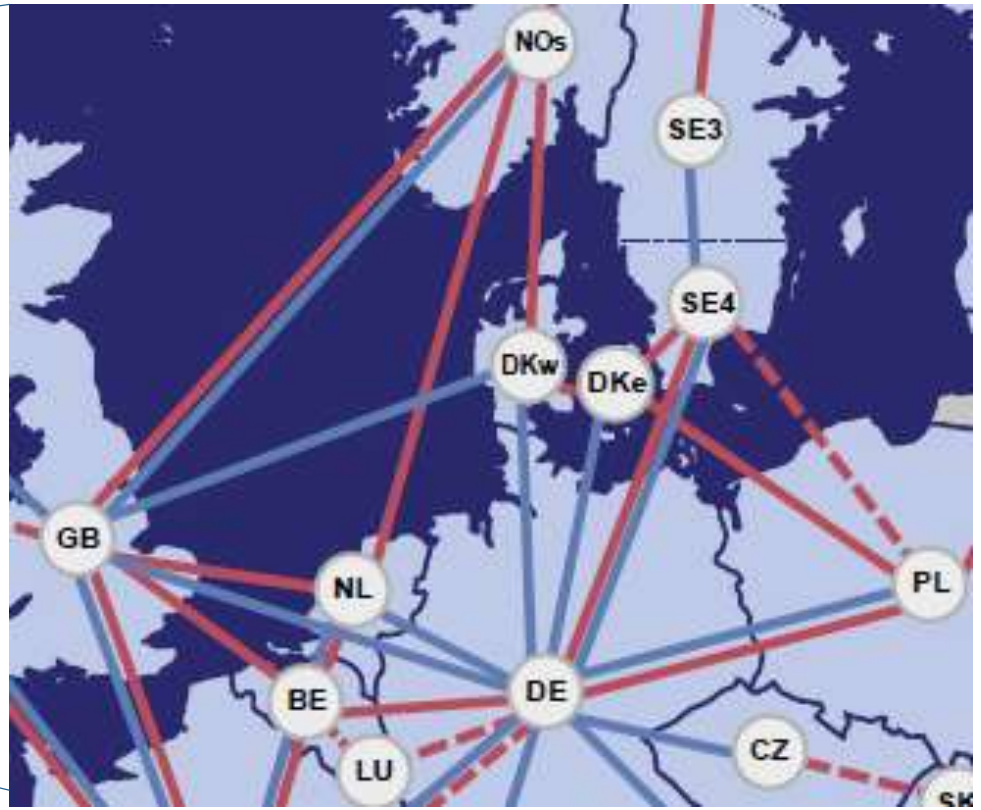


2040

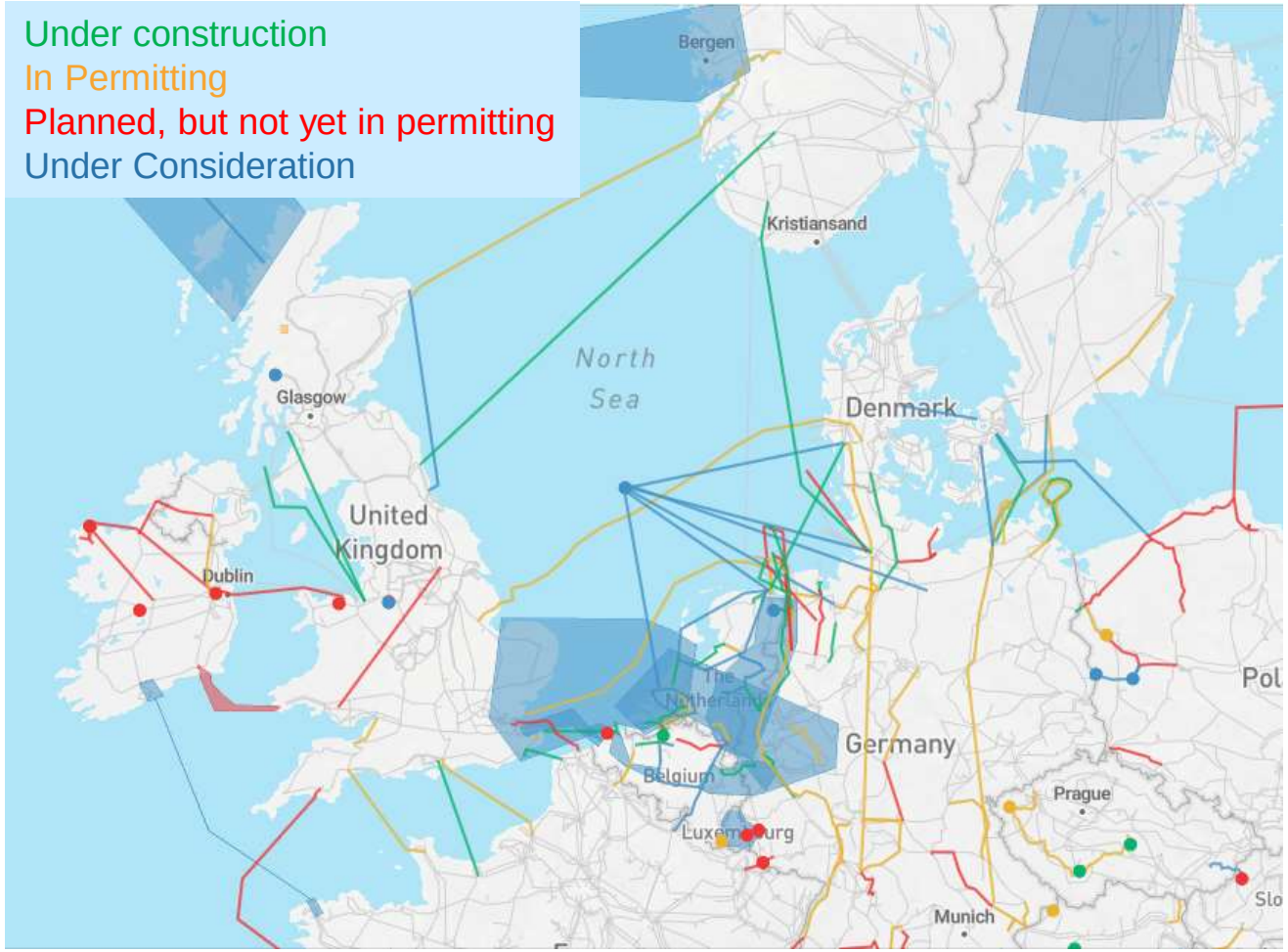
RGNS Regional Investment Plan (RegIP) – details online: http://tyndp.entsoe.eu/

Identification of System Needs (IoSN) - Results 2040





Result of project Collection: TYNDP 2018 projects
– zoom Northern Seas Area -



Undtil 2030:

