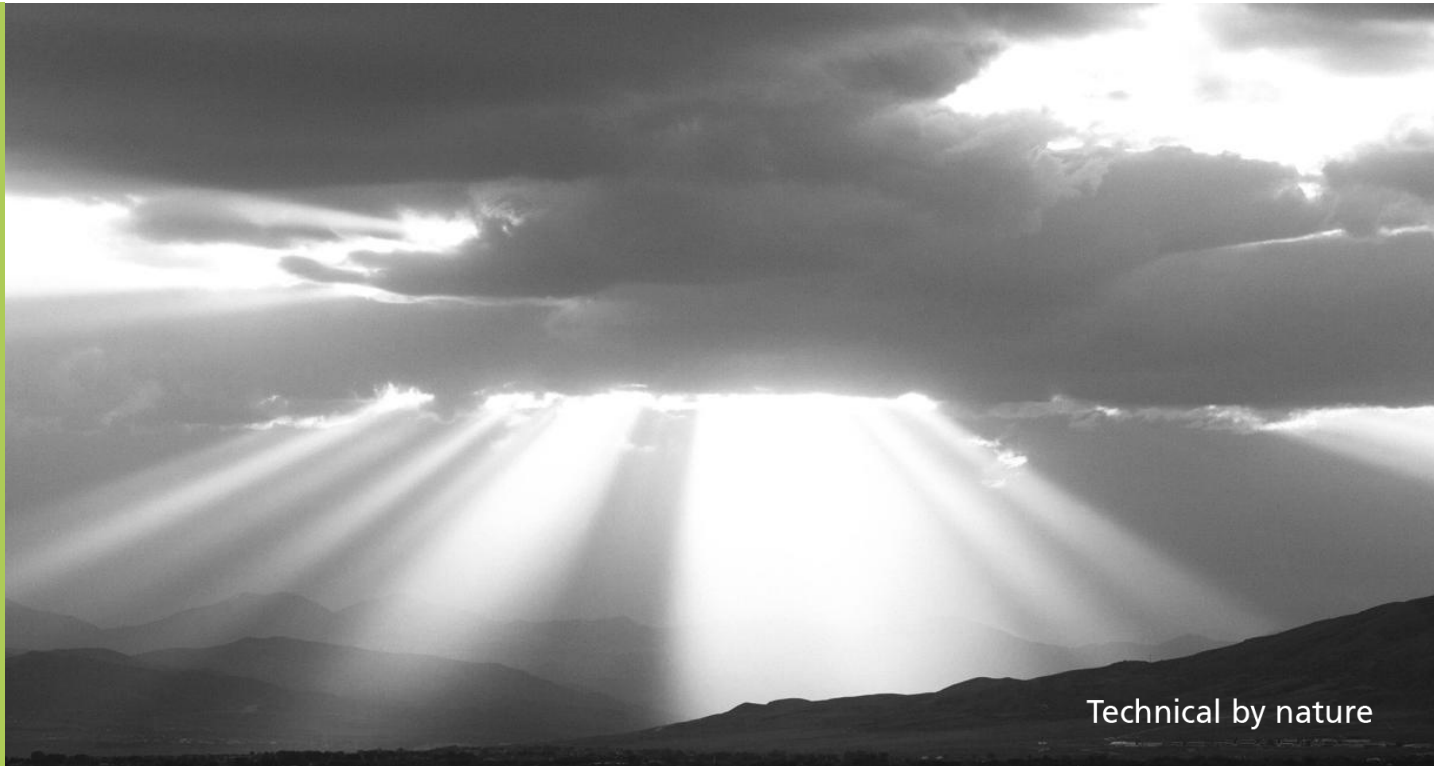


## Conditions for accelerating the deployment of offshore wind power in the BSR - Seminar

