



H<sub>2</sub>



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## Energy Cluster Denmark

North Jutland as an attractive offshore wind geography



Hans A. Pedersen, Project Director

# FIVE FOCUS AREAS



Wind Energy



District Heating



Green Gasses



Energy Efficient  
Solutions

Integrated Energy Systems

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# Cluster Activities:

- Workshops and conferences
- Networking activities
- Development of new projects
- International cooperation
- Thematic meetings
- Knowledge sharing
- Site visits
- Delegations



400+400+200

Members

Scientists

Visits

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# The Energy system



## ENERGY STORAGE

- Batteries
- Fuel cells
- Heat, Gas
- Water storage

## ENERGY EFFICIENCY

- Pumps and Compressors
- Ventilation, Cooling, Heat, and Accumulators
- Lighting
- Electrical motors, Generators, and Transformers
- Insulation and Window glass
- Sensors and Control systems

## ENERGY PRODUCTION

- Wind Power
- Solar panels and power
- Biomass
- Biogas
- Geothermal energy
- Wave and Hydro energy

## ENERGY INFRASTRUCTURE

- Transmission and Distribution of electrical power
- District and Central heating
- Natural Gas
- Conversion technologies
- Pipes and Cables

HyBalance

From wind power to  
**GREEN  
HYDROGEN**

HyBalance demonstrates the use of hydrogen in energy systems. It helps balance the grid. The hydrogen is used for clean transportation and industry.

hybalance.eu

## Energy system example:

- **The HyBalance project utilizes power from wind turbines to produce green hydrogen**
- **3 hydrogen powered busses will be implemented in the North Jutland region**
- **Next step in Progress.**  
 **$H_2 + CO_2 = \text{Metanol (CH}_3\text{OH)}$**



FORSK/EL

The HyBalance project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 671784. The Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation program and France, Germany, Denmark and Belgium. www.fuelcells.eu. The HyBalance project has further received funding from the Danish Research program, which is administered by Energiteknik. www.energi.dk

Air Liquide

Copenhagen Hydrogen Network (CHN)

NEAS ENERGY

HYDROGENICS

HYDROGEN VALLEY

Hydrogen Systems

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# We offer assistance with:

- Networking
- Thematic workshops
- Matchmaking: B2B, B2A / A2B
- Project creation
- Consortium formation
- Entrepreneurial guidance
- Funding
- Dissemination



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# International Activities :

- Common branding nationally and internationally of Danish energy skills and knowledge
- Participating in EU projects
- Managing EU projects
- Dissemination to 6 European regions
- Cluster to cluster activities



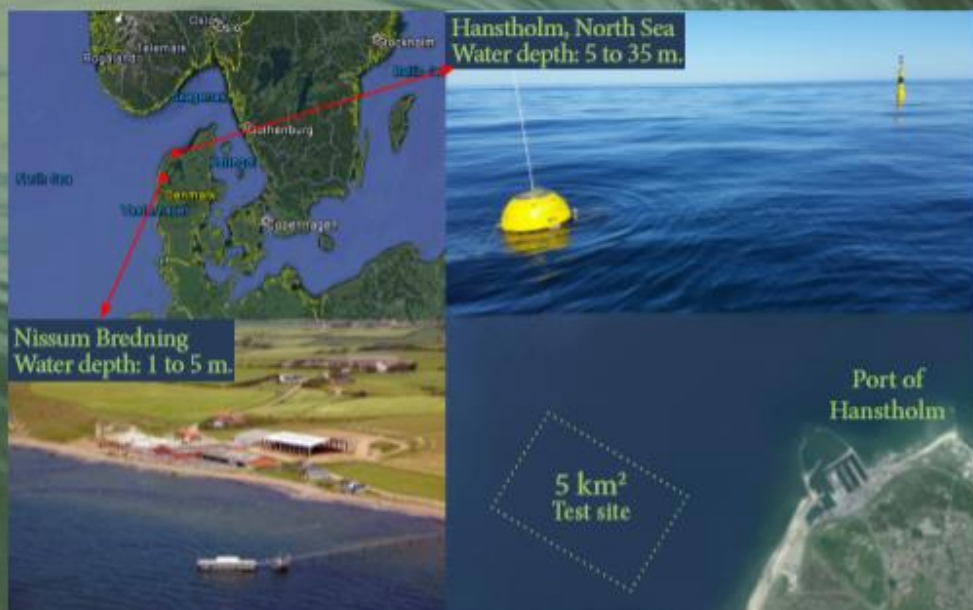
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# Hanstholm DanWEC

