THE BATTLE OF THE GRIDS 2030/2050

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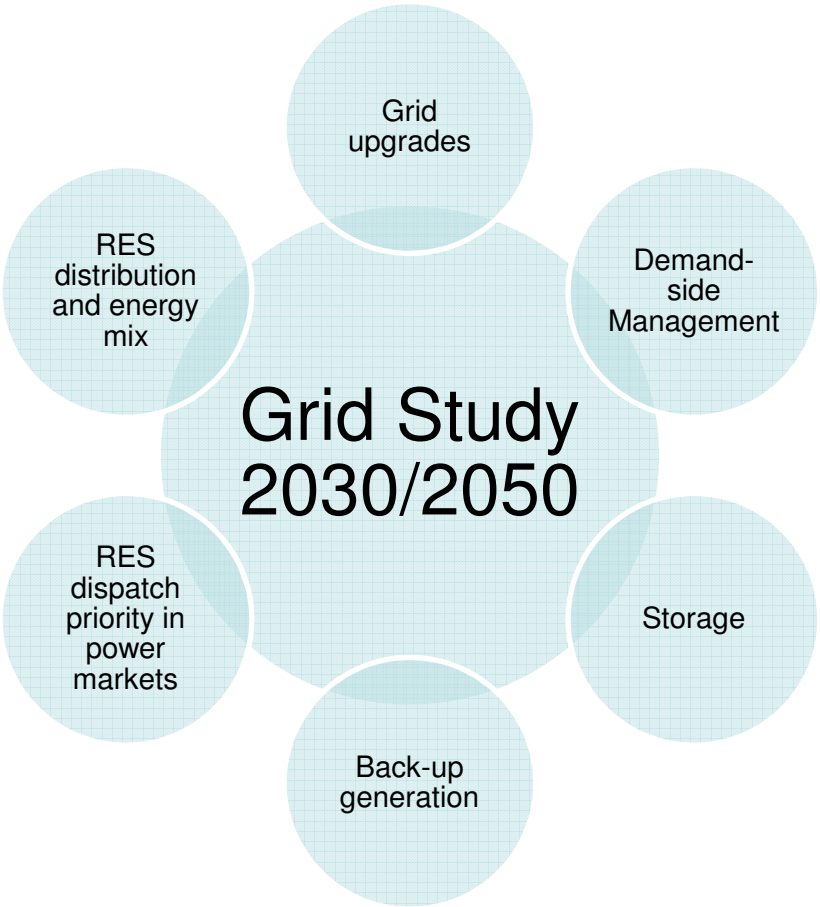
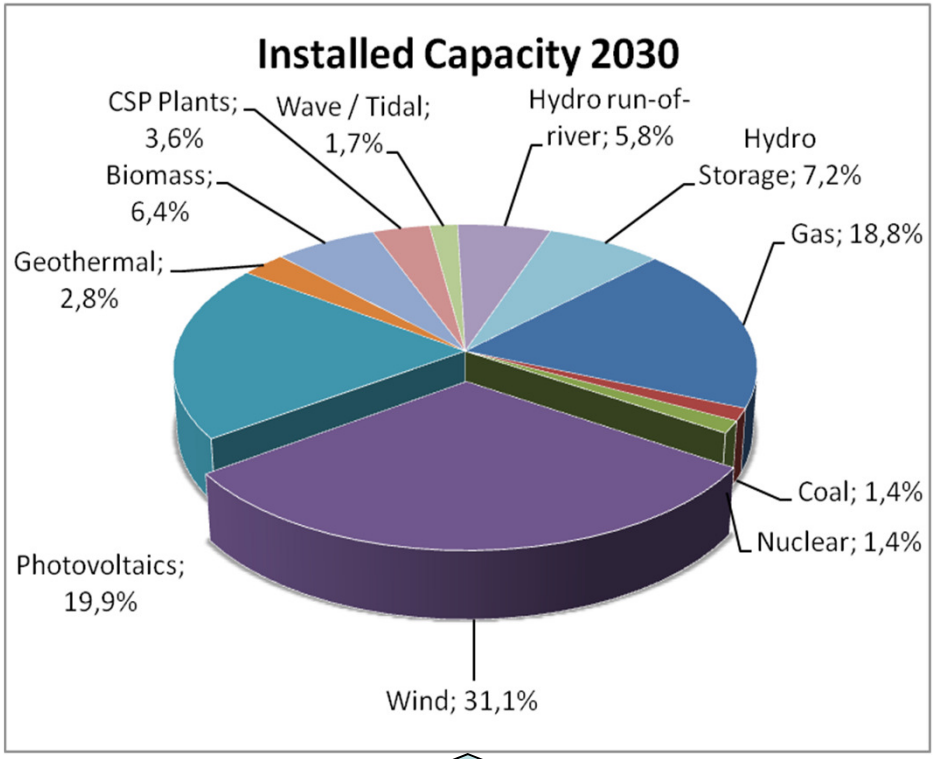
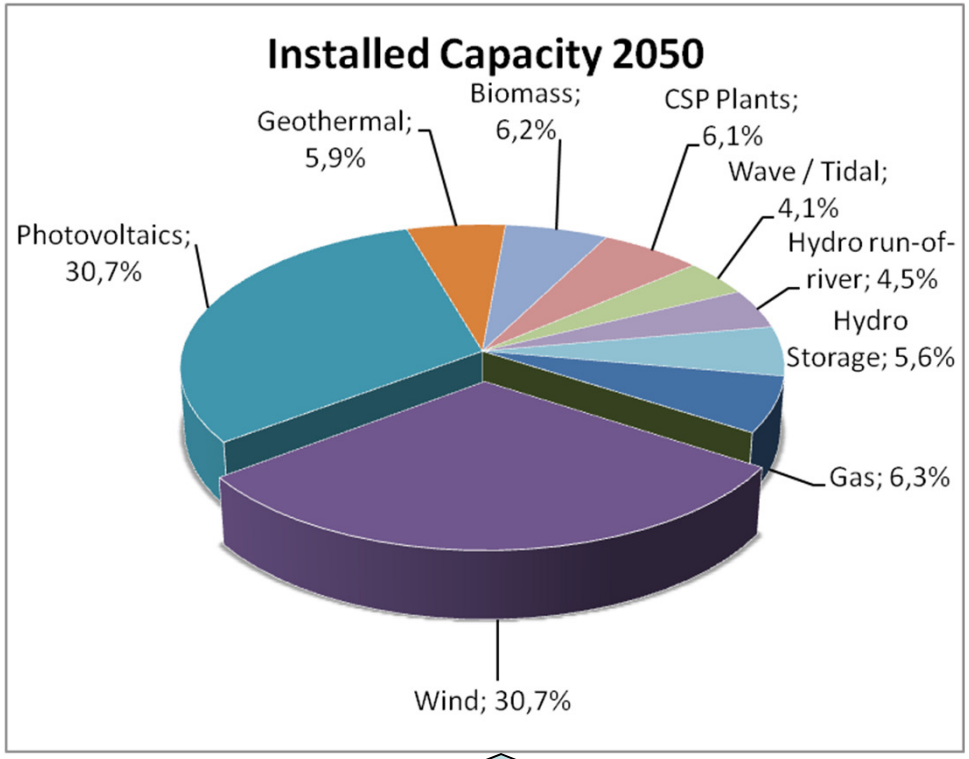
The optimal grid system for high renewables integration?