27 April 2012, Wind Power in the Nordic and Baltic Region



# BASREC - Wind

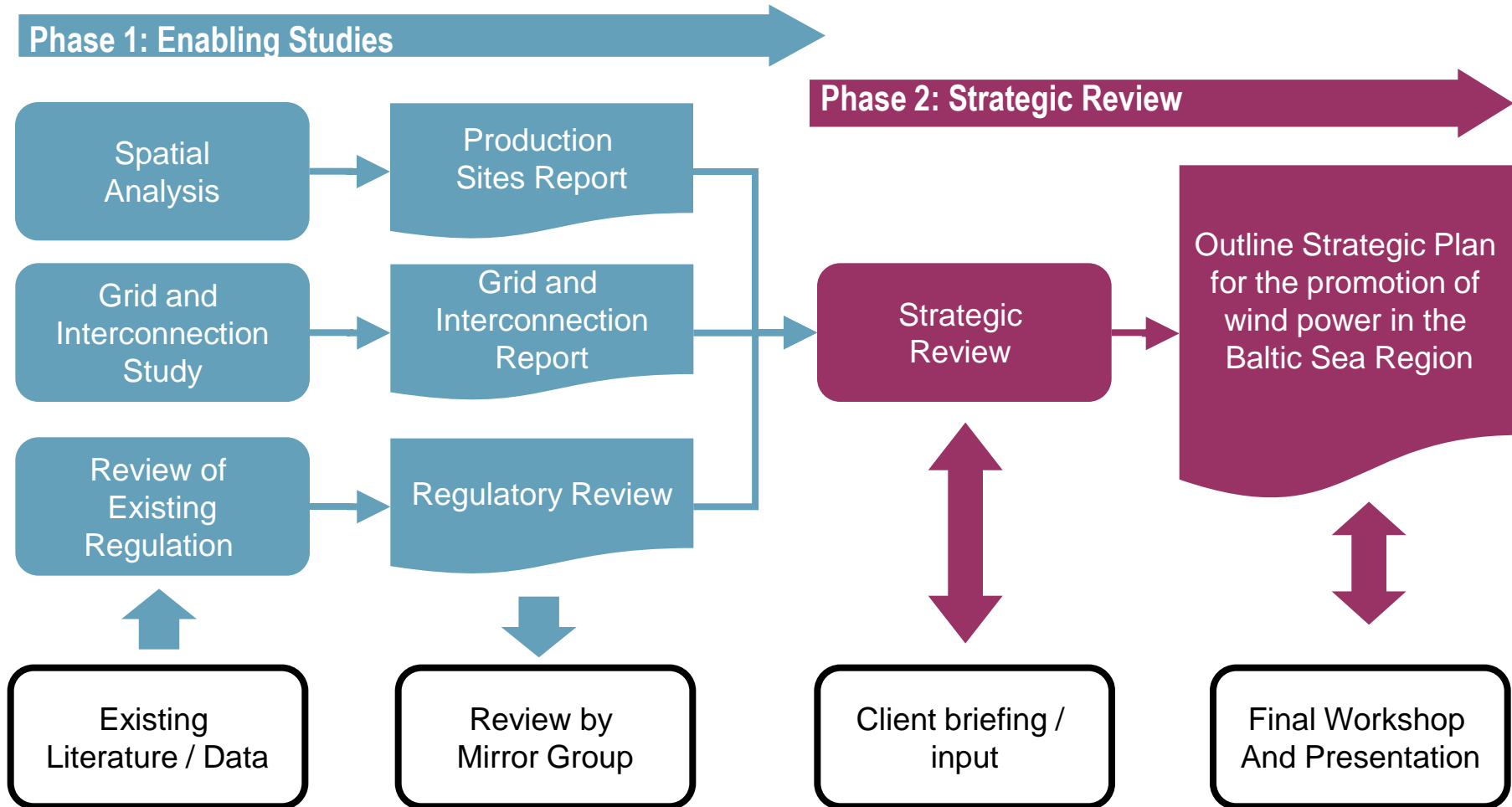
## Contents:

