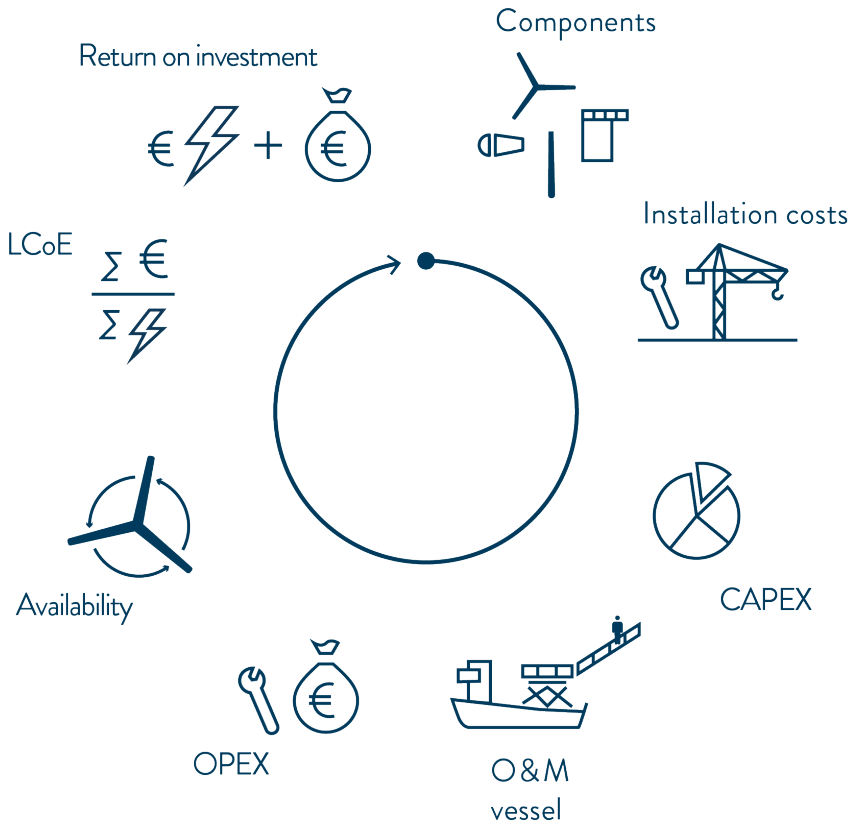
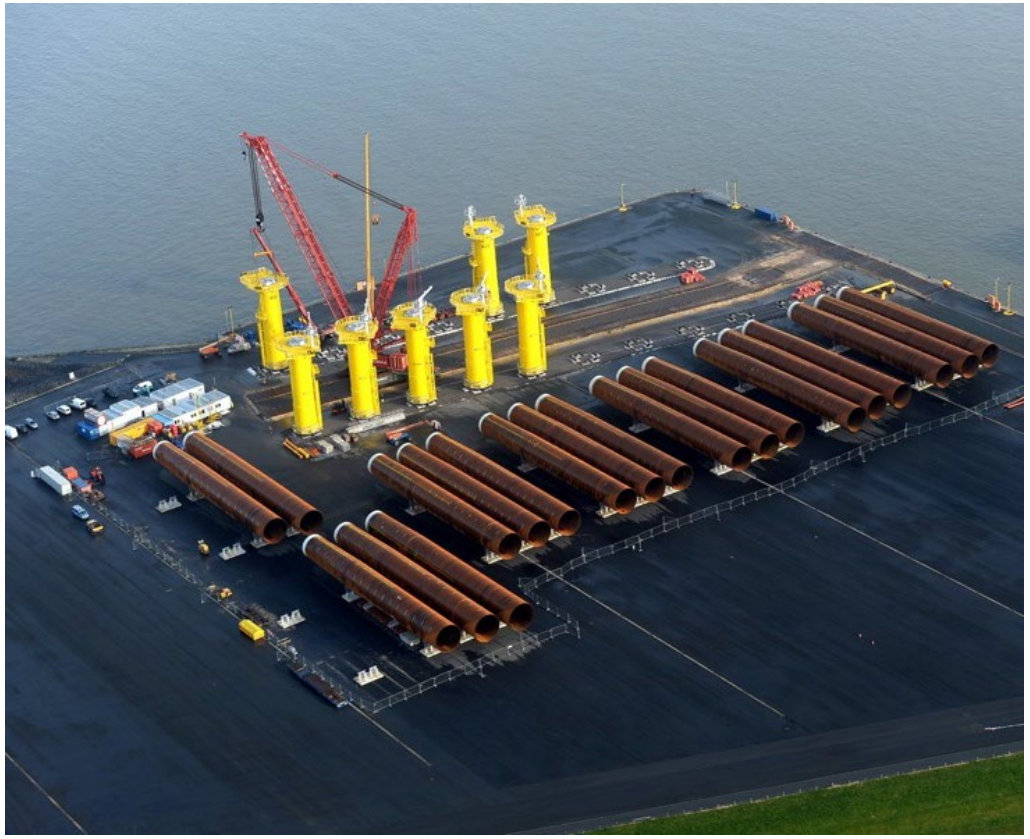
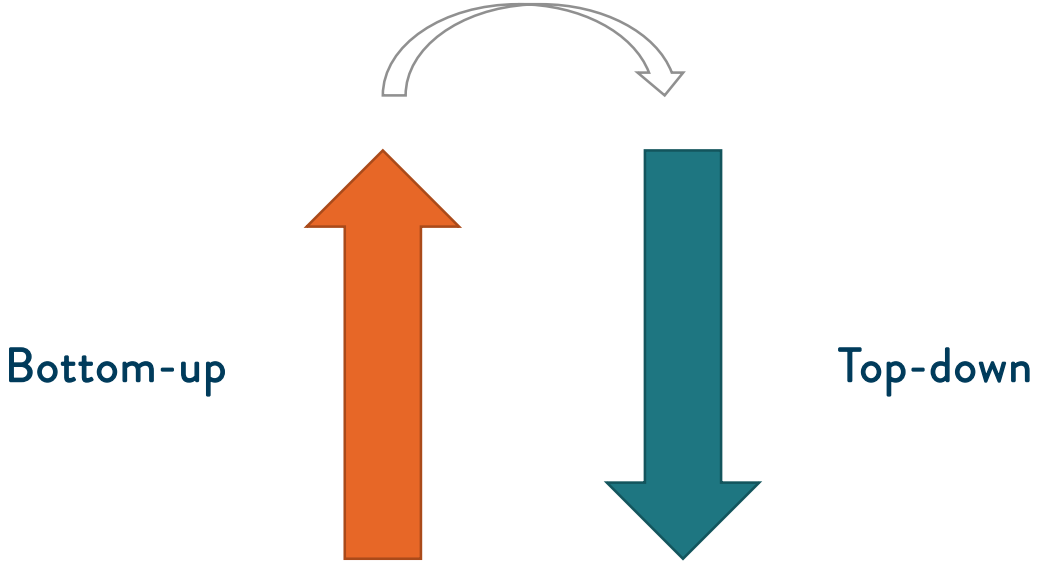
DE OUDE
BIBLIOTHEEK
ACADEMY

