

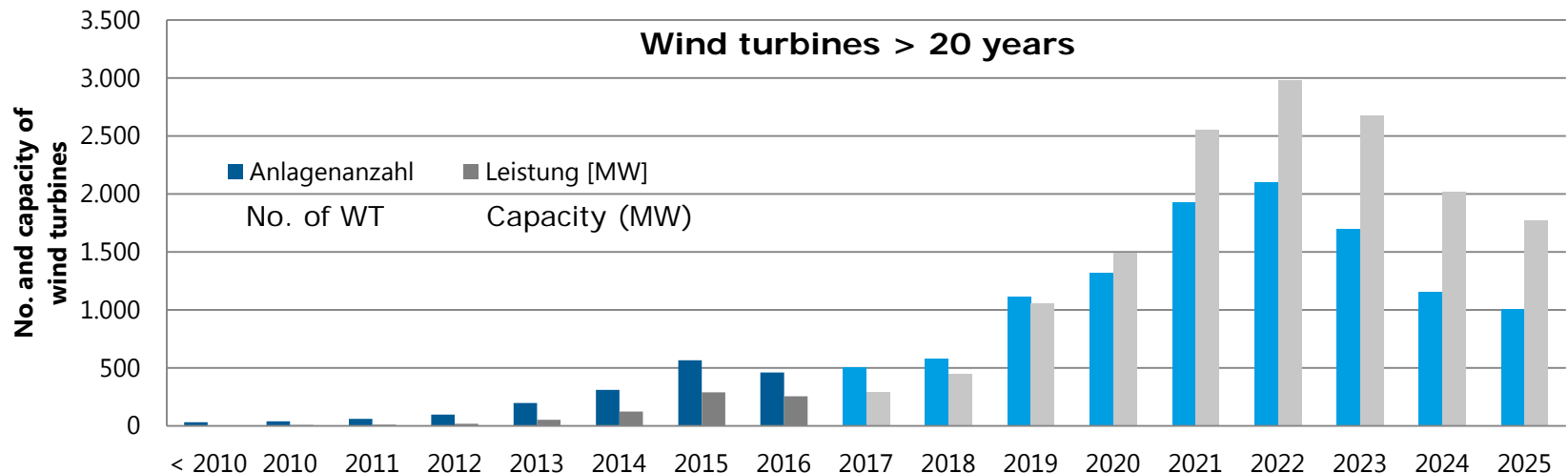
OPERATION OF WIND TURBINES
AFTER DESIGN LIFETIME

