ENERGY TARGETS BALTIC SEA REGION

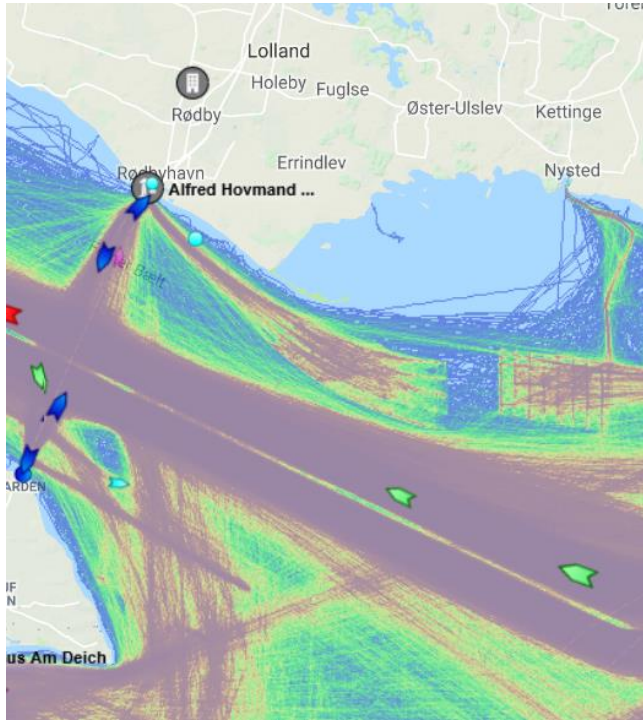
Tanja Tränkle

30 October 2018

RISE Research Institutes of Sweden

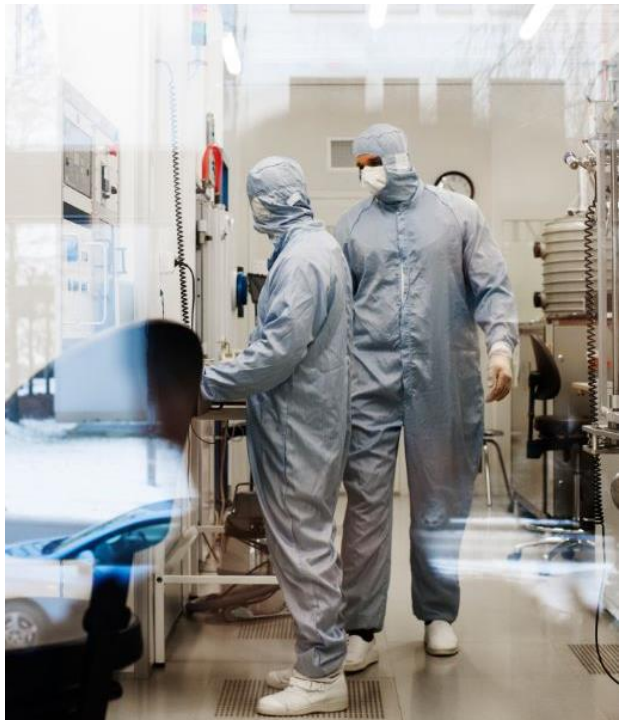
Maritime Research

Safety &Transport



RISE in brief

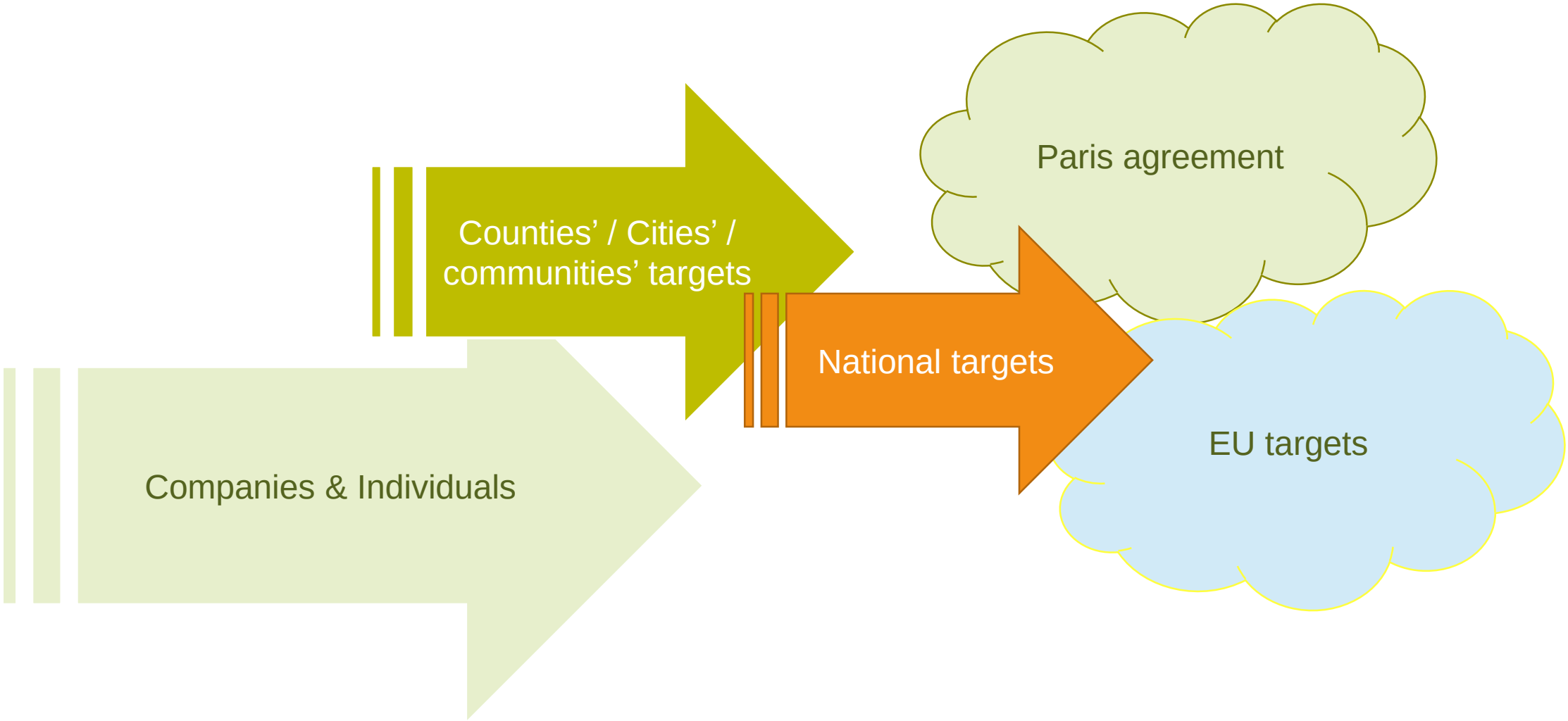
- 2,800 employees, 30 % with a PhD.
- Turnover approx. SEK 2.7 billion (2017).
- SME clients, accounting for approx. 30 % industry turnover.
- UN 17 sustainable development goals is a central pillar of our business strategy
- Runs 100s of test and demonstration facilities, open for industry, SMEs, universities and institutes RISE is owner and partner in 60 % of all Sweden's T&D facilities.



Why setting energy targets?

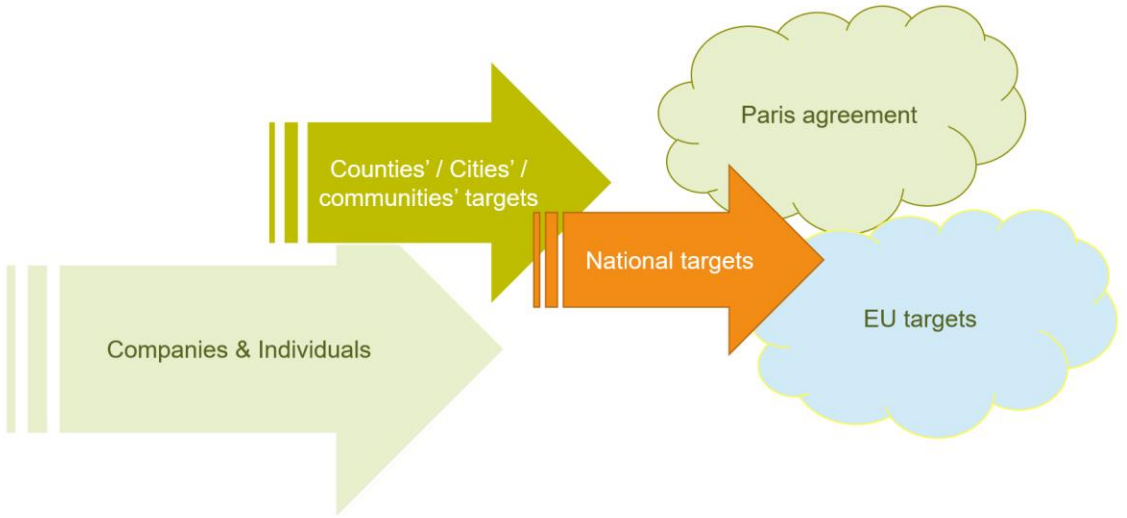
- Committed to the Paris Agreement
- Reduce emissions, reduce effects of climate change
- Transition to renewables is less costly than to continue with current energy mix
- Securing energy supply
- Moving forward may position your domestic industry well for the energy market of the future
- …

Various levels



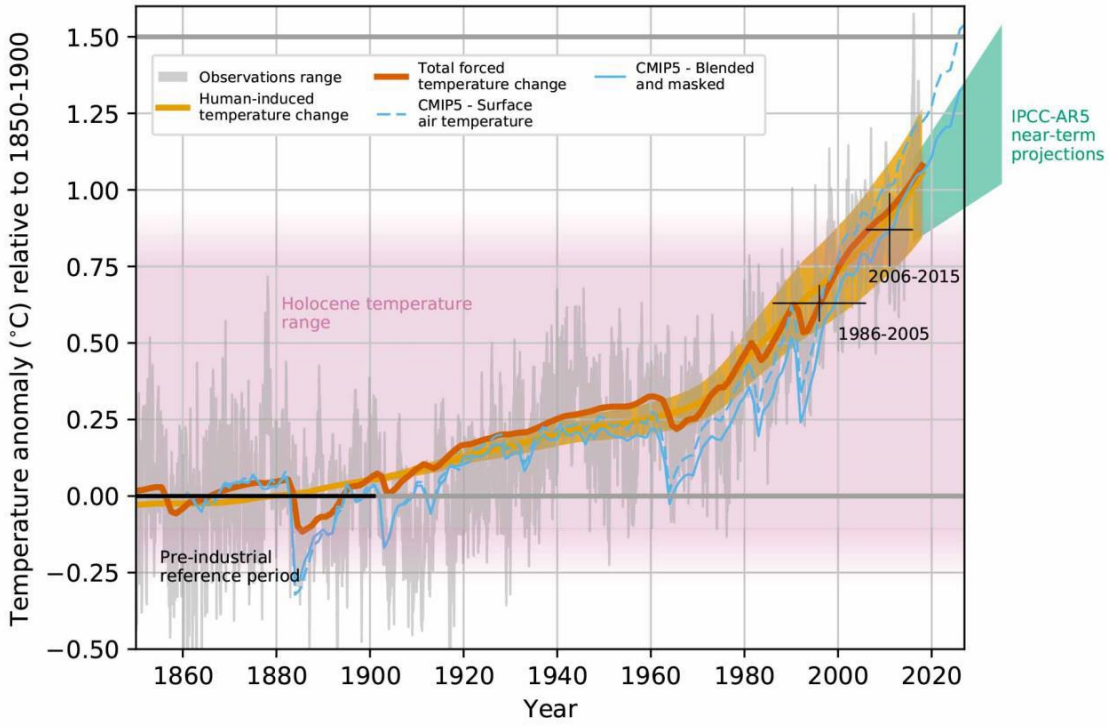
Various targets on various levels

- Reduction in greenhouse gas emissions
- Increase your energy savings and efficiency
- Increase your share of renewable energy
- Increase electrification of transport and heating/cooling
- Ambition of 100 % fossile free community
- Increase in installation of solar and wind energy
- …



Paris Agreement – the 2 degree target

- (a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;
- (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; and
- (c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development.



