Offshore wind Power Plants Overview of R&D in the Netherlands

This presentation was given at the inauguratie van dr. Gerard Schepers, 11 April 2013, NHL te Leeuwarden

P. Eecen

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Offshore Wind Power Plants
Overview of R&D in the Netherlands

Dr. Peter Eecen

Bij de inauguratie dr. Gerard Schepers

NHL te Leeuwarden
11-4-2013

Overview Presentation

- Introduction ECN
- Strategic goal: Reduction cost of energy
- NL ambition toward 2020
  - Subsidy requirements until 2020
- Effect R&D on COE
- Overview R&D in Wind Power in The Netherlands

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ECN Wind Energy

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Energy Research Centre of the Netherlands

- ECN is the largest, independent, market oriented and innovative Dutch energy research institute.
- ECN investigates and develops technologies and products for a safe, efficient and environment-friendly energy supply with 600 fte.
- With and for the market the energy technology is developed by ECN.

Solar energy

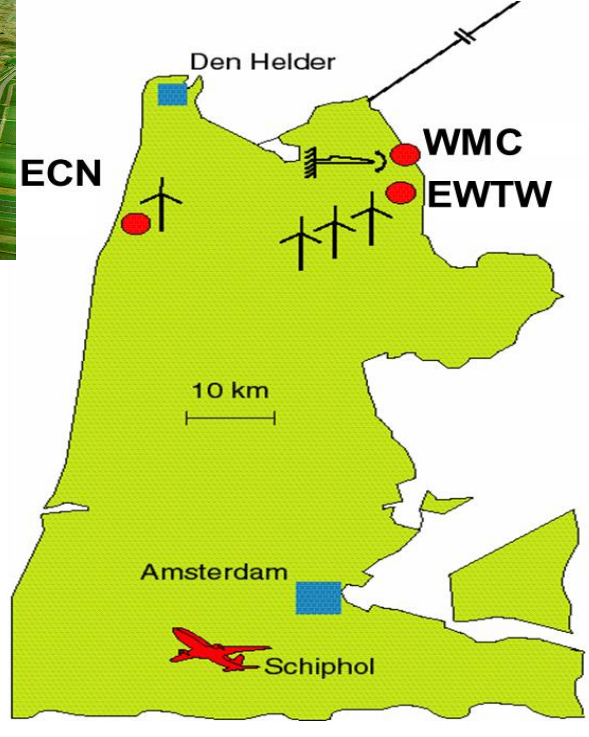
Biomass

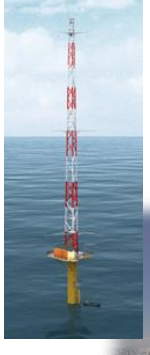
Wind energy

Efficiency & Infrastructure

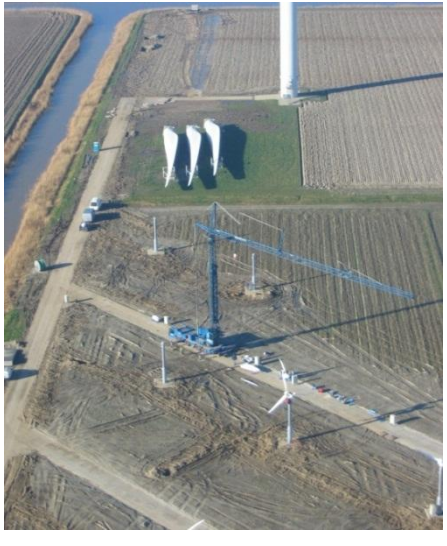
Policy Studies

ECN: Developing wind since 1974



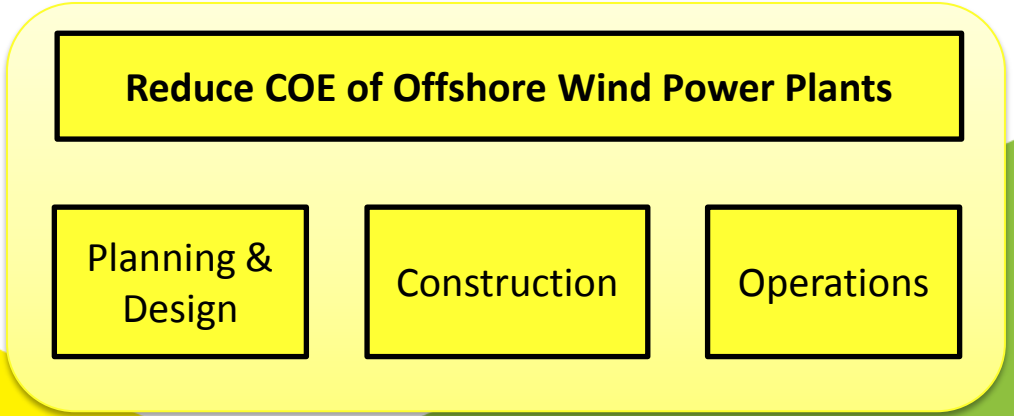


Metmast
IJmuiden



ECN Wind R&D Strategy

Offshore Wind Power Plants



80% of EU offshore wind farms have been realised with ECN support

Top industrial players are exploiting ECN technology and knowledge

By 2015
ECN will have facilities for
14MW+ prototype turbines

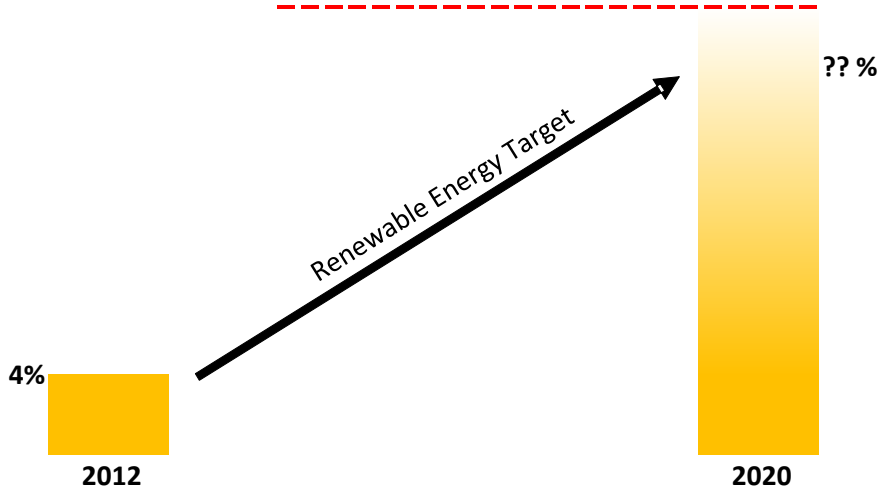
A Wind of Change
Working with the industry

1. Turbine performance improvement
2. Component analysis
3. Software based analysis
4. Onshore development
5. Wind turbine + wind farm

1. Wind farm performance improvement
2. Component analysis for wind farms
3. Simulated & Measured improvement
4. Offshore development
5. Integrated wind farm approach

Government Policy

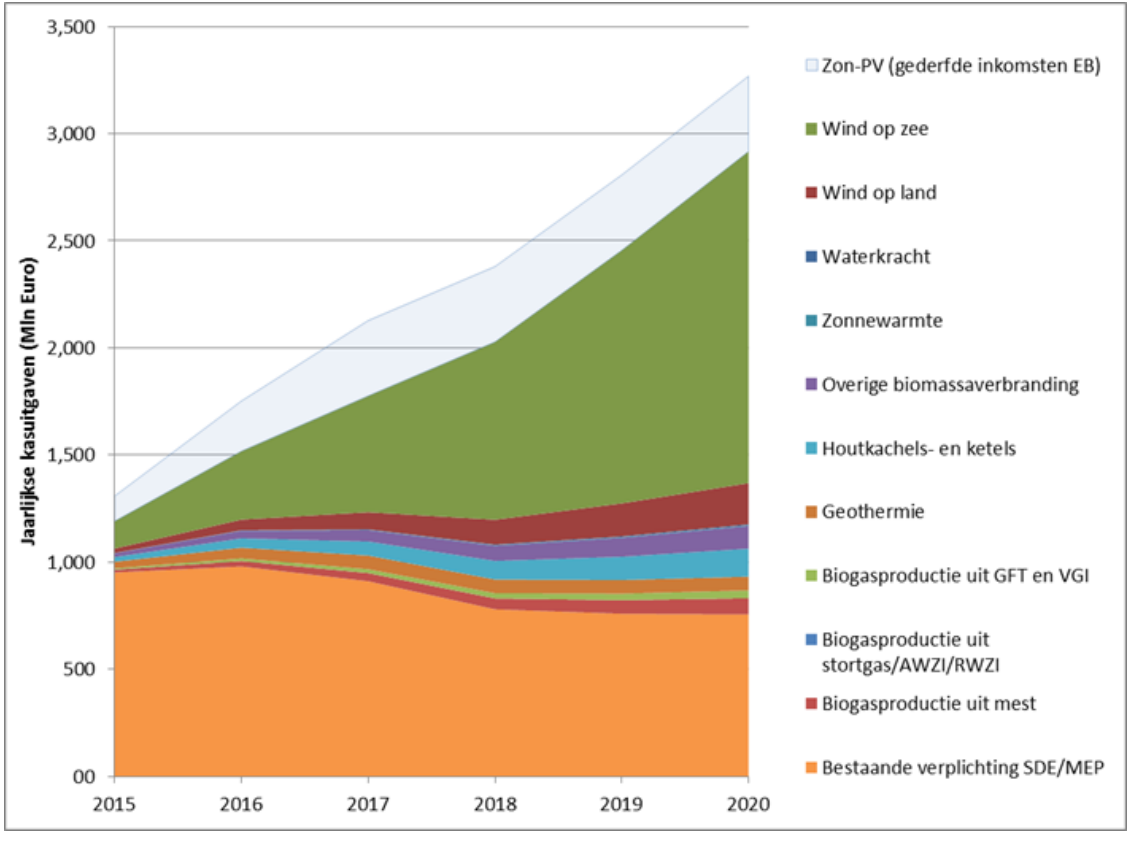
Can NL reach 16% RE in 2020?



