

Support schemes and risk premiums for renewable energy technologies

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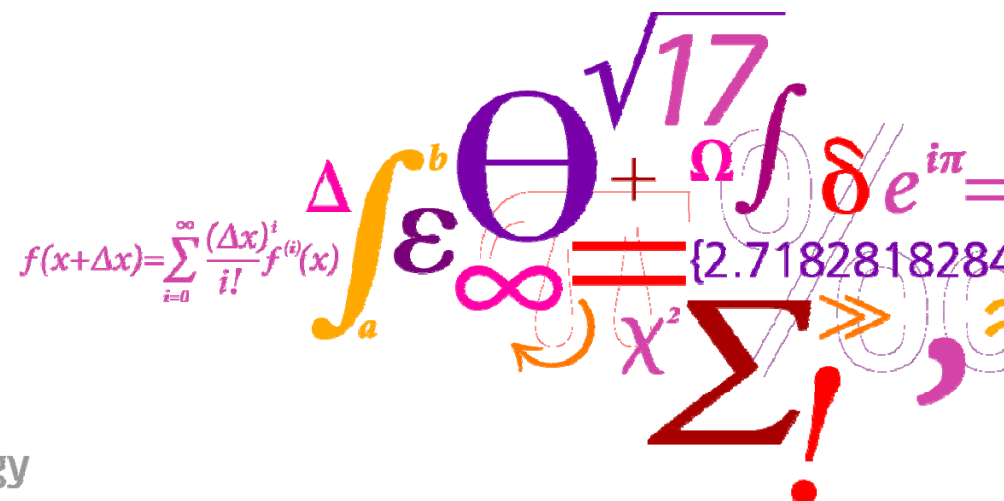
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Support Schemes and Risk Premiums for Renewable Energy Technologies