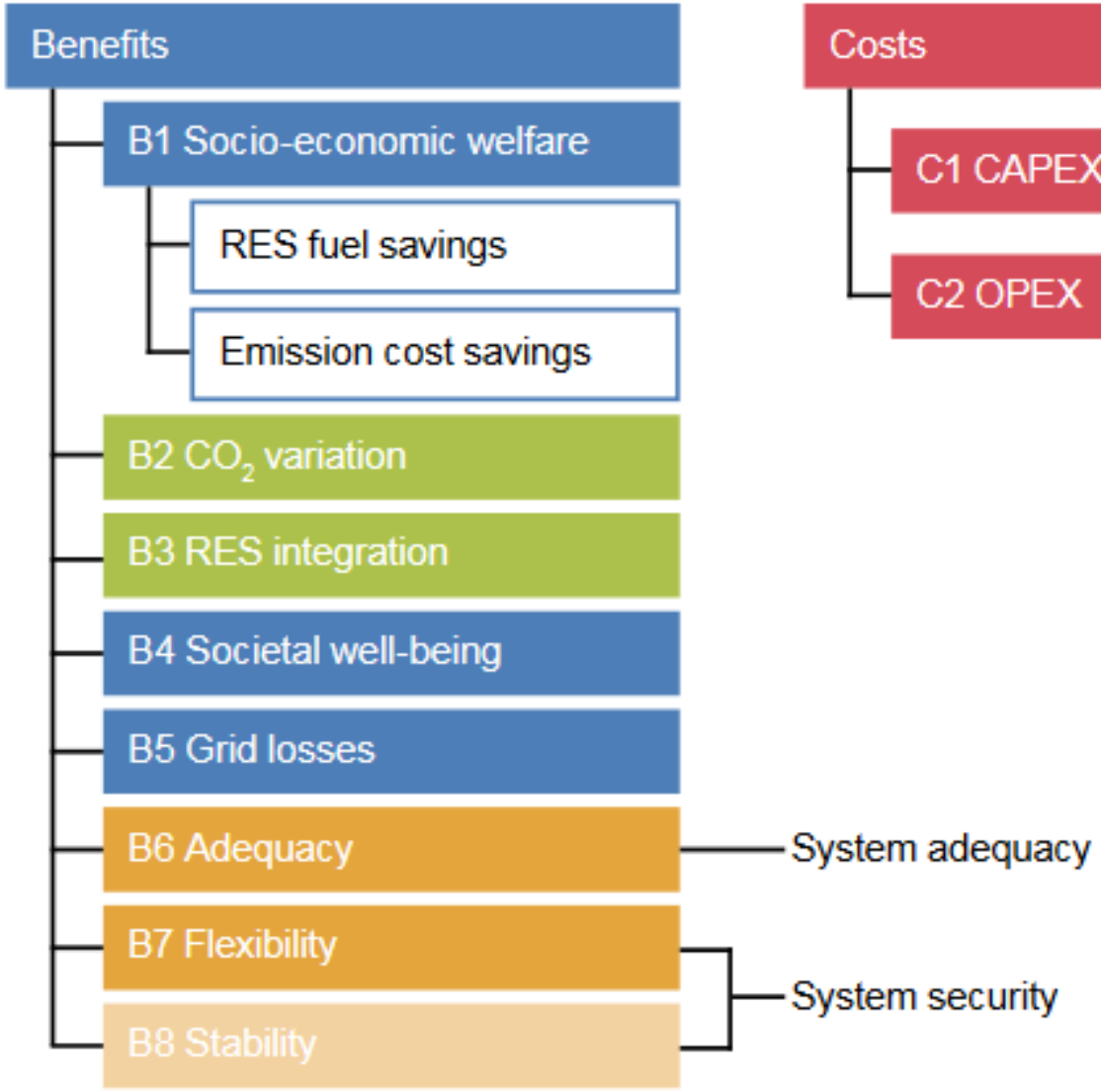
166 transmission projects in Europe
~ 60 in RGNS/ BS

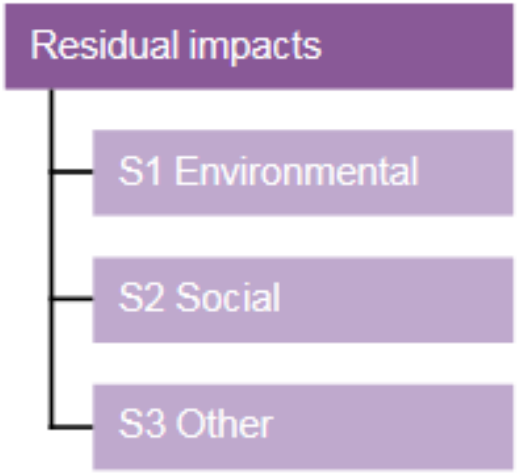
15 storage projects in Europe
(12 pump storage, 3 CAES)
7 i RGNS / BS

See interactive online map :
http://tyndp.entsoe.eu/

a click on the project links
to each 'project sheet' and get
detailed information plus CBA results

