

Renewable energies and Power Prices
-
Incentives to Invest under Different Support Schemes

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Overview



- Political Framework
- Power Market
- Green Certificate Markets (RECs / GoO etc...)

Political Framework for Wind Energy



- EU Climate & Energy Package (23 January 2008)
 - 20 % renewables in 2020
 - Transportation
 - Heat
 - Power
- “Pilot Study Renewable Energies 2007” (Federal Ministry for the Environment, Germany)
 - Almost 80 % of power production from renewables in 2050
 - About 50 % of installed capacity = wind



How can we meet such targets in liberalised markets?

- Support schemes (for transitional period)
- Competitiveness in liberalised markets

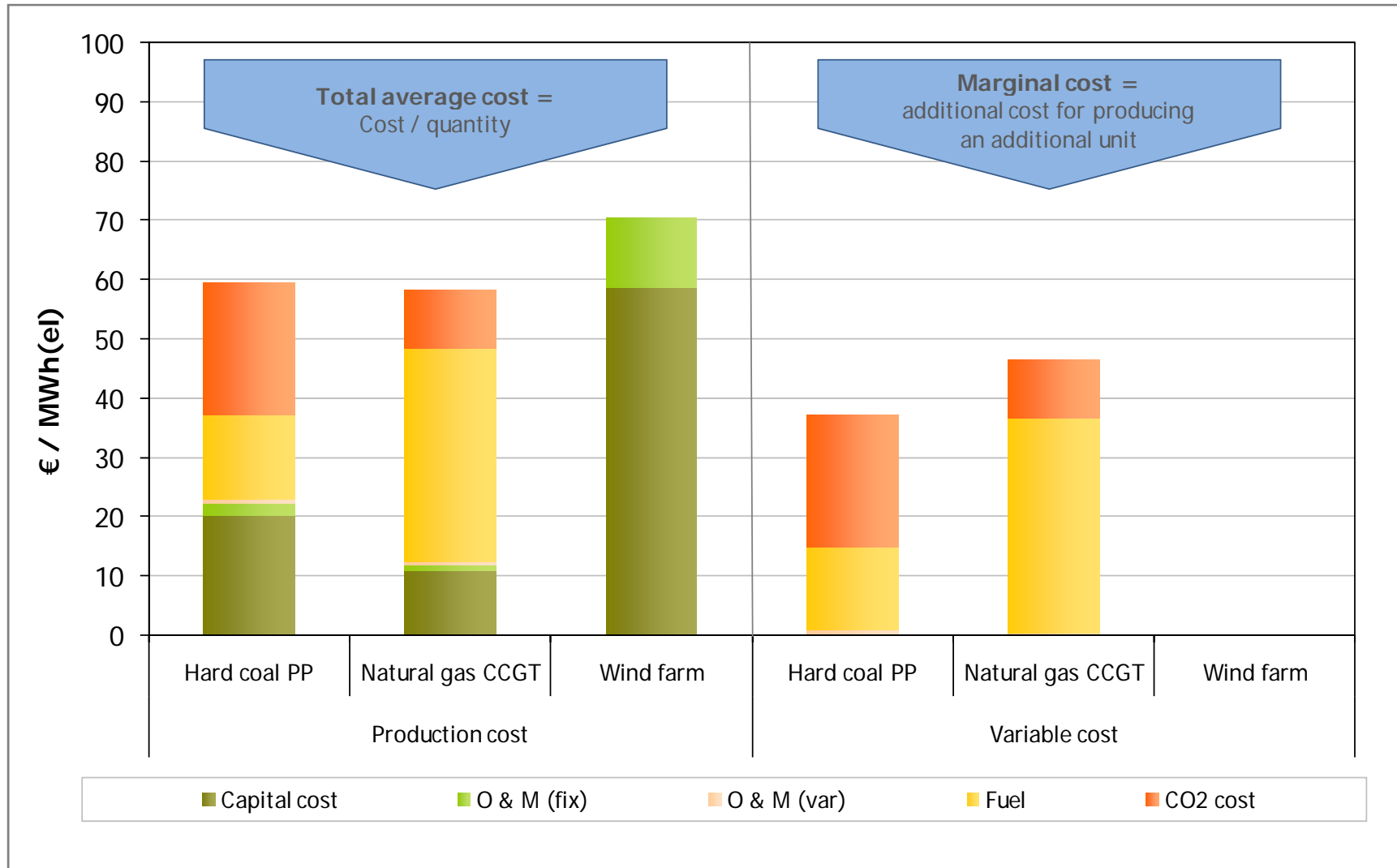
Investment decision vs. operation decisions



