INCREASING THE MARKET VALUE OF WIND POWER

Options from an investor´s perspective

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CONTENT

1. **Increasing competition through tendering**

2. **Improve value factors**

3. **Generate extra revenues**

4. **Reduce revenue reductions**

OFFSHORE WIND TENDERS: A HIGHLY COMPETITIVE BUSINESS

DE 🇩🇪	Tender „with" projects for feed in premium
UK 🇬🇧	
NL 🇳🇱	Tender „on" projects with feed in premium
DK 🇩🇰	
SE 🇸🇪	Technology neutral green certificates
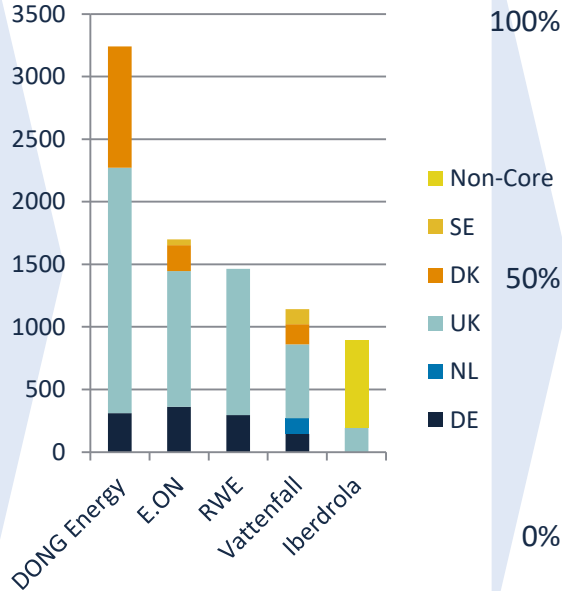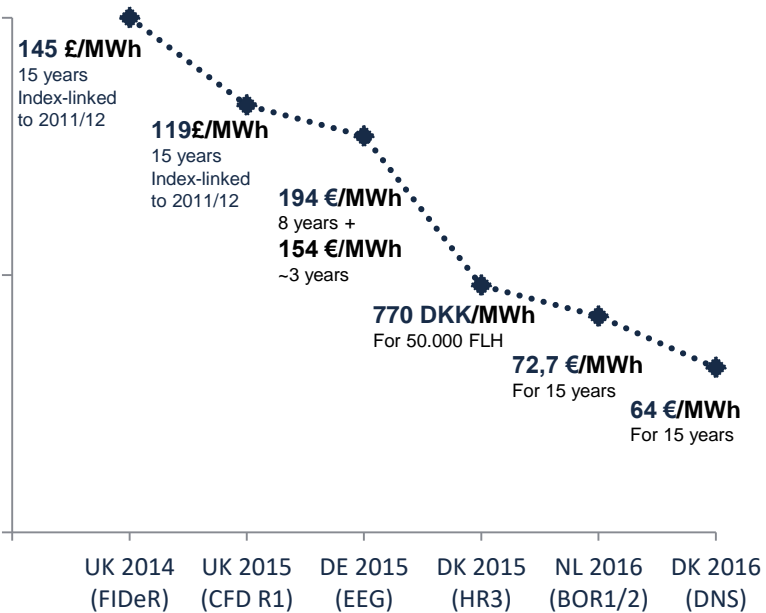
Competitors (2015)

MW

Legend:
- Non-Core
- SE
- DK
- UK
- NL
- DE

Companies: DONG Energy, E.ON, RWE, Vattenfall, Iberdrola

Price development

145 £/MWh
15 years
Index-linked to 2011/12

119£/MWh
15 years
Index-linked to 2011/12

194 €/MWh
8 years +
154 €/MWh
~3 years

770 DKK/MWh
For 50.000 FLH

72,7 €/MWh
For 15 years

64 €/MWh
For 15 years

UK 2014 (FIDeR) · UK 2015 (CFD R1) · DE 2015 (EEG) · DK 2015 (HR3) · NL 2016 (BOR1/2) · DK 2016 (DNS)

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HOW TO COMPETE SUCCESSFULLY?