Costs versus income



Component price





OffshoreWIND.biz

Total price

RECHARGE
The global source for renewable energy news & intelligence

WIND More

Vattenfall globally is the Nr. 2 offshore operator
Photo: Vattenfall

Vattenfall wins Kriegers Flak with record €49.90/MWh

RELATED NEWS

Borssele 3&4 on track to deliver lowest offshore wind price
EUROPE OFFSHORE
19 Oct 2016

Vattenfall post small net profit in 3Q after lignite sale
EUROPE
17 Oct 2016

Vattenfall bid in 680MW Borssele 3&4 offshore wind tender
EUROPE OFFSHORE

by William Steel in Aarhus

09 November 2016
Updated 09 November 2016

Share: Facebook Twitter LinkedIn E-mail Print

Swedish utility Vattenfall won a bid in the tender for the giant 600MW Kriegers Flak array off Denmark with a bid of €49.90 ($55.34) per megawatt hour, the lowest-ever achieved in offshore wind.

"The announcement is an essential milestone for our ambition to increase our production of renewable power. We are already the second largest offshore player globally," Vattenfall chief executive Magnus Hall said.

"The winning bid of €49,9 per MWh proves that Vattenfall is highly competitive and brings down the costs for renewable energy."

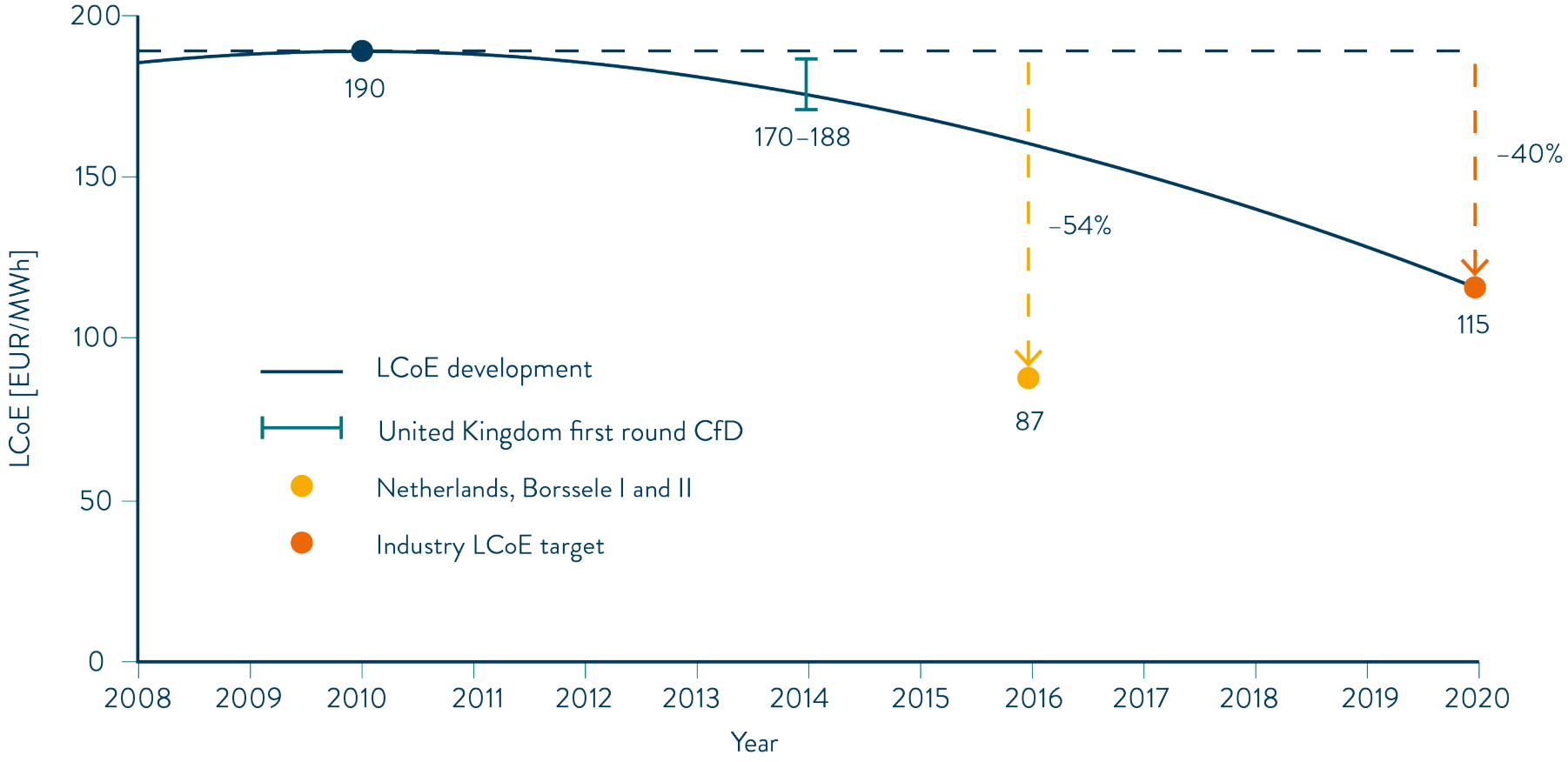
RECHARGE
The global source for renewable energy news & intelligence

How sustainable are sub-€50/MWh offshore prices?

Vattenfall's record low price for Krieger's Flak raises questions over how much lower the sector can go, writes Bernd Radowitz

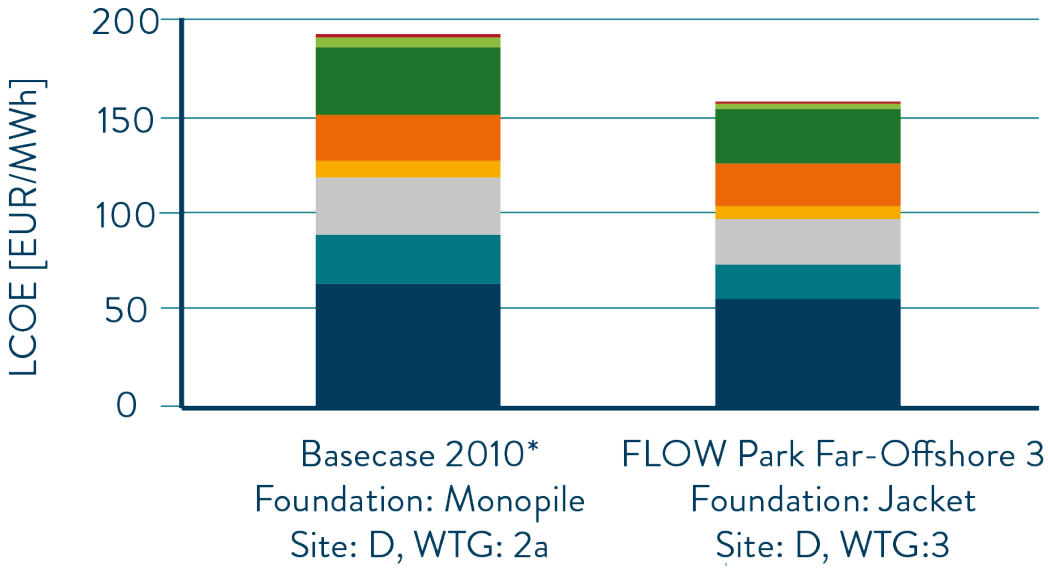
- We know the bits and pieces
- Can we get a price?