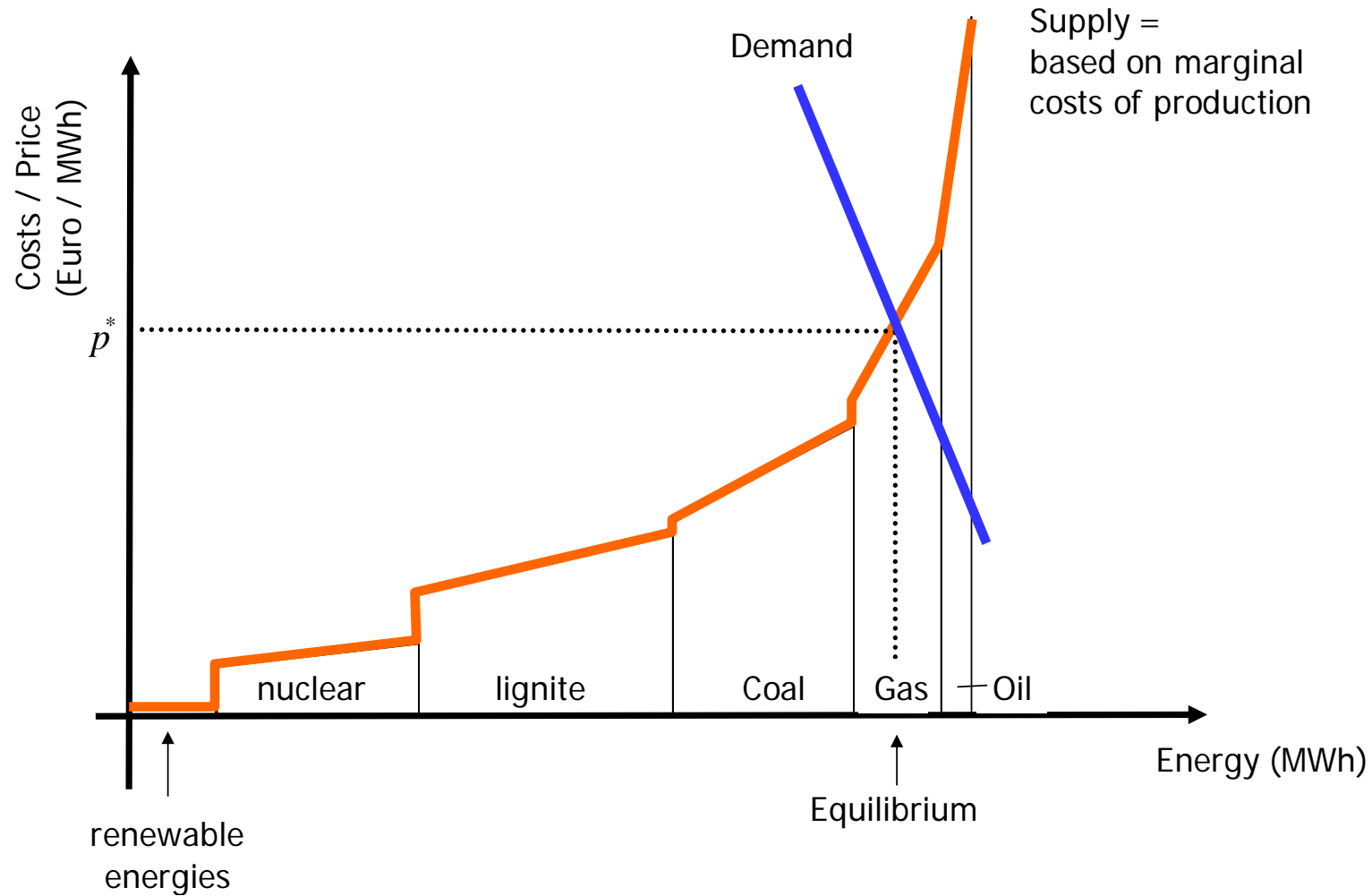
- Investment decision
 - Invest if total average costs (TAC) smaller average revenue (=price)
 - As TAC for renewable greater "price"; little incentive for investments
 - Public support schemes in place

- Operation decision (existing plant)
 - Offer at marginal costs
 - Supply if marginal costs are smaller / equal price