UNITED NATIONS 2015

Paris Agreement → IPCC Report 2018 (what happens at 1.5 degree?)

- Human-induced warming reached approximately 1°C (±0.2°C *likely* range) above pre-industrial levels in 2017, increasing at 0.2°C (±0.1°C) per decade (*high confidence*).
- Warming greater than the global average has already been experienced in many regions and seasons, with average warming over land higher than over the ocean (*high confidence*).
- Past emissions alone are *unlikely* to raise global-mean temperature to 1.5°C above pre-industrial levels but past emissions do commit to other changes, such as further sea level rise (*high confidence*).
- Under emissions in line with current pledges under the Paris Agreement (known as Nationally-Determined Contributions or NDCs), global warming is expected to surpass 1.5°C, even if they are supplemented with very challenging increases in the scale and ambition of mitigation after 2030 (*high confidence*).
- Limiting warming to 1.5°C depends on greenhouse gas (GHG) emissions over the next decades, where lower GHG emissions in 2030 lead to a higher chance of peak warming being kept to 1.5°C (*high confidence*).
- Limiting warming to 1.5°C implies reaching net zero CO2 emissions globally around 2050 and concurrent deep reductions in emissions of non-CO2 forcers, particularly methane (*high confidence*).

EU Energy Policies

EU targets:

- The European Commissions Renewable Energy Scenarios for 2030 imply the following targets (European Commission, 2014):
  - a 40% cut in greenhouse gas emissions compared to 1990 levels
  - at least a 27% share of renewable energy consumption
  - at least 27% energy savings compared with the business-as-usual scenario.
- The European parliament has voted for a renewable target of 35% by 2030 and 35% for energy efficiency as well. (European Parliament, 2018)
- In June 2018, the Commission, the Parliament and the Council agreed on 32% EU-wide binding target for renewables 2030, with a clause for an upwards revision by 2023.
- The corresponding levels named in the roadmap for 2050 (European Union, 2012) are:
  - a 80-95% cut in greenhouse gas emissions compared to 1990 levels
  - about 2/3 share of renewable energy consumption
  - at least 41% energy savings compared to the peaks in 2005-2006.

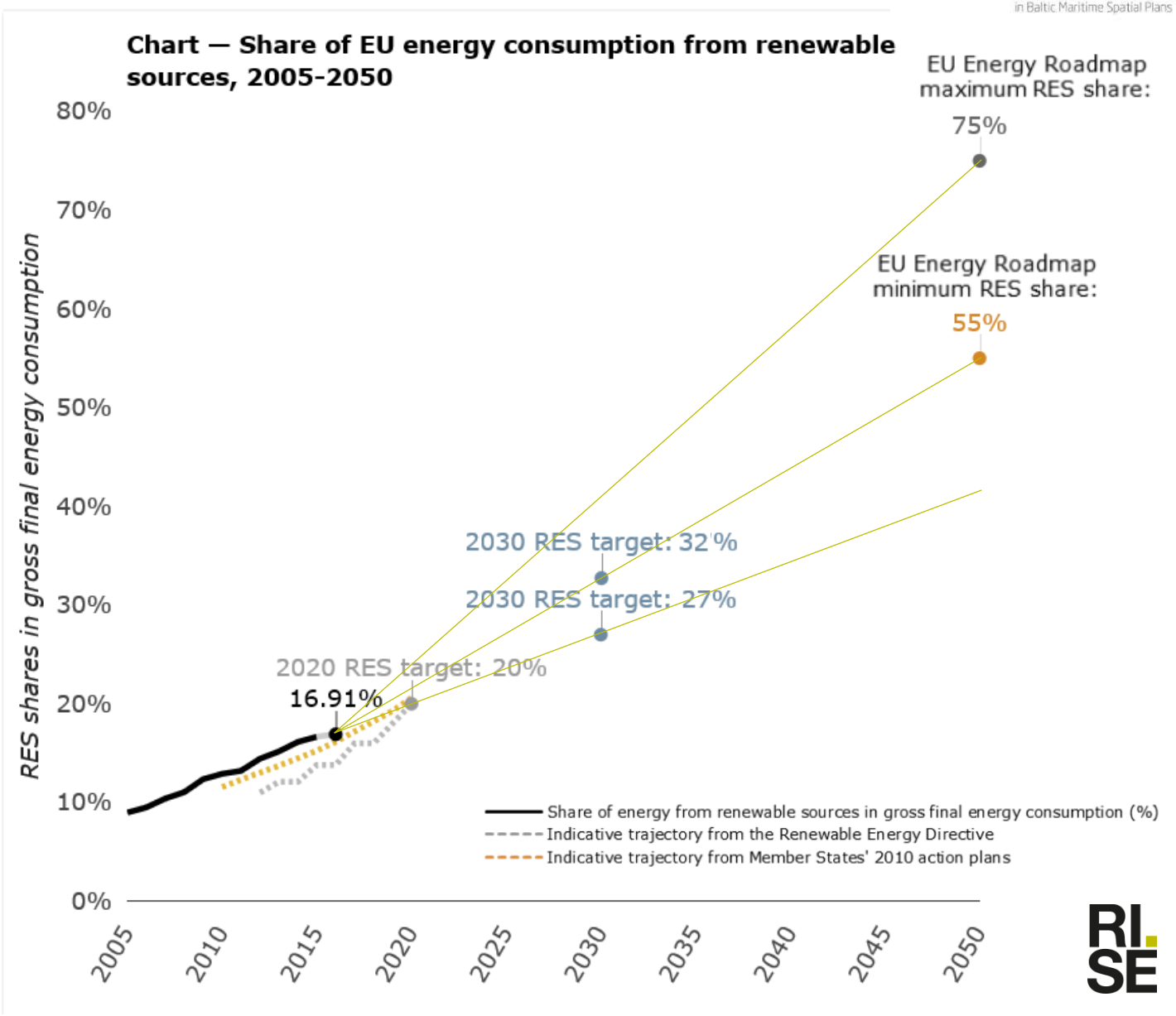
EU Energy Policies

The EU has increased targets for renewable energy since the start. The new target for 2030 can be revised upwards several times

Several studies indicate, that the Paris agreement might not be reached by the current energy targets for the EU. (cumulative volume of emissions) → IPCC, DNV GL, Climate Action Network Europe

Probable that stricter emission regulation will affect all industries and consumers making the move towards more renewable energy will be supported by future policies.

TARGET / YEAR	2020	2030	2050
GREENHOUSE GAS EMISSIONS	20%	40%	80-95%
RENEWABLE ENERGY CONSUMPTION	20%	32%	About 66%
ENERGY EFFICIENCY	20%	27%	41%



National Energy Policies

National targets:

- **Germany**: The Renewable Energy Act (EEG) commits to 700 MW of offshore wind power per year from 2023-2025 and 840 MW per year from 2026-2030.
- **Denmark**: Danish parliament unanimously voted in favour of a new energy agreement for the country on Friday, 27 June, which includes building three new offshore wind farms by 2030 with a total capacity of at least 2.4GW.

Taking into account the Paris agreement, the targets are nevertheless probably too low, and some analyses show that the full decarbonization must be effective from 2045 increasing the demands. There are no firm targets on how much energy shall be produced by offshore wind, but there are various scenarios on how the electricity needed will be produced.

National trajectories

- **Denmark**: Denmark has, according to its EU commitments, a 20 % greenhouse gas emission target for 2020 (compared to 1990). No further targets have been set in relation to 2030. The Government has a long-term vision for the energy system to be independent of fossil fuels in 2050. Danish parliament unanimously voted in favour of a new energy agreement for the country, which includes building three new offshore wind farms by 2030 with a total capacity of at least 2.4GW.
- **Estonia:** The new plan will include energy and climate policies and objectives for the period up to 2030, with an outlook to 2050. In the current draft it is proposed to set an indicator of 45 % of renewables in final energy consumption by 2030.
- **Finland:** Finland's medium-term climate and energy objectives are outlined in the 2013 updated National Energy and Climate Strategy. Wind power permitting will be facilitated to increase its electricity generation to 6 TWh by 2020 and to 9 TWh by 2025.
- **Germany**: In 2010 Germany has adopted the Energy Concept (Government Decision), a comprehensive strategy covering both medium (2030) and long (2050) term strategies. The Renewable Energy Act (EEG) commits to 700 MW of offshore wind power per year from 2023-2025 and 840 MW per year from 2026-2030. No split between Baltic and North Sea is made here. In the last round, the Baltic Sea was allocated a certain volume, but no split can be made now, but a bigger share is expected in the North Sea as the allocated areas are bigger in total.