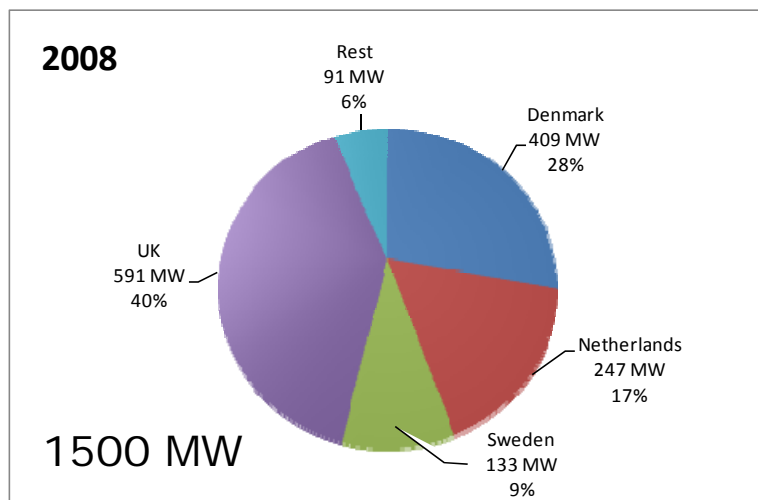
Poul Erik Morthorst, Risø DTU

Stine Grenaa Jensen, Danish Energy Association

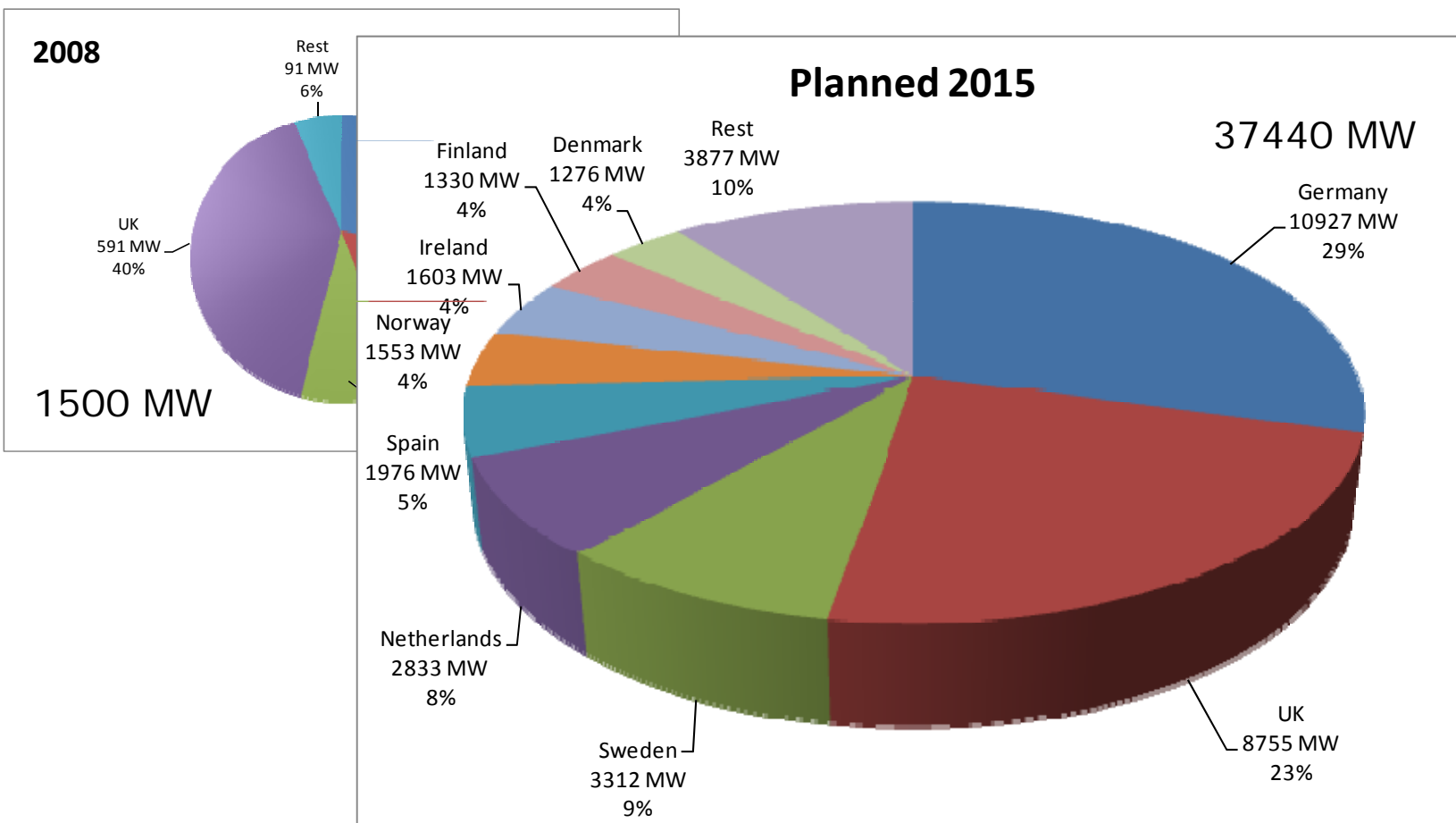
14. September 2009



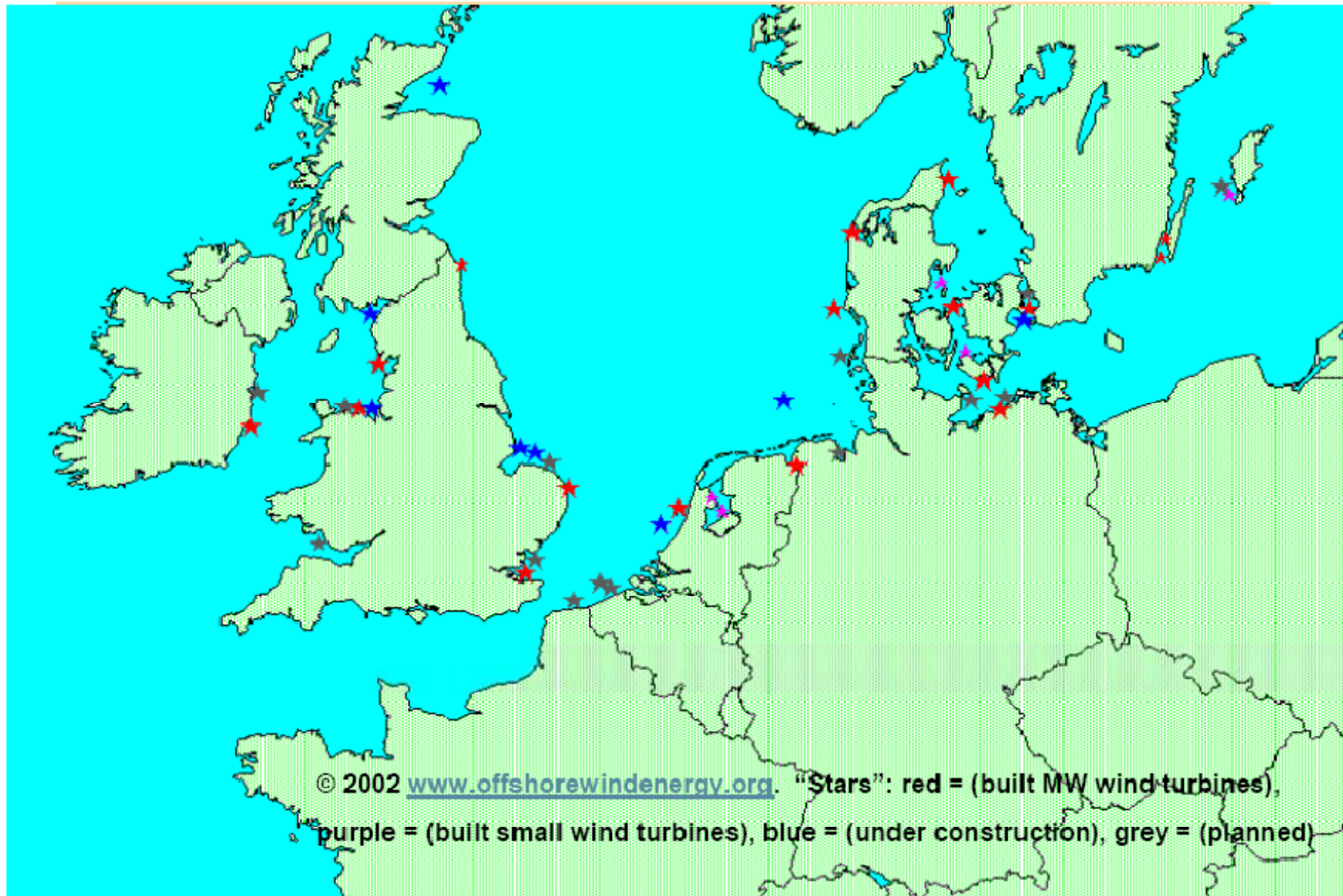
Offshore Wind Power Development



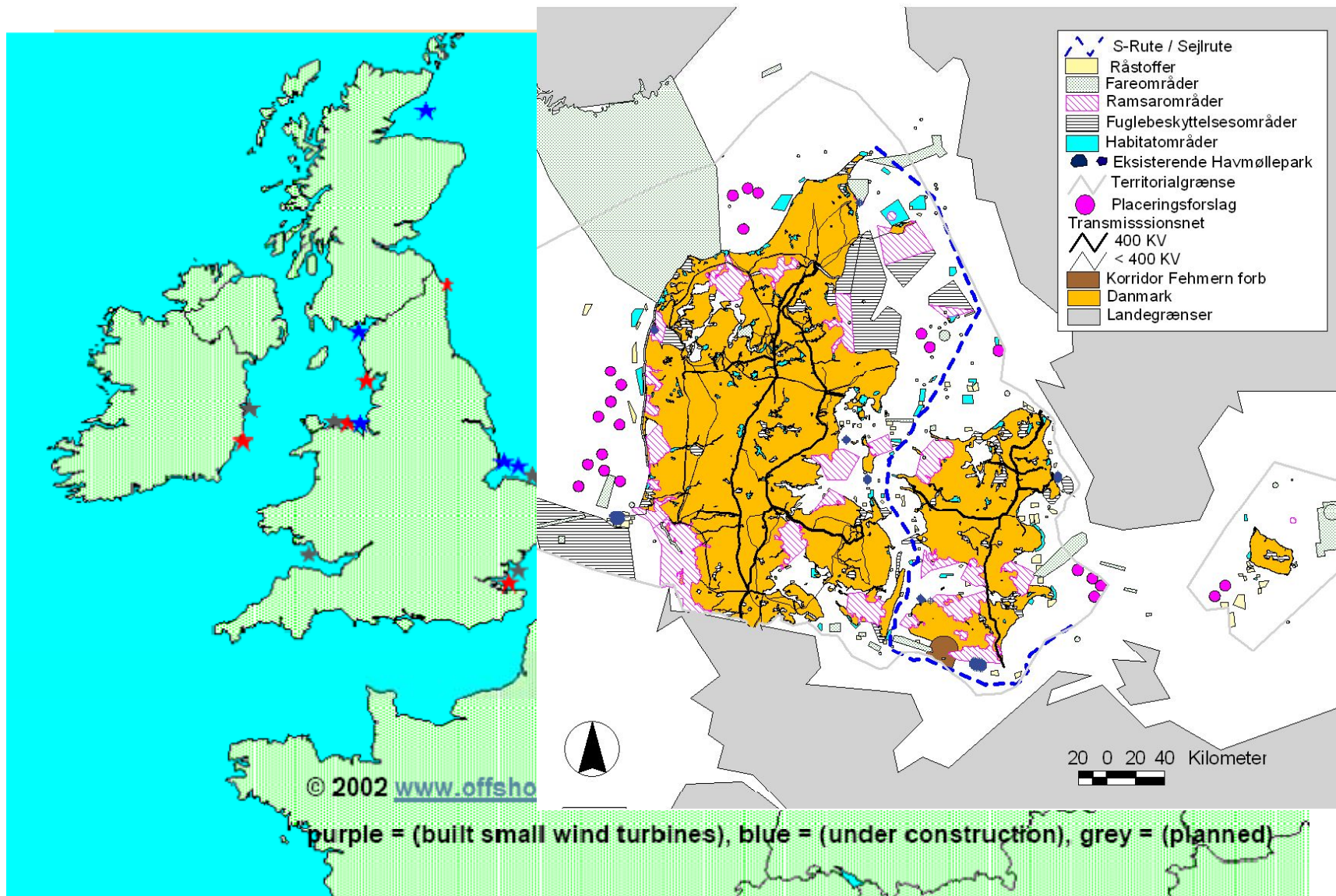
Offshore Wind Power Development



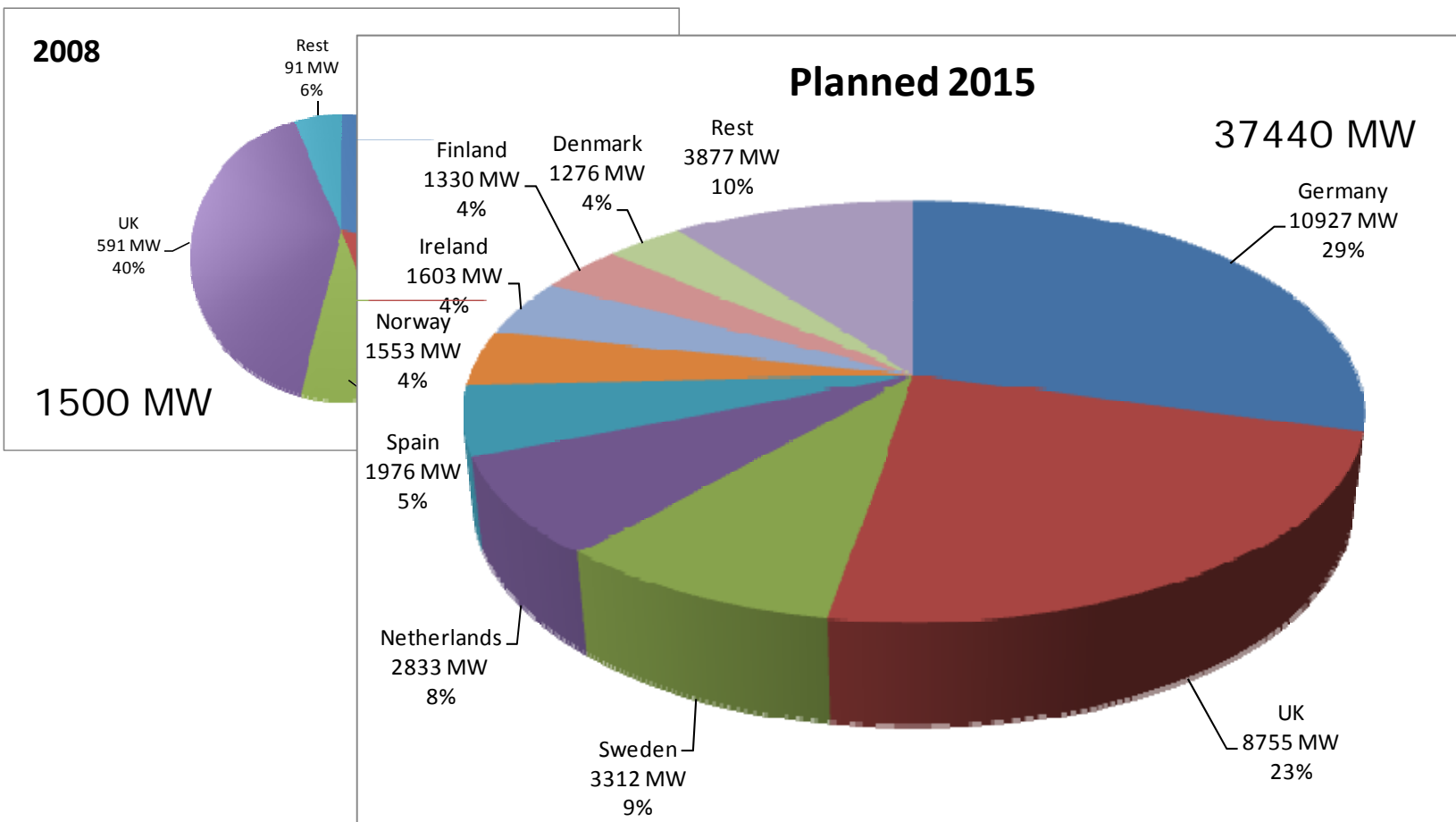
Offshore Wind Farms – Built and Planned



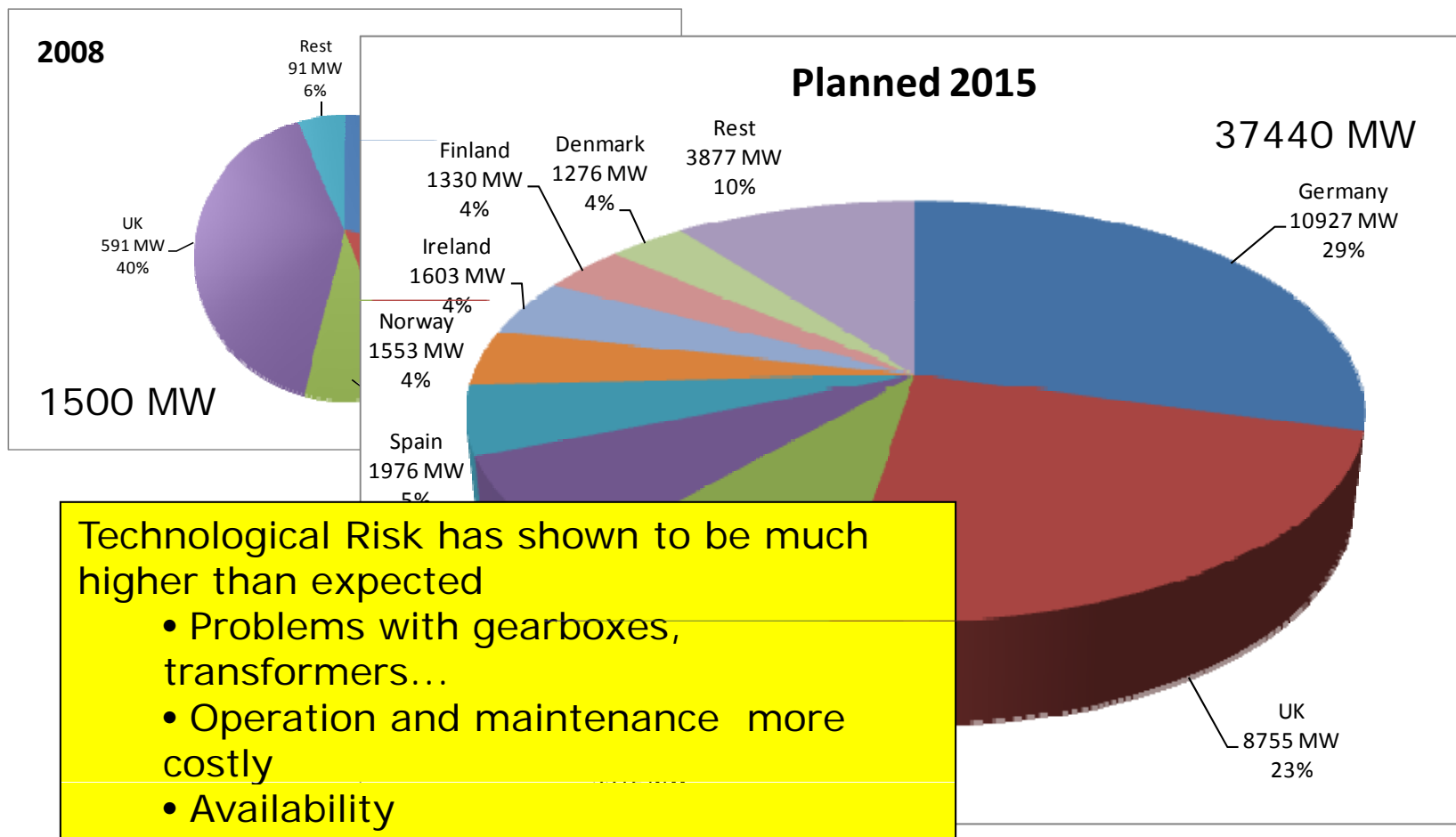