Assumed Power Mix



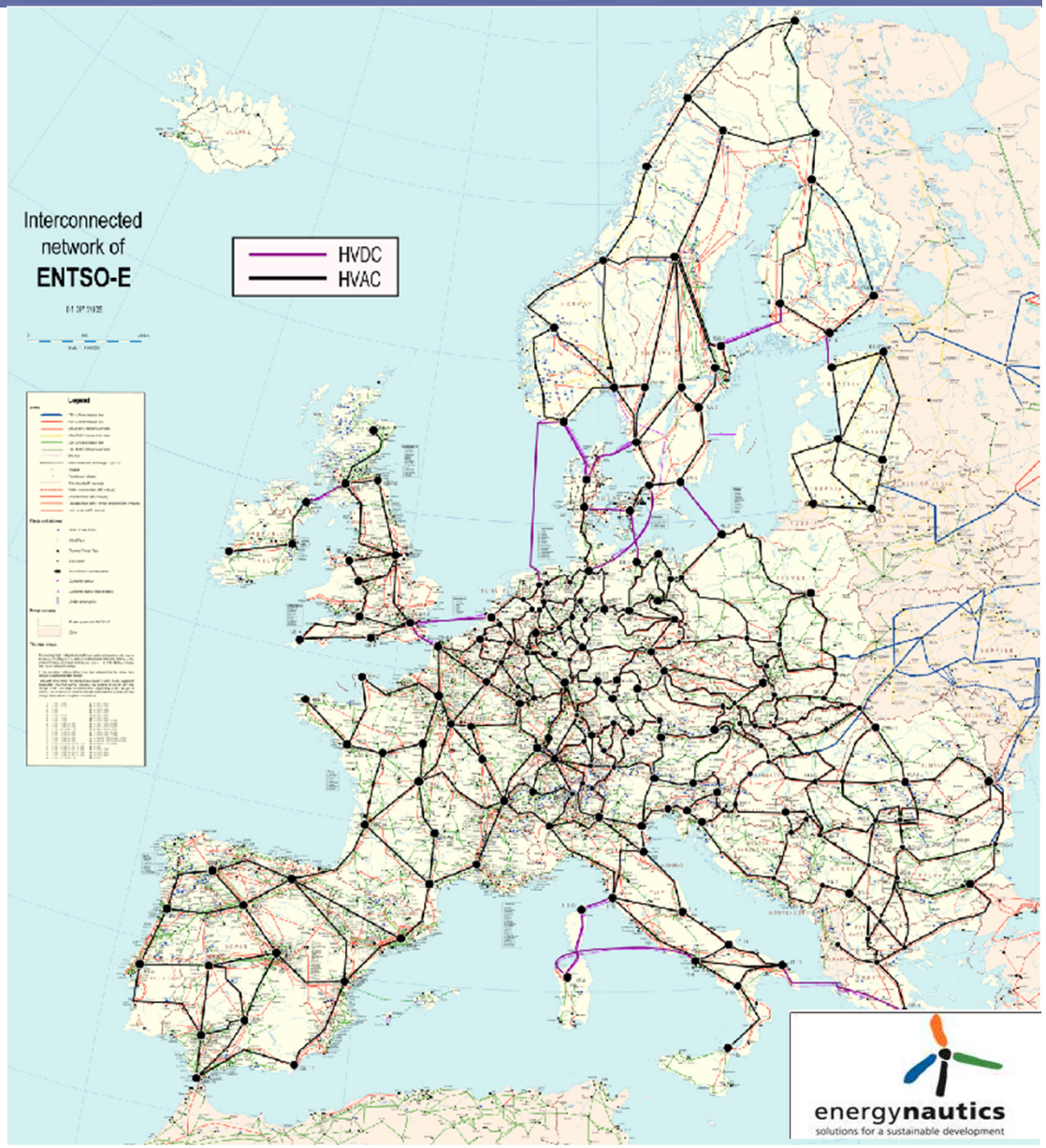


68% RE

98% RE

Grid Model:

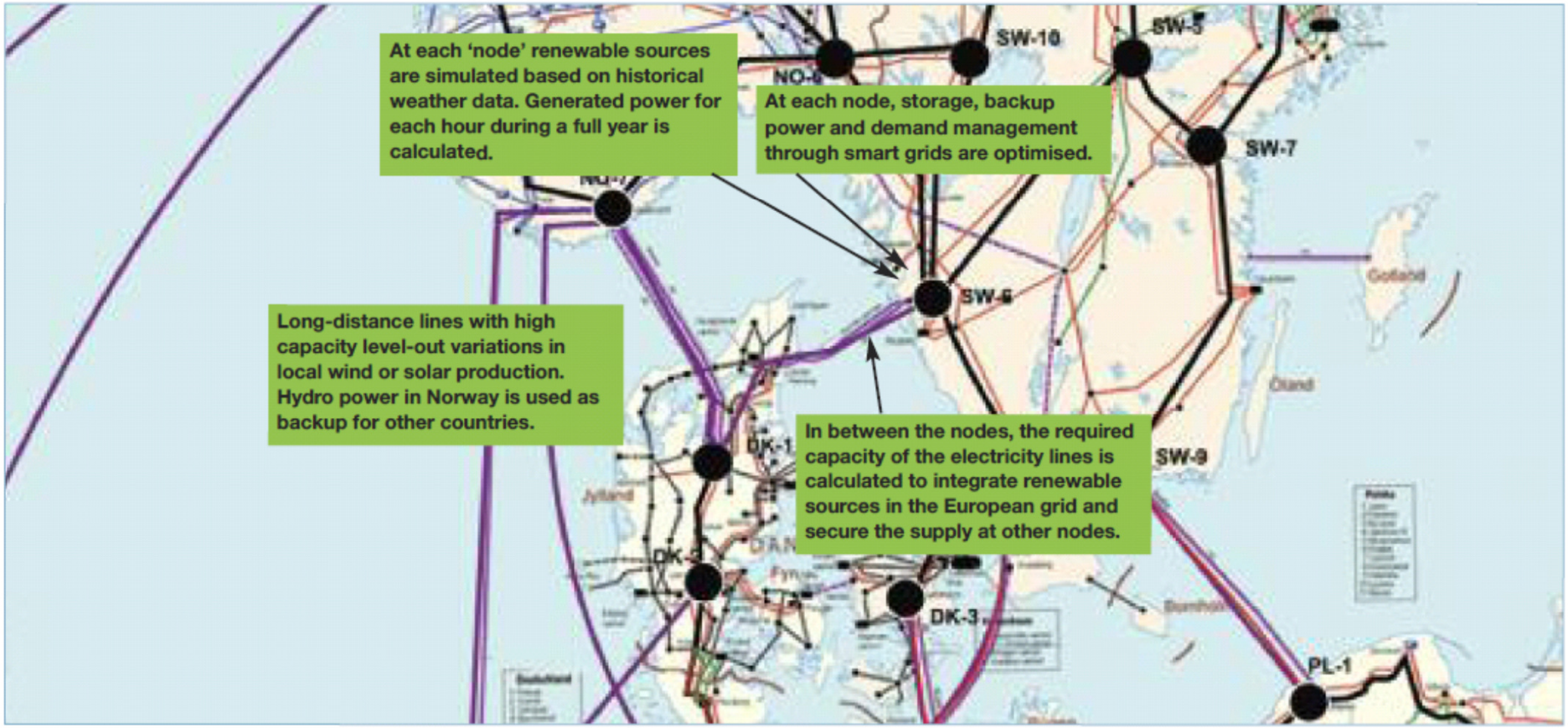
- 224 nodes
- DIgSILENT PowerFactory



Simulations 2030/2050