Danish Wave Energy Center

DanWEC is the Danish knowledge and testing centre for the development of wave power. The centre supports the exploitation of wave power by developing, owning, leasing and operating facilities for testing, demonstration and the accumulation of knowledge. DanWEC offers testing of wave power devices in the smaller scale prototype and demonstration phase at the Nisum Bredning Test Site in the Limfjord, as well as on a larger scale at Hanstholm Test Site, which includes a 5 km<sup>2</sup> marked test area in the North Sea of Hanstholm Port.



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Wave power example



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# DTU - and Danish test centers



● ØSTERILD TEST CENTRE  
● TEST STATION AT HØVSØRE

DTU LYNGBY CAMPUS ●  
DTU RISØ CAMPUS ●

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**ØSTERILD**

NATIONAL TEST CENTRE FOR  
LARGE WIND TURBINES



- Decided by Law in 2010
- Established 2012 with 7 test stands  
Height: 210 - 250 meter
- 2 new test stands in 2017  
Height: 330meter

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# Test Centre Høvsøre

- Decided by law in 1990
- 5 test stands  
Height: 165 meters
- 2 new test stands in 2017  
Height: 200 meters

# Danish Energy Agency test program

- innovative test center for offshore technology

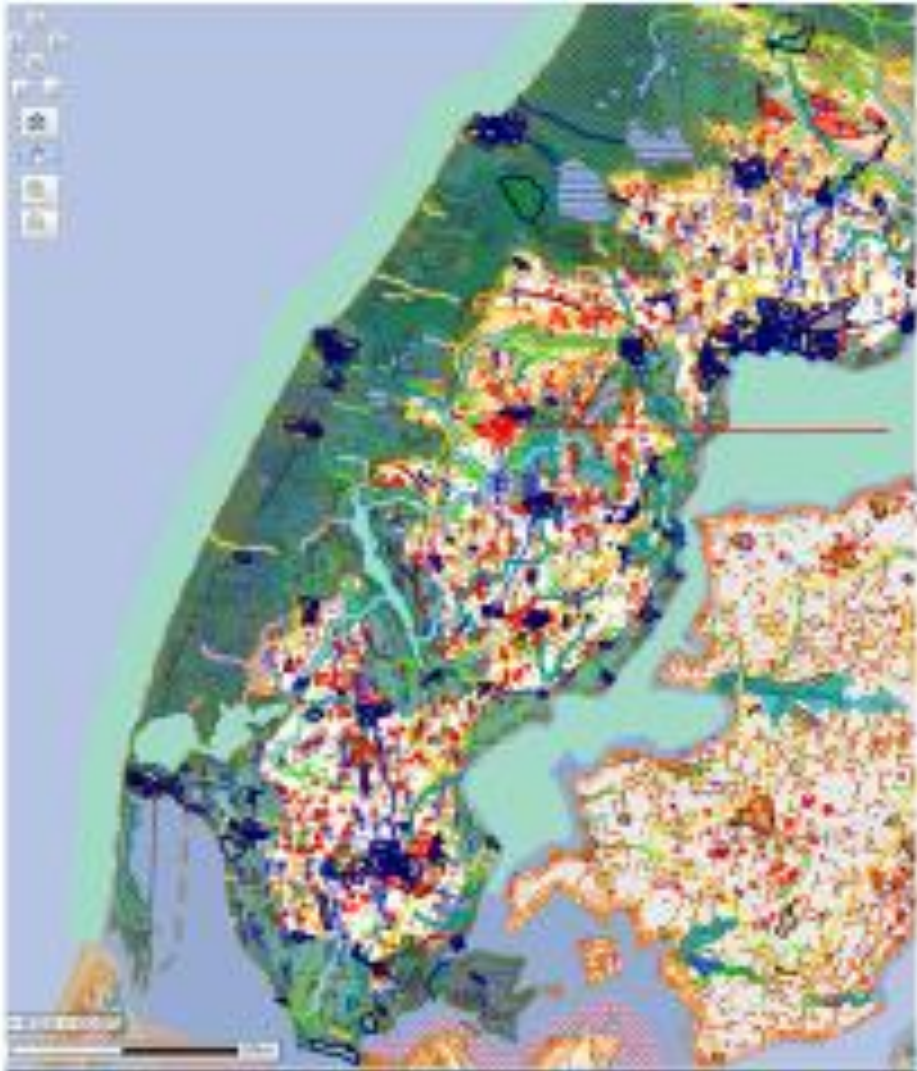


28 MW test site located in Nisum Bredning