Husum, 13.09.2017

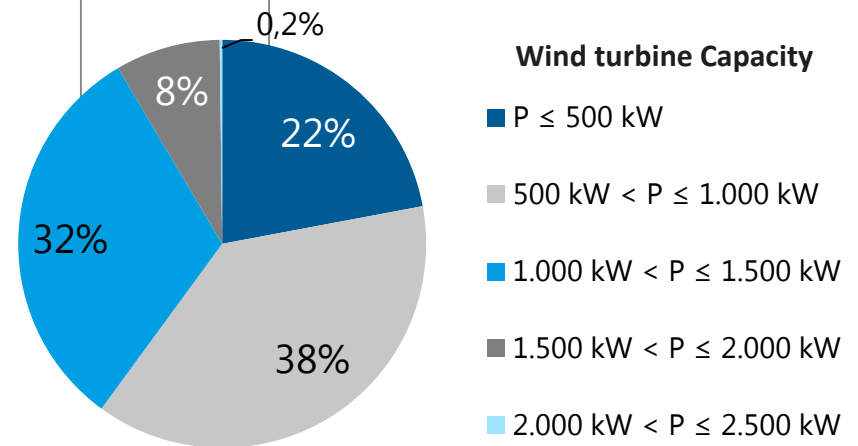
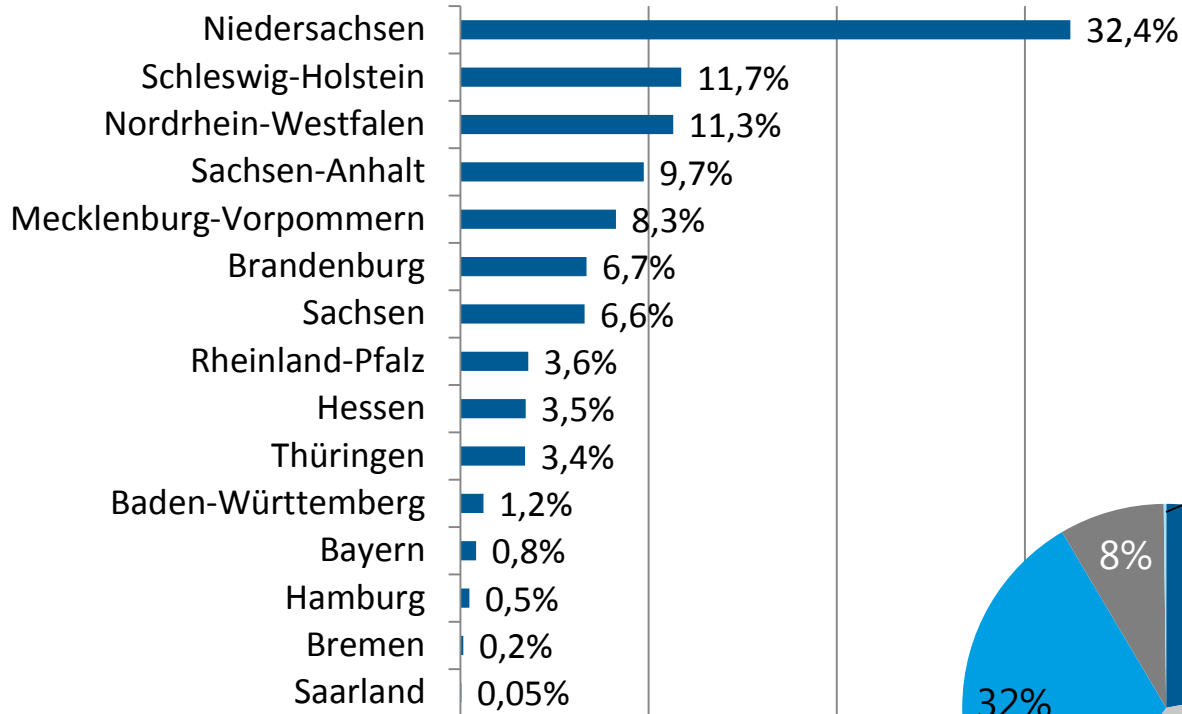
- Markets & Politics Department
 - Market analysis / Cost analysis
 - Consulting of governments with regard to political frameworks
 - Statistics
- Analysis „Extended operation of wind turbines after 2020“ (on behalf of Naturstrom AG)
- Deeper analysis will be published soon (on behalf of Bundesverband Windenergie)
- Further services of Deutsche WindGuard:
 - Inspections of wind turbines >20 years
 - Certification of lifetime extension



- EEG 2000: WT installed before 2000 receive the EEG feed-in tariff until 31-12-2020
- On this date the owners of 4 GW of wind energy capacity will be faced with the question, if extended operation is profitable
- In the years 2020–2025 on average 2,4 GW are affected each year
- Today, ~2.000 WT with a capacity of 885 MW >20 years still in operation
- Instruments have been implemented to ensure safe operation >20 years

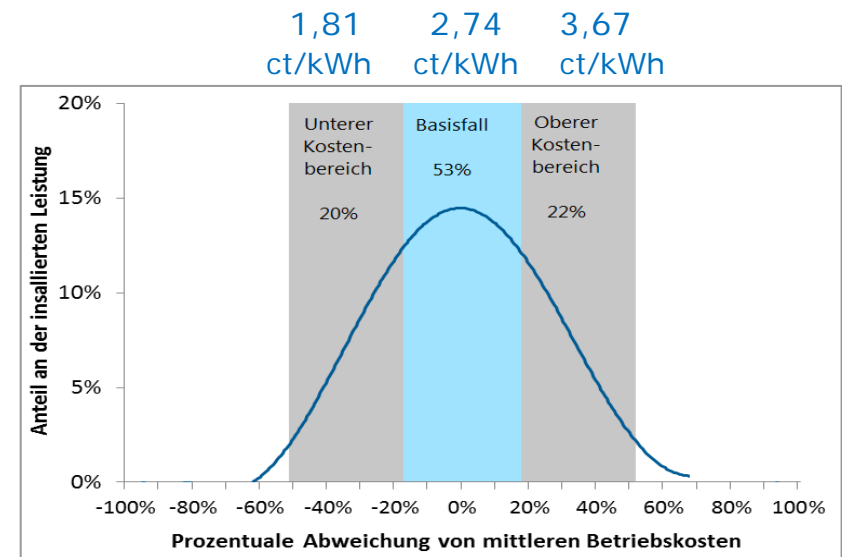
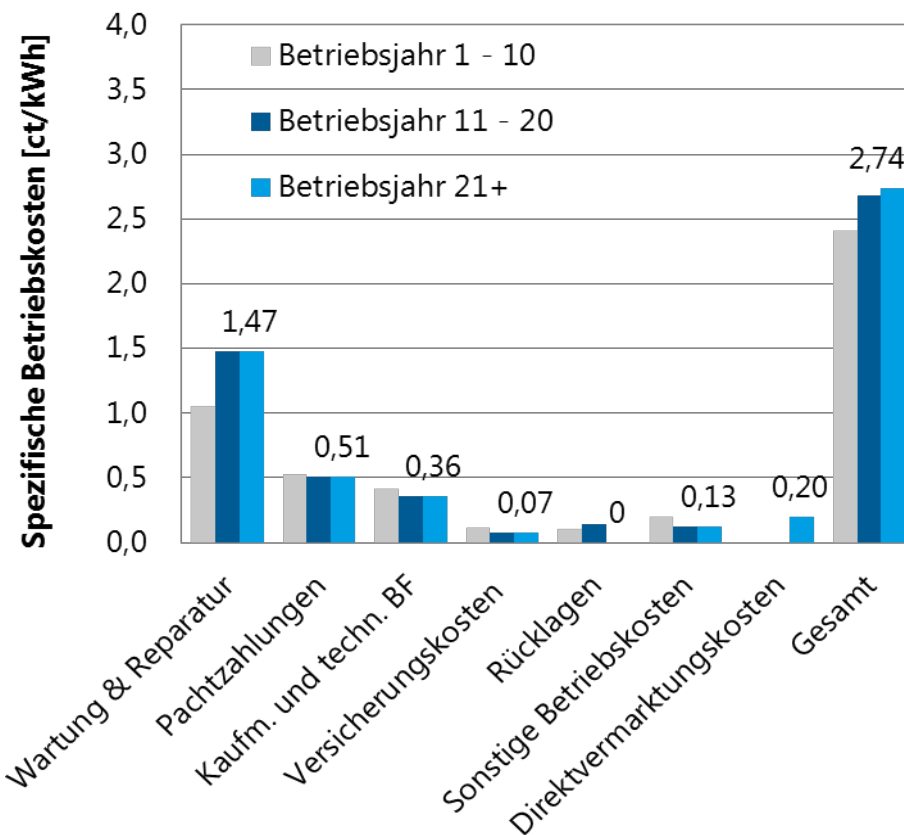