Offshore Wind Farms – Built and Planned



Offshore Wind Power Development



Offshore Wind Power Development



Risk and Uncertainty

- **Technological Risk**

- Investment Costs
- Maintenance Costs
- Production
- Availability
- Lifetime

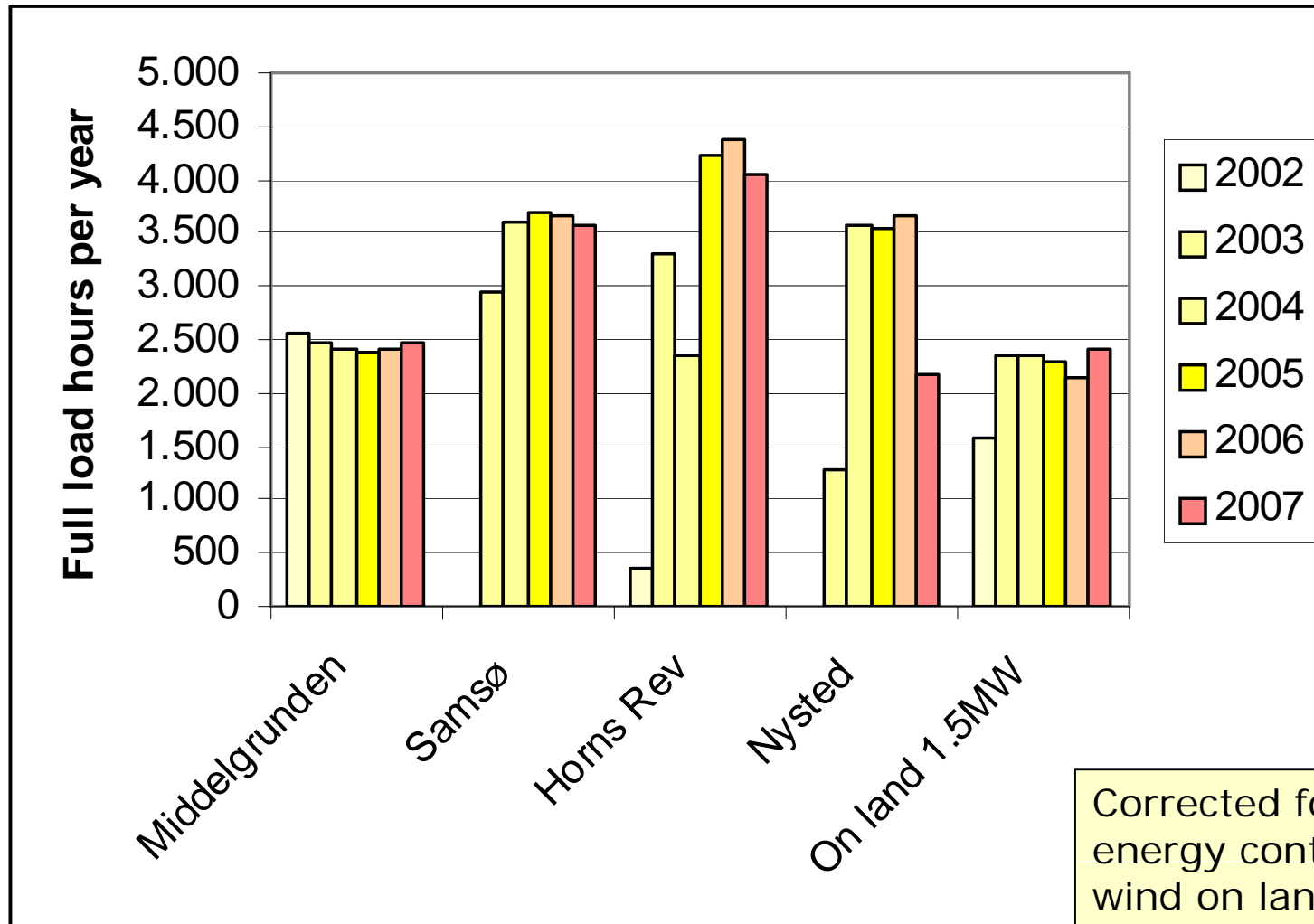
- **Regulatory Risk**

- Support Levels
- Market design

- **Market Risk**

- Power price
- Competition
- Fuel prices
-