Reduce costs

$$LEC = \frac{\sum_{t=1}^{T} \dfrac{Devex_t + Capex_t + Opex_t}{(1 + i_n)^t}}{\sum_{t=1}^{n} \dfrac{Production}{(1 + i_r)^t}}$$

- Reduce turbine costs
- Enhance power curves
- Learning curve effects
- Costs of capital
- …

and

Increase revenues

$$LER = \frac{\sum_{t=1}^{T} \dfrac{Market_t + Subsidy_t}{(1 + i_n)^t}}{\sum_{t=1}^{n} \dfrac{Production}{(1 + i_r)^t}}$$

- Improve value factors
- Generate extra revenues
- Reduce revenue reductions
- …

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or..

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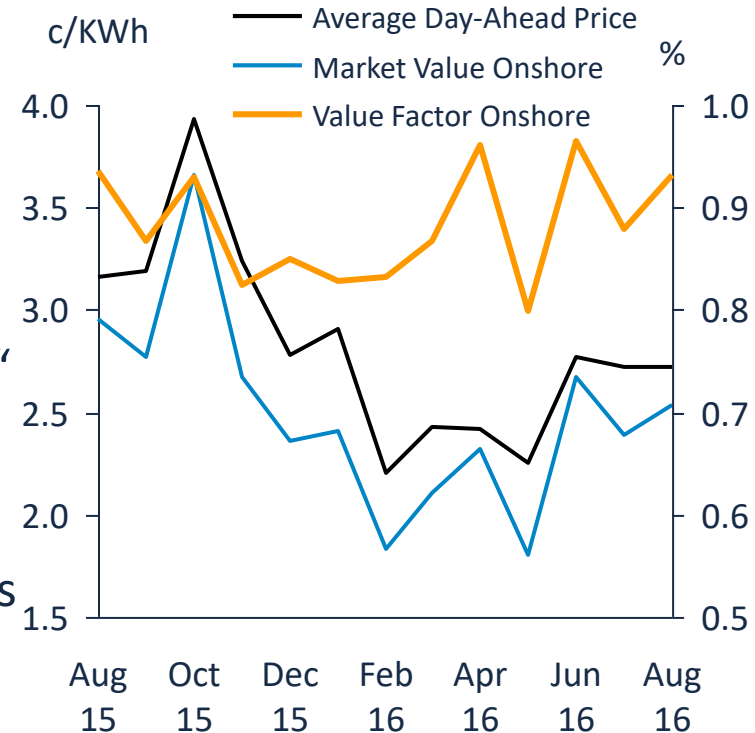- Reduce turbine costs

Factors that increase „system friendliness"

- Improve value factors
- Generate extra revenues
- Reduce revenue reductions
- …

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IMPROVE VALUE FACTORS

Def. Value Factor $= \dfrac{\overline{P}_{Wind}}{\overline{P}_{Base}} = \dfrac{\dfrac{\sum_{t=1}^{T} W_t * P_t}{\sum_{t=1}^{T} W_t}}{\dfrac{\sum_{t=1}^{T} P_t}{T}}$

➡ „produce when other wind turbines are not"

1. Install low wind speed turbines (LWST)
2. Shift production to high day-ahead price hours

Source https://www.netztransparenz.de/ and own calculation

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INSTALL LOW WIND SPEED TURBINES

- LWST = turbine with a lower rated capacity at a fixed rotor diameter

- EEG 2016: bid level = market value + market premium

- Market value = $\frac{\sum_{t=1}^{T} P_t * W_t}{\sum_{t=1}^{T} W_t}$; P_t = day-ahead price, W_t = wind production; t = delivery hour 1,2,…730.

- Assuming that wind power production in a country is highly correlated between sites (80%?) and wind production significantly reduces the day-ahead market prices, then producing during low wind speed times increases the market value above the average market value

Market Premium

M. Value Premium

M. Value

LWST   HWST
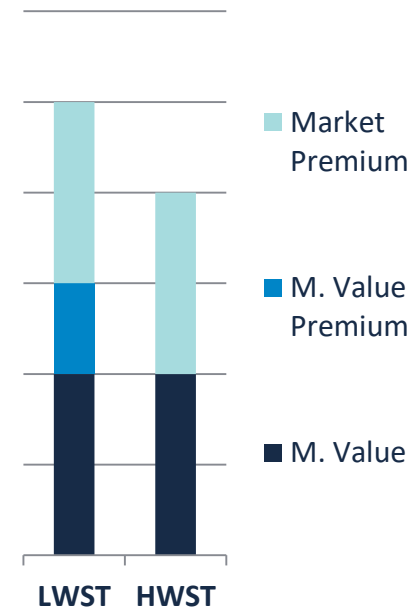
SYSTEM FRIENDLYNESS IS INCENTIVIZED

