

# RENEWABLE ENERGY POLICIES IN GERMANY AND EUROPE IN THE LIGHT OF FALLING ELECTRICITY MARKETS AND RES BECOMING MAINSTREAM

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# AGENDA

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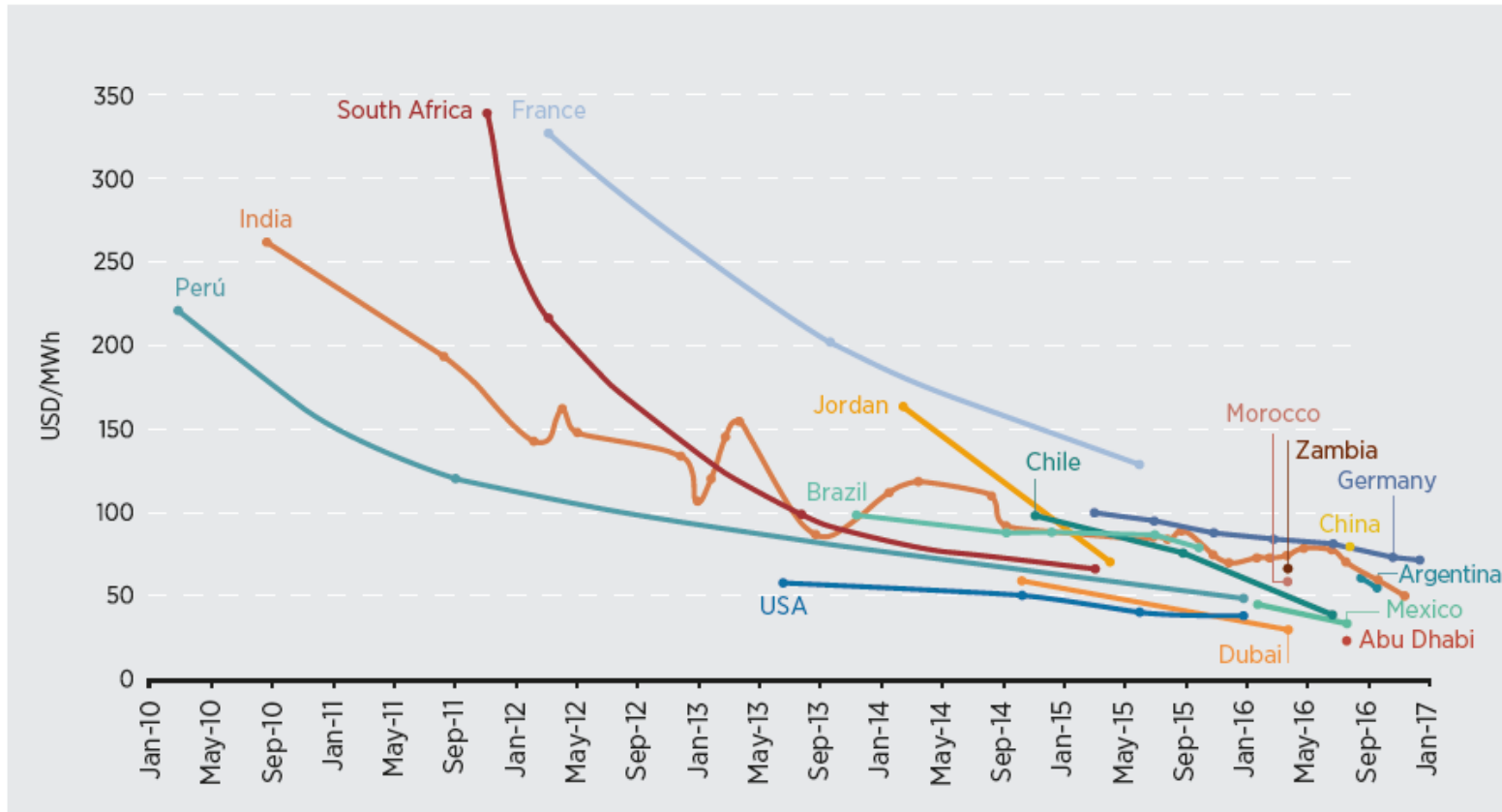
- Renewables: costs and revenues
- Supporting renewables in the electricity sector

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# Renewables: costs and revenues