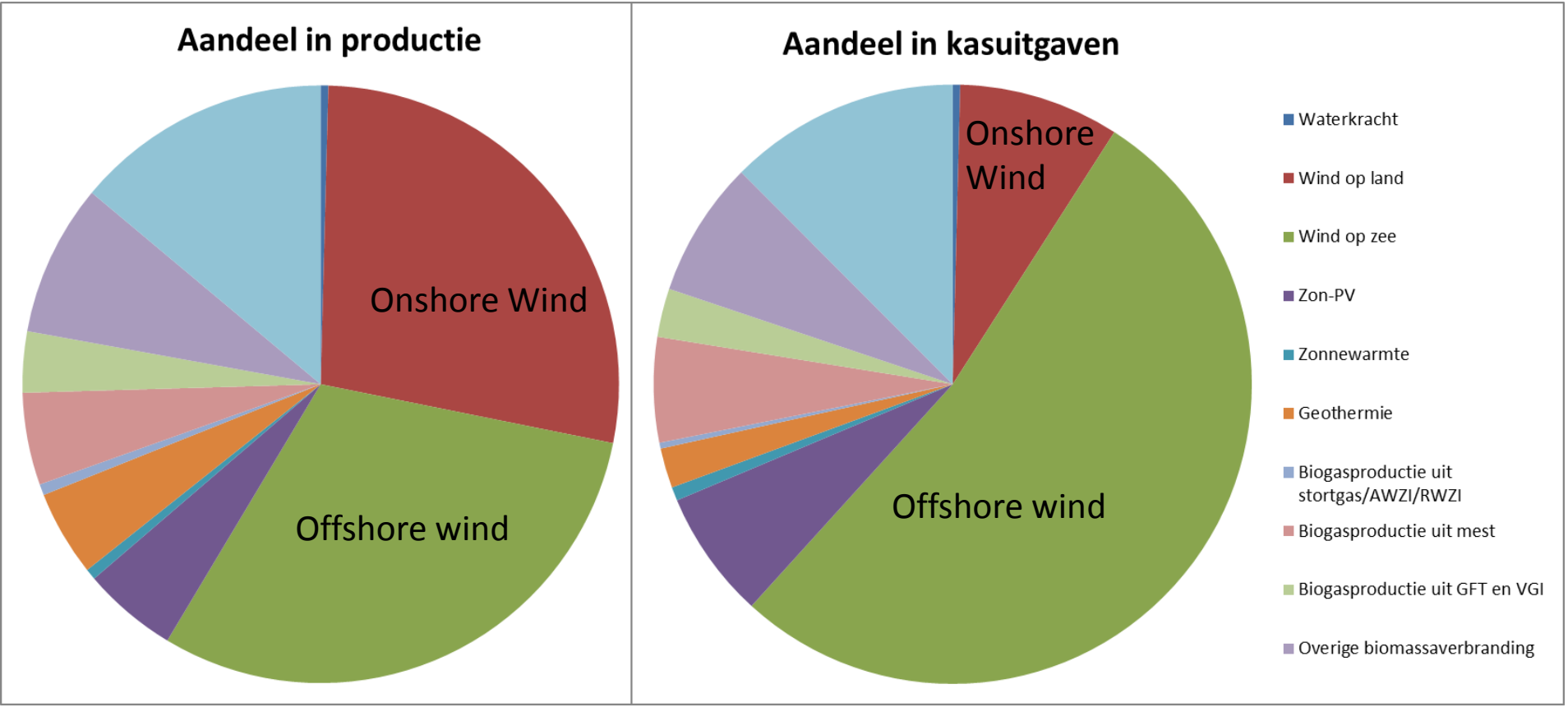
- ECN: YES, 16% is reachable
  - Government has provided sufficient means
  - Wind energy plays a key role (onshore and offshore)
  - Other constraints will dominate the succes (draagvlak)