Recharge


200
150
100
50
0
LCoE [EUR/MWh]
190
170–188
–54%
–40%
87
115
LCoE development
United Kingdom first round CfD
Netherlands, Borssele I and II
Industry LCoE target
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Year

DE OUDE BIBLIOTHEEK ACADEMY

		UK-2014 First round CdF	NL-2016 Borssele I and II	Indicative impact on LCOE
STRUCTURAL	Strike prices (EUR/MWh, incl. grid connection)	170-188	87	
	Track record (TWh)	104	180	↘ ↘
	Technical/operational innovation	ongoing	ongoing	↘ ↘
	Bankable turbine suppliers (#)	2	5	↘ ↘
	Turbine capacity (MW)	3-4	7-8	↘ ↘
	Competetive bidding for subsidy	no	yes	↘ ↘
	Pipeline and support certainty	no	yes	↘ ↘
	Grid connection certainty	no	yes	↘
	Wind farm capacity	90-400	700	↘
CYCLICAL	Interest base rate (German bond 10 years)	-2%	-0%	↘ ↘ ↘
	Steel price (EUR/t)	410-450	320-340	↘
	Oil price (Brent, USD/bbl)	57-107	36-50	↘



- Decommisioning
- DEVEX
- OPEX
- Total Install
- Other CAPEX
- Electrical Supply
- Foundation Supply
- Wind Turbine Supply