1. Objectives & Implementation Framework
2. Enabling Study 1 – Spatial Analysis
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4. Enabling Study 3 – Regulatory Review

# Project Objectives

- To support the BASREC cooperation in the formation of their strategic actions for the promotion of offshore wind power in the BSR
- To assess the required conditions for deployment of offshore wind power consistent with the EU 20-20-20 targets and other energy policy targets in the BSR
- To provide a strategic outline for the integrated economic promotion of offshore wind energy at the BSR level, based on evaluation of resource potential, grid integration possibilities and appropriate supporting regulatory framework

# Implementation Framework



# BASREC - Wind

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# Enabling Study 1 – Spatial Analysis: Approach

- *Objective:* to guide discussion on development in the BSR, giving preliminary assessment of deployment potential and relative attractiveness of areas
- Techno-economic banding *Cost of Energy* study:
- Based on 3 main cost drivers: wind resource, water depth and distance from shore

Input	Source
Wind resource map	GLGH MC2 mesoscale model
Power production	Generic 5MW WTG, 150m diameter, 100m HH, 5MW/km <sup>2</sup> , 16.2% loss
Bathymetry	GEBCO 1-minute resolution
Dist. from shore	GIS mapping
Spatial restrictions	Helsinki Commission (HELCOM) & GLGH project database

# Enabling Study 1 – Spatial Analysis: Constraints

## 3 Categories:

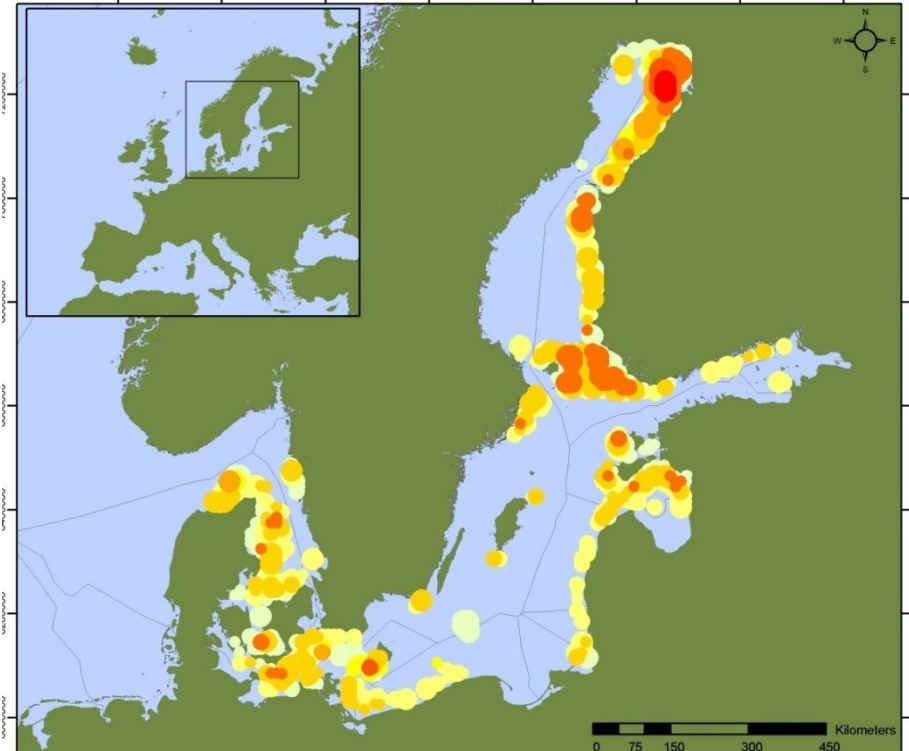
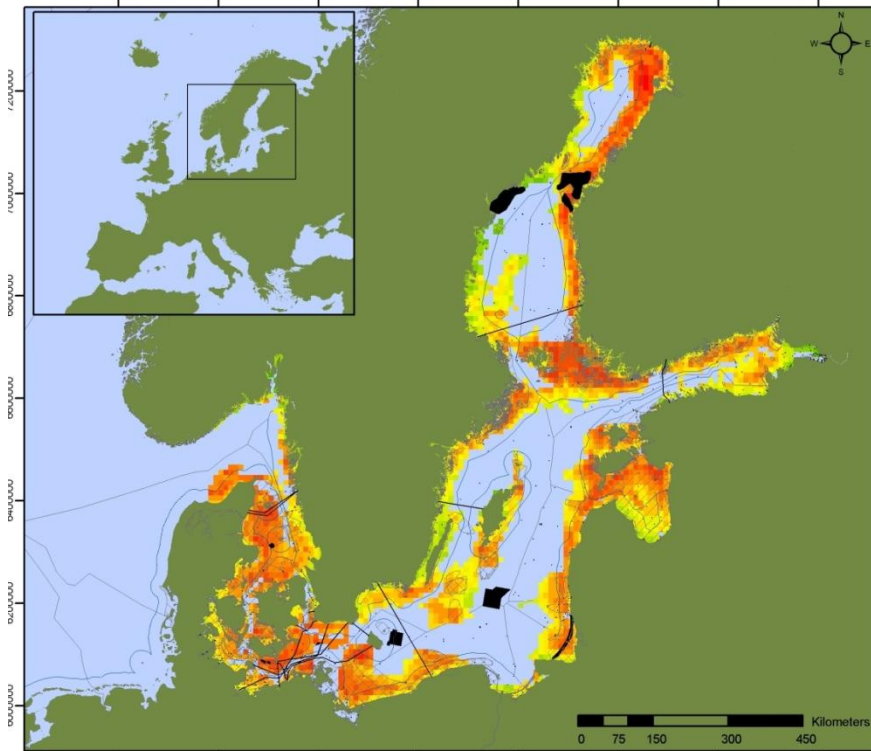
1. Hard Constraints (exclusion zones):
  - Wind farms in operation or construction
  - Existing physical infrastructure :
  - Chemical munitions dumping grounds
  - Water depths greater than 60m (pre-2020 assumption)
2. Soft Constraints (treated probabilistically – subjective!)
3. Constraints not considered