- Under subsidy scheme: LWST provide higher market values at a constant market premium. But trade-off between higher market value and reduced installed capacity

- After subsidy scheme: subsidy length equals typical lifetime of onshore turbines (20 years). Market status after 20 years unknown. High share of newly installed LWST may result in equally low value factors than for HWST but lower installed wind park capacity

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SHIFT PRODUCTION TO HIGH PRICE HOURS

- Investment in storages
  - Batteries: CAPEX expenditures vs. increased market revenues
  - Limited storage capacity: 20 MW wind park with 5 MWh battery -> battery charged in 15 minutes, if wind park operates at full power

GENERATE EXTRA REVENUES

Participation in imbalance market

- Inflexibility of power system persists in the medium run
- reluctance to divest conventional base- and mid-load plants
- wind and solar PV expansion continues in DE and neighboring countries
- increased likelihood of negative prices where conventional power plants operate at their technical minimum load

➡ Balancing service provision = additional revenue stream for wind?

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OPPORTUNITY COSTS DETERMINE THE ATTRACTIVENESS OF RESERVE POWER PROVISION
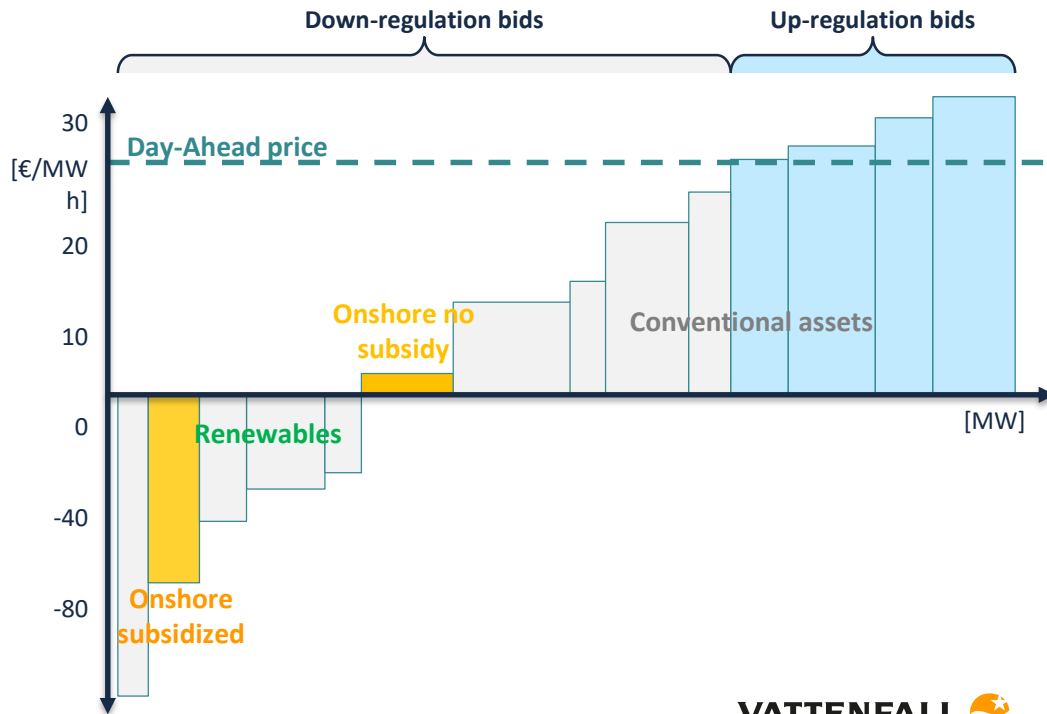
- Non-subsidized renewables may successfully bid in the minute reserve market
- Subsidized parks tend to have prohibitively high opportunity costs

REDUCE REVENUE REDUCTIONS

Further Levers to increase revenues:

- Continuously improve forecasting
- Operational excellence – maintenance planning, availability
- …

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THANK YOU!