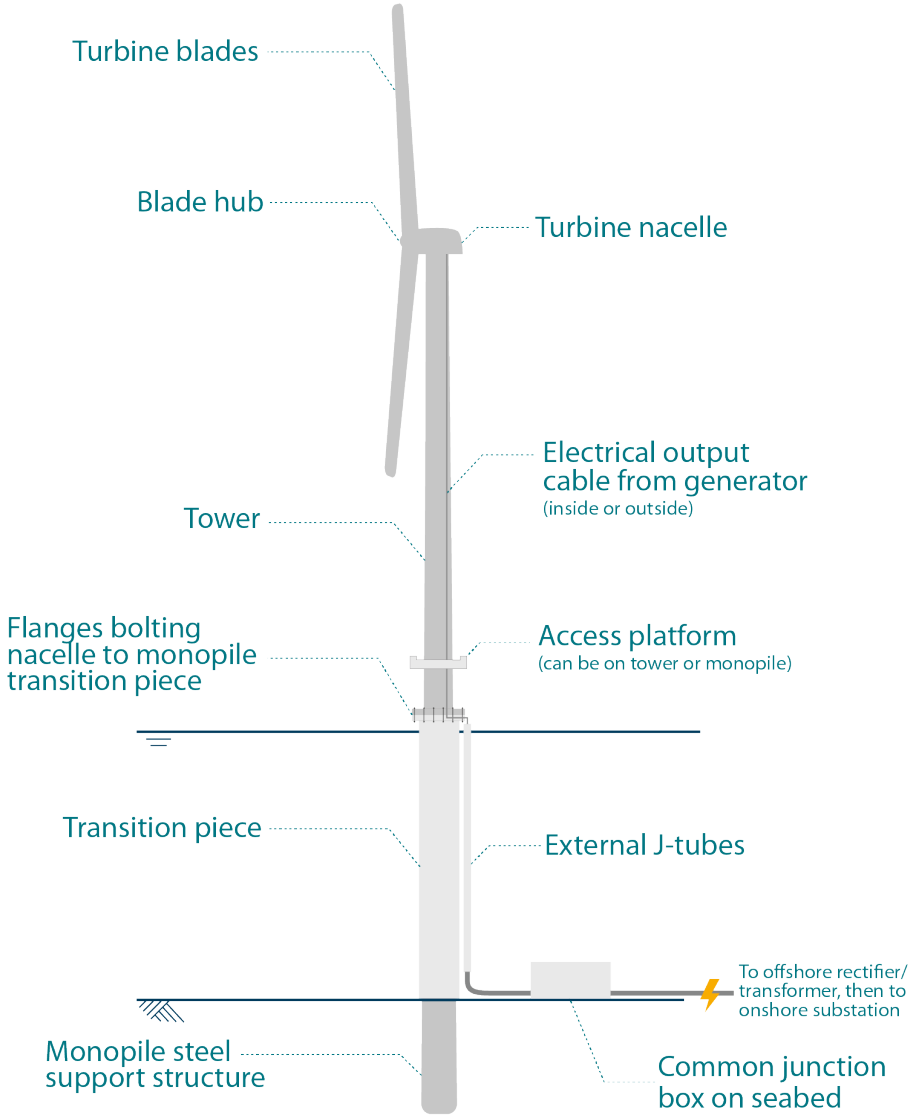
Upfront investment: 75%

Component prices

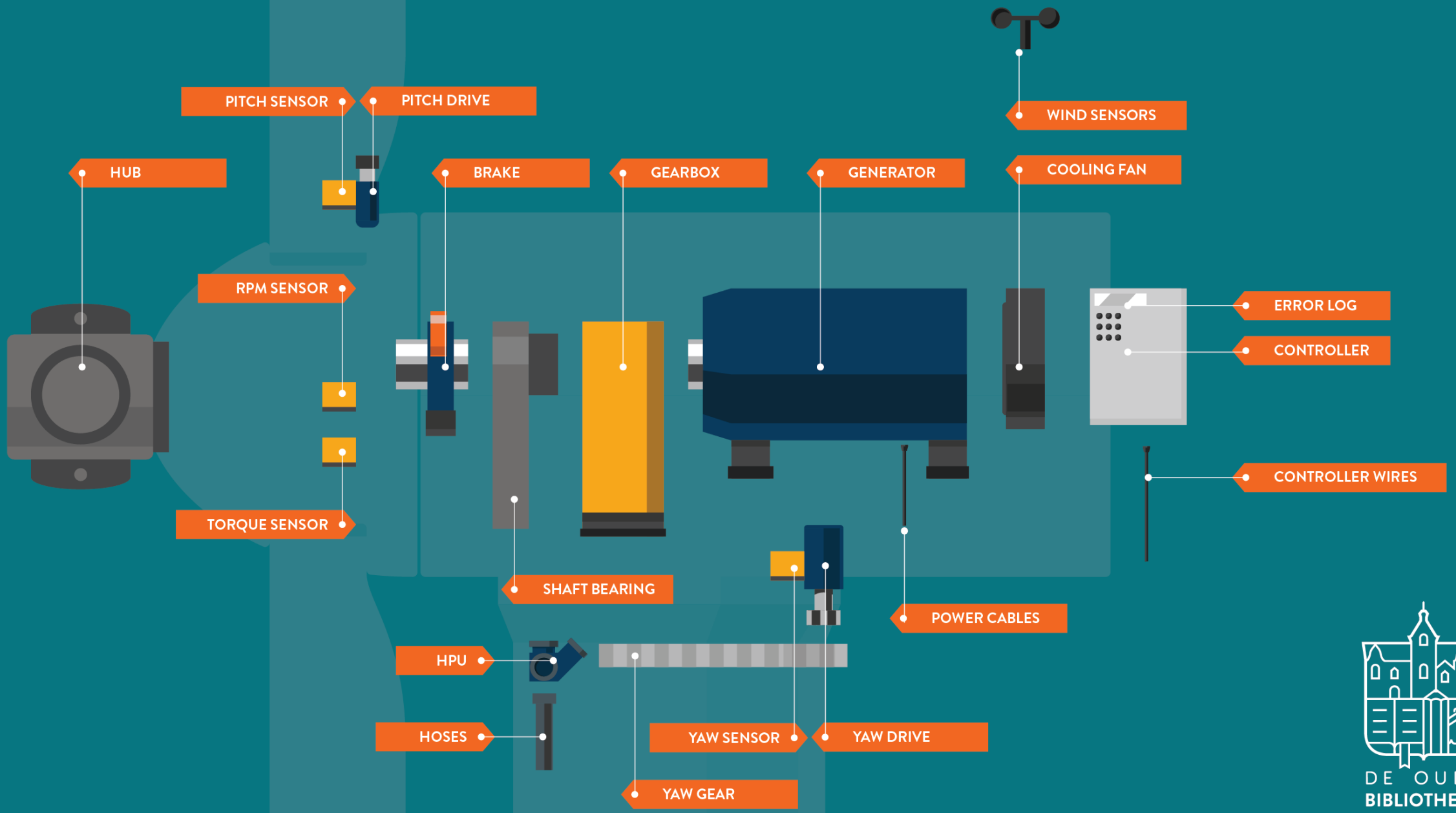
40-60% of investment costs

Windpower monthly, 2014

- Drive train including generator and load path 30%
- Blades 20%
- Tower excluding electrical and control system 16%
- Electrical and control system including converter and transformer 13%
- Auxiliary systems and nacelle and hub cover 10%
- Hub casting, blade bearings and pitch system 9%
- Nacelle and hub assembly