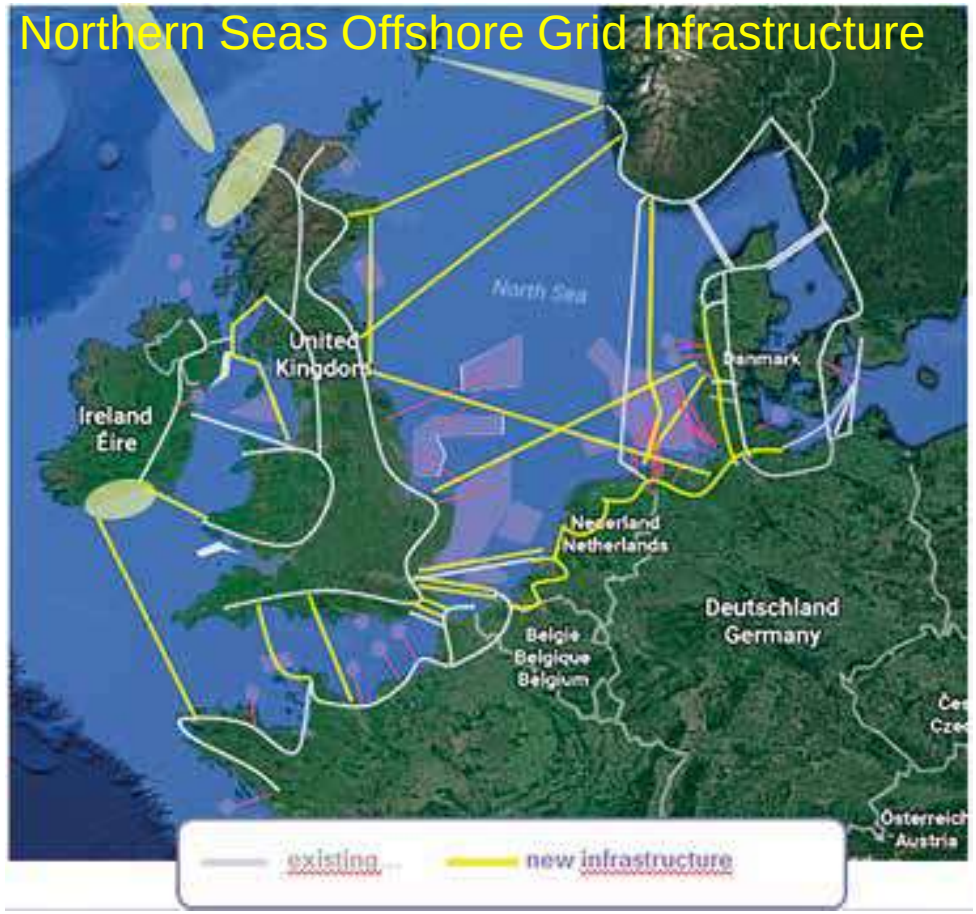
Overview of CBA indicators





Each project is investigated with:
- At least 3 market modelling tools and
- At least 2 grid modelling tools
- For 3 scenarios, with
  - 3 klimate-years per scenario
  - 8760 hours per year

2030 Northern Seas Offshore Grid infrastructure in TYNDP 2018



Wind Power to be integrated into the NSOG Region

	2020	ST 2030	DG 2030	EUCO 2030	ST 2040	DG 2040	GCA 2040
Onshore wind (GW)		142	142	137	170	185	197
Offshore wind (GW)	24	59	59	40	86	86	127

Offshore Wind 40… 60 86… 127

Key Figures:

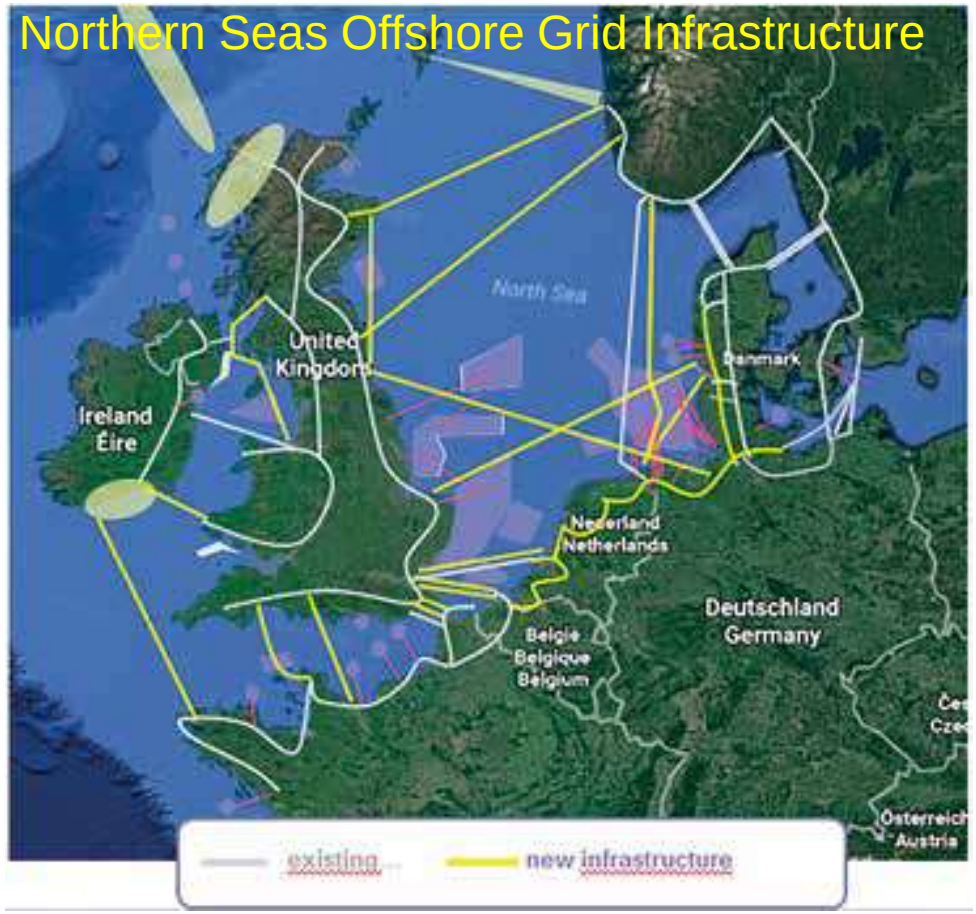
- 20 individual projects develop into a global scheme
- Infrastructure costs of 14 - 27 bn €
- Socio-economic benefits of 1.3 – 2.4 bn € / yr
- Facilitates extra RES generation between 13.8 – 19.2 TWh/yr
- Reduces annual CO2 emissions between 7,500… 15,000 kt / yr