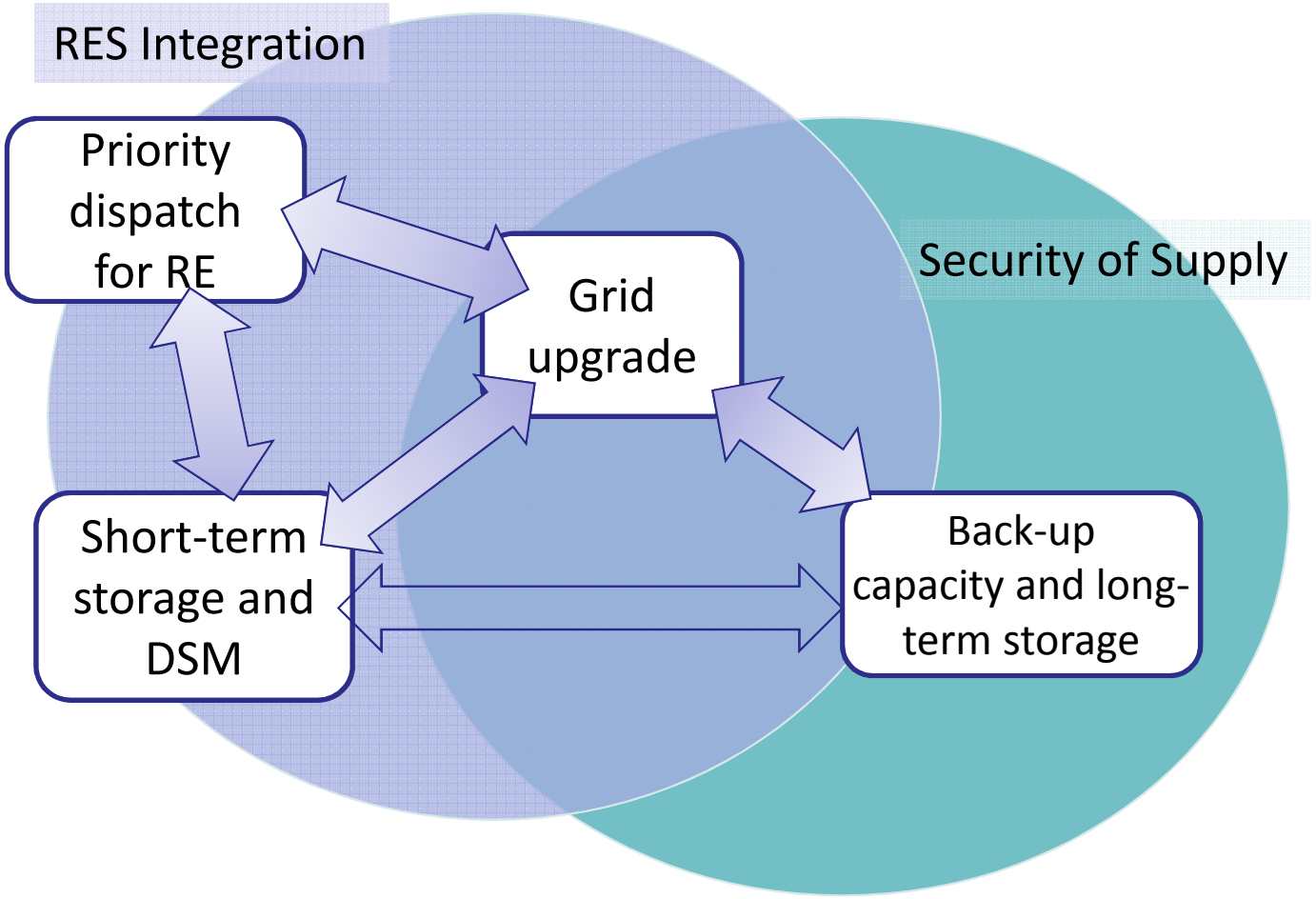
1. Full-year (hourly); 2. Extreme weather situations (30 years)