Estimated Governement Spending to reach the 16% target

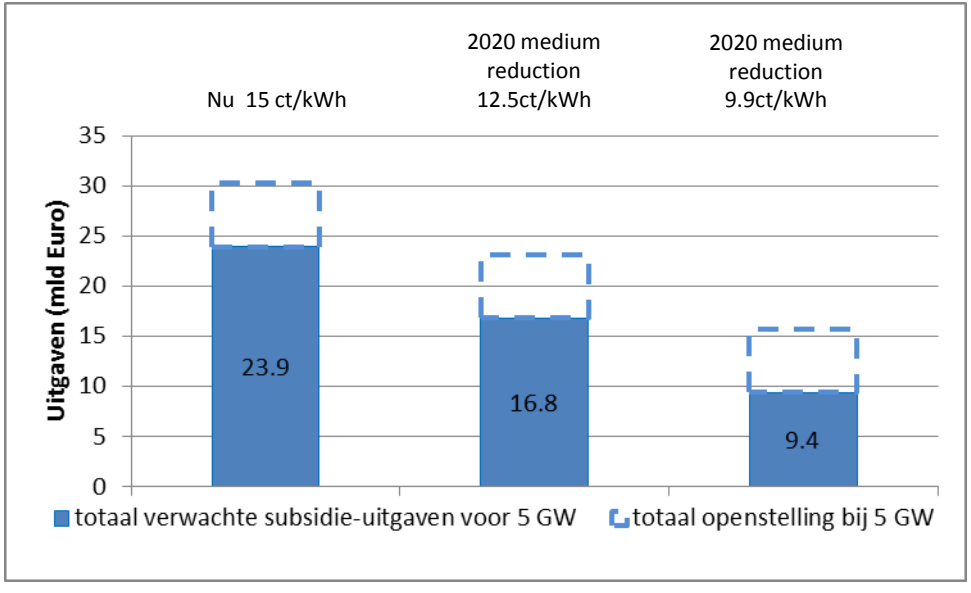
- Scenario developed by ECN
- Without subsidy for biomass (meestook)



Generation vs Government Spending 2020



COE Offshore Wind vs subsidy



- Subsidy when consenting 5 GW offshore wind: 23,9 billion € when COE is 15 ct/kWh
- 0,1 ct/kWh reduction of COE reduces 285 M€ (19 Mln/jaar)