2030 Northern Seas offshore grid infrastructure addressing RES- and Market integration

Source: TYNDP17 Insight report "North Seas Regional Planning"

List of Projects ≤ 2030

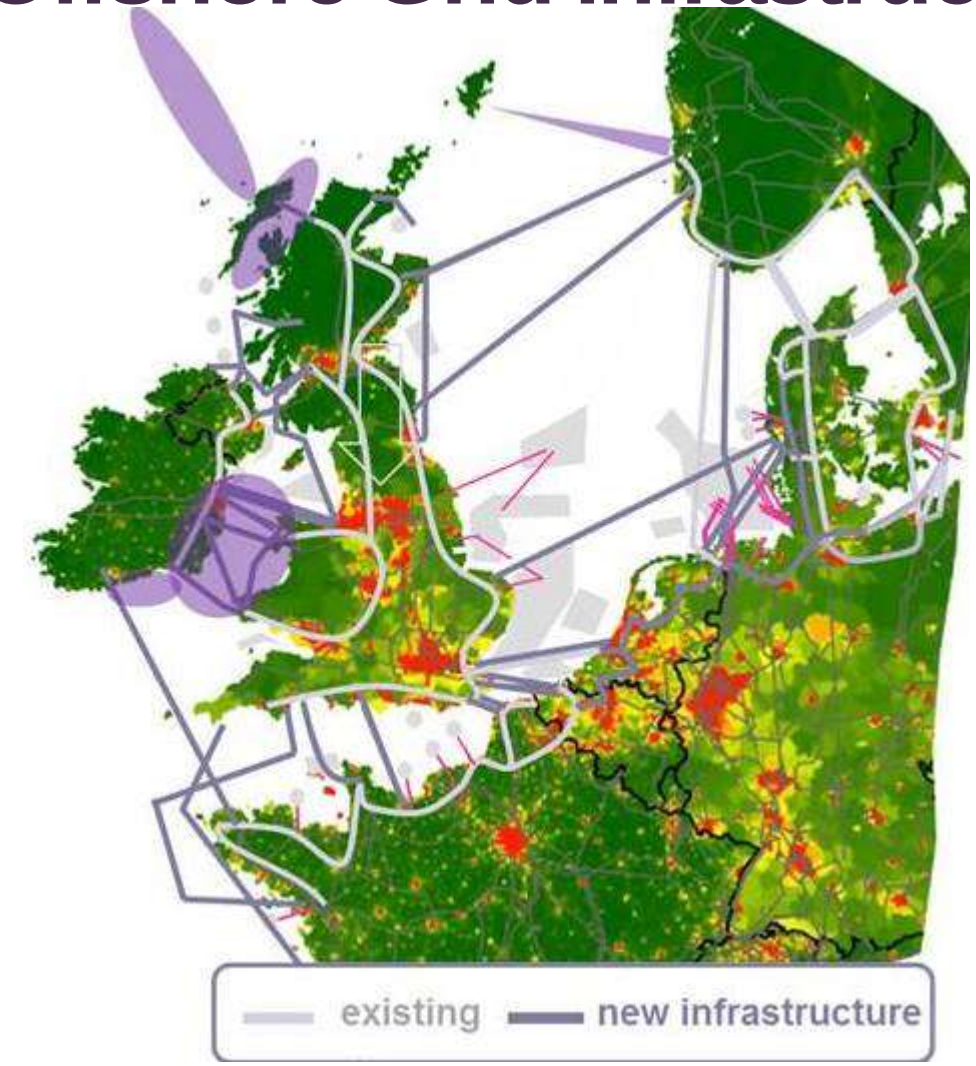
TYNDP 2018



Country/ ies	Project ID	Project Name	Commissioning	Capacity
FR, GB	25	IFA 2	2020	1000
FR, GB	153	France- Aldernay – Britain (FAB)	2022	1400
FR, GB	172	Electlink	2019	1000
BE, GB	74	Thames Estuary Cluster (NEMO)	2019	1000
BE, GB	121	Nautilus: 2nd link BE-UK	Earliest 2018	1000
FR, IE	107	Celtic Interconnector	2026	700
GB, NO	110	North Sea Link	2021	1400
GB, NO	190	NorthConnect	2022	1400
DE, NO	37	Nordlink	2020	1400
DKW, NL	71	Cobra Cable	2019	700
DKW, GB	167	Viking Link	2023	1400
FR, GB	247	Aquind Interconnector	2022	2000
FR, GB	285	Gridlink	2022	1400
GB, NL	260	New GB-NL Interconnector	2030	1000-2000
IE, GB	286	Greenlink	2023	500
