

SUPERCONDUCTORS FOR BULK POWER TRANSFER

SUPERNODE™

The logo for Supernode features a central white circle with four colored lines extending outwards to smaller circles: a blue line to the top-left, a red line to the top-right, an orange line to the bottom-left, and a yellow line to the bottom-right.

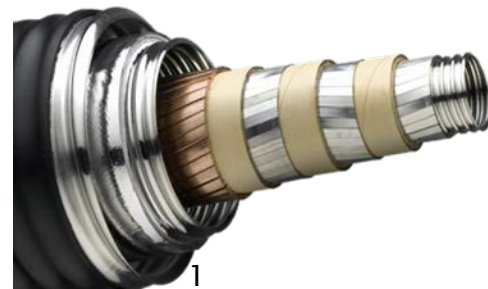
Who are SuperNode?

Mission

- To Decarbonise the Global Economy
- To harness the best Renewables
- To Build and Grow the Renewable Industry

Technology

Superconductor based transmission technologies



People

John O'Connor, Founder
(Executive Chairman, Mainstream Renewable Power)



Pat Cox, Chairman
(President of EU Parliament 2002-04)



John Fitzgerald, CEO
(Dir. Grid Development and Interconnection EirGrid 2013-18)

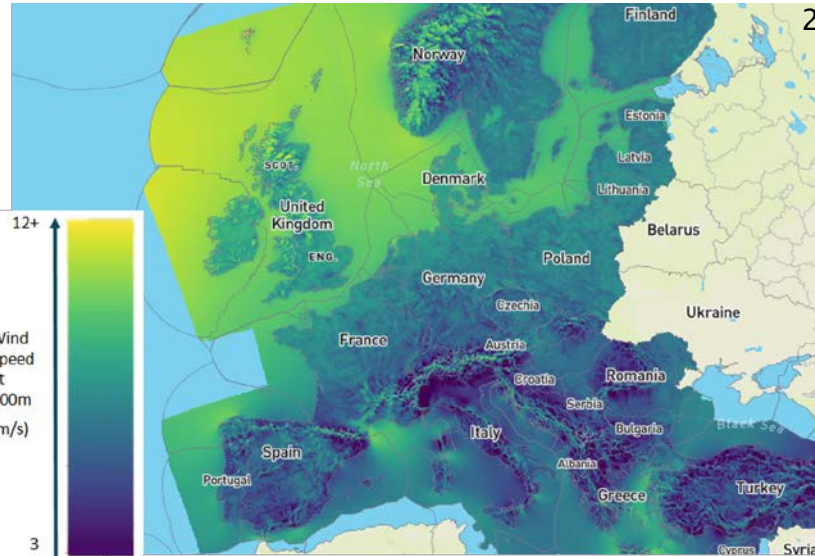


Growing Technical Team – currently 10

(Global experience in renewable energy technology and projects, offshore generation and transmission)

Market opportunity – 2050 zero Carbon

Offshore Wind Resource



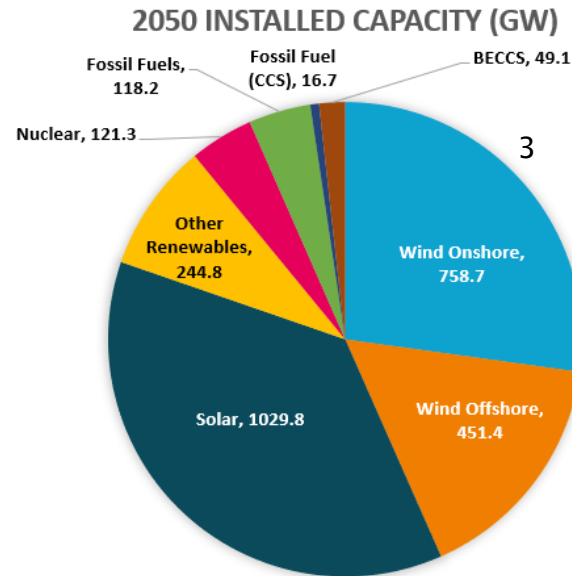
2. <https://map.neweuropeanwindatlas.eu/>