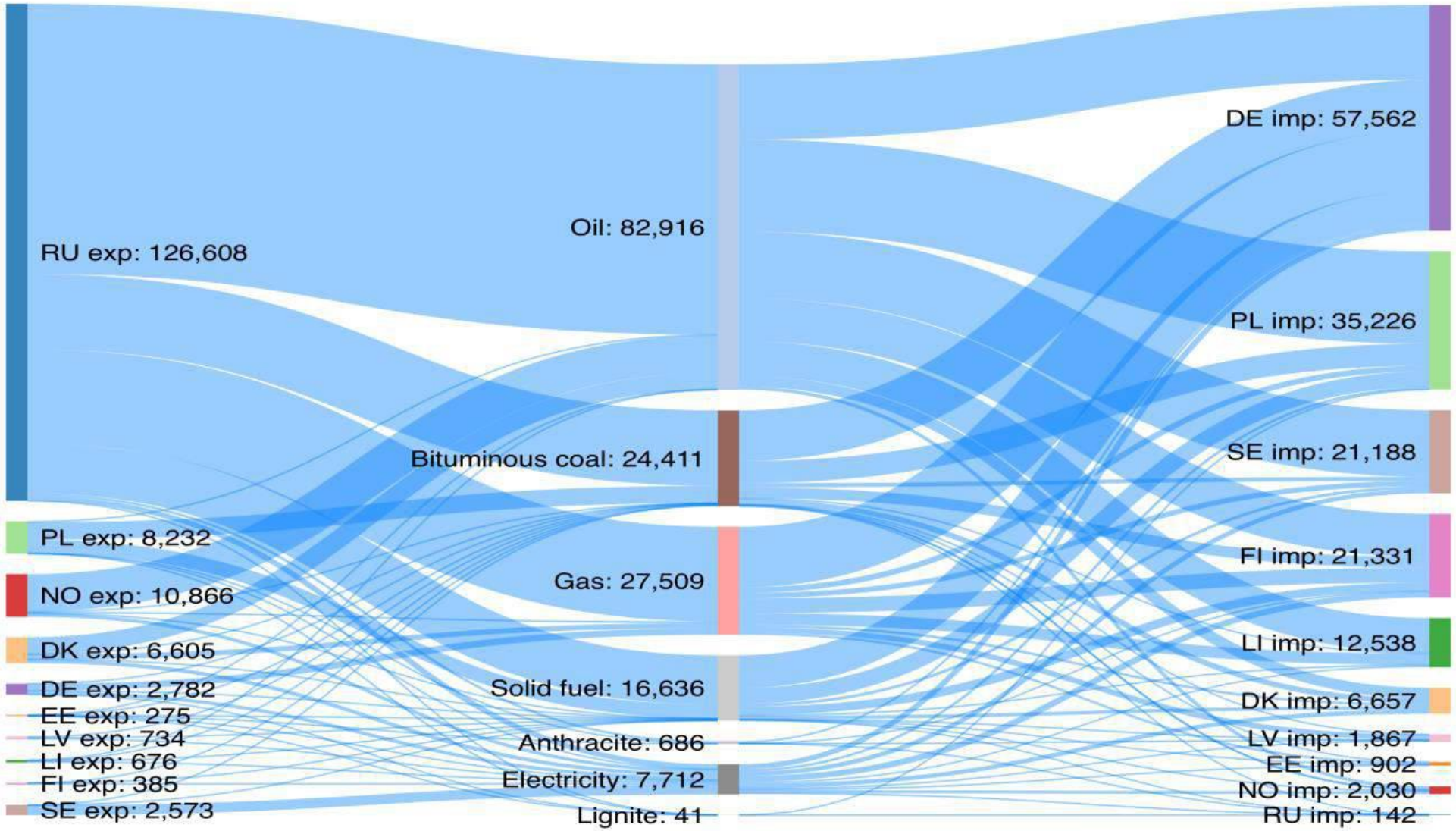
National trajectories

- **Latvia:** The Latvian Energy Long-term Strategy 2030 ("Strategy 2030") which includes energy-related targets and planned policy measures contains the targets for Latvia.
- **Lithuania:** By 2050, Lithuania aims to be independent from fossil fuel and to produce its energy from nuclear and renewable energy sources only. Aim for a 45% renewables share of its electricity mix by 2030 and 100% by 2050.
- **Poland:** No post-2020 climate-specific strategy has been established yet. In comparison to its National Renewable Action Plan (NREAP) for 2020, Poland is in line with its indicative trajectory for renewable heating and cooling sector. However, shares of renewable electricity and transport are below values envisaged by NREAP.
- **Sweden**: Several steps have been taken by Sweden or are underway to prepare a low-carbon development strategy for 2050, such as the appointment by the Government of a Committee to develop a strategy for implementing the vision of zero net emissions in 2050 and 100 % renewable energy by 2040/2045, expected offshore wind capacity (no fixed target): 50 TWh ~ 12 GW

Overview of the types of renewable energy policies and measures adopted

NATIONAL POLICY	REGULATORY INSTRUMENTS	FISCAL INCENTIVES	GRID ACCESS	ACCESS TO FINANCE	SOCIO-ECONOMIC BENEFITS
• Renewable energy target • Renewable energy law/ strategy • Technology-specific law/ programme	• Feed-in tariff • Feed-in premium • Auction • Quota • Certificate system • Net metering • Mandate (e.g., blending mandate) • Registry	• VAT/ fuel tax/ income tax exemption • Import/ export fiscal benefit • National exemption of local taxes • Carbon tax • Accelerated depreciation • Other fiscal benefits	• Transmission discount/ exemption • Priority/ dedicated transmission • Grid access • Preferential dispatch • Other grid benefits	• Currency hedging • Dedicated fund • Eligible fund • Guarantees • Pre-investment support • Direct funding	• Renewable energy in rural access/ cook stove programmes • Local content requirements • Special environmental regulations • Food and water nexus policy • Social requirements

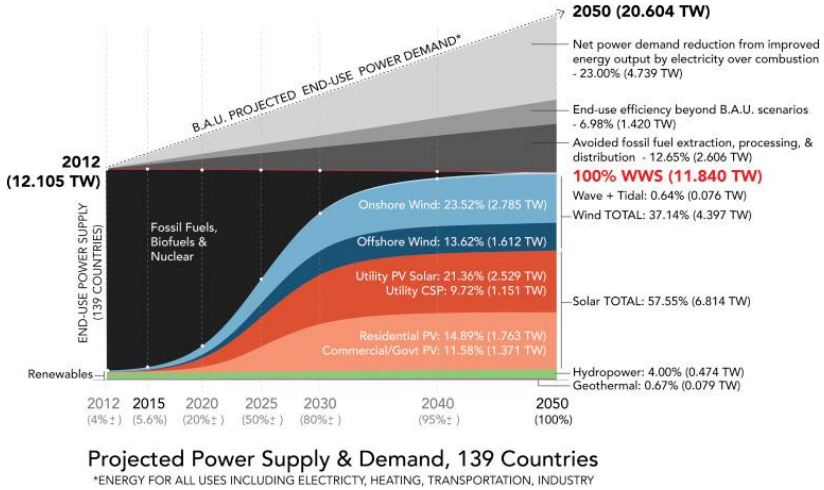
Energy Trading Patterns within the Baltic Sea region



Sources: (Shadurskiy, Westphal, Daborowski, & Liuhto, 2015)

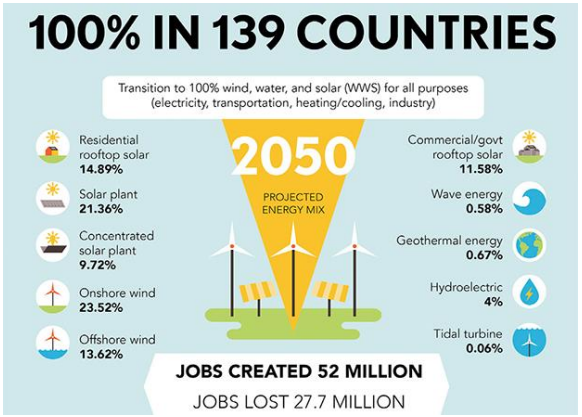
Stanfort Study on Renewables

- All countries switch to renewables 2050
- Different shares of renewables based on the local circumstances are derived
- Differentiated between only electricity and total power consumption and energy efficiency:
  - The roadmaps envision 80% conversion by 2030 and 100% by 2050. WWS not only replaces business-as-usual (BAU) power, but also reduces it ~42.5% because the work-energy ratio of WWS electricity exceeds that of combustion (23.0%), WWS requires no mining, transporting, or processing of fuels (12.6%), and WWS end-use efficiency is assumed to exceed that of BAU (6.9%).