Innovaties lead to reduction COE
NL involved in all aspects

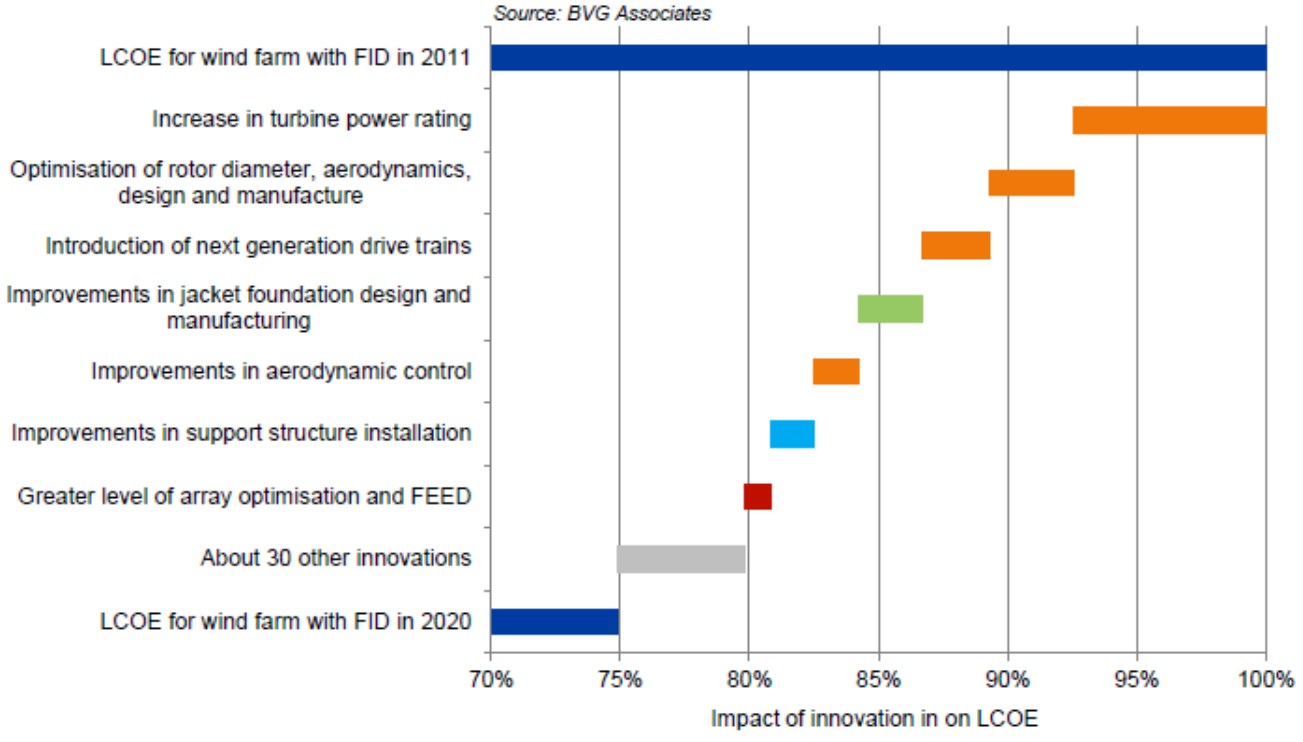


Figure 0.1 Anticipated impact of technology innovations for a wind farm using 6MW-Class turbines with FID in 2020, compared with a wind farm with 4MW-Class turbines with FID in 2011.[1]

R&D leads to large cost reductions

- Government spending for offshore wind is significant
  - Reduction COE offshore wind leads to large structural reductions
  - 0,1 ct/kWh reduction → €19 mln reduction cashflow in 2020 and 285 mln € reduction in committing entire SDE+ period
- Reduction COE is effect of world-wide effort (implementation and innovation)
- Effect of innovation is visible several years later
  Leeghwater accelerates innovations. High impact reduction subsidy
- Impact on reduction COE is reached by the combination of top-R&D institutes with a dominant industrial sector

Innovatiecontract Wind Op Zee

- The sector (industry and R&D institutes have defined a collaborative R&D programme for offshore wind power plants

- For 2012, allocated additional budget Wind op Zee: 8M€
- For 2013, allocated additional budget Wind op Zee: 11.5M€

- Aim: reduction COE 40% in 2020

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R&D Facilities for Wind Energy

ECN test sites
WMC – blade and material test centre
Delft University of Technology
MARIN, DELTARES – wave tanks
NLR – wind tunnels

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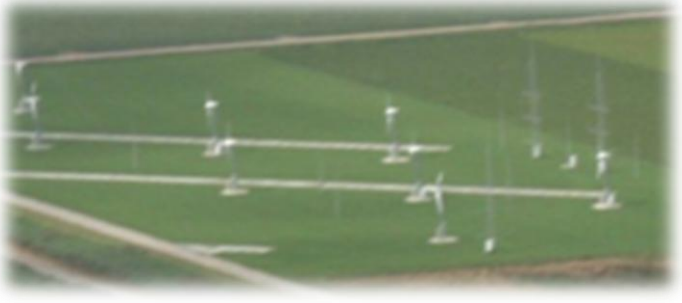
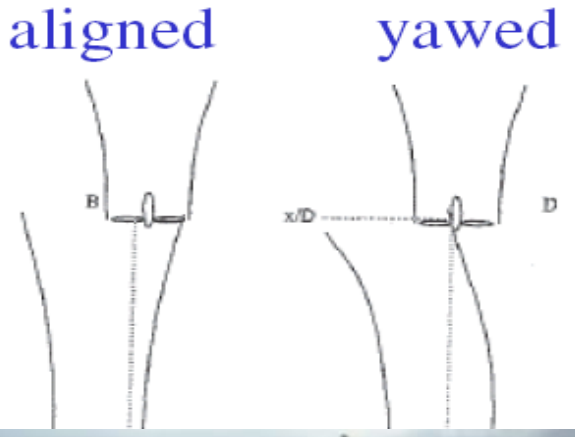
ECN Wind Turbine Test site Wieringermeer (EWTW)

- Six 2.5MW research turbines N80 with one 108m high meteorological mast (mm3)
- Six locations for prototype turbines with meteorological masts (108m, 108m and 100m)
- Measurement Infrastructure
- Measurement Pavilion



- Scale Wind farm

Wind Farm Control



- Yaw upstream turbine :
  - Less power (higher loads)
  - Yaw deflects wake
- Downstream turbines yield higher produc