Figure 9 Sample illustration of nodes and interconnectors in Northern Europe



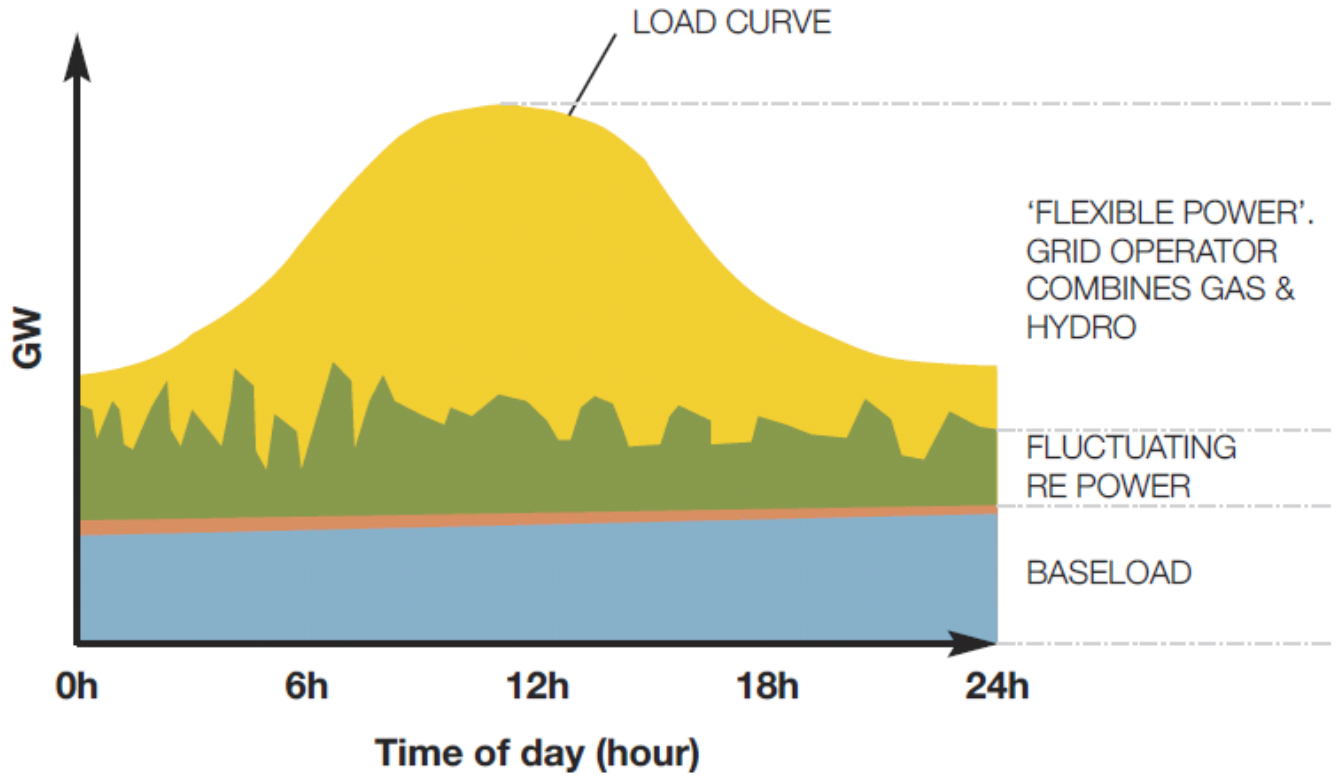
MAIN RESULTS

1. Large-scale integration entirely feasible



2. Changes in the energy mix

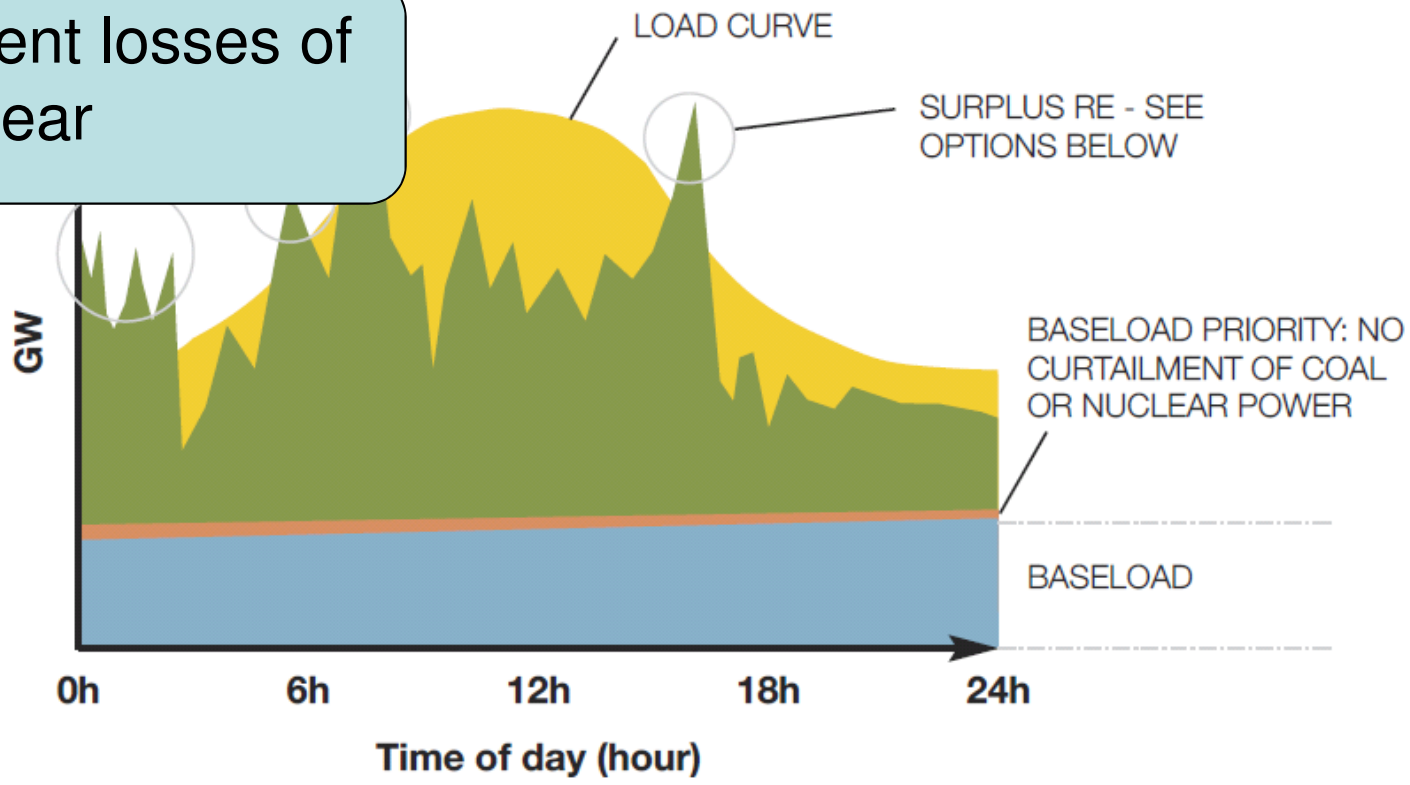
Current supply system with low shares of fluctuating renewable energy



Inflexibility leads to inefficiencies

Supply system with more than 25 percent fluctuating renewable energy – baseload priority