GB- NO	294	Maali	2025	600
BE	75	Modular OFG 1	2020	1000
BE	120 + 329	Modular OFG 2 + new onshore corridor	2030 + 2028	2000
GB DE	309	NeuConnect	2022	1400

Source: TYNDP17 Insight report ”North Seas Regional Planning”

Offshore Grid infrastructure in TYNDP 2016



2030 Northern Seas offshore grid infrastructure addressing RES- and Market integration

Wind power [GW] to be integrated in NSOG region

	2020	2030 Vision 1	2030 Vision 2	2030 Vision 3	2030 Vision 4
offshore	24.1	30.6	30.8	72.2	79.7
onshore	94.0	110.9	124.7	155.0	154.5

Key Figures:

- **25 individual projects develop into a global scheme**
- **Infrastructure costs of 12 - 25 bn €**
- **Socio-economic benefits of 2 - 3 bn € / yr**

Source: TYNDP16 Insight report "North Seas Regional Planning"

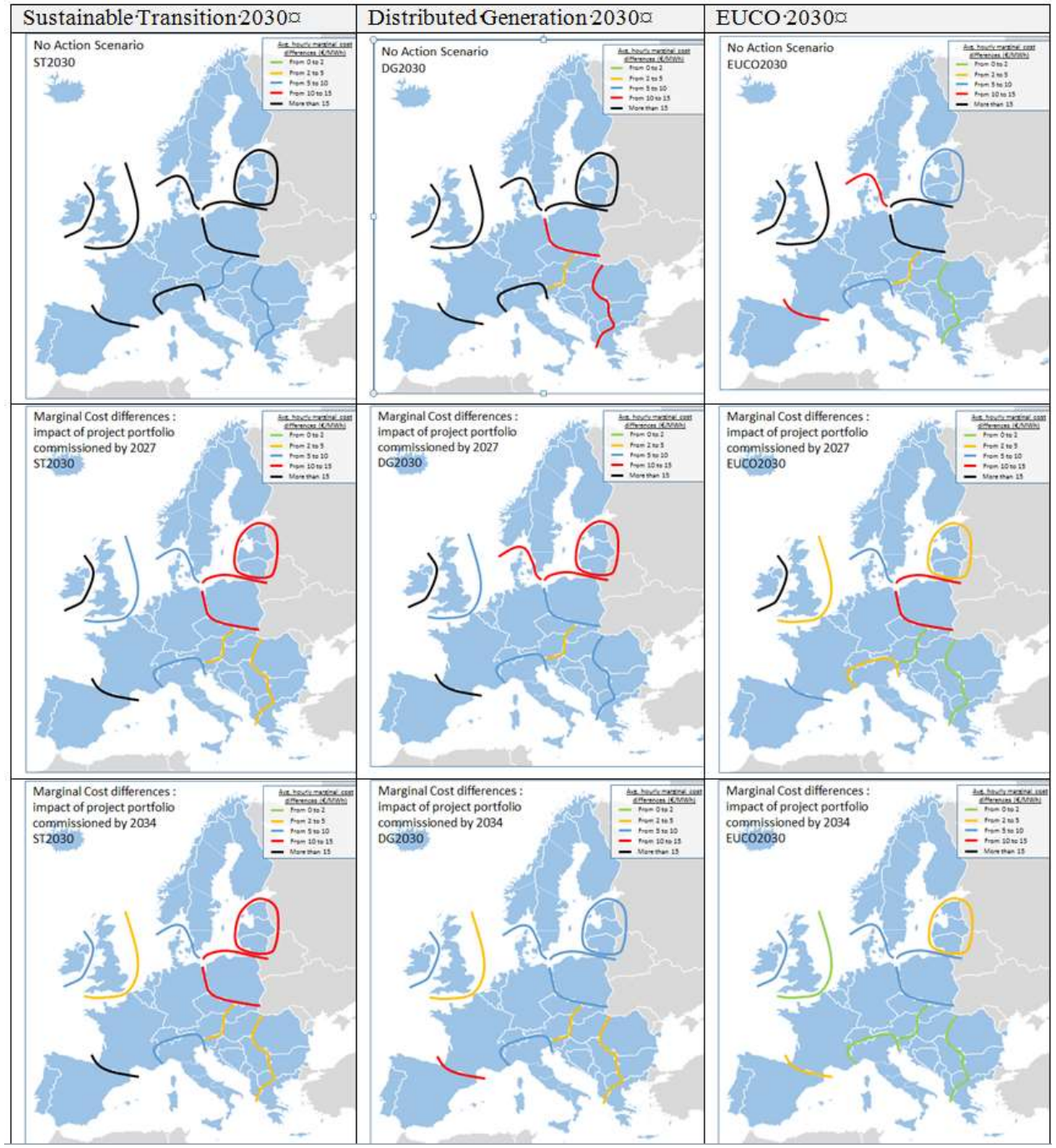
Offshore Grid infrastructure in TYNDP 2014