Willie Scott, 2010



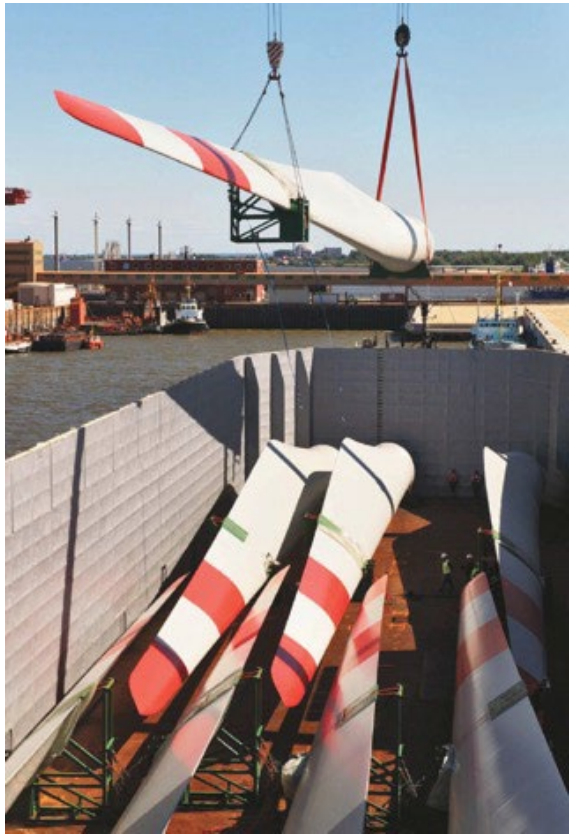
DE OUDE BIBLIOTHEEK ACADEMY

Component prices

- Euro/ton steel
- Simple (monopile)
- Advanced (secondary steel)
- m^3 of grout

Gather components in port

- Onshore transport
- Trucking
- Unloading
- Storage
- Assembly onshore



Cable collection

- From manufacturer
- To site

Foundation installation

- Vessel
- Tools (hammer, handling)
- Loading, sailing, installing
- Waiting for good weather

Turbine installation

- Vessel
- Tools (handling, blades)
- Loading, sailing, installing
- Waiting for good weather

Cable installation

- Vessel
- Tools (ROV)
- Handling on turbines
- Loading, sailing, installing
- Waiting for good weather