Share of federal states on installed capacity



Operation Cost in the 3rd Decade

- Most important cost factor for operation after 20 years
- No cost data for wind turbines in the 3rd decade available yet
 - Cost data of 2nd Decade was used and interpreted



Required revenues

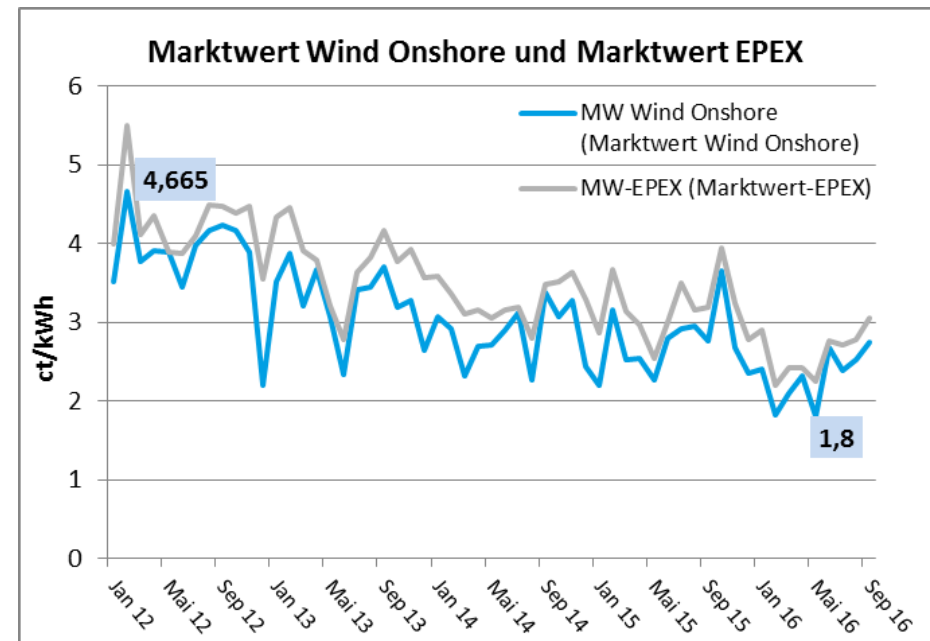
- Required investments to get approval of extended operation after 20 years (cost for certificate, administration)
- Incentive (rate of return) required for economic feasibility

RESULTS	Cost in ct/kWh		
	Low Case	Base Case	High Case
Certificate, administration	0,33	0,33	0,33
Operation cost	1,81	2,74	3,67
Incentive (return)	0,5 - 1,0	0,5 - 1,0	0,5 - 1,0
Required revenues	2,6 - 3,1	3,6 - 4,1	4,5 - 5,0

Stock prices (EPEX)