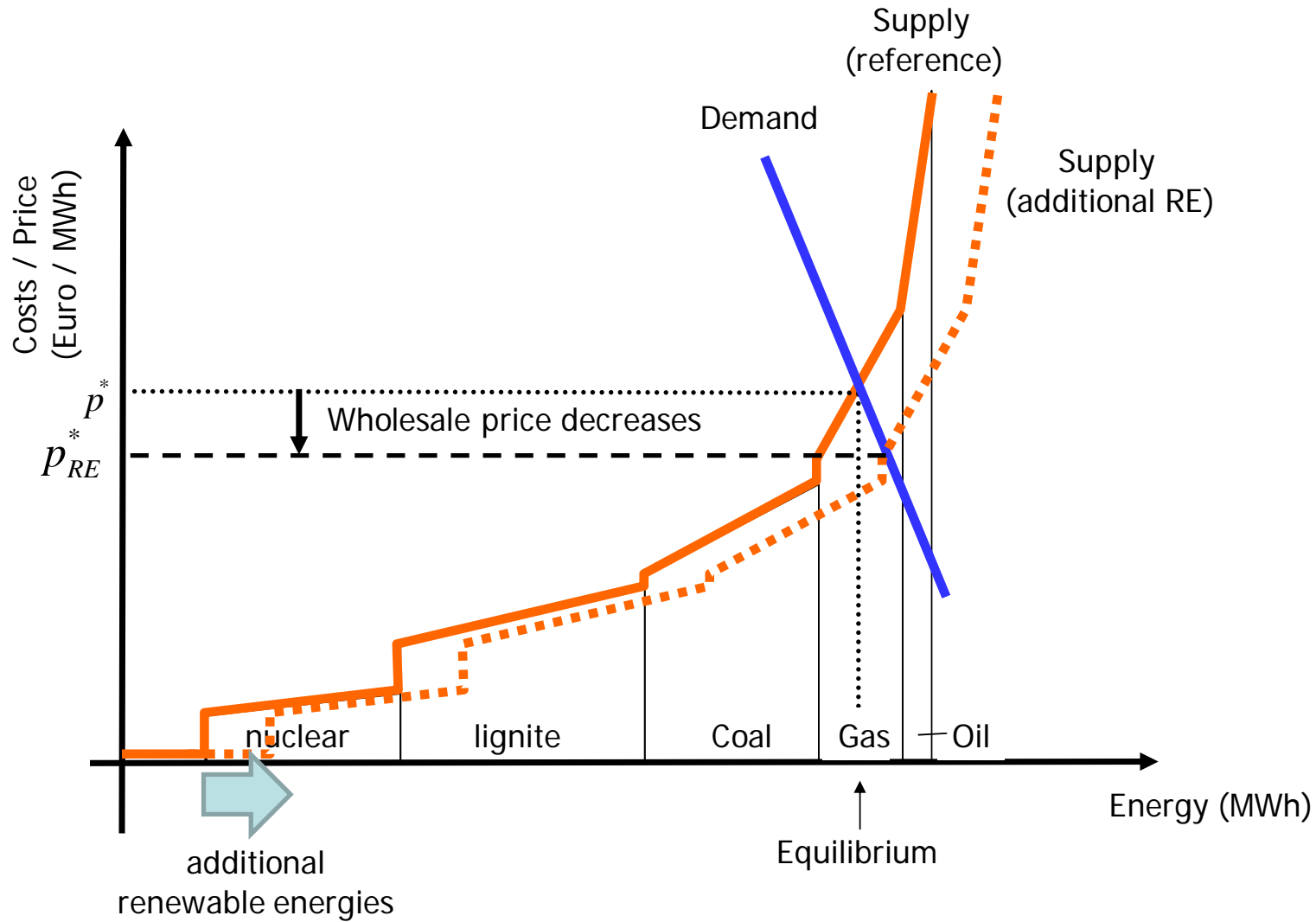
Different types of "costs" available in economic theory with different relevance for investments