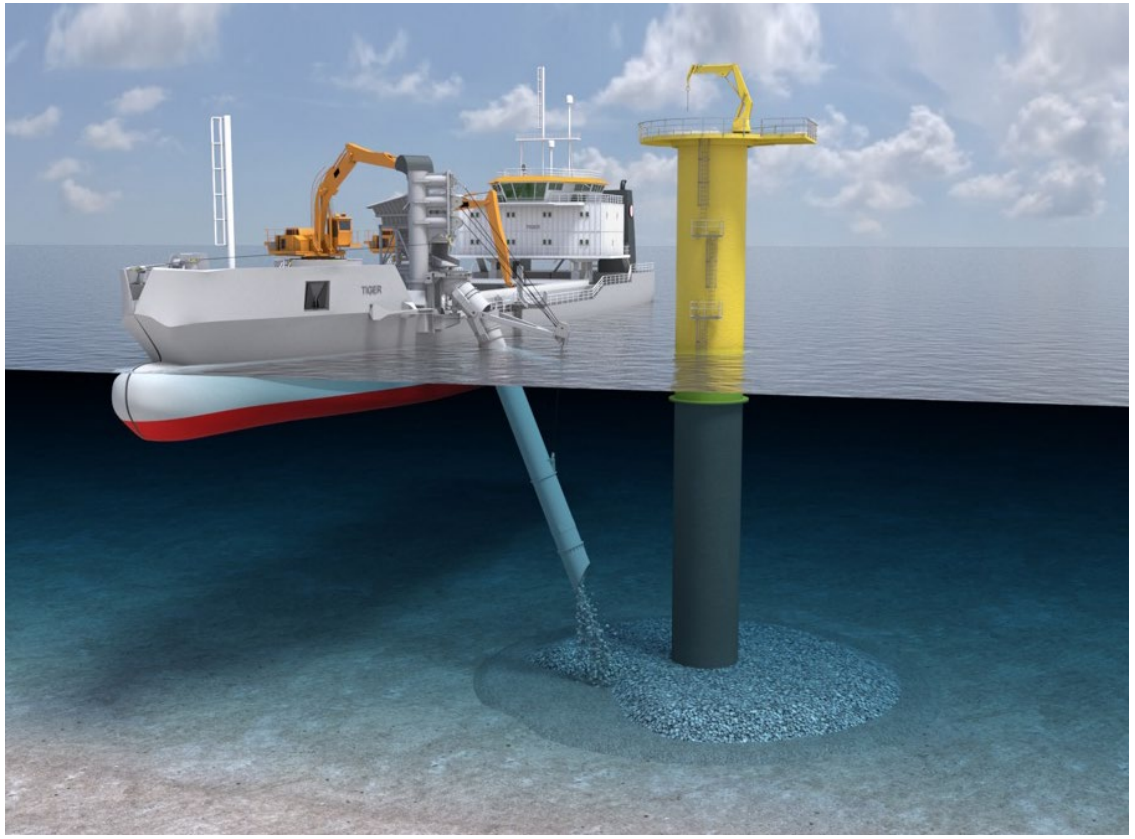
Ennsub

Dino Planet

Van Oord

Scour protection installation

- Vessel
- Rock
- Loading, sailing, installing
- Waiting for good weather



Dredgepoint.org

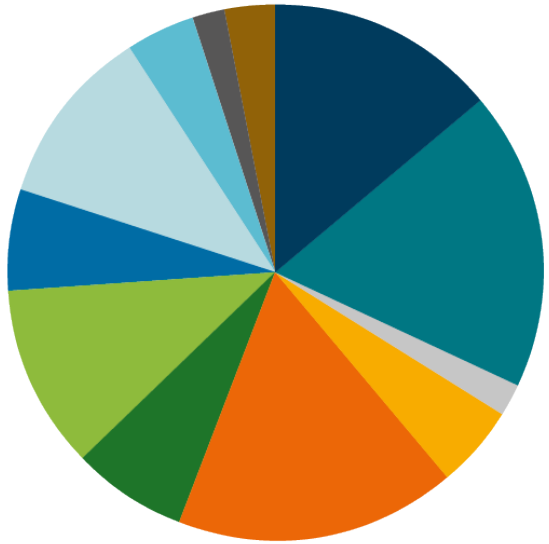
Your CAPEX build up

- Bottom-up
- And top-down

- Check numbers with findable fact
- Give insight in differences

- Add your innovations!

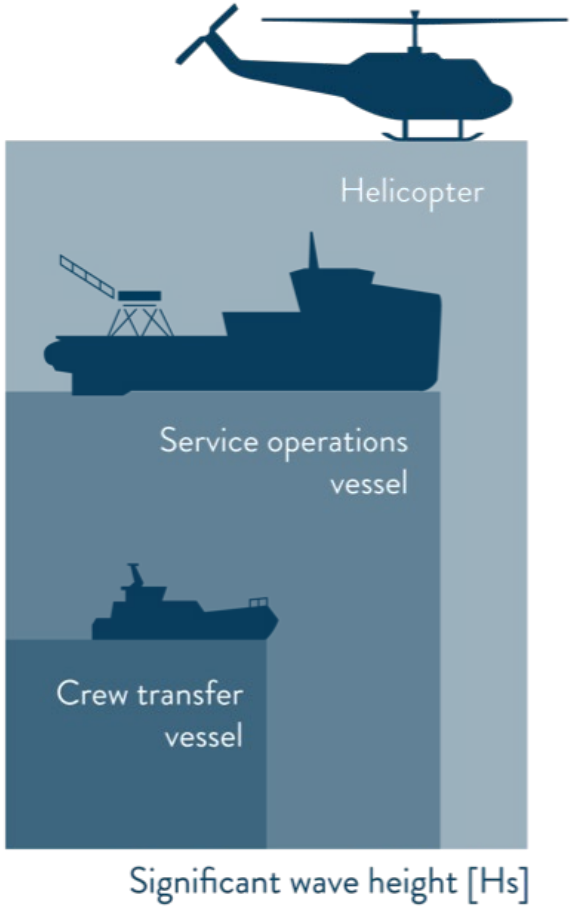
- Economy of scale: -0.08



- Rotor 14%
- Nacelle components 18%
- Nacelle assembly 2%
- Tower 5%
- Foundation 17%
- Cables 7%
- Electrical infrastructure 11%