Comparison between NSCOGI Grid study, TYNDP14 results & EC study, concluding:

- Northern Seas Offshore Grid Infrastructure will be composed of
  - various technologies (AC and DC)
  - Various designs:
    i. point-to-point interconnections (ICs)
    ii. Radial offshore wind connections (single of via hubs)
    iii. Hybrid projects (combination of offshore wind connection and IC)
    iv. Multiterminal offshore platforms combining interconnections.

- **Modular** and **stepwise** offshore grid development with choices based on case-by-case decisions, evaluating technical and economic parameters.
- **Compact hybrid offshore design** could be envisaged in cases where scheduling and technology required for ICs & wind connetions match (DC/AC/voltage level …).

ST 2030 DG 2030 EUCO 2030



Impact on Price Differences per Boundary

No Action

Reference Grid Projects (2027)

All projects until 2035

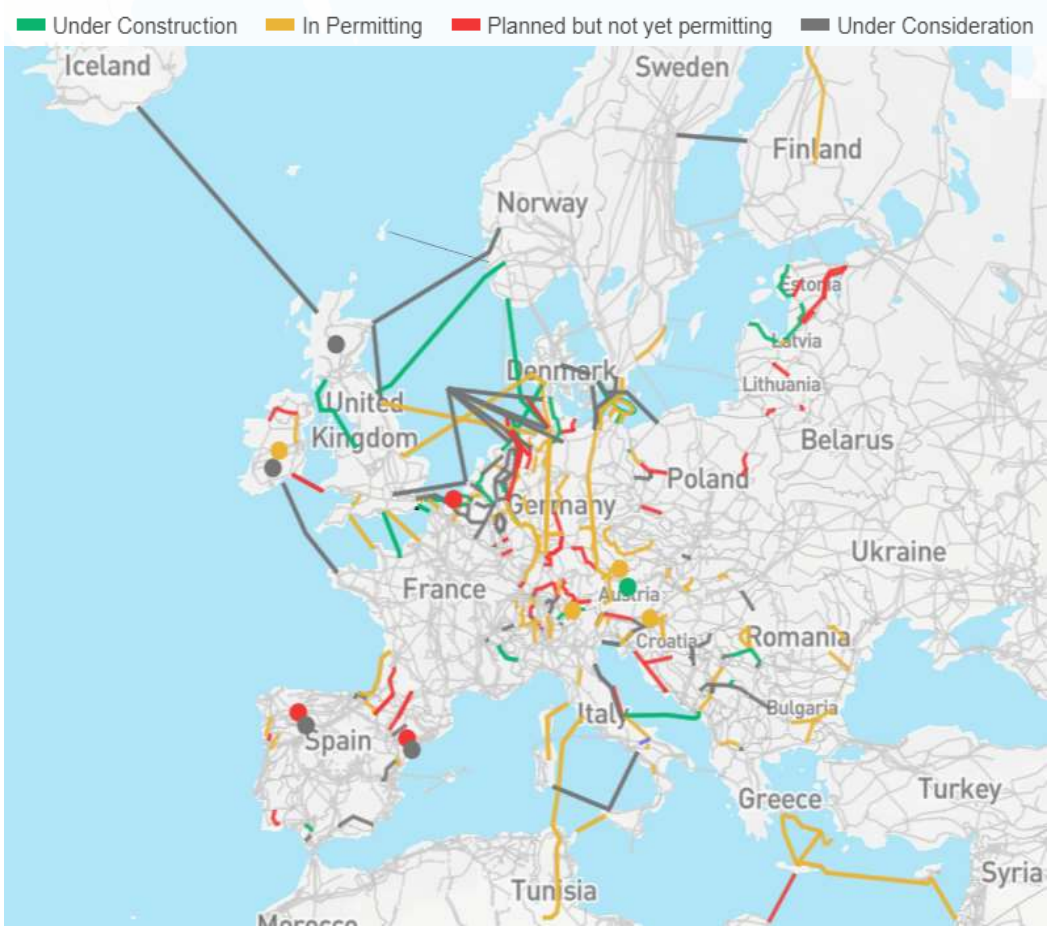
Avg. hourly marginal cost differences (€/MWh)