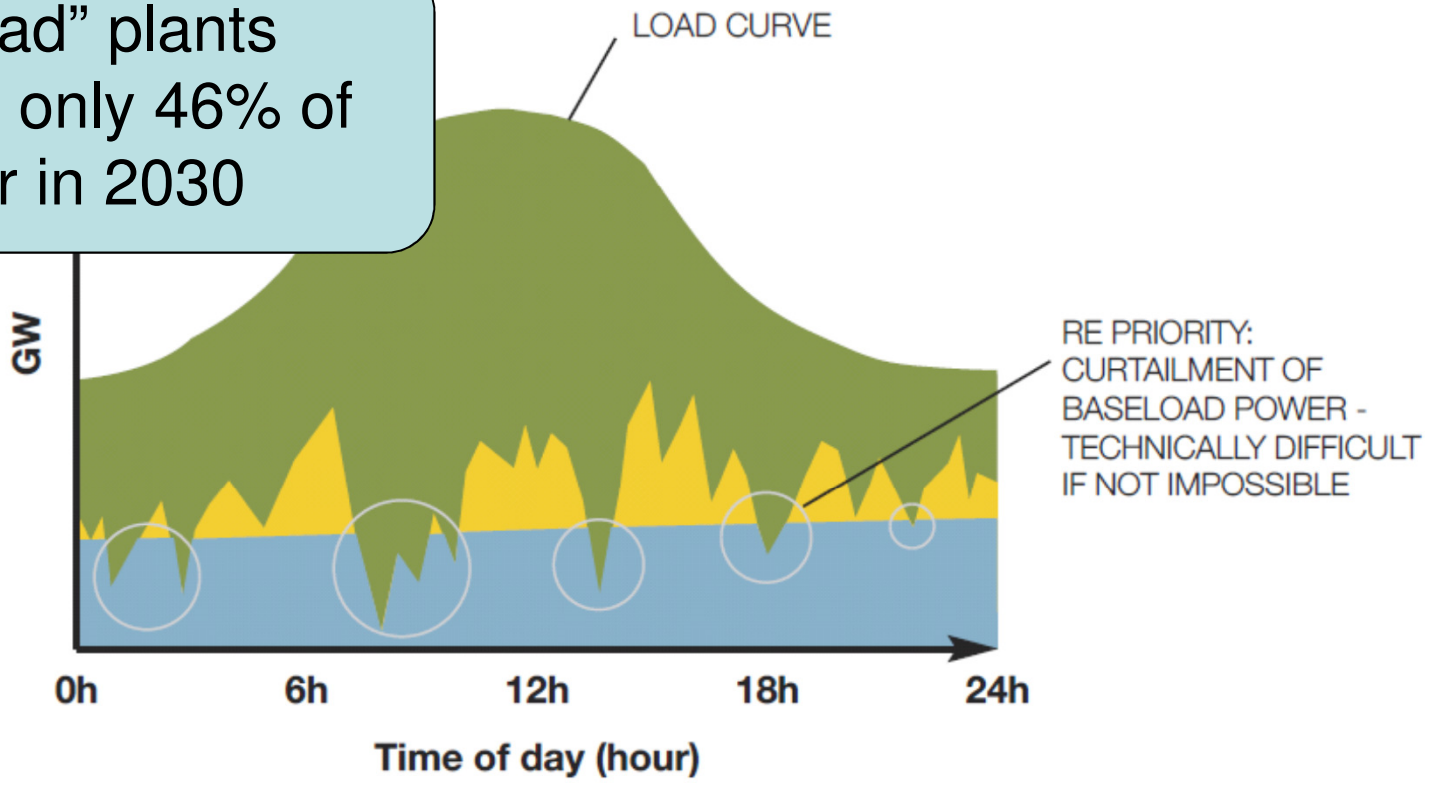
Curtailment losses of €32bn/ year



Baseload investments become uneconomic

Supply system with more than 25 percent fluctuating renewable energy – renewable energy priority

"baseload" plants running only 46% of the year in 2030



3. Necessary grid upgrades

2030:

- "missing links"
- offshore wind grids
- first step onshore supergrid

230 000 km
€ 74-98 bn