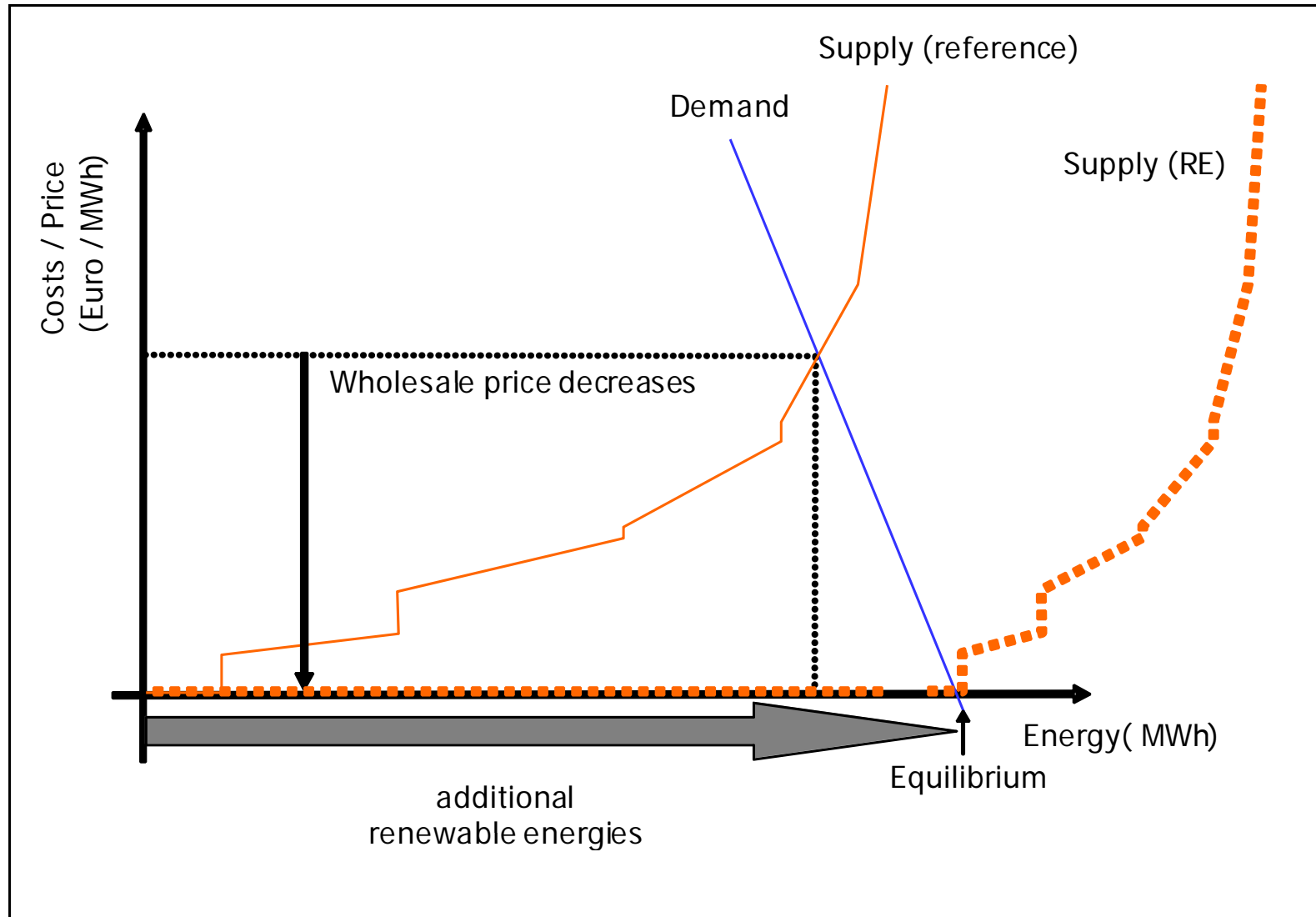
Price Formation in Competitive Markets (1/3)



Price Formation in Competitive Markets (2/3)



Price Formation in Competitive Markets (3/3)



RE and its impact on power prices (and vice versa)



- With increase in capacity of RE installations (with small marginal costs), the power price decreases:
 - Average annual power price
 - Hourly power price (especially with strong wind)

- Consequently, the average revenue of wind farms also decreases (always) if they produce.
 - Example: strong wind, weak demand → power price zero → no revenue

- The characteristics of costs and fluctuating supply results in an inherent revenue problem for RE installation (the stronger, the higher the market penetration is)
 - Incentive to invest in additional installations decreases with increasing market penetration in liberalise markets

Support schemes necessary - but which is suitable?



Support schemes discussed by means of income stream types

Remuneration for:	Power	Greenness of power	Power	Greenness of power	Power	Greenness of power
		variable	variable	variable	fixed	fixed
Scheme type	Quota + certificate trade		investment grant		Feed-in tariff	
			Quota with fixed price for certificate		Tender	

RE quota and green certificates (RECs, GoO)?