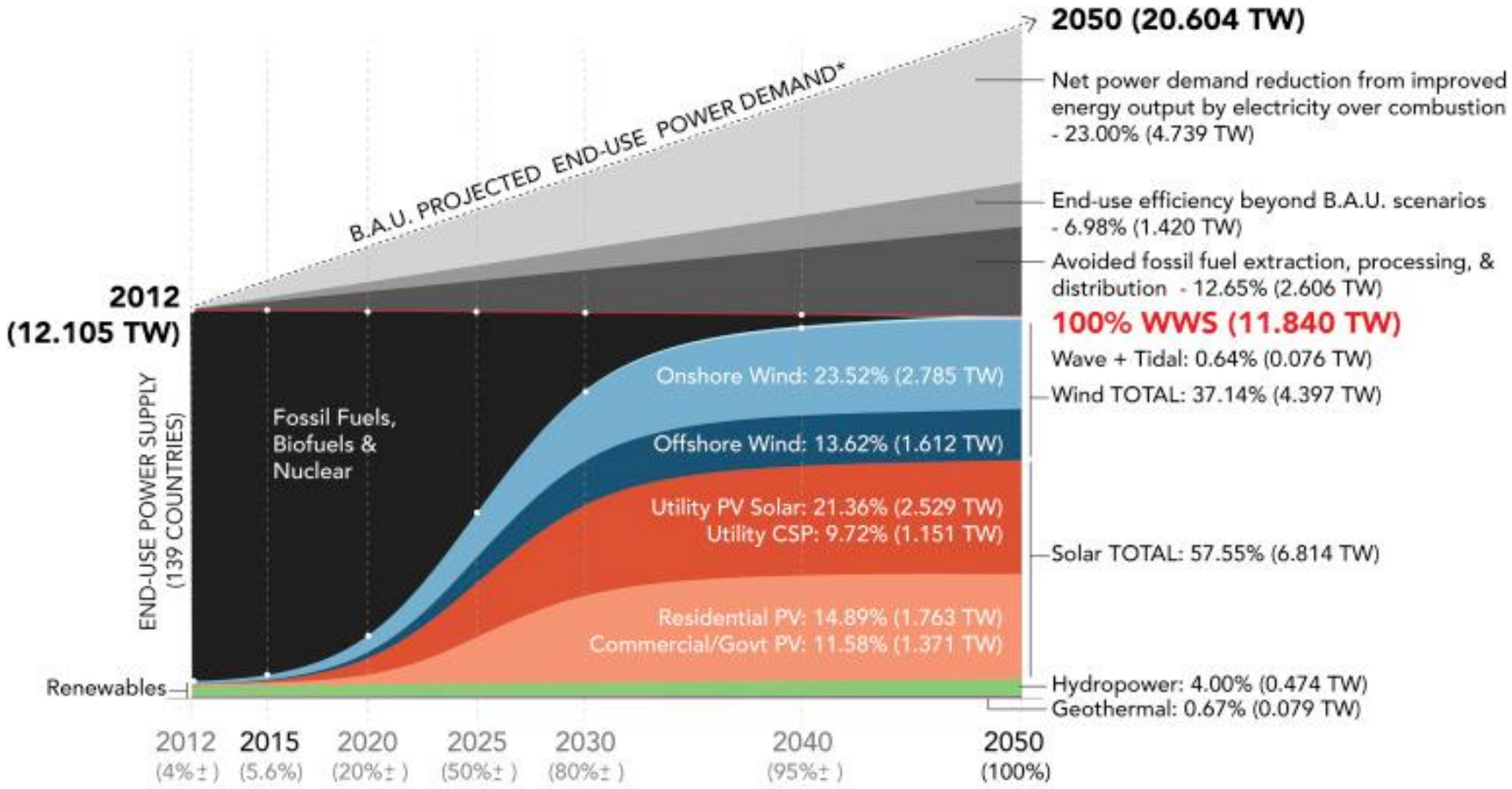


Projected Power Supply & Demand, 139 Countries

*ENERGY FOR ALL USES INCLUDING ELECTRICTY, HEATING, TRANSPORTATION, INDUSTRY



Stanford Study on Renewables



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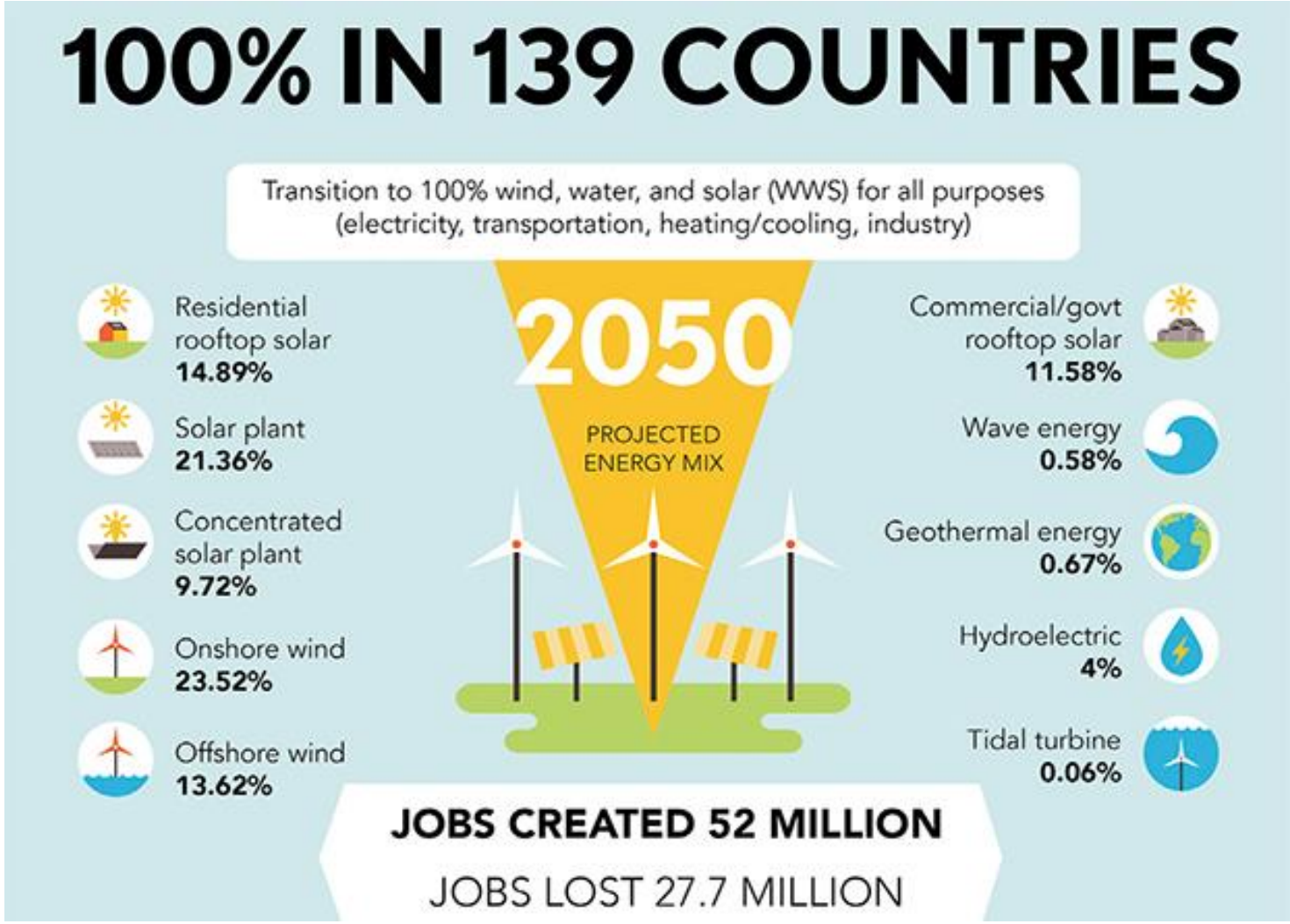
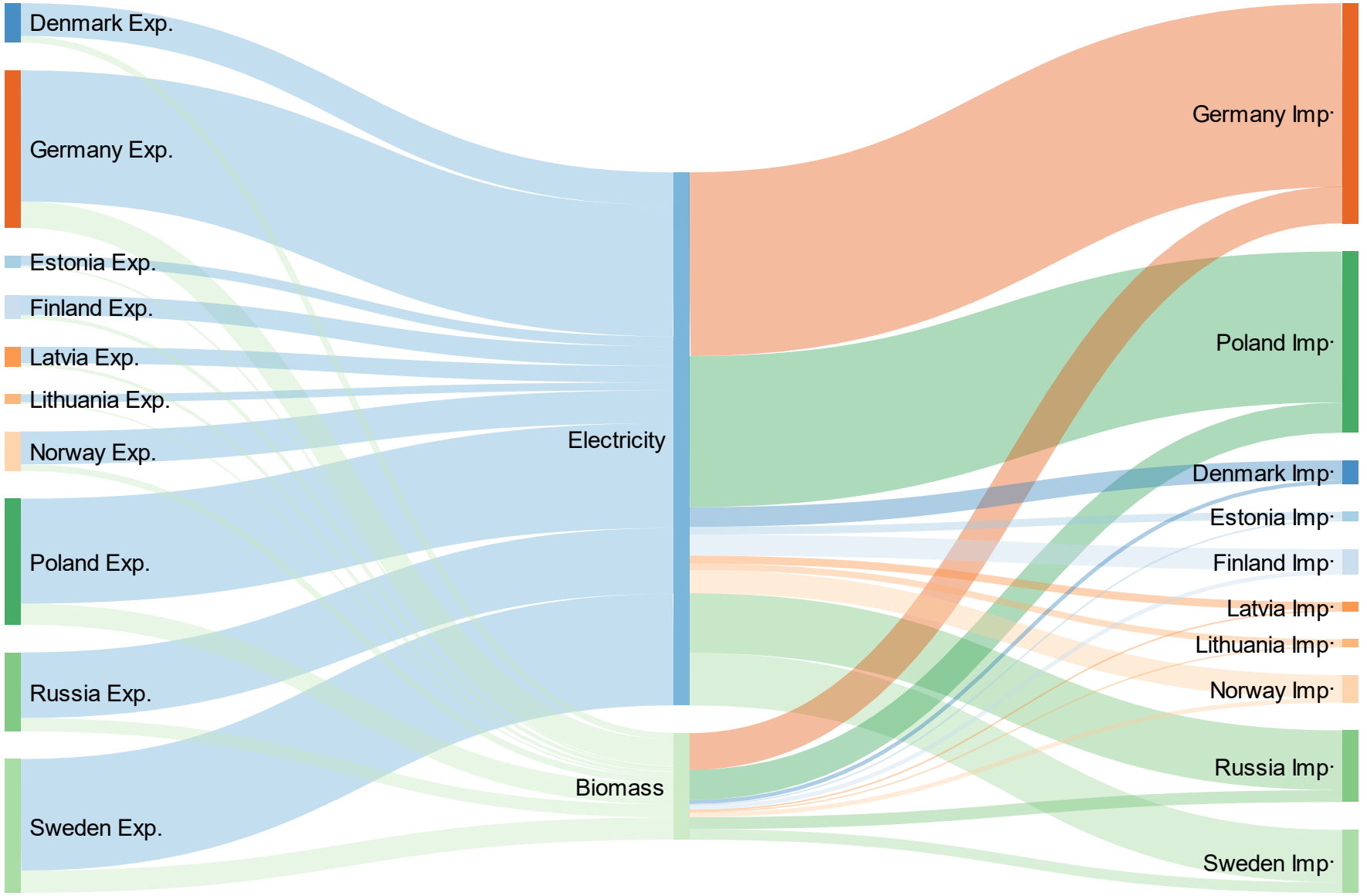


Energy Trading Patterns the within Baltic Sea region

How will the 2050 scenario look like?



What we found…

- Huge difference in energy mix in the countries within the Baltic Sea Region
- EU targets are a huge compromise
- Varying motivation to establish energy production (offshore wind) depending on each country
- MSP in most cases not prioritizing energy production sites
- High need for interconnections within Baltic Sea Region. Expected congestions are denser in the region and need investment and various projects that affect the MSP.
- Becoming more self-sufficient is a target for the whole EU and even for single countries, which implies further need for interconnection and strong national grids.
- Technical development is ongoing and will have to challenge MSP process once ready to be established.