- comprised of 4 x 7 MW-154 Siemens Gamesa offshore wind turbines



# New testcenter, small wind turbines Hundborg, Thisted



## Press release

Januar 29, 2018 at 13:00 pm:

**North Europe will get a professional, up-to-date, and fully equipped test center for smaller wind turbines to be used by individual houses. The location is in Thy, North Jutland. The first steps have been taken...**



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# Existing test center, "Folkecenter" Small Wind Turbines



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# Next possible test site

- Kite Wind turbines



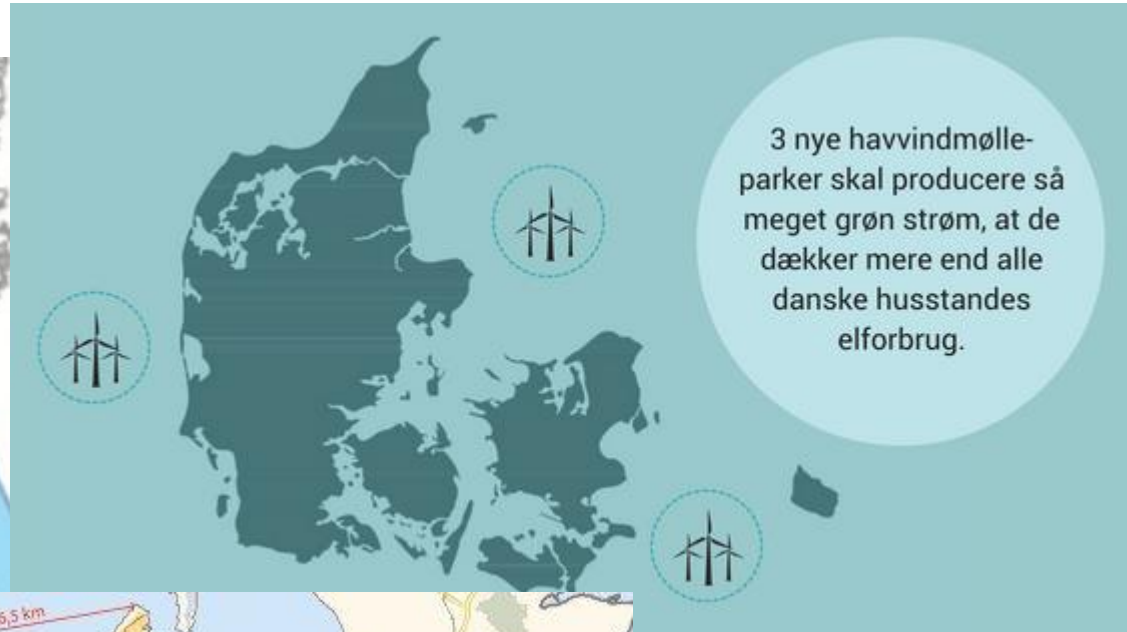
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# Future Projects



**240 MW**



**2400 MW**

**180 MW**  
**21 x 8,4 MW Siemens Gamesa**



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# Nu skal frederikshavnerne tage stilling til testmøller



 **ENERGY SUPPLY**

12. November 2018

Det danske selskab European Energy har nu meldt sig på banen med ønsket om at realisere testsitet som projektansvarlig.

Der er tale om et testområde med seks havvindmøller med en højde på op til 300 meter. Dette tænkes placeret i havet i 4,5 kilometers afstand nordøst for Frederikshavn Havn.

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Thank you for your attention!

Questions and answers?!

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