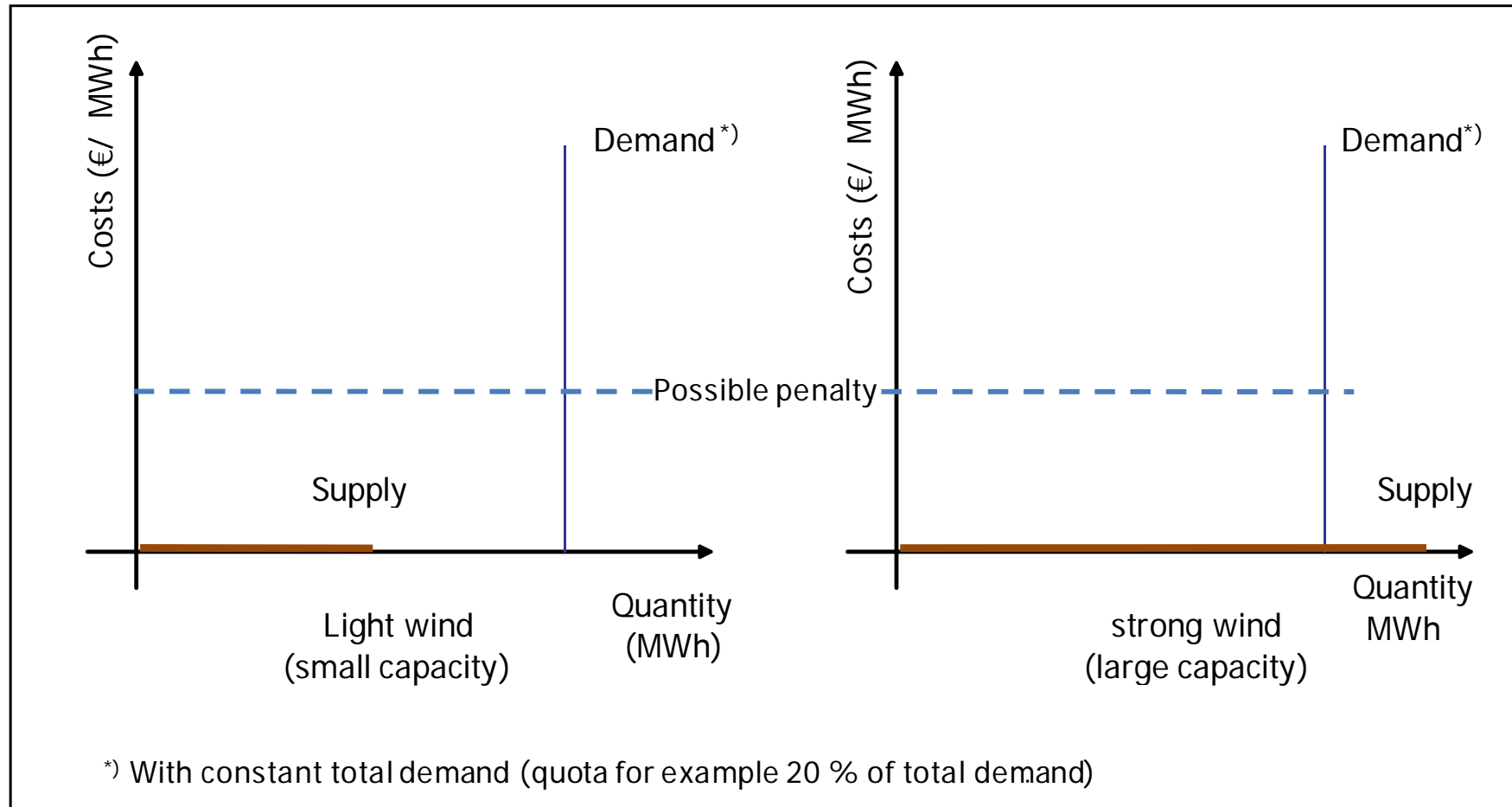


- Power and certificates are joint products
 - Constant relation (1 certificate for 1 MWh electricity fed-in)
- Power is dominant
 - A certificate can only be generated if power is fed-in
- Therefore, rational supply offers at marginal costs on the power market
- If successful s/he gets a green certificate at zero costs “on top”
- All certificate generators supply at zero (marginal) costs
- “Random” price formation on certificate market (next slide)
- Uncertain revenue from sale of certificates

RE quota and green certificates (RECs, GoO)?



Renewable Energy Certificate Market



Willingness-to-pay depends inter alia on buyers expectations on total supply

Conclusion



- Market share of RE is to be increased (considerably)
- With increasing market penetration RE installations face reduced power prices at the time of production / sale
- Revenue risk → risk premium → higher capital costs

- Support schemes necessary even in 2050 if high penetration wanted
- RE quota / green certificates face similar (inherent) problem → incentives to invest under this instrument unclear

- Support schemes with fixed remuneration (feed-in tariffs or tender) possibly more suitable to assure higher market penetration

Discussion

More Questions?
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