What we found…

- The world is not on track!
  - Strong efforts are needed to commission extensively renewable energy.
  - Limited physical areas and less cost-efficient energy resources in some countries
  - Potential for green stream
- Hardly any firm national targets for 2050
  - trajectories for the long term are uncertain
  - Feasible to strive for 100 % fossile free
- Changing the picture
  - Increased exchange of intermittent energy
  - Security of supply by sharing of energy with origin within the EU
  - Rely on exporters of renewable energy Especially Denmark, Germany and Poland will have to invest in reinforcements of their national grid but even all other countries will have to make significant efforts.
  - Reduced transport of fuels
- Energy mix will have a high impact
  - on MSP
  - on electrical infrastructure
  - Cooperation between countries necessary
  - Cooperation of national agencies, TSO's and MSP will be necessary

CONTACT DETAILS

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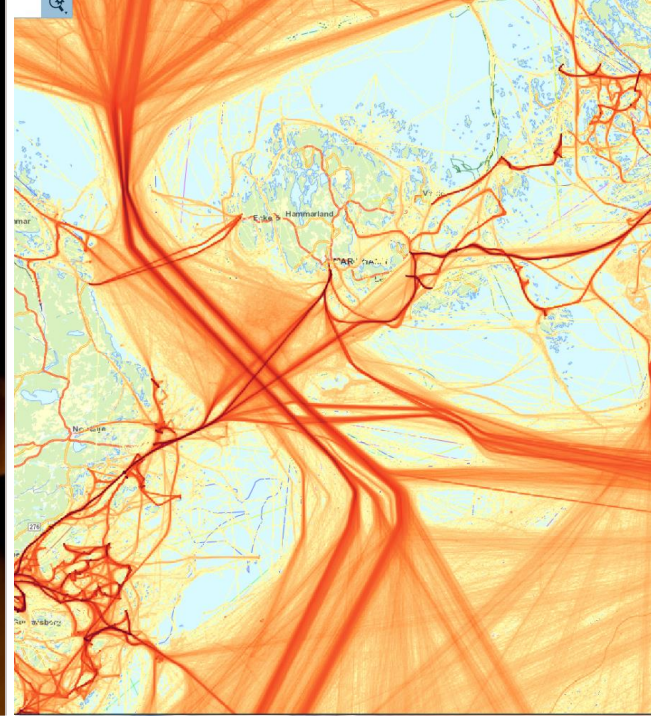
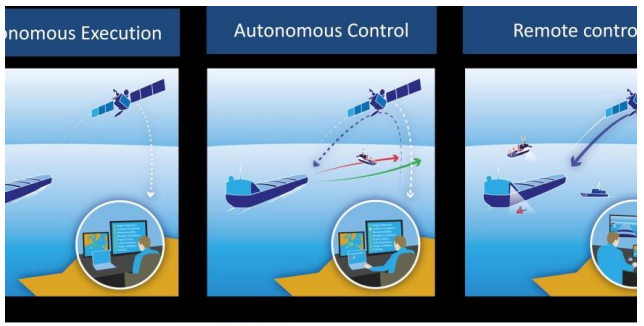
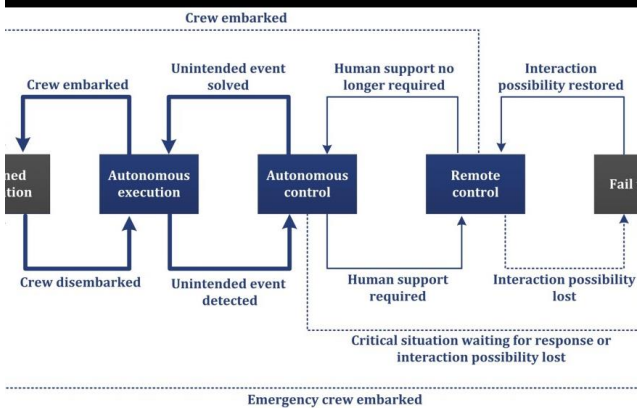
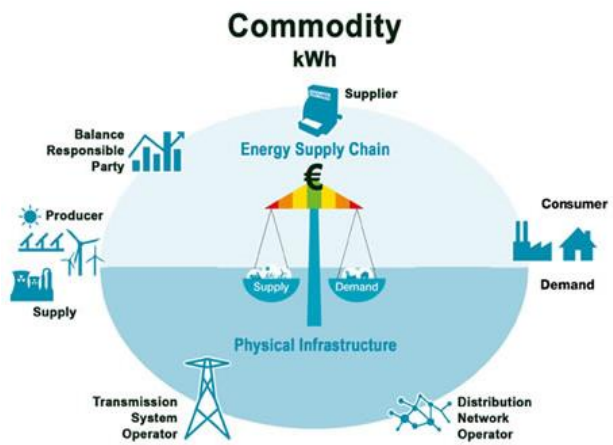