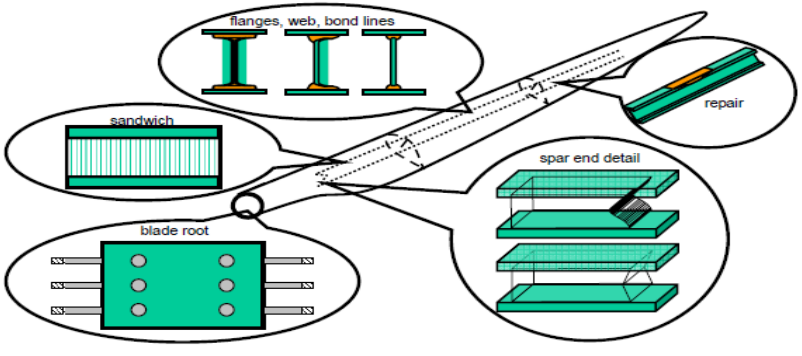
Offshore facilities

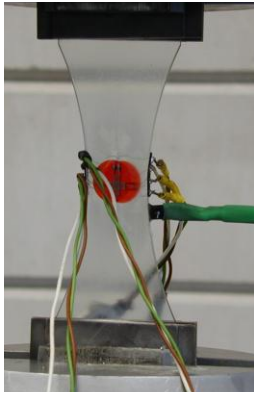
- Measurement and evaluation programme Egmond aan Zee
- Various demonstrations of innovations in offshore wind farms
- Measurement Mast IJmuiden
- Goal: demonstration of innovations with industry in offshore wind farm ‘Leeghwater’
  previously known as ‘Proeftuin op Zee’

