



SINTEF

Project idea

ACable: Reliable extension of transmission distance of HVAC submarine cable connections

Project owner: SINTEF Energy Research

Contact SINTEF:

Andrzej Holdyk, +47 93005617

Andrzej.Holdyk@sintef.no





About

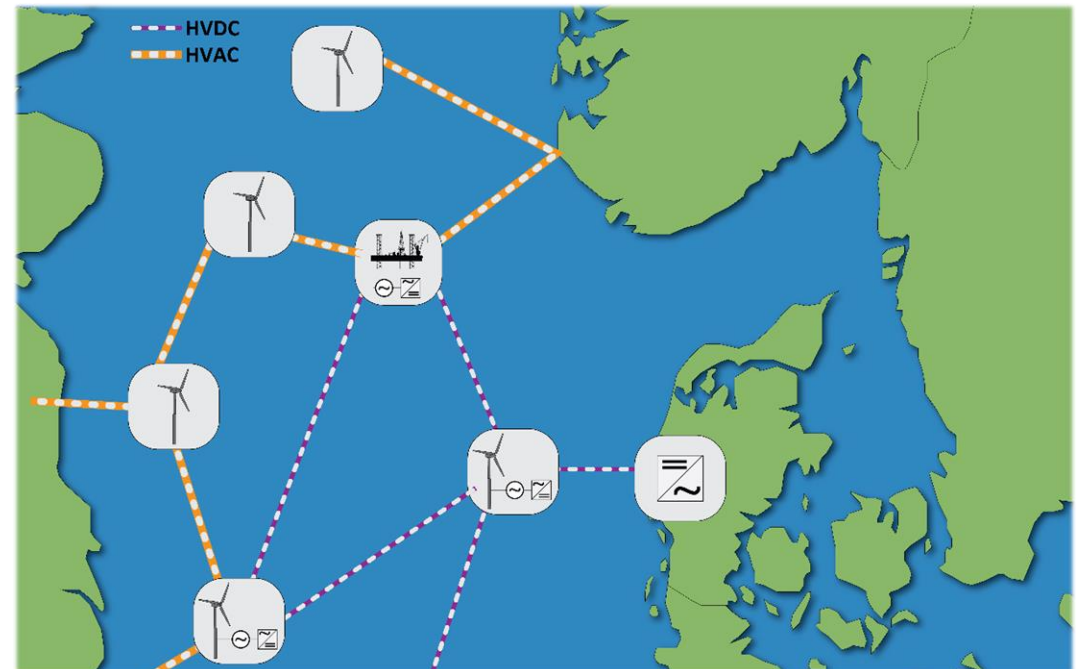
- Idea for a research project to be submitted to the Research Council of Norway (RCN)
- KSP-type project:
 - Knowledge Building Project for Industry
 - To develop new knowledge and generate competence in the research organisations needed by society or the business sector to address important societal challenges
 - Financing: 20% industry / 80% RCN
 - Next deadline: 15 February 2023
 - Duration: 4 years
- Why this pitch?
 - To facilitate discussion on the topic
 - To present idea to potential partners (industry and academia)



SINTEF

Background

- Large offshore grid might be formed in the North Sea in the near future:
 - Large deployment of offshore wind farms
 - Electrification of oil and gas platforms
 - Subsea cable connections to other countries
- In some cases it might be beneficial to utilize long HVAC connections, e.g.
 - Due to smaller footprint
 - Simpler system integration of HVAC transmission equipment
 - Larger developer experience





SINTEF

Background

- Cables have large electric capacitance that generates reactive (capacitive) power under all operating conditions and require compensation
 - Reactive current increases with length → more compensation
 - Traditionally, shunt reactors are used: onshore, offshore, middle,...
- Large impact on the system and operations
 - Zero miss; energization of parallel cables might result in high inrush currents
 - High overvoltages during cable energization in weak grids
 - Large capacitance shifts resonances to low frequencies
 - Background harmonic amplifications
 - Extended voltage oscillations during energization
 - High inrush currents during ground fault; high reactor currents during faults



SINTEF

Background

- Many existing technologies/techniques can be used to increase transmission lengths further. However, they are often not mature enough or simply are too expensive
 - Increasing conductor size / Increasing insulation thickness (leading to lower capacitance)
 - Dynamically vary export system voltage depending on loading
 - Series compensation for systems that are often lightly loaded
 - Cable hot spot monitoring and cooling
- We want to focus on exploring innovative or improved solutions to extend the HVAC transmission in a cost-competitive and reliable manner due to development in:
 - Power electronics converters and FACTS devices
 - The subsea technology



SINTEF

Goal: Reliable extension of transmission distance of HVAC submarine cable connection

Improved estimation of armour losses and thermal (2D representation of 3D effects) dependencies
PhD at NTNU and cable manufacturer
Theoretical and lab work

Improve loss estimation and models

Methods for length extension

Define possible future HVAC offshore grid designs
System topology selection and optimization
Estimation of representative cable stresses

Investigate main cable aging factors based on representative stresses
Provide recommendations for cable life extension
Lab testing

Representative stresses

Cost benefit and technology roadmap

Identify the life-time-cost-optimal design of a long AC cable transmission link for a given application case
Present technology roadmap for most promising technologies

ACable



Value

- Built competence in design and operation of long subsea HVAC cable systems
- More accurate cable loss estimations will improve system OPEX calculations
 - Better models for initial calculations and later system studies
- Improved cable life estimation reduces project risks



Project participants

- Project owner:
 - SINTEF Energy Research
- Scientific partners:
 - SINTEF Energy Research
 - NTNU
- Industry partners:
 - Cable manufacturer (preliminary confirmation)
 - TSOs, operators of O&G platforms, OWF developers, component suppliers,...
- This application will be submitted to:
 - LowEmission Centre's KSP spin-off programme. Companies supporting the programme have shown interest in the project.
 - NorthWind Centre partners



SINTEF

Technology for a
better society