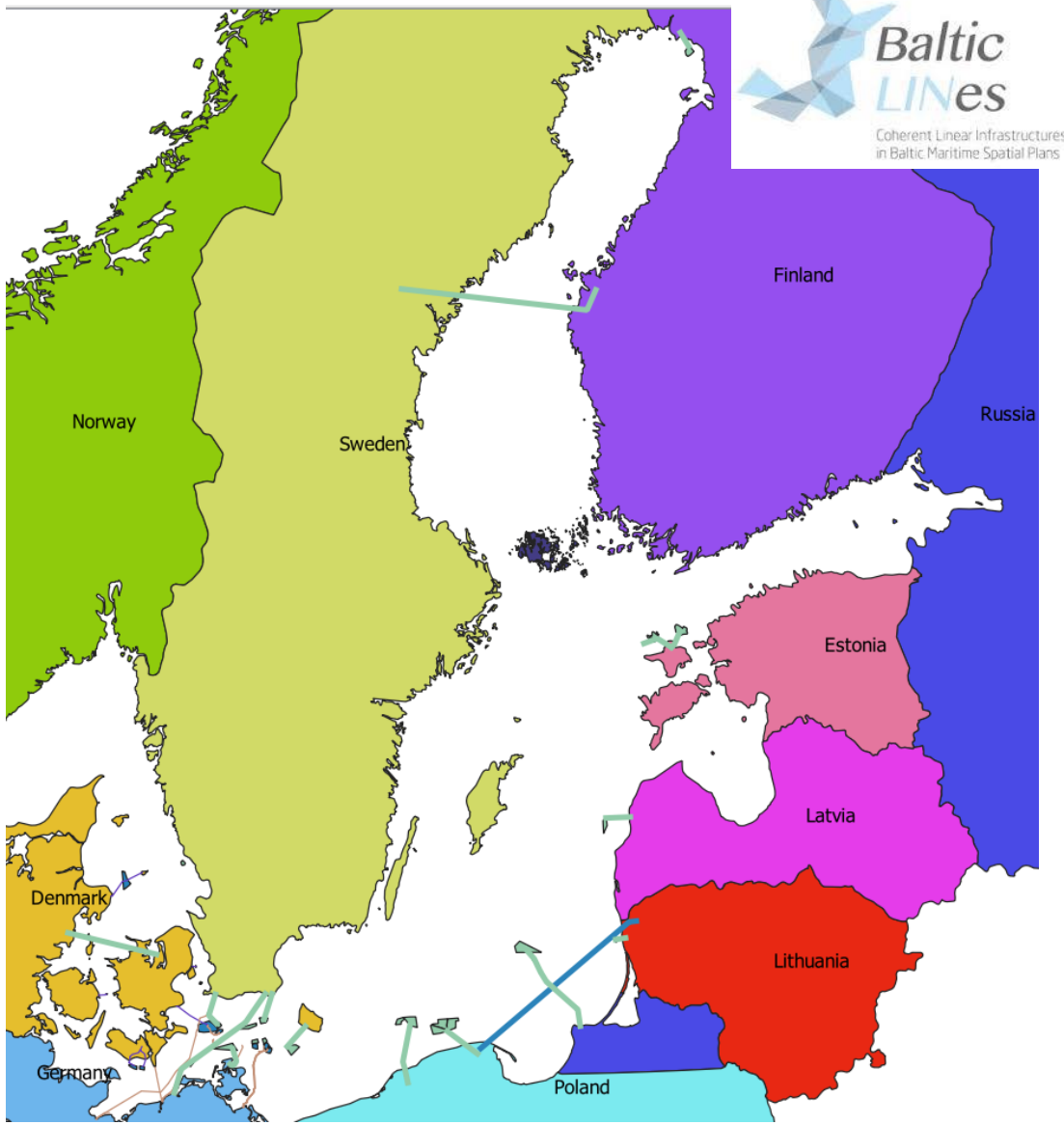




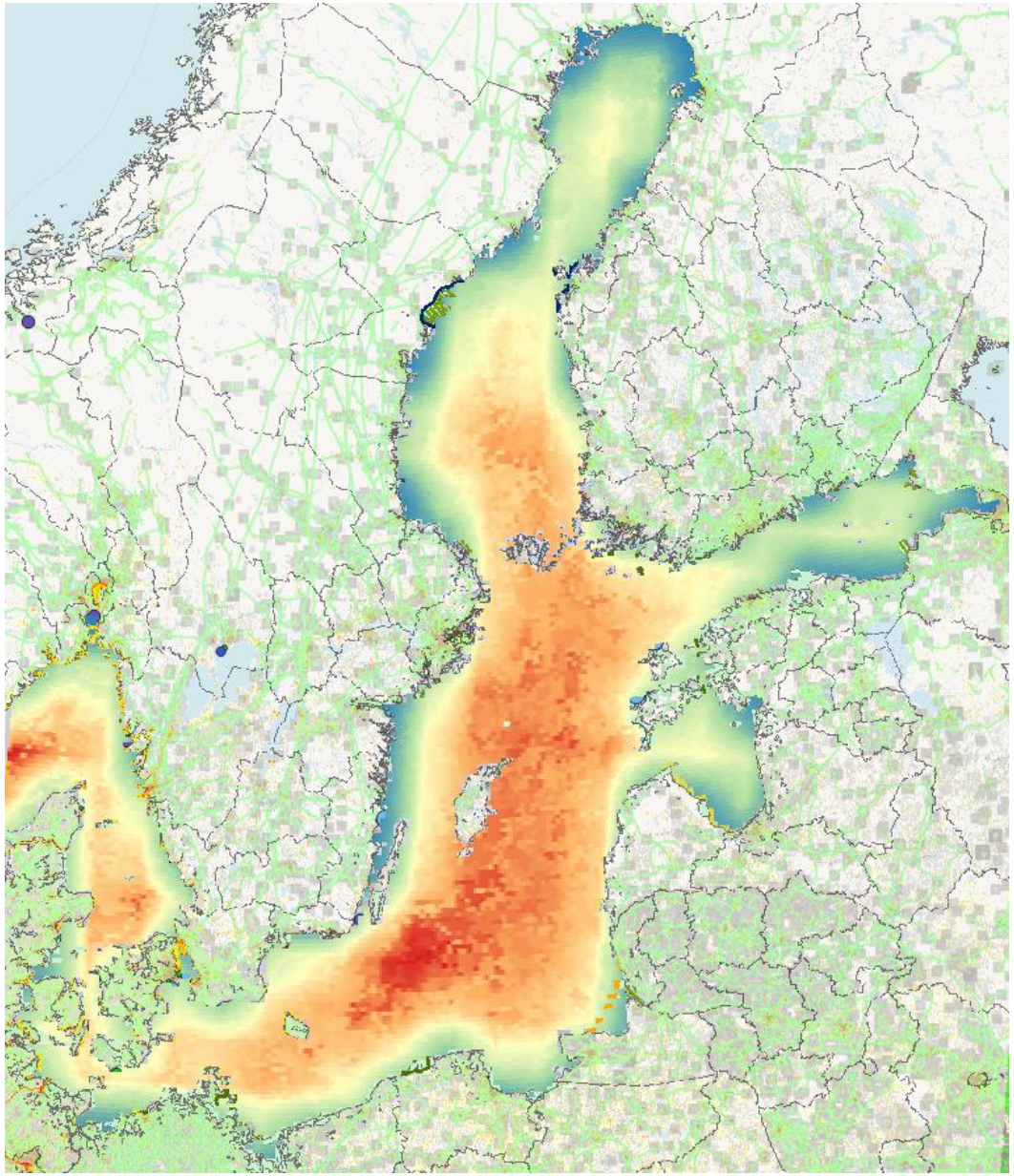
Outlook 2030 + 2050 scenarios

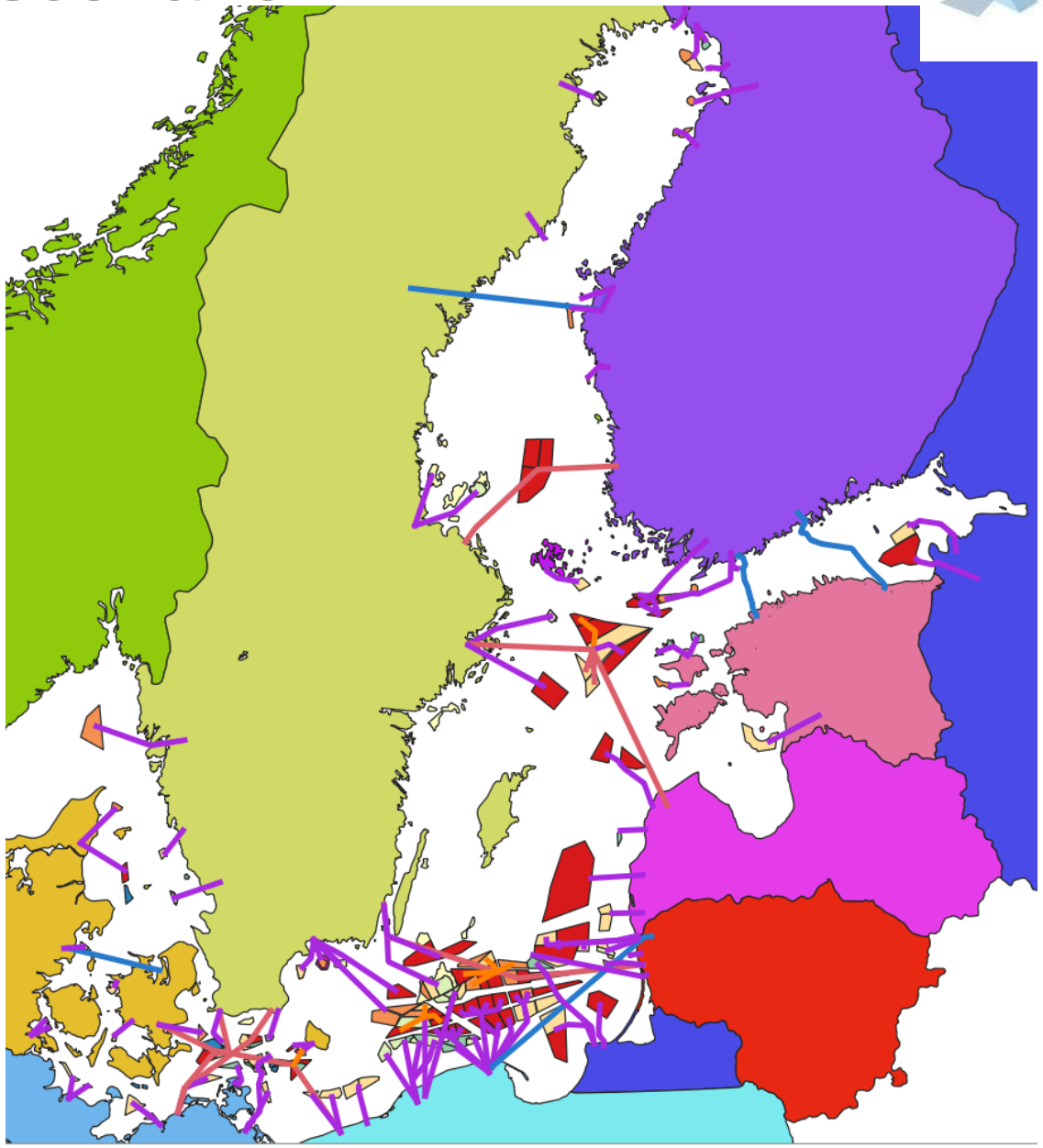
Operational 2017	MW	2030 Low	2030 Central	2030 High		2050 Low	2050 Central	2050 High	Area use [%]
880	Denmark	1 620	1 769	2 169		1 769	3 926	8 786	5,45%
689	Germany	2 124	2 084	2 368		8 542	17 737	49 732	67,03%
200	Sweden	386	757	1 157		4 496	11 030	26 055	4,16%
90	Finland	235	448	539		2 694	10 722	34 511	8,61%
-	Poland	1 464	1 727	3 411		4 981	20 109	61 193	38,05%
-	Estonia	225	425	900		2 042	2 807	4 722	2,69%
-	Lithuania	-	50	100		1 672	3 343	8 232	26,68%
-	Latvia	-	-	133		824	2 093	5 762	4,20%
1 858	**Baltic EU**	**6 055**	**7 260**	**10 777**		**27 020**	**71 768**	**198 992**	**11,26%**
-	Norway	-	-	-		329	811	1 939	
-	Russia	144	433	1 040		1 040	9 305	25 901	22,04%
1 858	**Total**	**6 199**	**7 693**	**11 818**		**28 390**	**81 884**	**226 831**	**12,03%**
442	TWh	1 476	1 832	2 814		6 759	19 496	54 007	
372	Km2	1 240	1 539	2 364		5 678	16 377	45 366	
0,10%	% Baltic	0,33%	0,41%	0,63%		1,51%	4,34%	12,03%	

*Sources: RISE own database, Offshore4c, WindPower Net, Stanford, ECOFYS, WindEurope, EU, BalticIntergrid, IEA, project internal information on Russia



Power density and the 2050 scenario

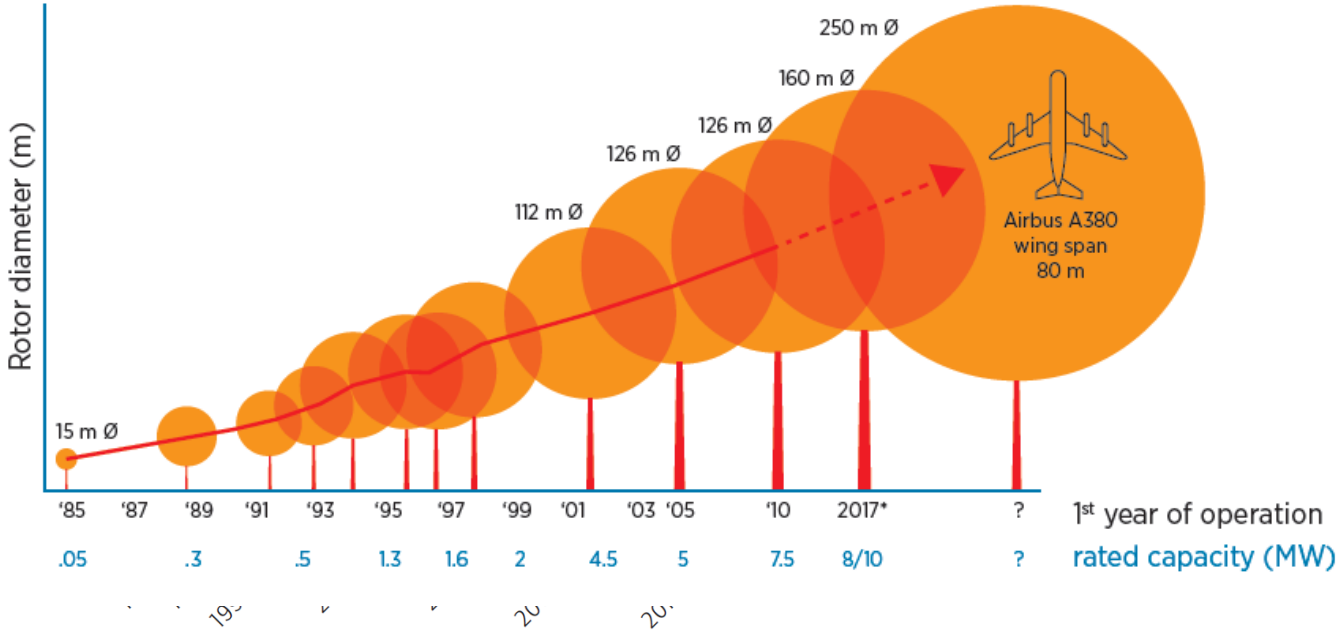


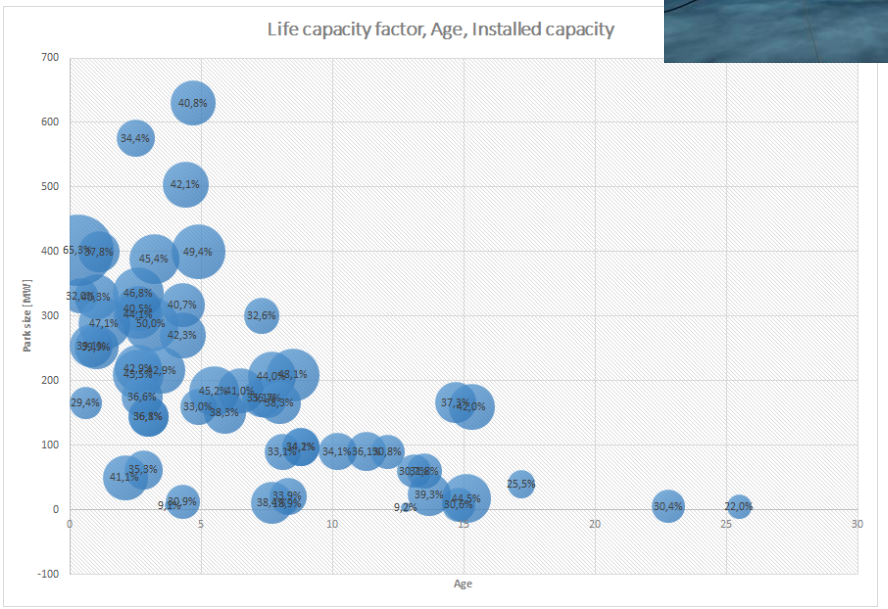


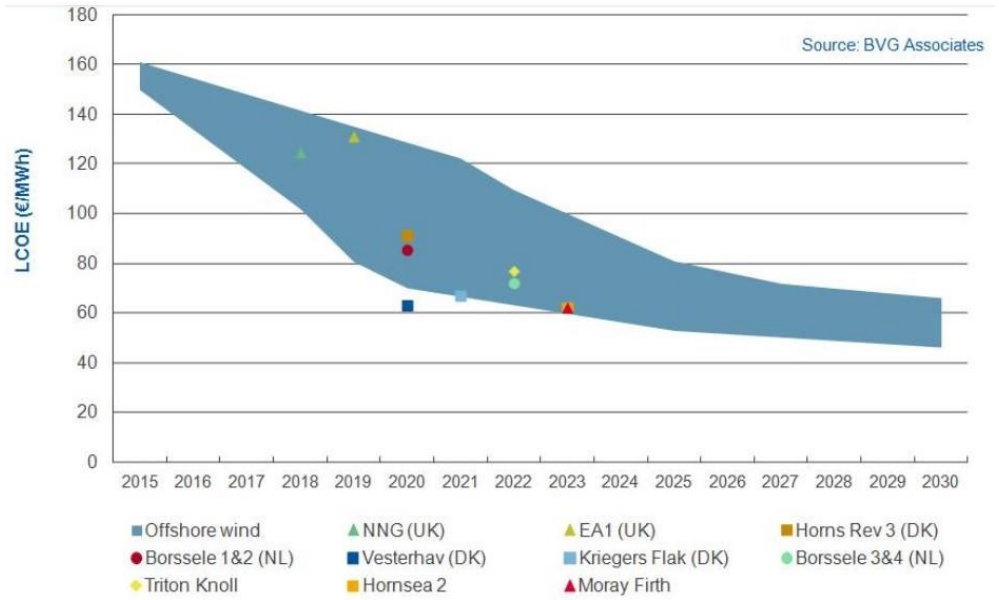
Baltic LINes
Coherent Linear Infrastructures in Baltic Maritime Spatial Plans