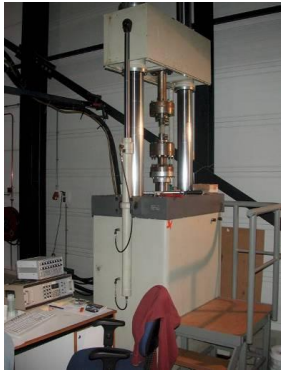
Knowledge Centre **WMC**

Wind turbine Materials and Constructions

ECN







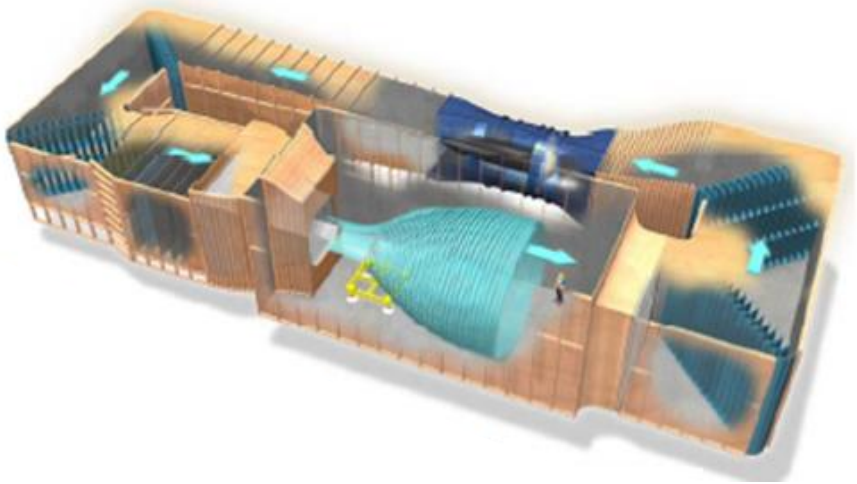
Axial / Torsion 250kN / 4kNm

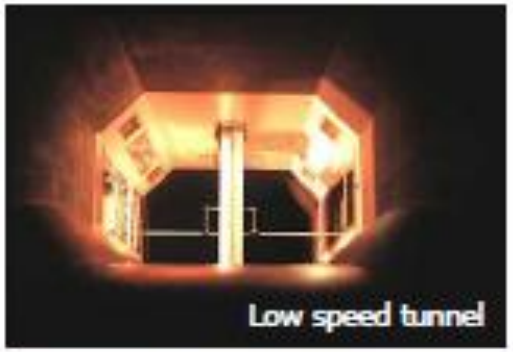
Static / Fatigue 400kN

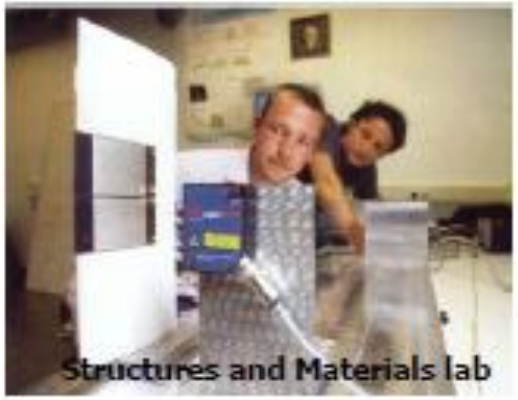
Static / Fatigue 1000kN

Delft University of Technology Facilities

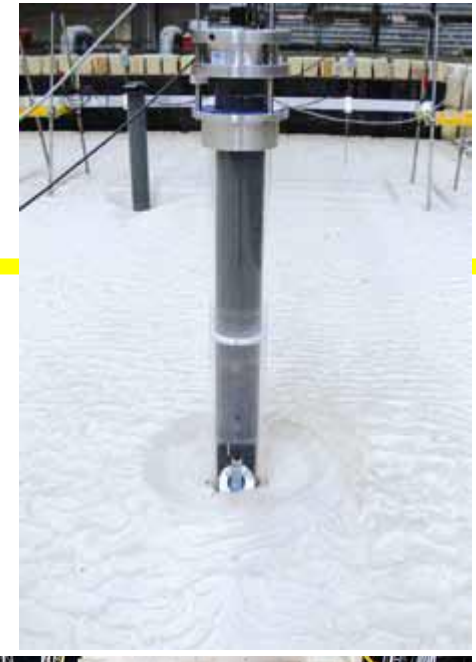
- DUT has numerous facilities, among others
  electrical test facilities,
  wind tunnels,
  wave tank,
  structures and materials lab …



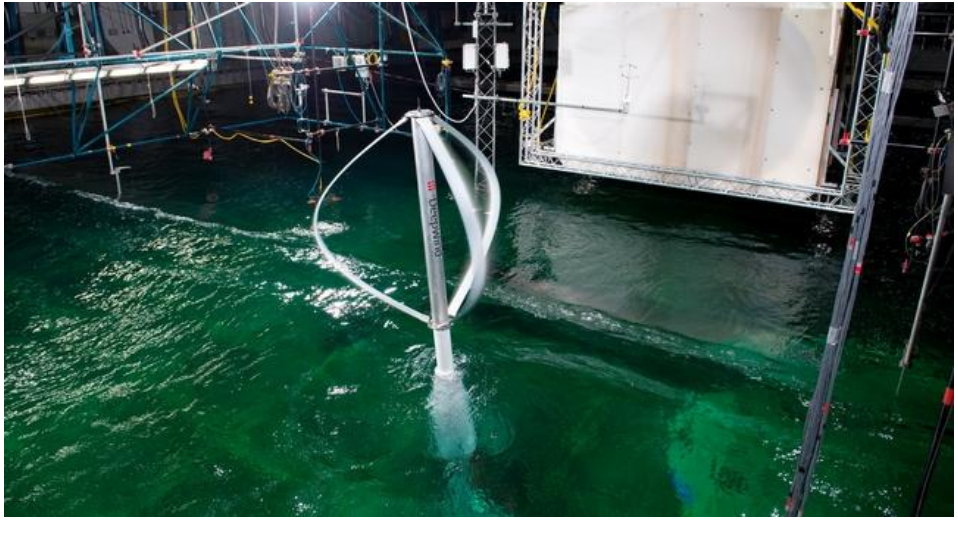




DELTARES



MARIN



NLR

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Summary

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Investing in Innovations reduces COE offshore wind power

- Transition towards 16% renewables in NL is possible
  (offshore) Wind energy plays an important role

- Dutch R&D has significant impact
  and is organised with industry

- Reduction of COE by innovation is effective several years later
  Leeghwater accelerates innovations
  and has high impact reduction subsidy

	Opera-tioneel*	Capaci-teit [MW]	Ontwerp and Engineering	Fundering	Turbines	Installatie	Onderhoud	Ontwikkeling en operatie	Overig
Vindeby	1991	5							
Lely	1994	2							
Tunø Knob	1995	5							
Irene Vorrink	1996	17							
Bockstigen	1998	3							
Blyth Offshore	2000	4							
Middelgrunden	2000	40							
Utgrunden I	2000	11							
Yttre Stengrund	2001	10							
Horns Rev I	2002	160							
Frederikshavn	2003	11							
Nysted	2003	166							
Samsø	2003	23							
North Hoyle	2003	60							
Arklow Bank	2004	25							
Scroby Sands	2004	60							
Kentish Flats	2005	90							
OWEZ	2006	108							
Barrow	2006	90							
Lillgrund	2007	110							
Burbo Bank	2007	90							
Prinses Amalia	2008	120							
Inner Dowsing	2009	97							
Lynn	2009	97							
Rhyl Flats	2009	90							
Horns Rev II	2009	209							
Robin Rigg	2009	180							
Gunfleet Sands	2009	173							
Alpha Ventus	2010	60							
Belwind I	2010	165							
Rødsand II	2010	207							
BARD 1	2010	400							
Thanet	2010	300							
Walney I	2010	184							
Greater Gabbard	2010	504							
EnBW Baltic I	2010	630							
Ormonde	2011	150							
Sheringham Shoal	2011	317							
Walney II	2011	184							
London Array	2011	185							
Thornton Bank II	2012	48							
Anholt	2013	111							
Thornton Bank III	2013	400							
Lincs	2013	270							
Borkum West II	2014	200							