- Economic
- Environmental
- Social

➤ SEAs and site specific EIAs & consultations will be required

Constraint Type	Parameter	Shipping	Fisheries	Protected Bird Areas	Other Protected Areas
	Unit	Ship Transits Per Annum	Kilo-Tons landed per annum		
Soft	Range	30 - 150	5 - 10		
	Deployment Correction Factor	70%	70%	90%	20%
Hard	Range	>150	>10	-	-
	Deployment Correction Factor	0%	0%		

# Enabling Study 1 – Spatial Analysis: Results



Country	Banding <sup>1</sup>	GW Capacity (All Constraints)	Energy Production [TWh] (All Constraints)
Denmark	High	44.3	185
	Very High	1.6	7
Estonia	High	14.5	60
	Very High	1	4

Finland	High	73.5	307
	Very High	17.9	75
Sweden	High	22.4	93
	Very High	0.2	1
Totals	High	175.9	733
	Very High	20.7	87
	All top sites <sup>2</sup>	196.6	820



# Enabling Study 1 – Spatial Analysis: Qualifications

- Considerable additional work remains to be done!
- Social & Environmental:
  - Particular concerns regarding south-west Finland; military, summer homes, ornithological, logistical
- Ground Conditions:
  - Important cost driver not considered; rocks and variable strength substrates known problem in BSR
- Sea-ice:
  - May result in additional cost for design, manufacture and O&M access
  - Dependent on fetch, prevailing wind direction and extent of open water

**Even an 80% attrition rate on areas designated as “high” or “very high” yields 40 GW potential in these areas and enough for all countries to meet NREAP offshore wind expectations**