Experiences until now with Offshore wind power production



Corrected for energy content in wind on land

Risk and Uncertainty

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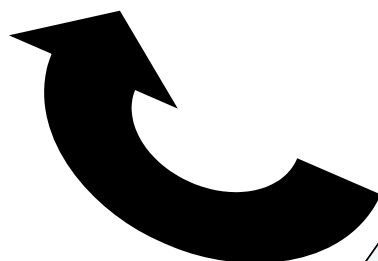
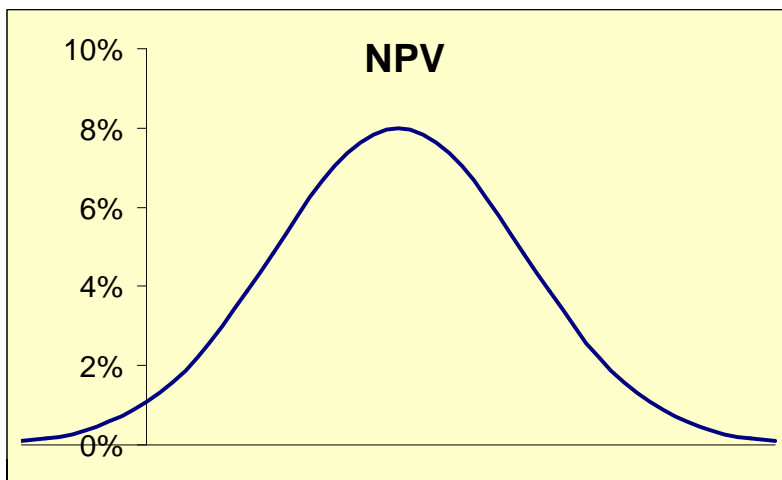
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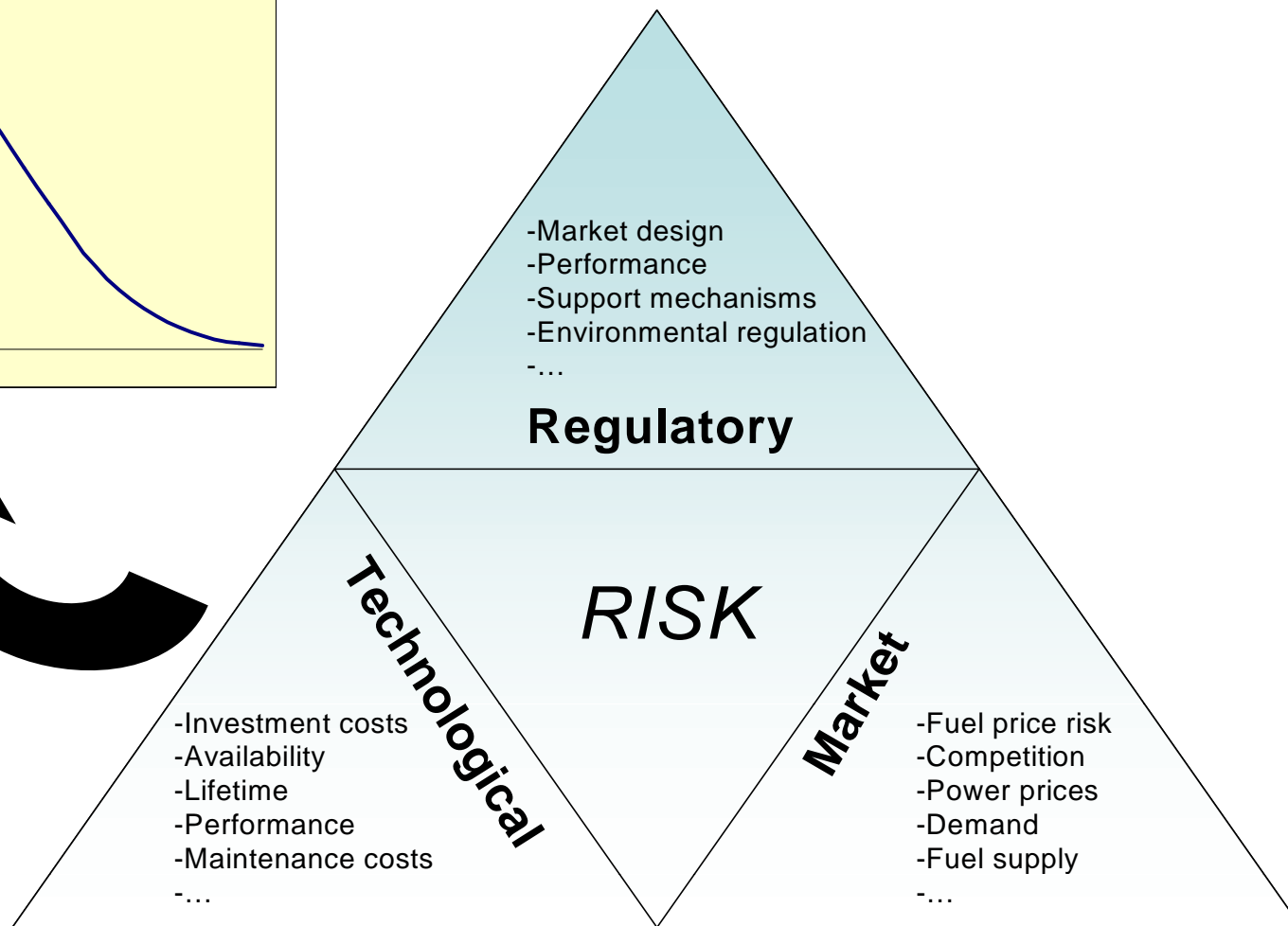
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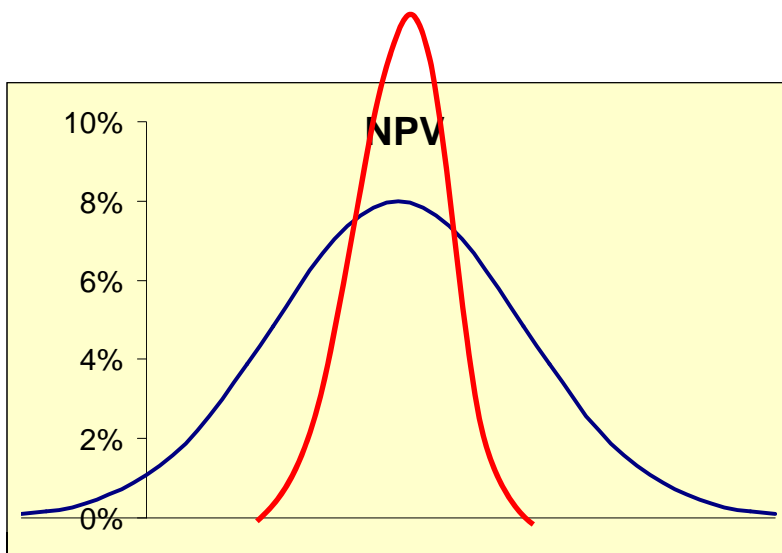
Risk and Uncertainty