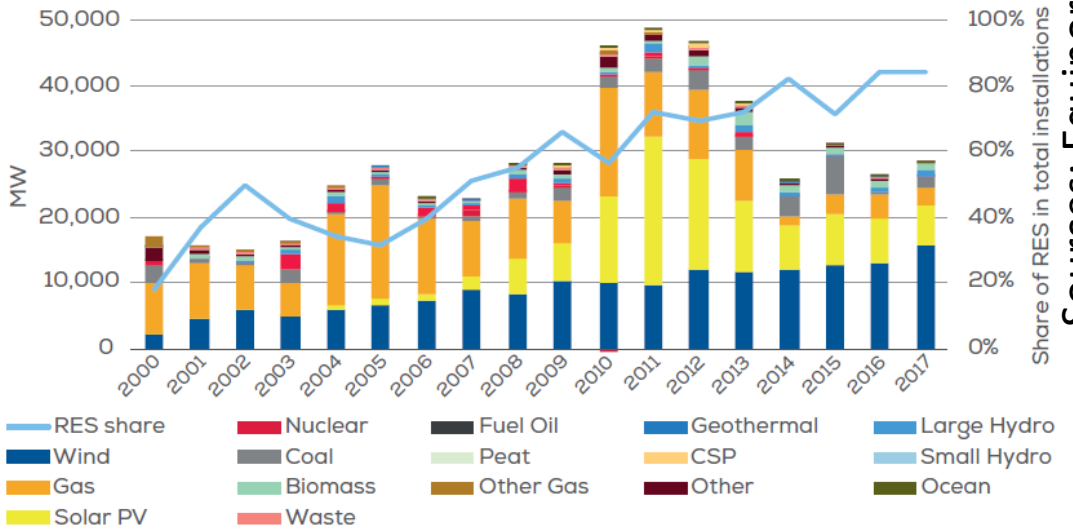
RI. SE

Marknadstrender



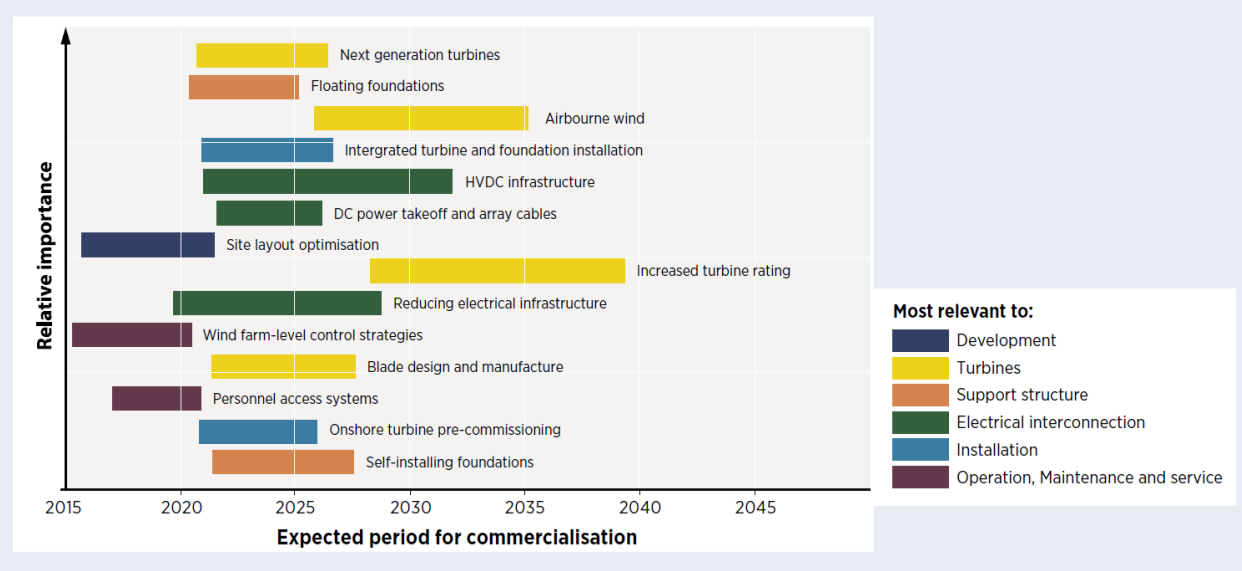




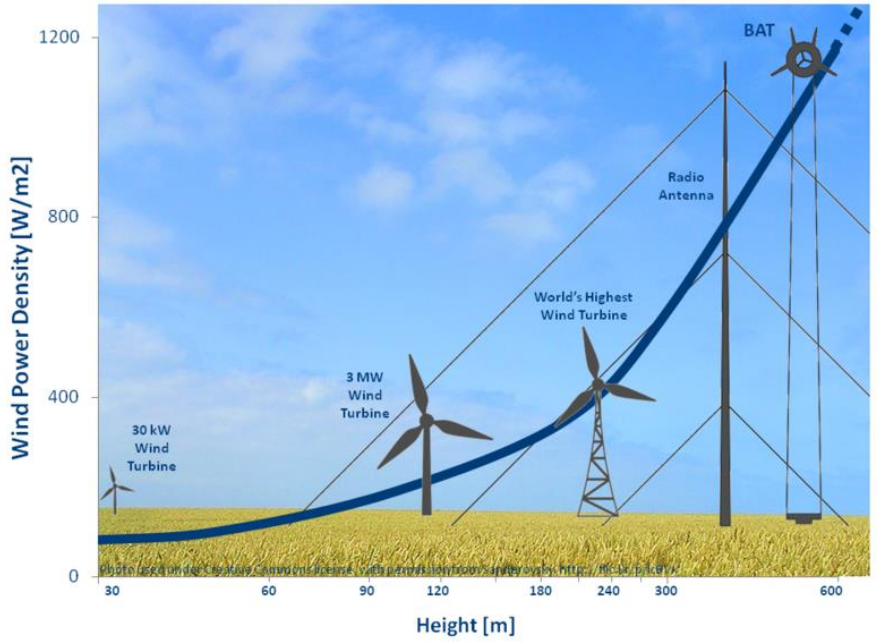


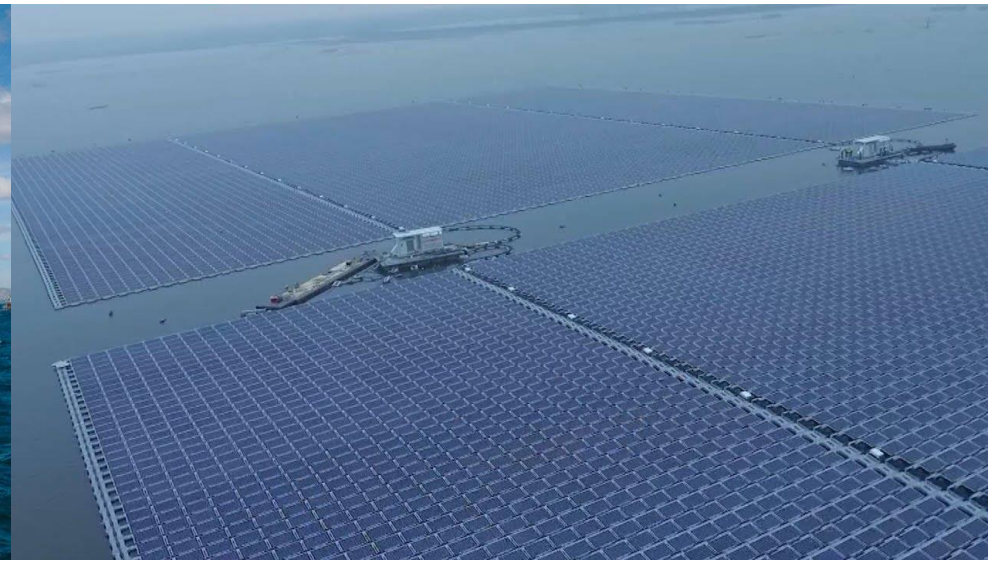
Sources: Equinor, IEA, WindEurope, (Lako & Koyama, 2016), RISE

What will energy scenarios be in the future?