- Turbine installation 6%
- Foundation installation 11%
- Cable installation 4%
- Electrical infrastructure installation 2%
- Project development and management 3%

O&M

- Insurance
- Regular maintenance
- Repair
- Spare parts
- Access to platform/turbines
- Administration



Staffing

- Teams offshore
- Team onshore
- Scale up/down in summer/winter

LunarWind

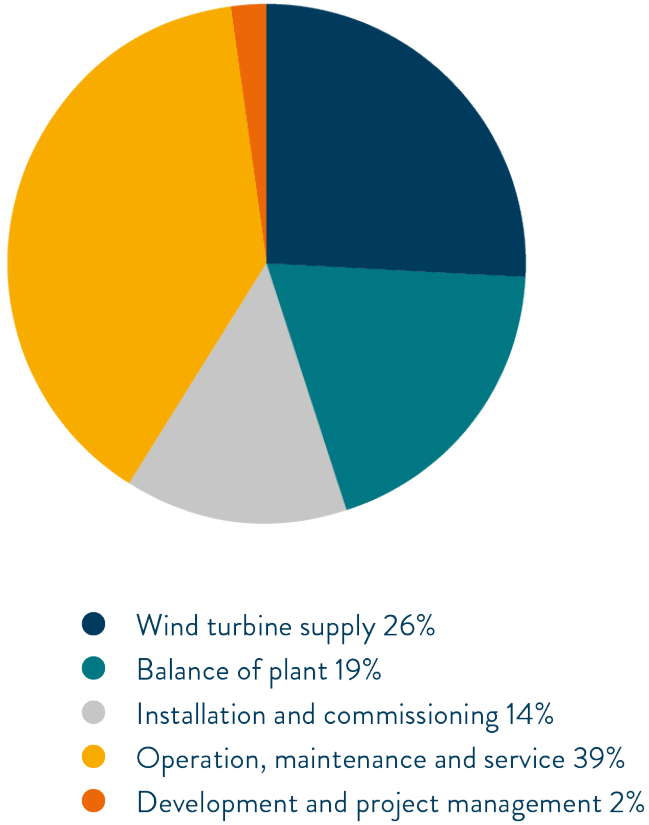
The Manufacturer

Component replacement/year

- Lubricants
- Wear and tear
- Overhaul

OPEX build up

- Again top-down + bottom-up
- 25% -30% of LCOE
- Why are you different?