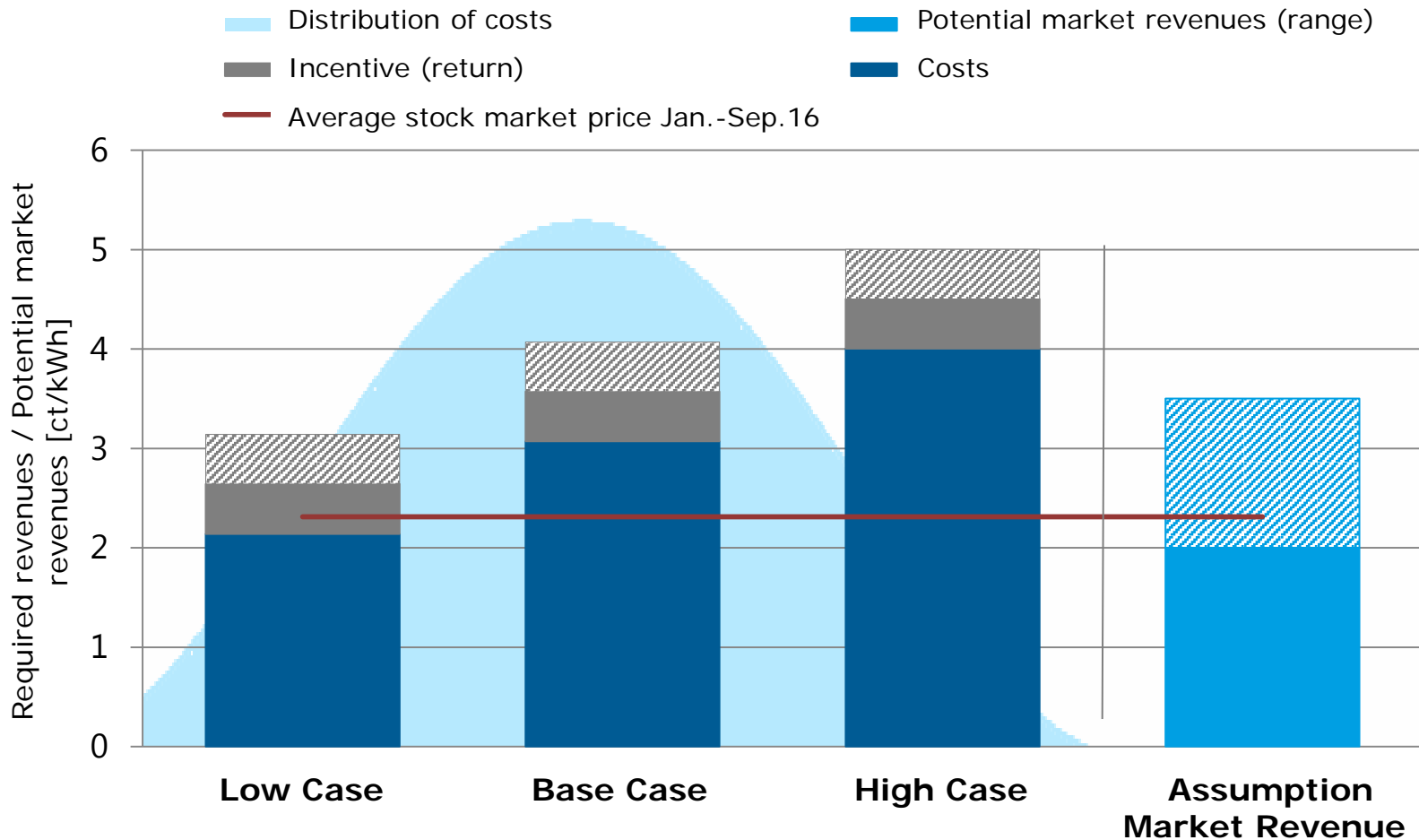
- Analysis of average stock market prices for wind energy
- Since beginning of 2013 no \emptyset market price of >4 ct/kWh
- Annual mean value has degressed continuously since 2012
- Jan.-Sep. 2016 \emptyset 2,3 ct/kWh

Market price of 2-3,5 ct/kWh as assumption for the further analysis



- Alternative distribution channels (green power suppliers, regional direct marketing) are difficult to assess

Overview on cost and expected revenue



Potential cost degression

- Maintenance & Repair
 - Minimal efforts with high risk and decommissioning after first relevant damage
 - Development of special concepts for turbines in 3rd decade
- Land lease
 - Opportunities for negotiation, e.g. no repowering option, no long-term fixed prices
 - Supposedly better negotiation position due to actual market situation (risk of acceptance of bid)
- Technical and Commercial Management
 - Possibly some financial latitude by implementing a less pro-active strategy

Thank you!

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