Alle genoemde organisaties hebben Wind op Zee R&D, engineering en/of productie activiteiten in Nederland.
*Vanaf 2005 zijn alleen de windparken met een capaciteit groter dan 50 MW inbegrepen (bron: 4COffshore.com)

ECN

- Offshore wind will be economically large.
- The Netherlands must maintain her top-position and realise its goals for green jobs in the Dutch Wind and Offshore industry.
- Stimulating wind energy innovations is a wise and valuable investment

Dank voor uw aandacht

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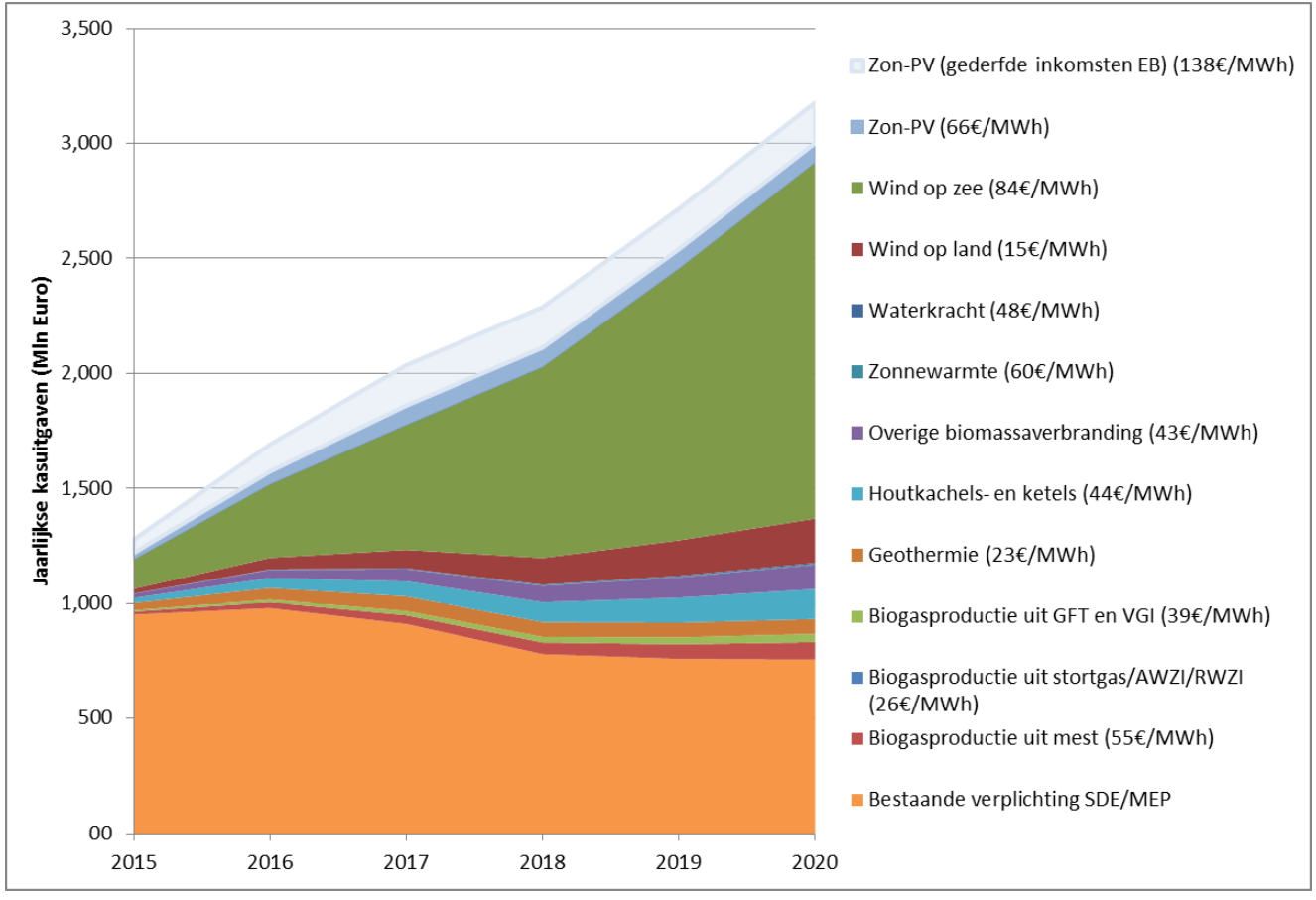
Overheidsuitgaven additionele productie, totaal en per MWh



- Ondersteuningskosten biomassameestook en warmte uit buitenlucht/WKO **niet inbegrepen**
- Ondersteuning Zon-PV 50-50 (SDE - saldering)

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