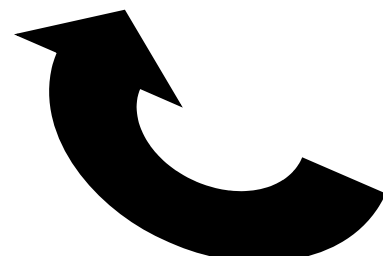
Uncertainty in Return of Investment



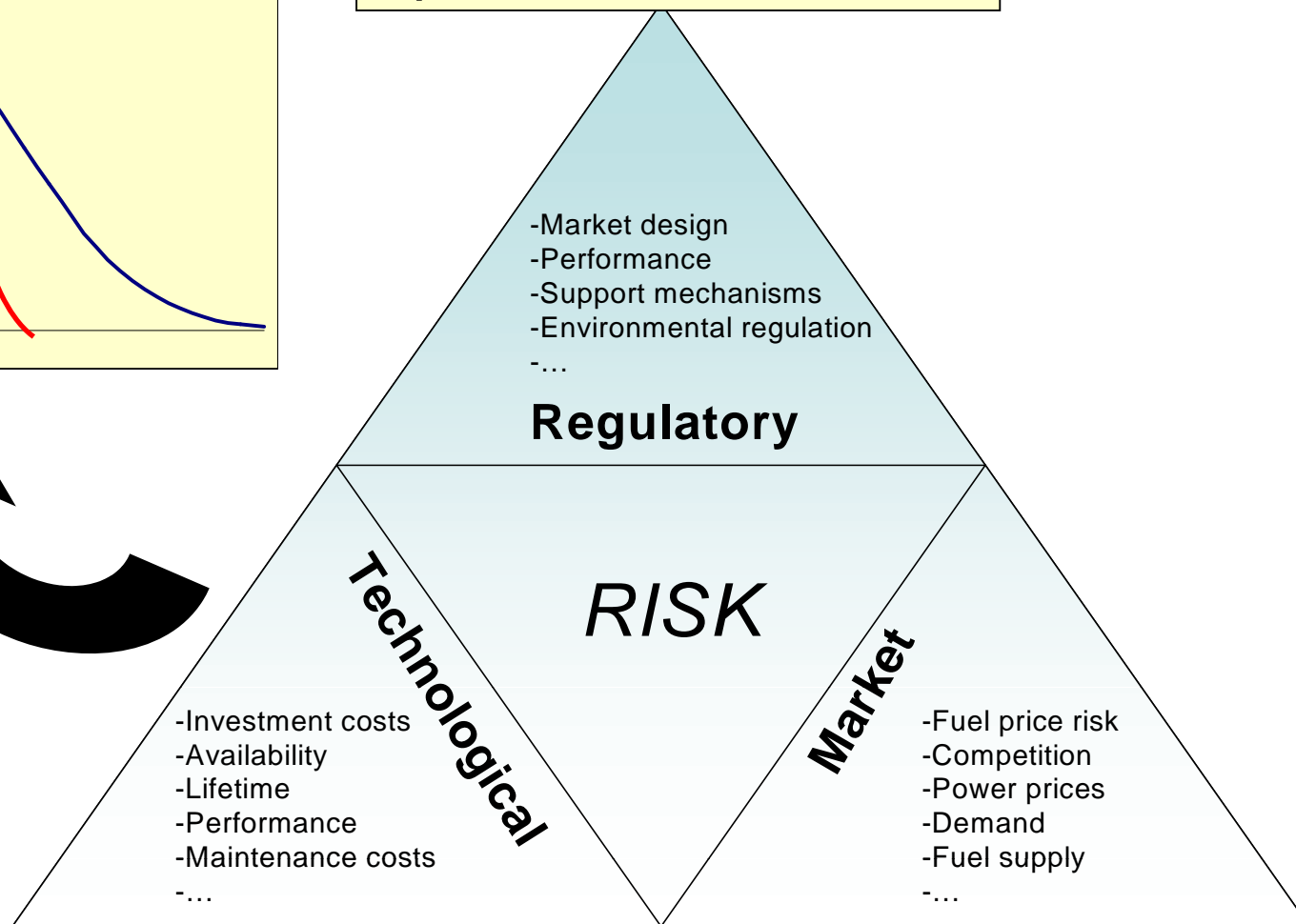
Risk and Uncertainty



Ex ante optimisation

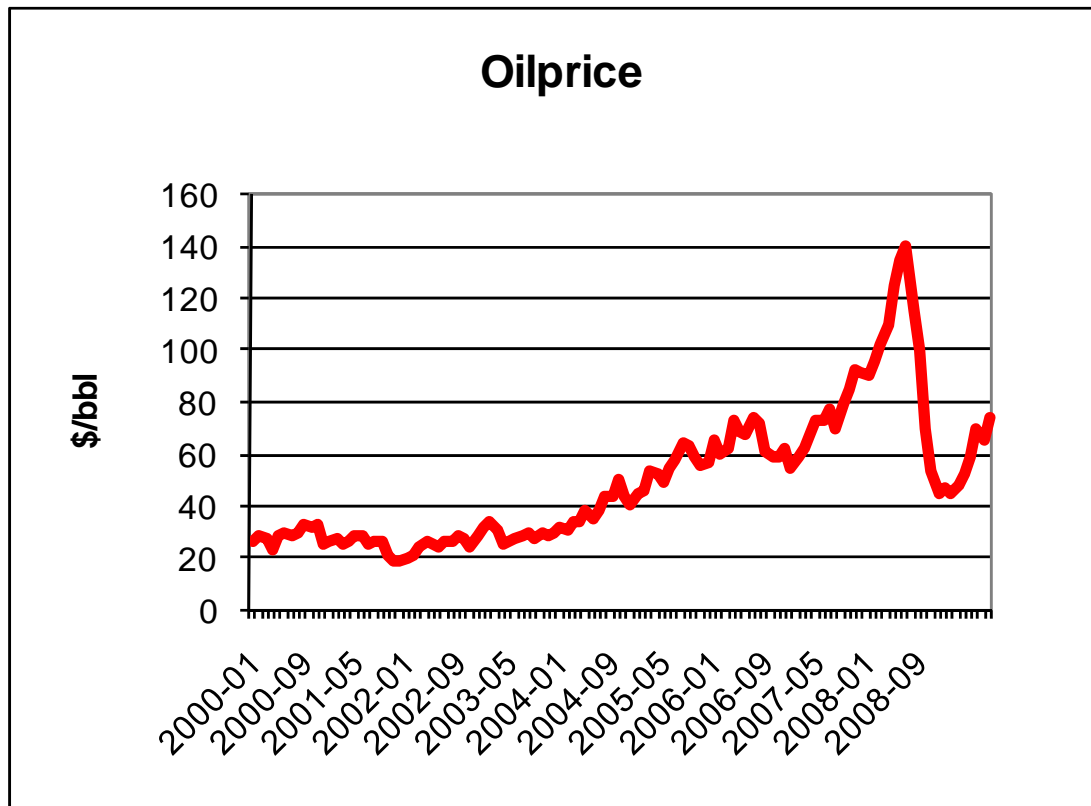


Uncertainty in Return of Investment



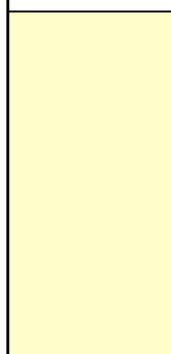
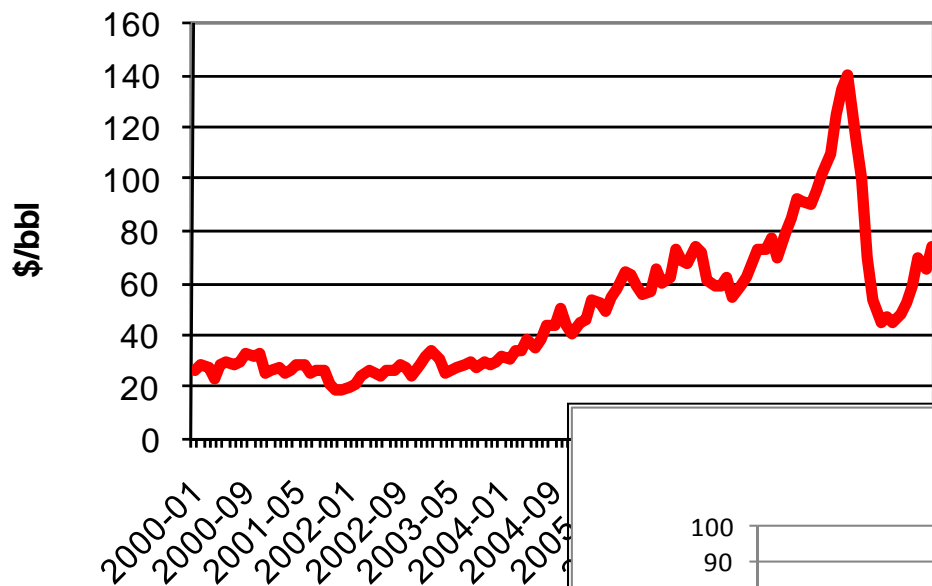
Ex ante optimisation

- **Technological Risk**
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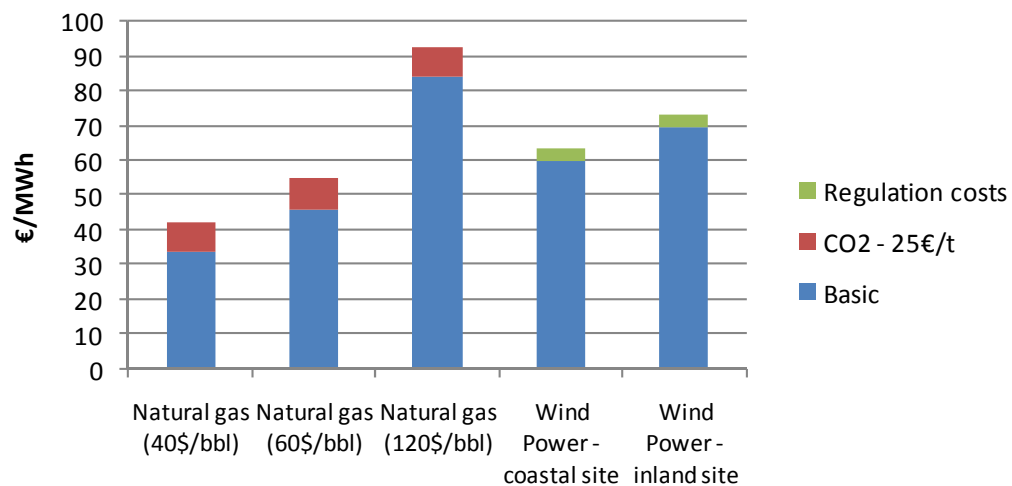


- Market design
- **Market Risk**
 - Power price
 - Competition
 - Fuel prices
 -

Oilprice



- Market
- Market
- Power
- Compe
- Fuel pr
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Ex ante optimisation

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Ex-post optimisation

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Ex post

When the turbine is established the sum of Risks is (almost) constant

- **But we can pay somebody else to bear the risk for us**
 - *We can hedge the power price*
 - *We can agree on a prepaid service contract*
 - *We can buy a production warranty*

- **... and, of course, some companies are more suited than others for taking risks**

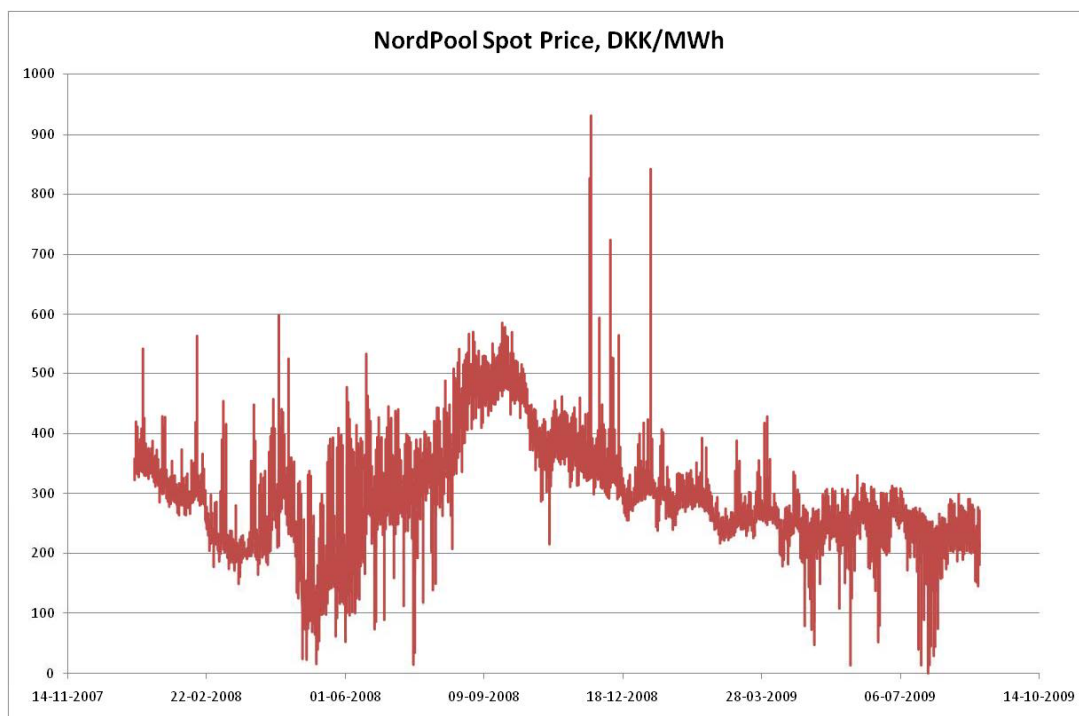
Comparison of two support systems:



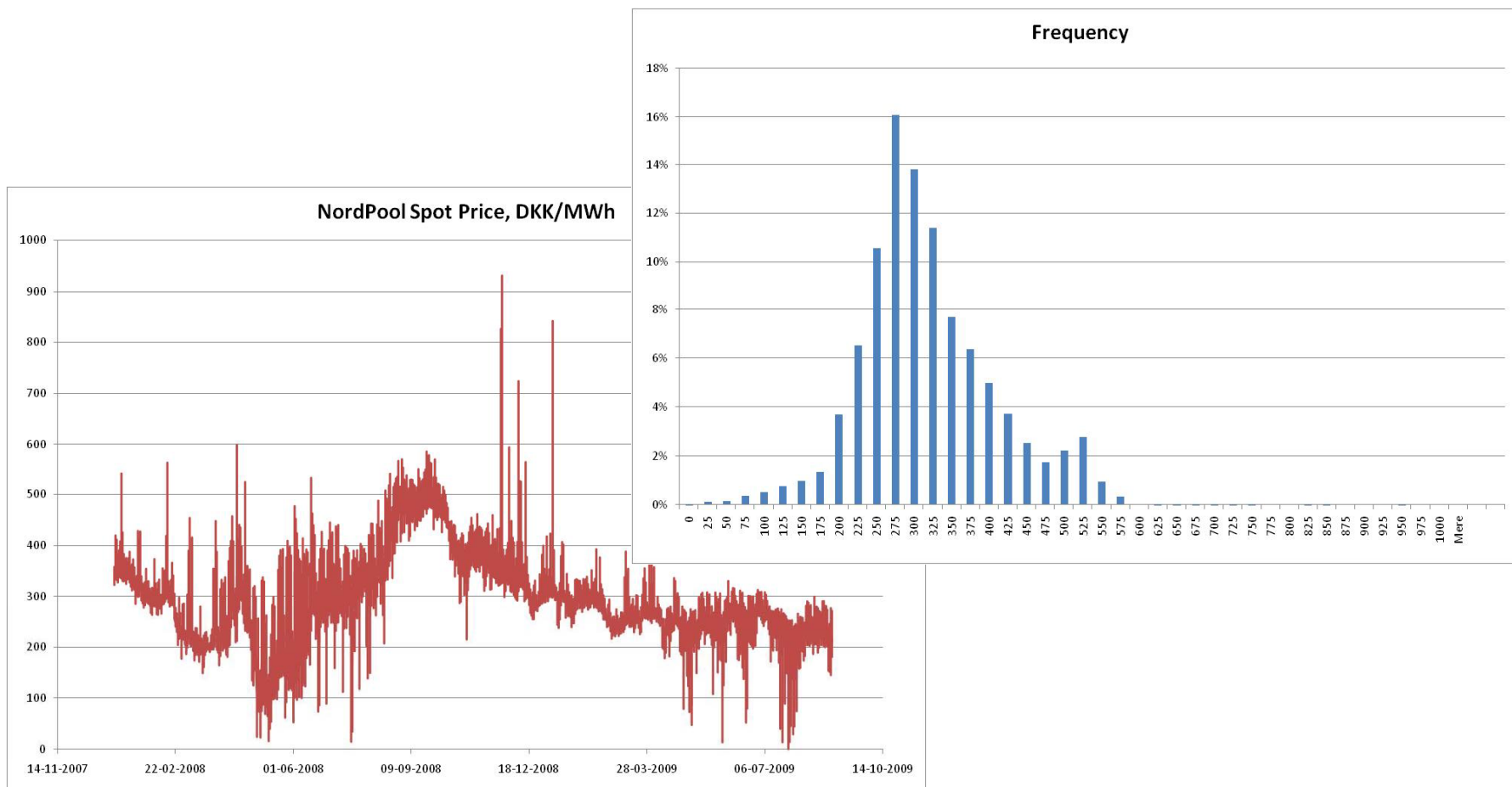
- A premium system and a fixed feed-in system
- Two actors: The private investor and the state

• Power price (average):	50 €/MWh
• Power price (std.):	5 €/MWh (10 %)
• Premium:	34 €/MWh
• Fixed feed-in:	84 €/MWh
• Duration:	44,000 Full Load Hours
• Discount rate:	6 %
• Production:	4000 h/MW/year