- From 0 to 2
- From 2 to 5
- From 5 to 10
- From 10 to 15
- More than 15

TYNDP 2018 projects

Benefit

- **48 - 58% RES share of energy demand in 2030**
  … and 65 - 81 % until 2040
- **65 – 75% CO2 reduction, compared to 1990**
  … and 80 – 90% until 2040
- **2 to 5 bn€ annual savings in cost of el-production due to TYNDP projects in 2030**
  … and 3 til 14 €/MWh reduction in marginal production costs with optimal grid in 2040



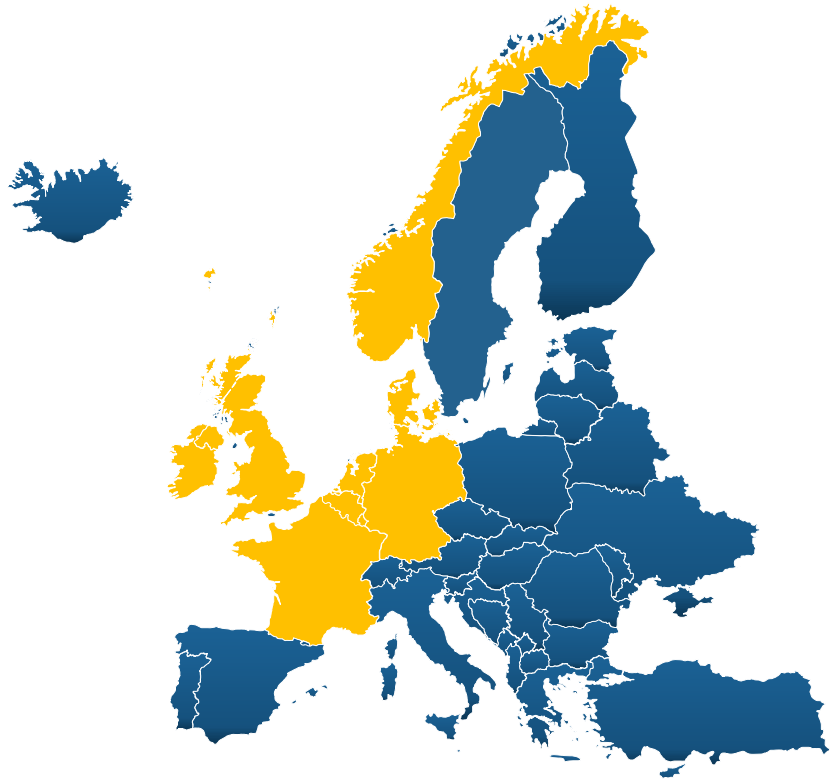
Until 2030:

166 transmission projects
15 storage projects

114 bn € investments

357 investments, out of which
201 overhead lines
23 cables
67 subsea cables

Thanks!



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