Wind-power-wake-availability

Bel Air Aviation

LCOE

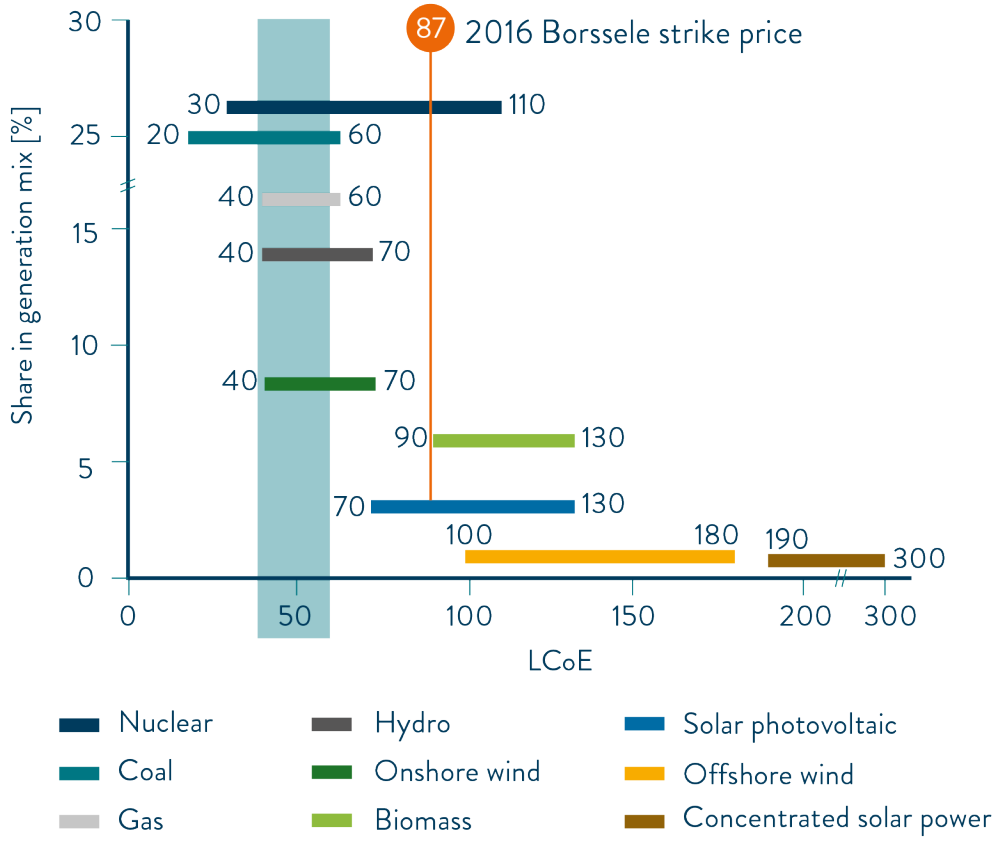
$$LCOE = \frac{\sum_{i=-m}^{n} \frac{C_i + O_i + D_i}{(1+W)^i}}{\sum_{i=-m}^{n} \frac{E_i}{(1+W)^i}}$$

$LCOE$	levelised cost of energy in £/MWh = revenue needed (from whatever source) to obtain rate of return W on investment over life of the wind farm (tax, inflation etc. not modelled)
C_i	Capital expenditure in £ in year i
O_i	Operational expenditure in £ in year i
D_i	Decommissioning expenditure in £ in year i
E_i	Energy production in MWh in year i
W	Weighted average cost of capital in % (real) = (cost of debt x % debt) + (return on equity X equity portion)
n	Operating lifetime of wind farm (baseline 20 years)
m	Years before start of operation when expenditure first incurred
i	i year of lifetime (-m, ..., 1,2, ...n)

- CAPEX 38%
- Project 2%
- Project development and permitting up to FID 1%
- Project management 1%
- Turbine supply 23%
- Nacelle 12%
- Rotor 9%
- Tower 3%
- Balance of pllant supply 8%
- Foundation supply 7%
- Array cables 1%
- Installation 5%
- Foundation installation 2%
- Array cables 1%
- Turbine installation 1%
- Operation, maintenance and service 21%
- Transmission charges 12%
- Unplanned service 4%
- Operation and planned maintenance? 3%
- Other 2%
- Decommissioning 0%
- Capital 41%

Source: BVG

Towards parity



- Old subsidy: bid and get
- New: lowest wins

- So: cost + margin
- Tune margin to win

DE OUDE
BIBLIOTHEEK
ACADEMY