Development of Power Price



Development of Power Price

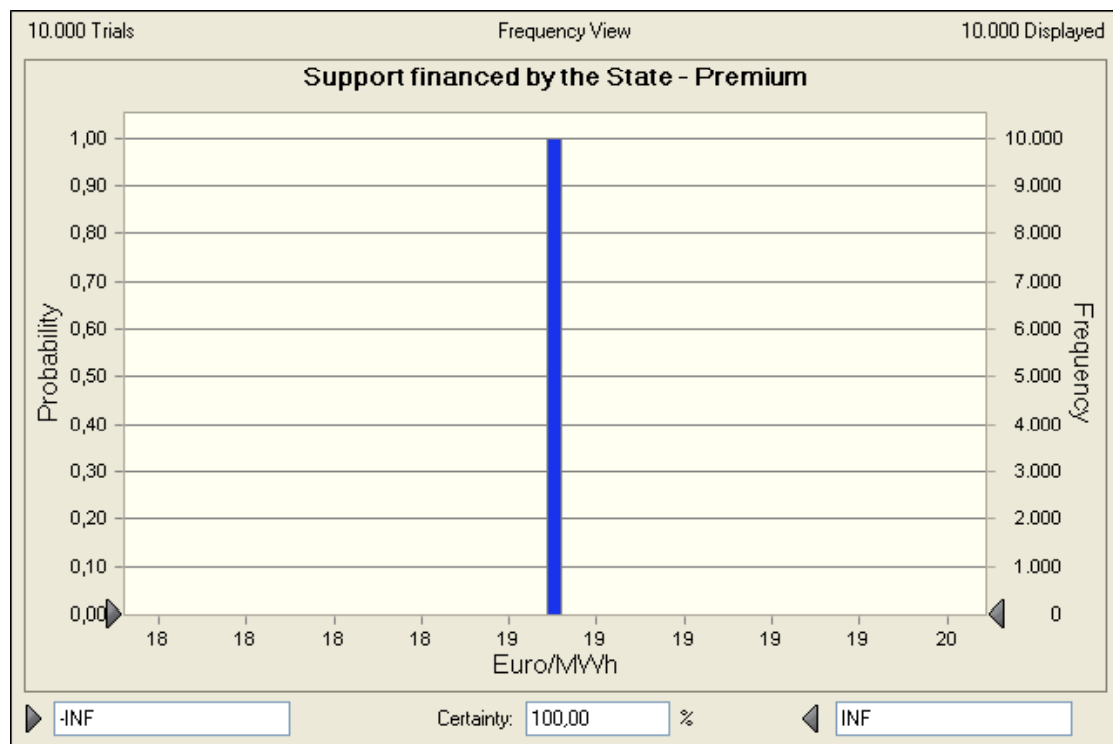


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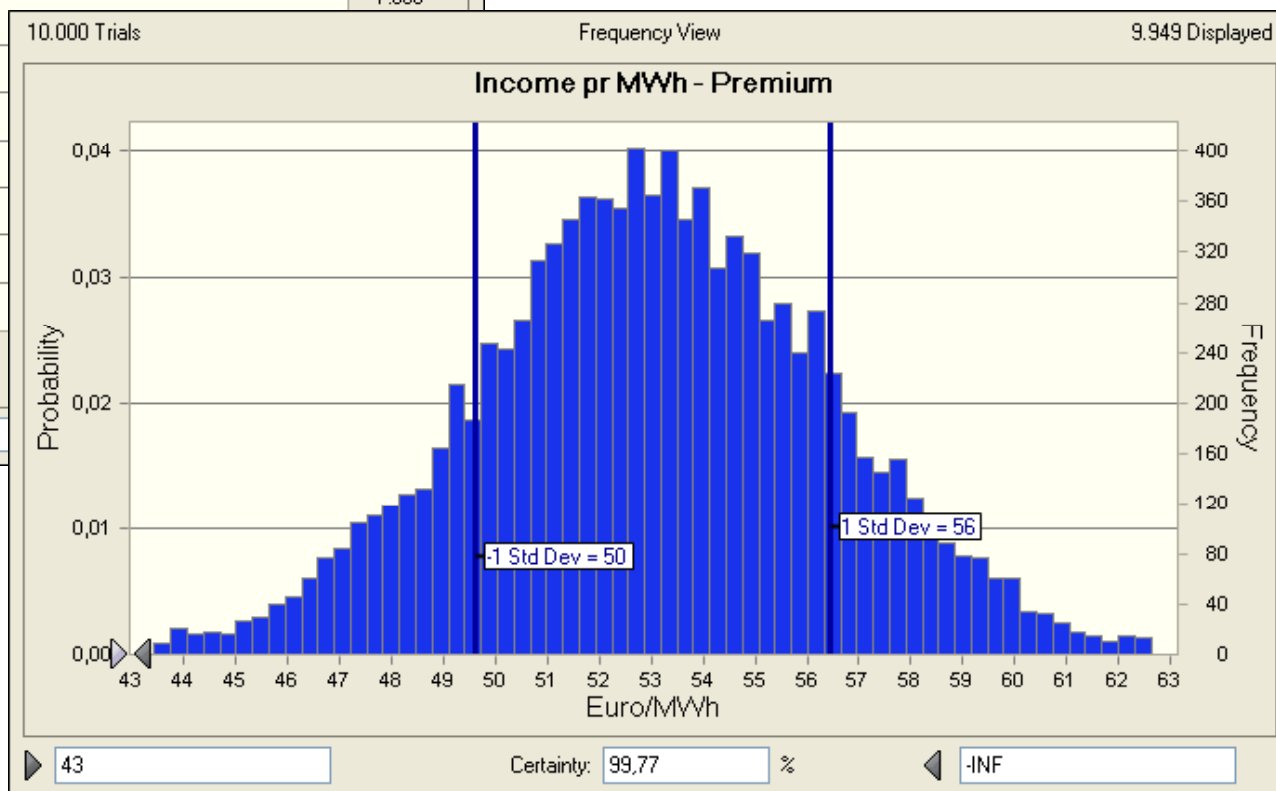
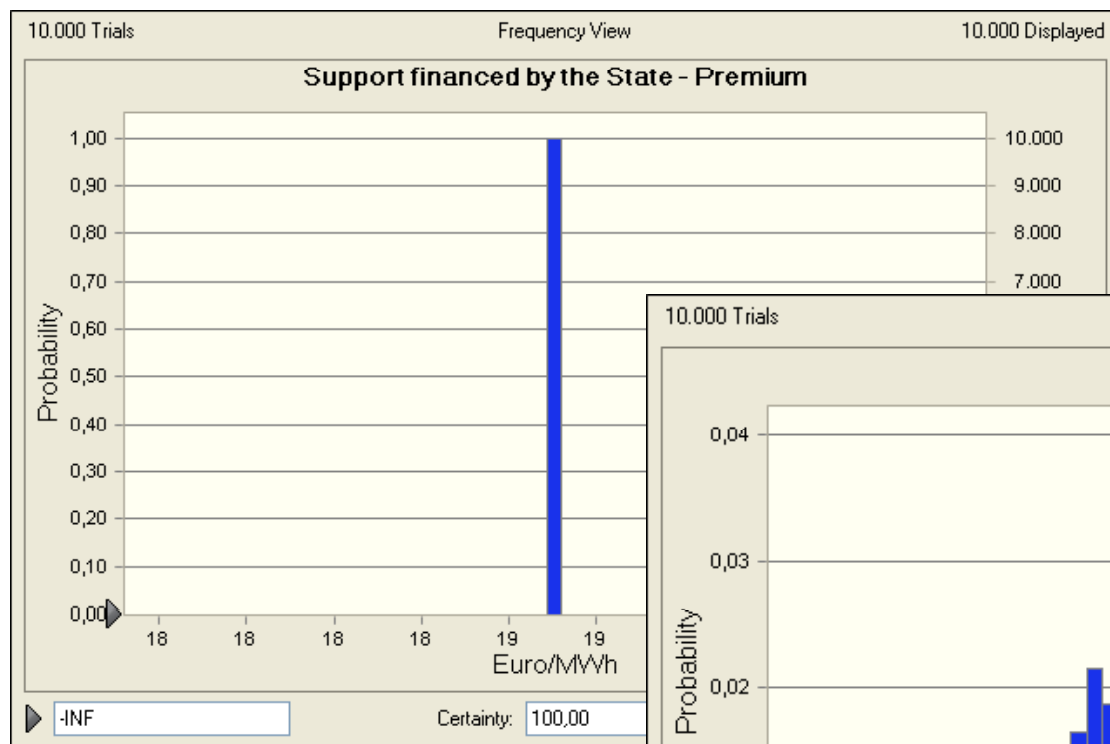
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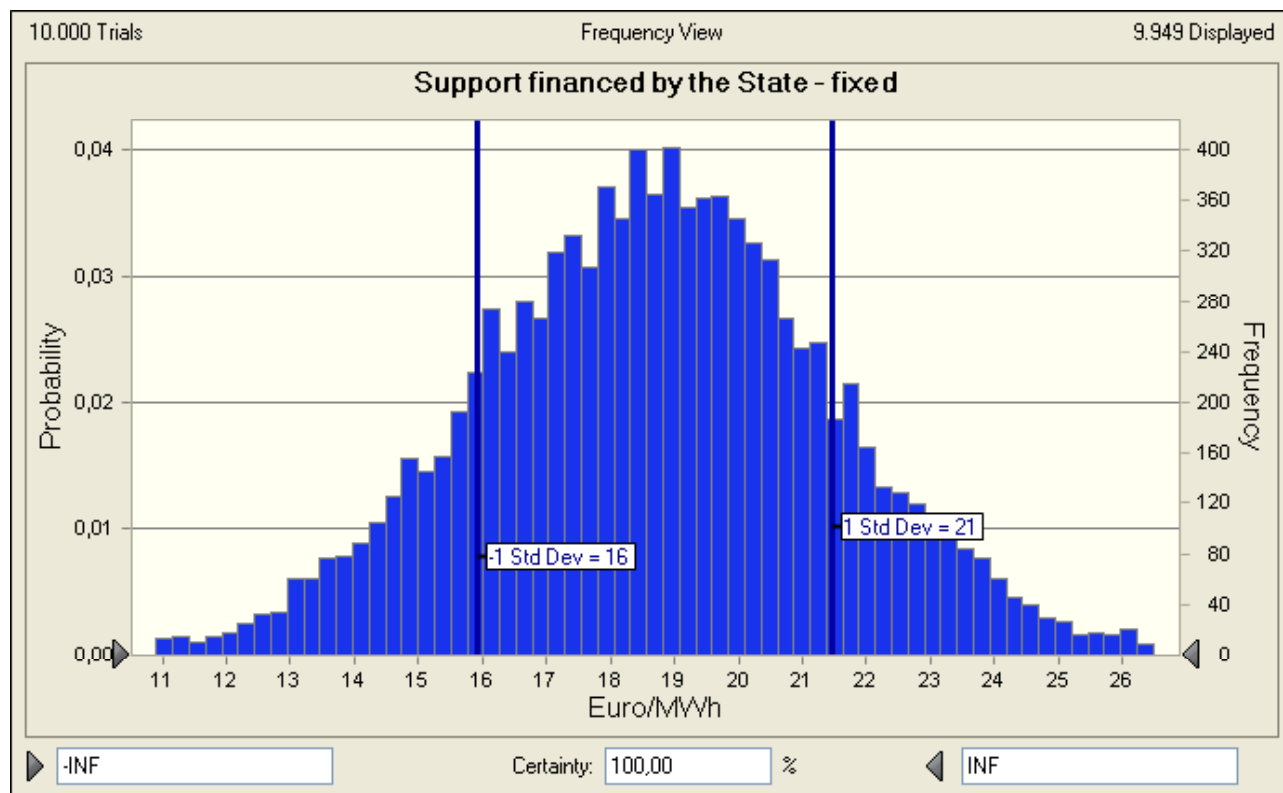
Premium Feed-in