# BASREC - Wind

## Contents:

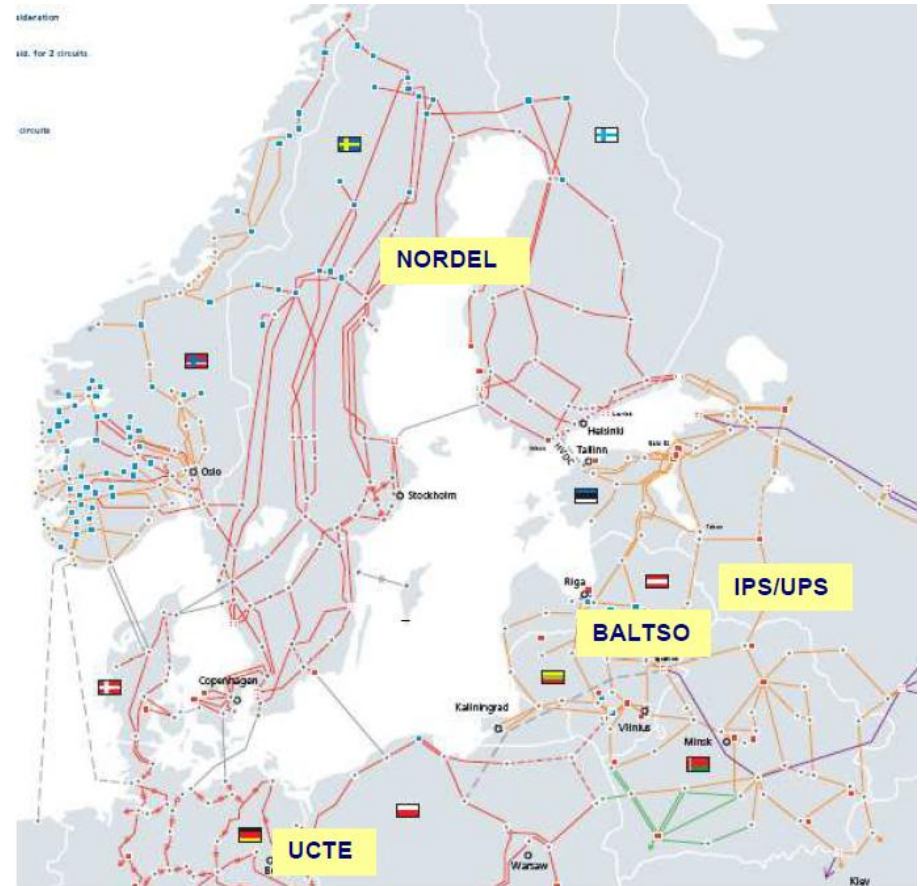
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# Enabling Study 2 – Grid and Interconnection: Overview

- *Objective:* identify important technical issues with integration of wind both with respect to NREAPs and spatial analysis. Particular focus on trans-national issues.
- *Approach*
  - Not a major, large-area wind integration and transmission study such as EWITS in the US.
  - Rather identify those issues which may be important for BSR in 2020; those already well understood from other studies and those which require further study
  - Study deals only with transmission not distribution systems.
- *Structure*
  - Literature review
  - Technical issues with high penetration levels
  - Impact of deployment potential on systems within the BSR
  - Review of possible connection arrangements

# Enabling Study 2 – Grid and Interconnection: Literature Review

- Reports considered included:
  - Design and operation of power systems with large amounts of wind power (IEA)
  - Powering Europe: Wind energy and the electricity grid” (EWEA)
  - Energy Analysis for the Baltic Sea Region (EA Energy Analysis)
  - Offshore Grid Project (EWEA)
  - ENTSO-E “Scenario Outlook and System Adequacy Forecast” and Ten-year Development Plan
  - BASREC ‘Post Kyoto’ report (EA Energy Analysis)
  - European Wind Integration Study (EU)
  - Tradewind Study “Integrating Wind” (EU)
  - Offshore Wind Market Outlook in Northern Europe (Nordvind)