Anticipated timing and importance of innovations in offshore wind technology, 2016-2045, (Freeman, et al., 2016)





Microsoft Tests Underwater Datacenter for Energy Efficiency

by John Howell on Friday, Jun 8th, 2018 TECHNOLOGY

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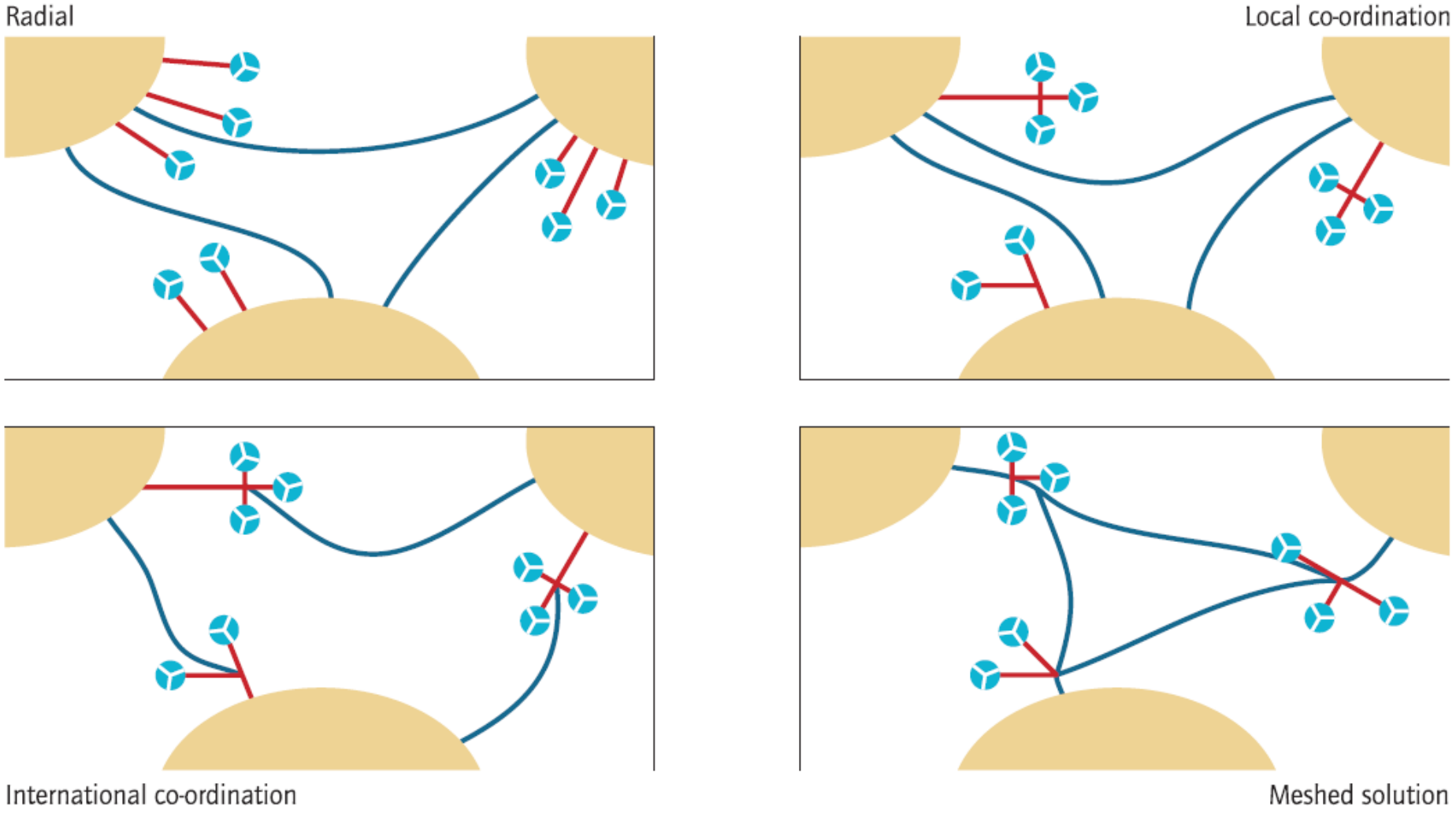
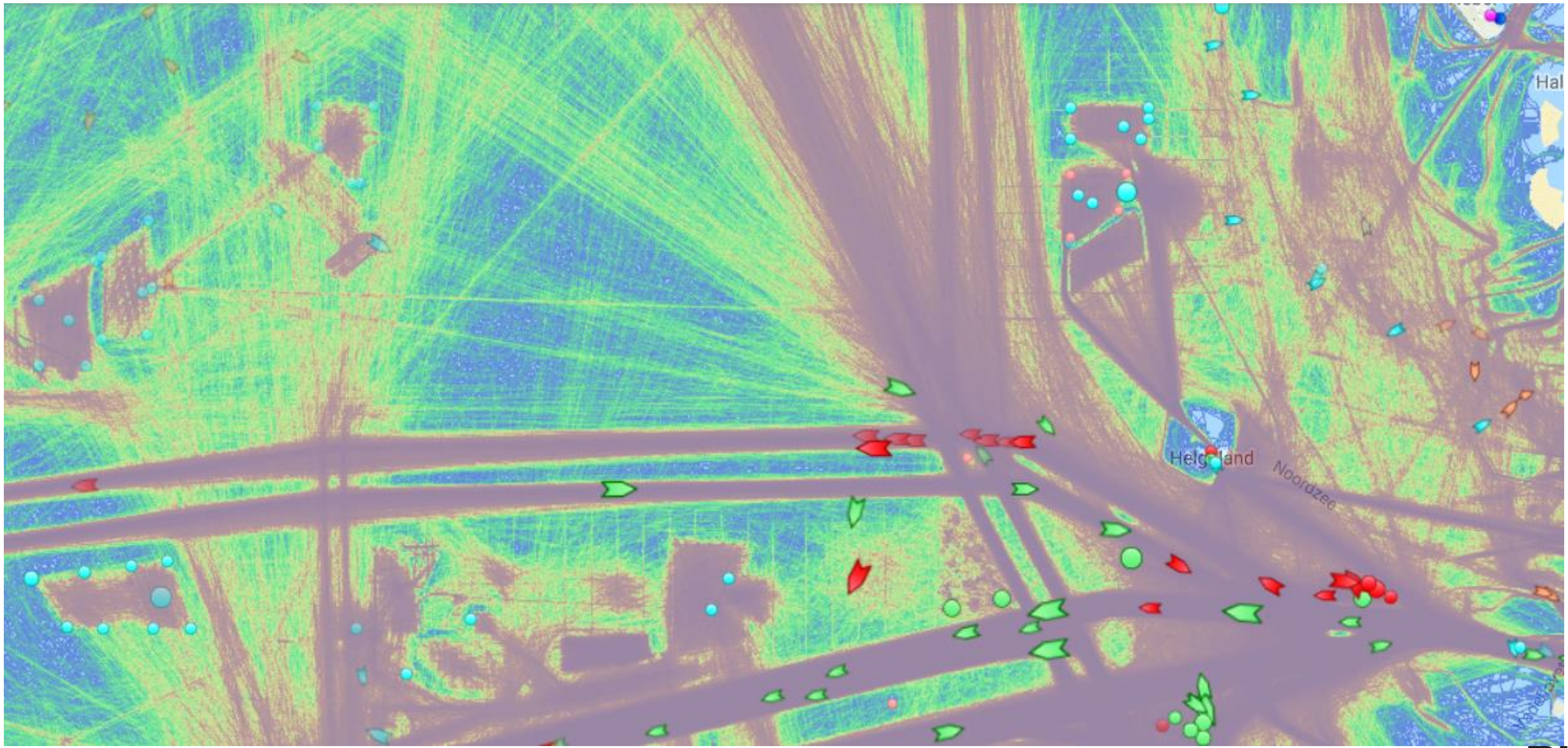
By John Howell

offshore, meshed solutions might be preferable but require more planning and higher certainty.



Source: NSCOGI, 2012.


Helgoland
Noordzee

Mål och syfte med studien för Havs- och Vattenmyndigheten

- Analys av energipolitiska ramverk inom EU och i varje land runt Östersjön för både havsbaserad vindkraft och för havsbaserade elnät
- Analys av marknadstrender för havsbaserad vindkraft
- Identifiering och utvärdering av havsplaneringens effekter som främjar eller hindrar utveckling av havsbaserad vindkraft och havsbaserade elnät
- Redovisning av aktuell status av havsbaserad vindkraft och havsbaserade elnät i Östersjön
- Framtida utveckling av havsbaserad vindkraft och havsbaserade elnät i Östersjön enligt tillståndsansökan, planerade projekt och utvecklingsprojekt av tidigare karaktär
- Redovisning av framtida utveckling av havsbaserad vindkraft och havsbaserade elnät i Östersjön inkluderande lämpliga områden, prioriterade områden och produktionskapacitet per km^2
- Sammanfattning, inkluderande ”information gap analysis”, en bedömning huruvida länderna kommer att nå sina mål samt förslag på nödvändiga åtaganden för att de politiska målen uppfylls

EU and National Targets

EU targets:

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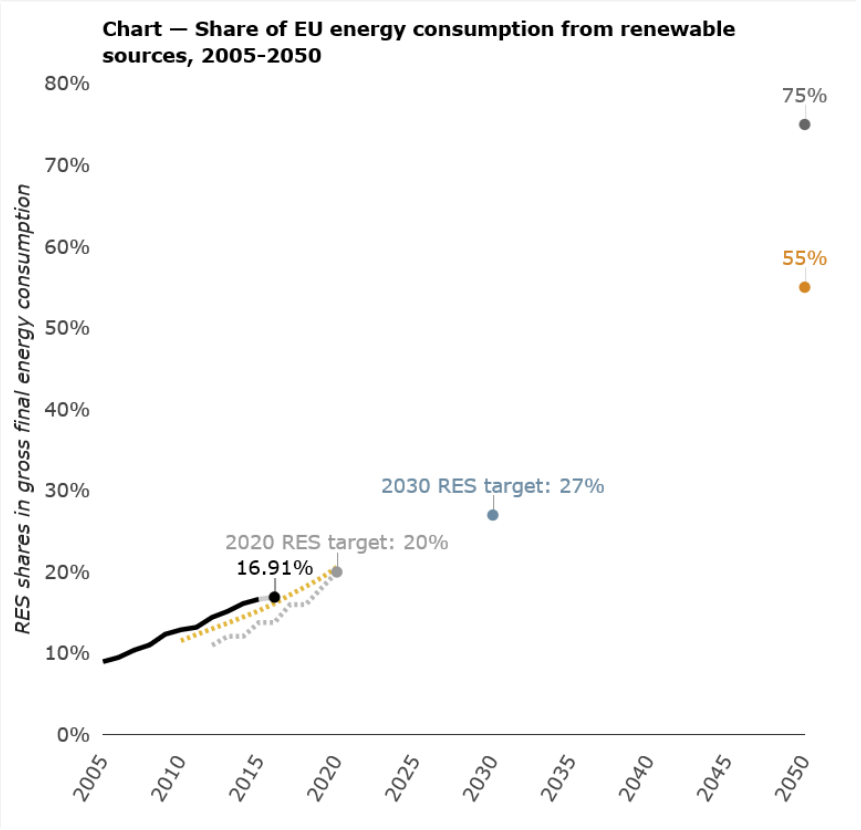
  - a 80-95% cut in greenhouse gas emissions compared to 1990 levels
  - about 2/3 share of renewable energy consumption
  - at least 41% energy savings compared to the peaks in 2005-2006.
- Interconnectivity of countries shall reach 10% in 2020 and 15% in 2030 if cost-benefit analysis is in favor



Sources: EU

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- Sweden: 100% renewable energy by 2040/ 2045, expected offshore wind capacity (no fixed target): 50TWh~12GW
- Denmark: Currently discussing targets for offshore wind, proposal from the government settling one additional park at the range of 700MW- 1 GW

Taking into account the Paris agreement, the targets are nevertheless probably too low, and some analyses show that the full decarbonization must be effective from 2045 increasing the demands. There are no firm targets on how much energy shall be produced by offshore wind, but there are various scenarios on how the electricity needed will be produced.