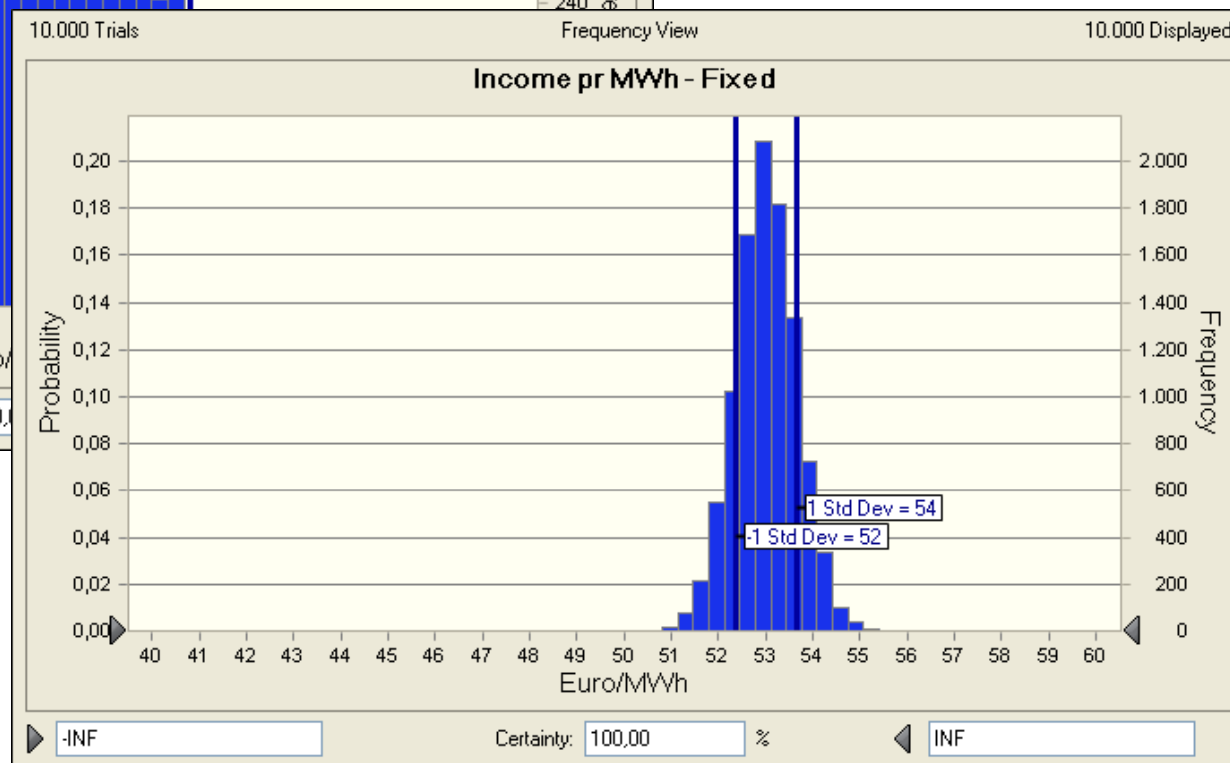
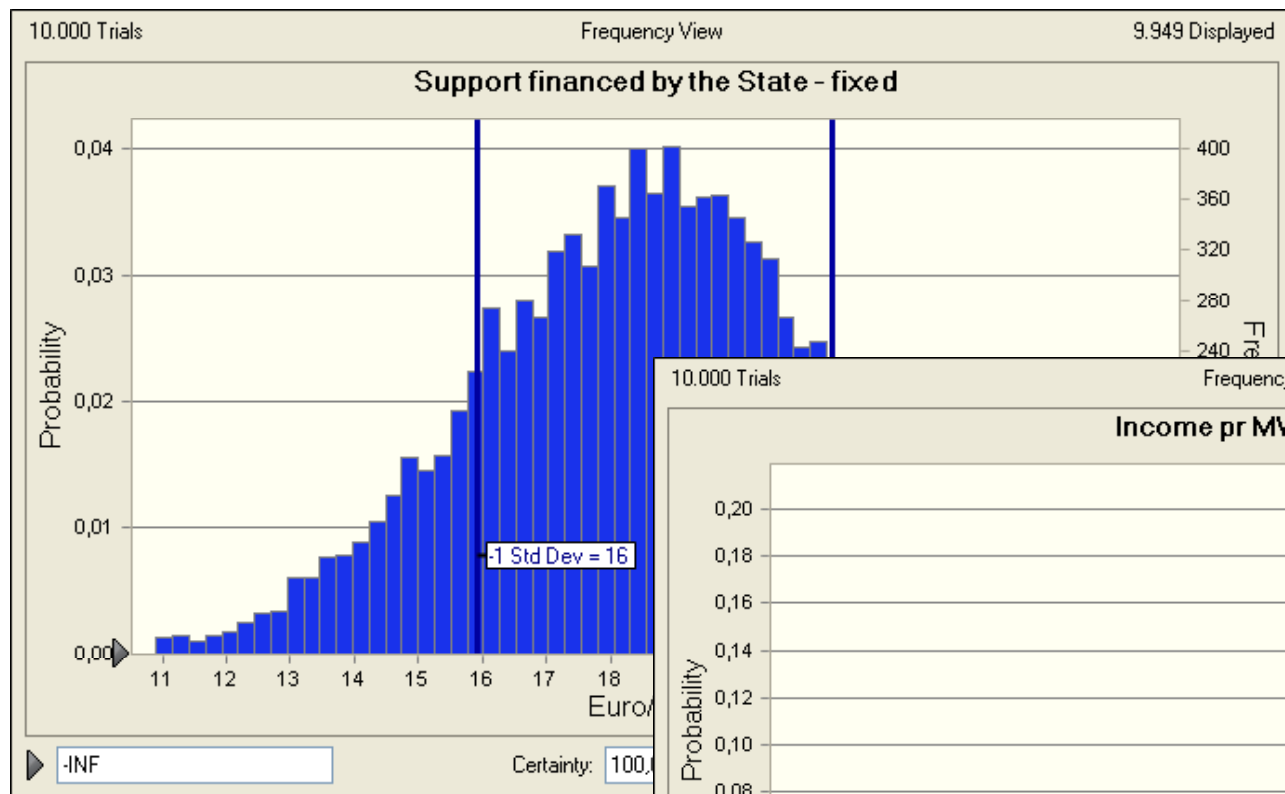
Premium Feed-in



Fixed Feed-in



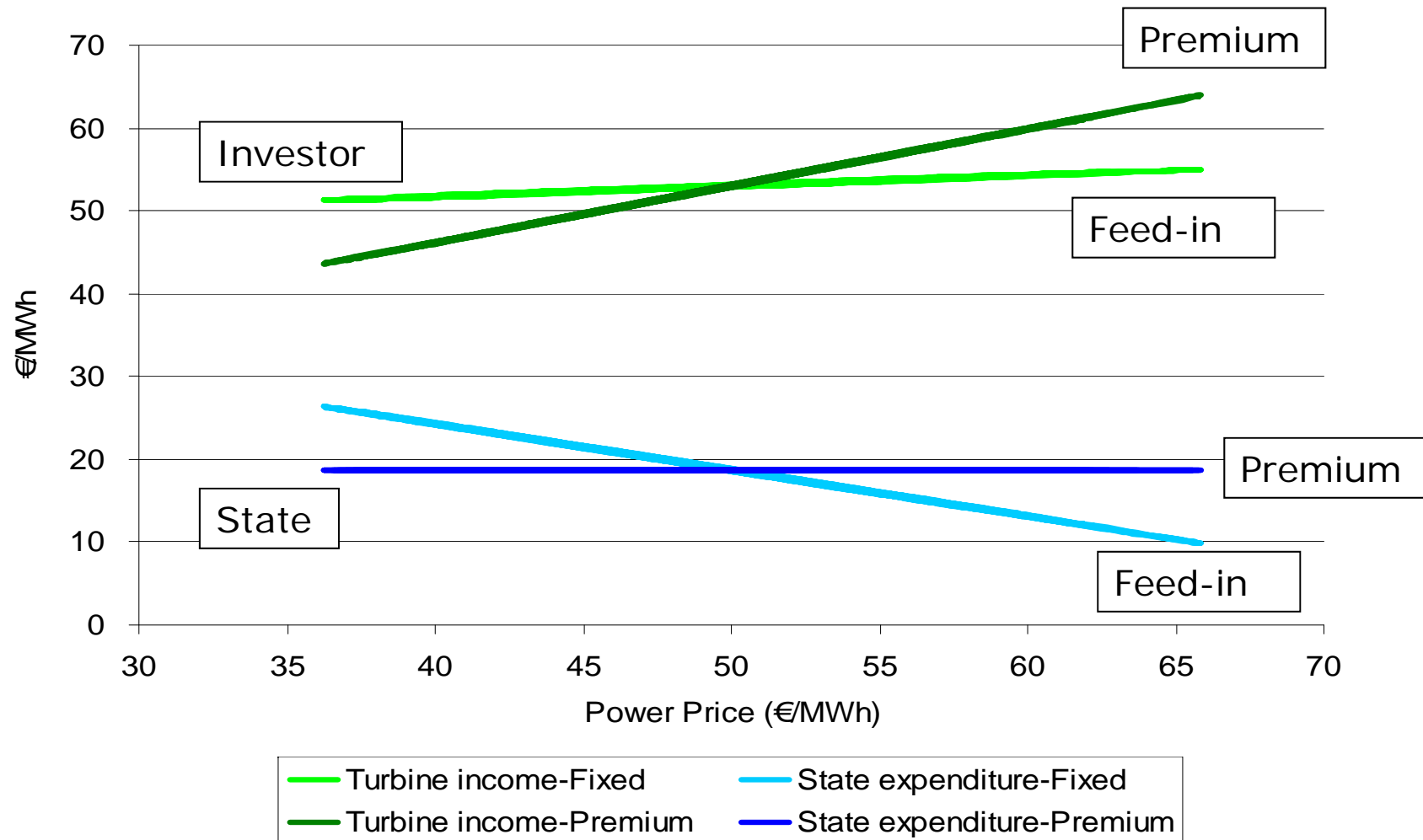
Fixed Feed-in



Risk for the State and the turbine owner

		<i>State</i>	<i>Turbine</i>
<i>Support</i>	<i>Premium</i>	0	3.42
	<i>Fixed</i>	2.78	0.64

Correlation between Price and Support



Conclusions

- **After the turbine is established the sum of risks is constant**
 - *But some companies/organisations might be better suited to bear the risk*
- **A premium system might for the private investor have a five-fold higher risk than a feed-in system**
 - *The state bears a high risk in the feed-in scheme*
- **If the state bears part of the risk this might imply a lower risk premium for society at large**