# Enabling Study 2 – Grid and Interconnection: Technical issues

- Scope to review those issues known or anticipated to occur with high levels of variable renewable generation
- Comparison to other regions:

	<b>Annual consumption (TWh)</b>	<b>Wind production (TWh)</b>	<b>Energy Penetration</b>	<b>Mean demand (MW)</b>	<b>Wind capacity (MW)</b>	<b>Capacity penetration</b>
<b>Nordic 2020</b>	434	37.2	8.6%	49,490	13,507	27.3%
<b>Baltic 2020</b>	33	3.7	11.1%	3,820	1,566	41.0%
<b>Poland 2020</b>	170	15.2	9.0%	19,383	6,650	34.3%
<b>Germany 2020</b>	562	104.4	18.6%	64,147	45,750	71.3%
<b>Iberia 2010</b>	346	51.2	14.8%	39,545	24,411	61.7%
<b>Ireland 2010</b>	36	3.4	9.5%	4,146	1,722	41.5%

- Apart from Germany (which has strong interconnection) penetration levels are not unprecedented. Cost will be incurred but no show-stopper technical issues likely
- Transmission capacity: main issues are cost and consenting
- Report details latest industry technology on Voltage and Reactive power control; Faults and voltage depressions; frequency control; inertia; predictability and forecasting, balancing and communication

# Enabling Study 2 – Grid and Interconnection: Implications for deployment potential

- Drawing from the “Post-Kyoto” report:
  - Additional transmission capacity expected to be build by 2020 appears adequate for NREAP levels of generation;
  - No obvious BSR country boundaries with further spare capacity for additional flows beyond that assumed in NREAPs
  - Therefore such additional generation either requires displacing other local generation or further interconnection transmission capacity to be constructed
- **Nordic system:** No insurmountable technical issues with absorbing the NREAP deployment levels and given substantial access to hydro, potential to go beyond these levels
- **Baltic system:** NREAP levels appear achievable without substantial technical issues. Additional deployment may however push penetration levels notably high with reinforcement for exports
- **Poland:** NREAP targets represent a margin of around 3 GW under those seen in Iberia
- **Germany:** Most wind capacity is in North Sea and so Baltic deployment not expected to have substantial impact on issues of system security and stability

# Enabling Study 2 – Grid and Interconnection: connection options

- Considers whether offshore wind in the BSR brings opportunities for further subsea interconnections between countries.
- Options described include:
  - Offshore “hubs” for multiple wind farms to connect into with single route to shore (national boundaries should not prevent economically optimal configurations)
  - Tee-in and split connection
  - Use of hub-to-hub as interconnectors
- Applications for BSR:
  - Many sites close to shore for which standard direct connections or perhaps hubs likely to be optimum
  - Notable opportunities lie on interconnection routes:
  - For projects on such routes study on combination with interconnection is recommended