2050 regional scenario:
RES close to demand

280 000 km
€ 150-170 bn

2050 import scenario:
60GW import (North Africa)

500 000 km
€ 530-680 bn

2030

1. South to Central Europe

2. North Sea Offshore

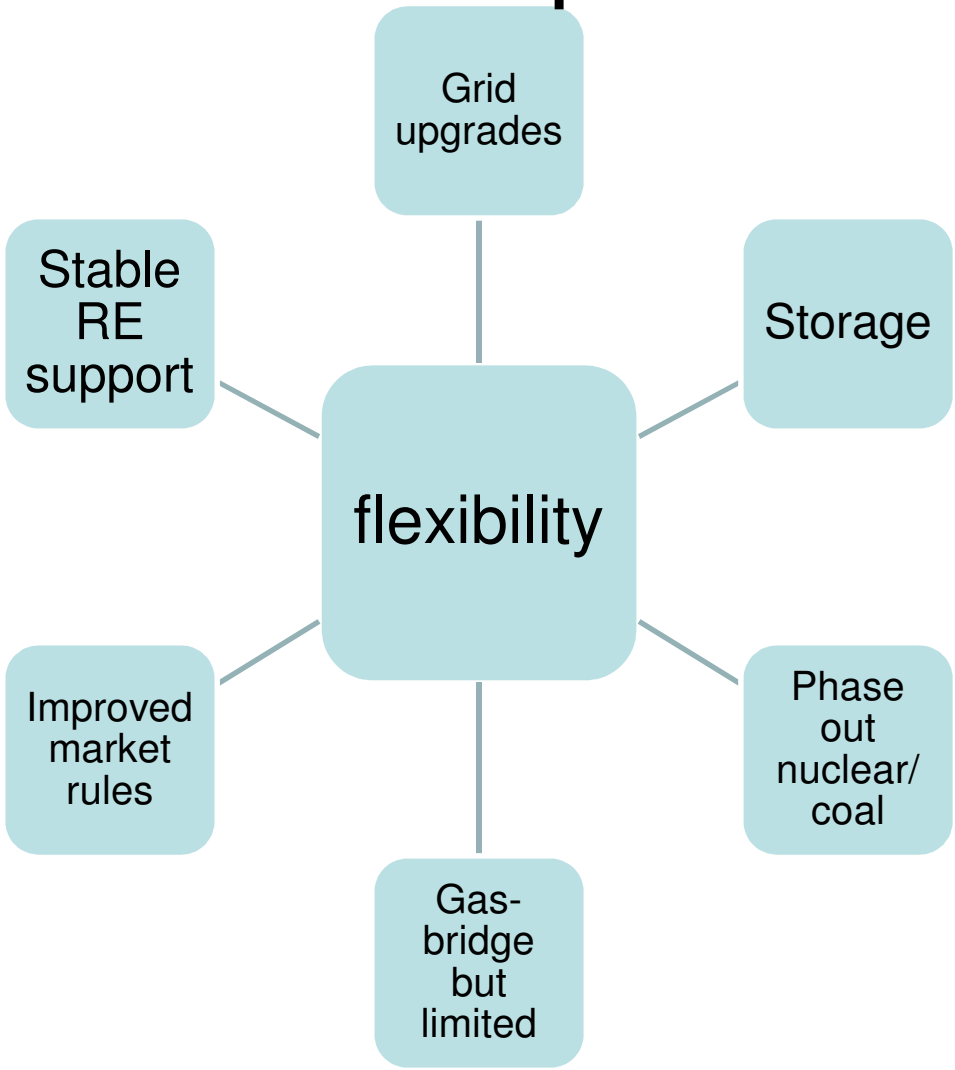
Source: Reproduced by energynautics with permission of ENTSO-E

2050

(High Grid case)

Source: Reproduced with permission of ENTSO-E by energy**nautics**.