3 EU Commission 2050

4. <https://www.boem.gov/National-Offshore-Wind-Strategy/>

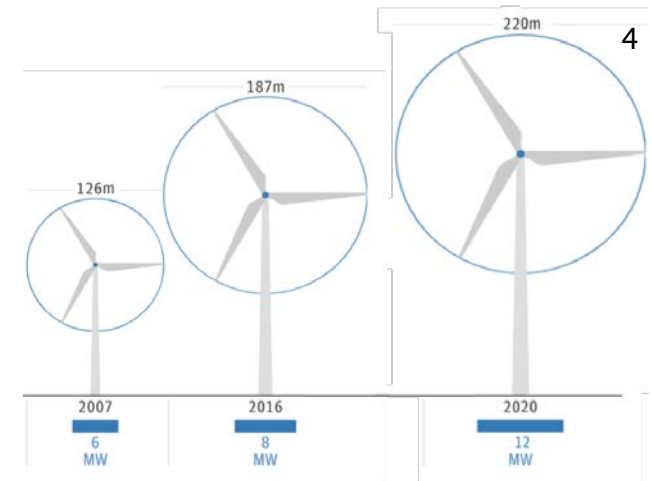
5. <https://www.boem.gov/National-Offshore-Wind-Strategy/>

Supply breakdown



Offshore Wind	2030 (GW)	2050 (GW)
EU	70	480
USA	22	86
Rest of World	49	247
	141	813

Capacity profiles



Offshore connections competition

Offshore wind electrical connection competition

Huge Offshore Platforms

- Expensive
- Onshore equipment 'marinized'
- Slow supply chain
- **Upper limits on power capacity**

Lower capacity MVDC/MVAC

- x100s onshore connections
- Public resistance
- **Planning Uncertainty**
- Limits on power capacity 300MW/link

Man-made Islands

- Onshore equipment 'on an island'
- State-level support required
- **Vast material source required**
- Shallow water only e.g. NSWPH

Offshore Hydrogen

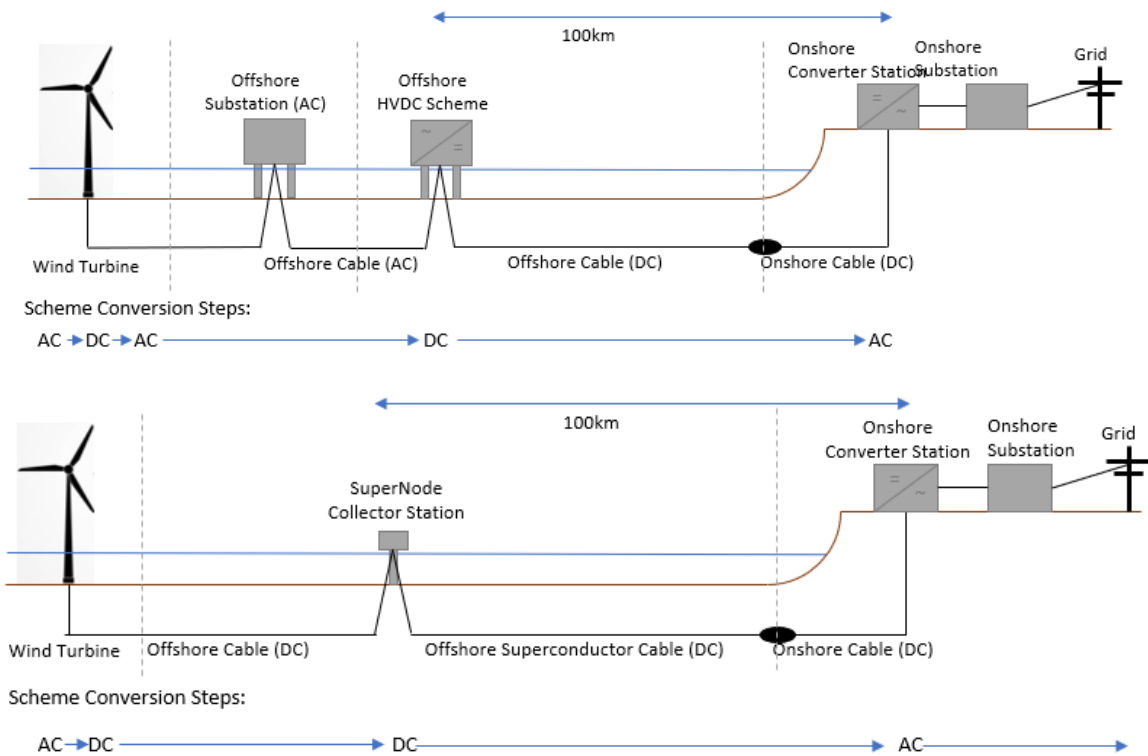
- Hydrogen/ammonia production
- Large offshore power platform required
- Use of existing gas networks unproven
- **Offshore production**



Dolwin 3 Specifications:

Capacity:	1 GW
Volume:	~120,000 m ³
Weight:	>20,000 tons
Cost:	>€1BN

SuperNode DC Connection concept



SuperNode Collector Specifications:

Capacity:	2 GW
Voltage:	100kV _{DC}
Volume:	~5000 m ³
Weight:	~500 tons
Cost:	<€100M

Superconducting cables enable high current transmission

- Obviate HVDC platforms
- Facilitate higher power capacity transmission

Superconducting transmission demonstrations

Superconducting transmission demos:

- Ampacity, Essen. [10kV, 40MVA]
- Shingal, Seoul. [50MVA, 23kV]
- REG, Chicago (under construction).
- Superlink, Munich (planned). [500MVA, 110kV]
- Horizon's 'Best Paths' Project [3.2GW, 320kV]

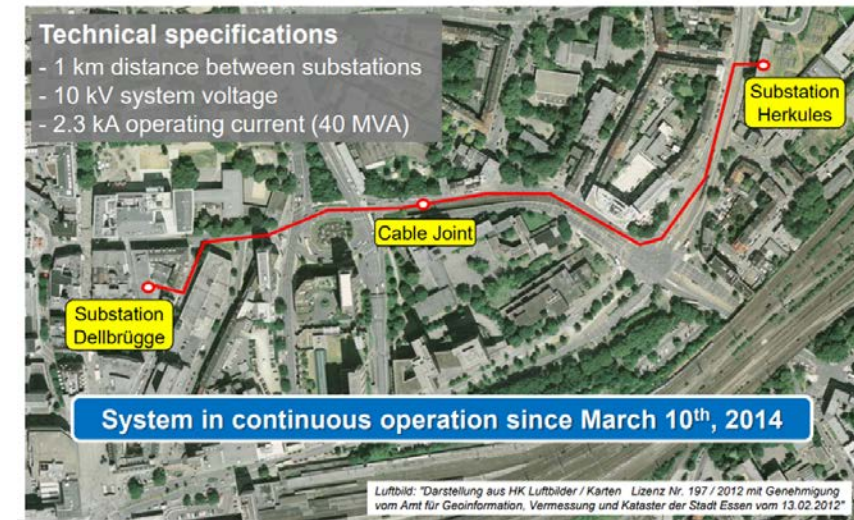
SuperNode are developing this technology

- to connect offshore renewable resources
- for longer distance transmission links

7. <https://www.semanticscholar.org/paper/Update-on-world's-first-superconducting-cable-and-a-Stemmler-Merschel>

8. <http://www.bestpaths-project.eu/>

AmpaCity installation in Essen, Germany



BEST PATHS PROJECT

Structure	Monopole
Power	3.2GW
Voltage	320kV
Current	10kA
Cooling	LN2 & He
Fault rating	35kA for 100ms

Design for cooling 50 km segments

Dimensions:

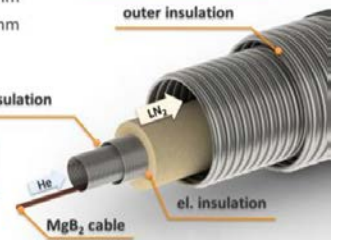
outer insulation	265 mm
el. insulation	140 mm
inner insulation	100 mm
inner tube	80 mm

Nitrogen circuit

inlet	65 K	20 bar
outlet	80 K	2 bar

Helium circuit

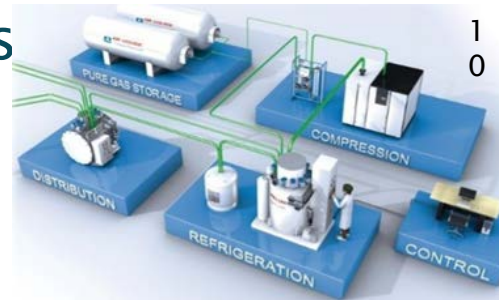
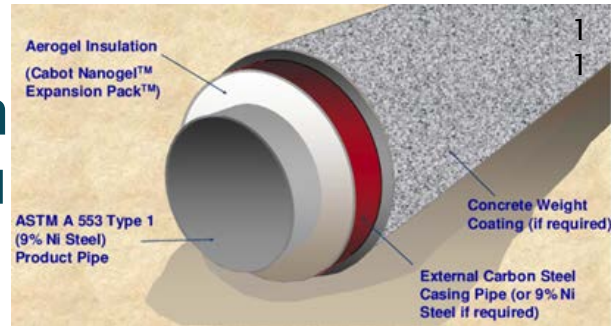
inlet	15 K	20 bar
outlet	25 K	2.5 bar



SuperNode Cable System Development

SuperNode's R&D program is developing Superconducting cable technology focus on:

- MVDC, 2GW+, 100km offshore transmission
- Marine deployment
- Marine environment O&M
- Optimal loss management
- Cooling and pumping stations
- Reliability & robustness



9. <https://www.bbc.com/news/technology-44368813>

10. <https://advancedtech.airliquide.com/turbo-brayton-cryogenic-systems>

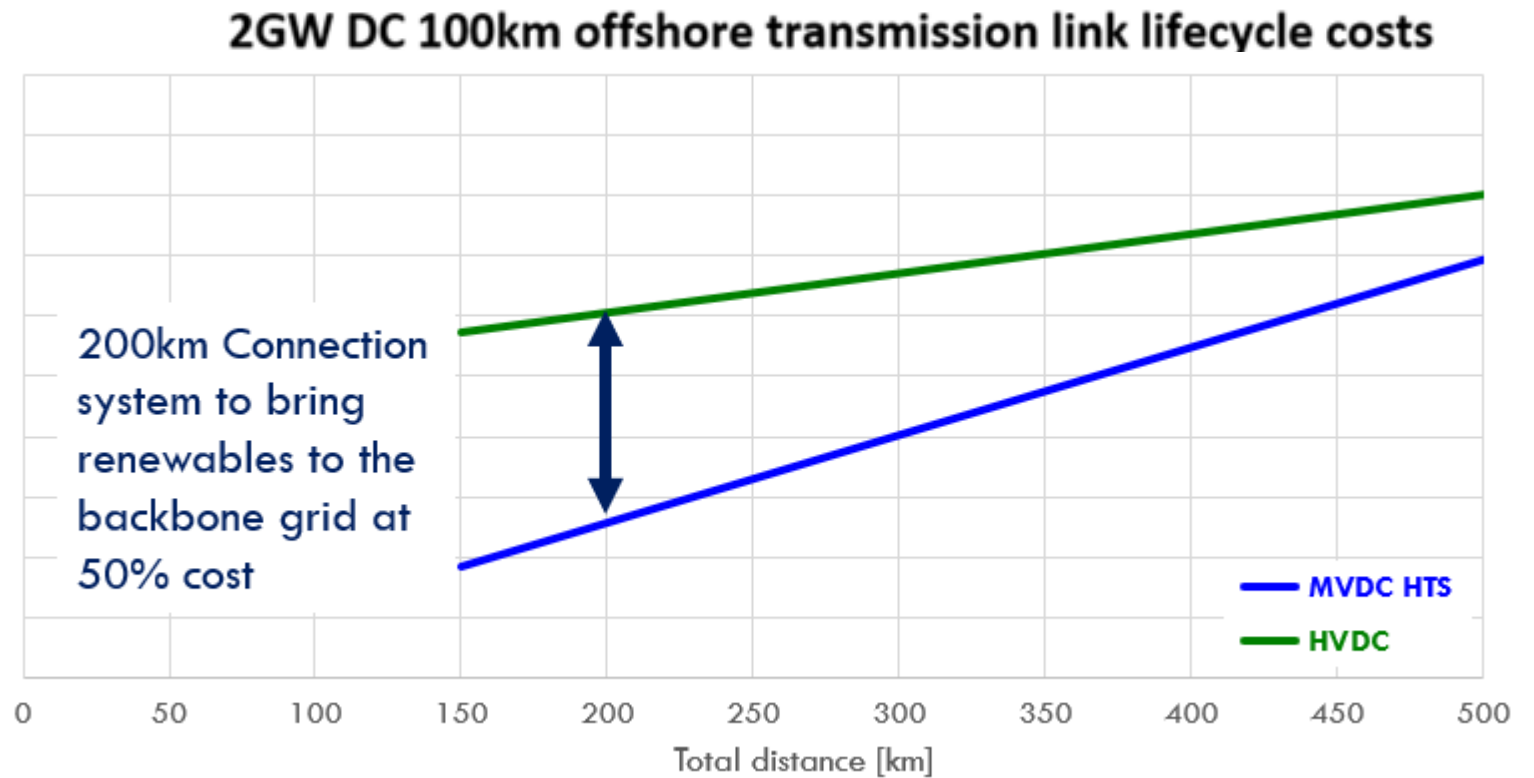
11.

https://www.researchgate.net/publication/254519335_Update_on_Subsea_LNG_Pipeline_Technology

technology

Cost comparison with HVDC

- Lower Totex costs for typical offshore connections
- Value proposition increases with capacity



Superconducting Cable Challenges

- Superconducting cable system development & qualification program
- Deployment / Demonstration projects
- DC connection system to supply Superconducting cable
- Industry collaboration
- Funding

QUESTIONS?

If you have any question, please contact:
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