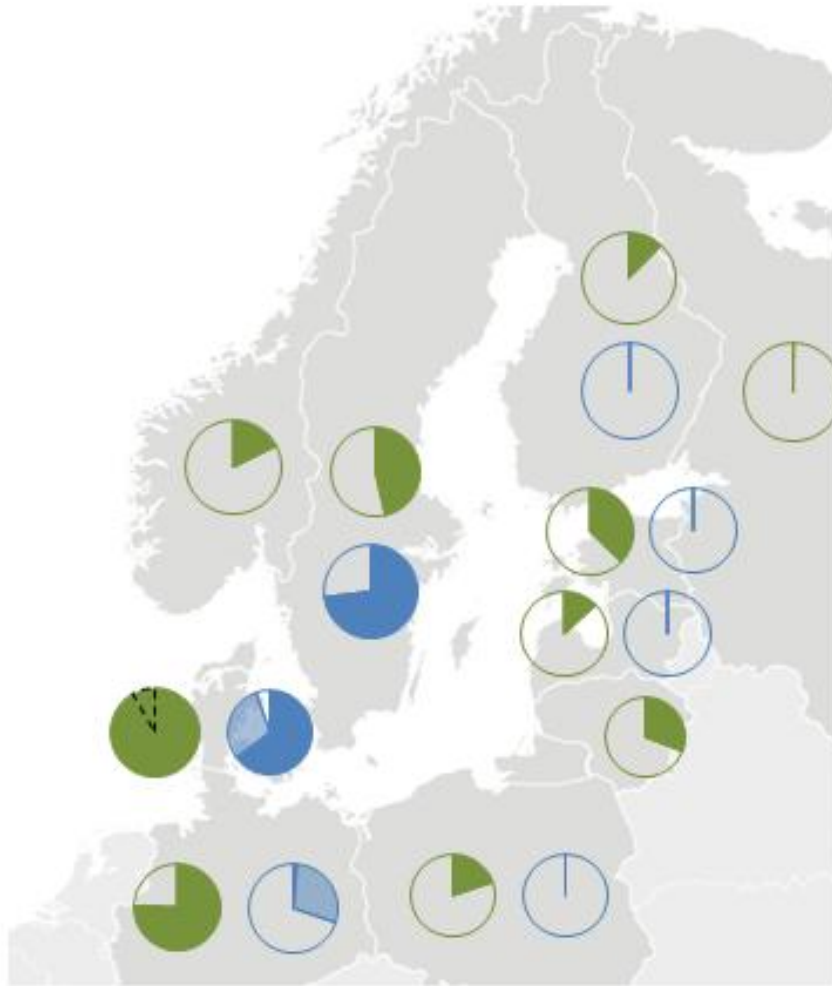
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# Enabling Study 3 – Regulatory Review: Current status



Wind's progress against 2020  
NREAP expectations....

Notes 5 groups in the BSR:

- Denmark & Germany
- Sweden, Norway and Finland
- Poland
- Estonia, Latvia, Lithuania
- Russia

# Enabling Study 3 – Regulatory Review: Comparative Analysis

- **Fuel Mix:** Competing fuel sources;
  - hydro a major source in Sweden, Norway, Finland and Latvia although further expansion is difficult
  - Poland and Russia access to cheap domestic fossil fuel although for former meeting 2020 RE targets is an issue. Estonia highly prized energy security through oil shale.
  - Germany, Denmark and Lithuania less blessed and with saturation of onshore in first two, offshore wind is increasingly attractive
- **Electricity market structure:** main considerations are market competition and trading platform options including intra-day trading
- **Financial support mechanism:** spectrum of options although currently differentiated support for offshore only available in Denmark and Germany
- **Grid connection:** issues are availability, cost allocation and processing of applications
- **Consenting process:** clarity of process, availability of information and guidance/assistance offered

Devil in the detail: framework scheduling and alignment is key

**POLITICAL WILL IS VITAL:**

# Enabling Study 3 – Regulatory Review: Comparative Analysis

Fuel mix and availability of alternatives	DE	DK	EE	FI	LT	LV	NO <sup>1</sup>	PO	RU	SE
							N/A			

Electricity market structure	DE	DK	EE <sup>1</sup>	FI	LT <sup>1</sup>	LV <sup>1</sup>	NO	PO	RU	SE

Financial support mechanism		DE	DK	EE	FI	LT	LV	NO <sup>1</sup>	PO	RU	SE
	Onshore							2012			
Offshore											

Grid connection	DE	DK	EE	FI	LT	LV	NO <sup>1</sup>	PO	RU <sup>2</sup>	SE

Consenting process	DE	DK	EE	FI	LT	LV	NO	PO	RU	SE



**Thank you!**

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