Conclusions for 2050 Roadmap?



www.100percentrenewables.eu/declaration

RENEWABLES IN THE EUROPEAN UNION BY 2050
"driving sustainable prosperity, technology and leadership"

100% renewable energy in Europe by 2050

Confronted not only with an economic downturn, but in particular with the challenges posed by climate change, an increasing fuel import dependency and rising fossil fuel prices, Europe urgently needs to develop solutions for a future sustainable energy system entirely based on renewable energy sources.

The answers to today's challenges do not lie beyond our reach – they lie in the palm of our hands. By promoting energy efficiency and renewable energy technologies, we will be able to tackle both security of energy supply and climate change, while at the same time creating a future-oriented sustainable economy with high-quality green jobs.

We therefore commit ourselves to promote an economy based on energy efficiency and renewable energy and call on local, regional, national and European leaders to support and advocate a truly sustainable 2050 vision:

Leading by example: 100% renewable energy for the European Union!

Europe needs the courage and the instruments to fully explore its energy efficiency and renewable energy potential and hence to bring about fundamental structural changes in the way we produce and consume energy. This change means no less than rewriting the rules of the game in the 21st century. Every year, each EU citizen pays around €700 for foreign fuel imports.[1] Investing these expenditures towards energy efficiency and renewable energy in Europe can boost economic development, secure energy independence, and deliver solutions to climate change.

The availability of renewable energy sources is vast enough to meet our energy needs many times over, while respecting ecological limits and social justice. In one day, the sunlight which reaches the earth produces enough energy to meet the current global power needs for eight years.[2] Numerous studies demonstrate the technical and economic scope of the EU's energy efficiency and renewable energy potential: 100% renewable energy is entirely feasible in 2050 if the right measures are taken today![3]

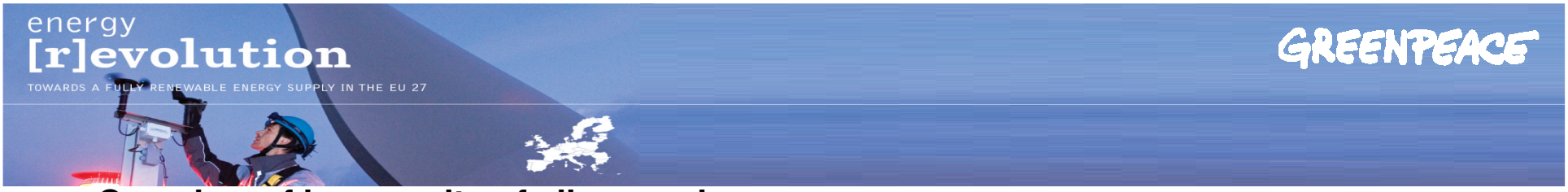
We urge European leaders to quickly act and make this 2050 vision become a reality for the benefit of all EU citizens by:

1. Ensuring the timely and fully effective implementation of the 2009 Renewable Energy Directive in all EU-27 Member States
2. Setting a legally binding energy efficiency target of at least 20% by 2020


THANK YOU
Contact: frauke.thies@greenpeace.org

3. Grid investments of € 70-98 bn by 2030 and € 149-679 bn by 2050

		Optimised Scenario 2030	Import Scenario 2050	Regional Scenario 2050
Distance (thousand km)	HVAC	170	242	190
	HVDC Onshore	19	125	26
	HVDC Offshore	43	135	62
	Total	233	501	278
Cost of upgrades vs 2010 grid (billion euro)	HVAC	20	59	31
	HVDC Onshore	21 -49	300 – 452	65 – 89
	HVDC Offshore	29	168	53
	Total	70 - 98	528 - 679	149 – 173



Overview of key results of all scenarios

	Base Scenario 2030	Base Scenario 2030 with DSM20%	Base Scenario 2030 with storage	Base Scenario 2030 with inflexible generation	2030 Grid optimised for curtailment	2050 Grid with 60GW import	2050 Grid without import
Total generation (TWh)	3886	3888	3863	3782	3867	4492	4543
RES (TWh)	2537	2643	2543	2250	2567	4438	4517
% RES	65%	68%	66%	59%	66%	99%	99%
Curtailed RES (TWh)	98	89	77	150	32	219	294
% curtailed	4%	3%	3%	6%	1%	4%	5%
Grid investments (billion Euro)	50 to 70	-	-	-	19 - 28 in addition to Base Scenario 2030 (70 - 98 vs 2010)	458 – 581 in addition to 2030 (528 - 679 vs 2010)	74 - 79 in addition to 2030 (149 - 173 vs 2010)