# RECENT AUCTION RESULTS

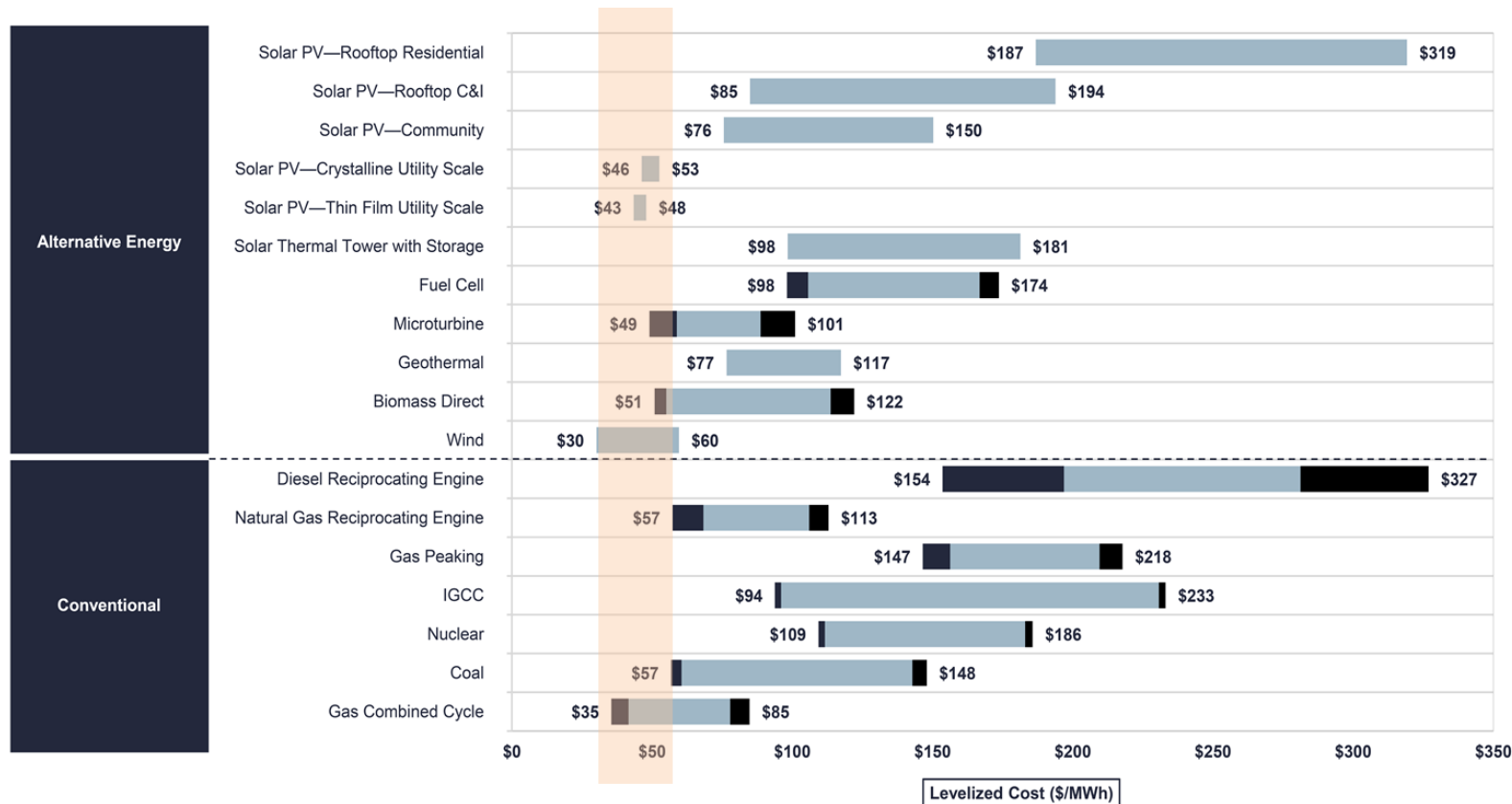


- Decreasing support needs according to auction results
- In some cases even bids of 0 €/MWh
- Auction results influenced by level of competition but can be interpreted as an indication for decreasing costs of electricity generation (and market-based profitability)
- in addition: market-based investment in renewables has already started in many EU countries

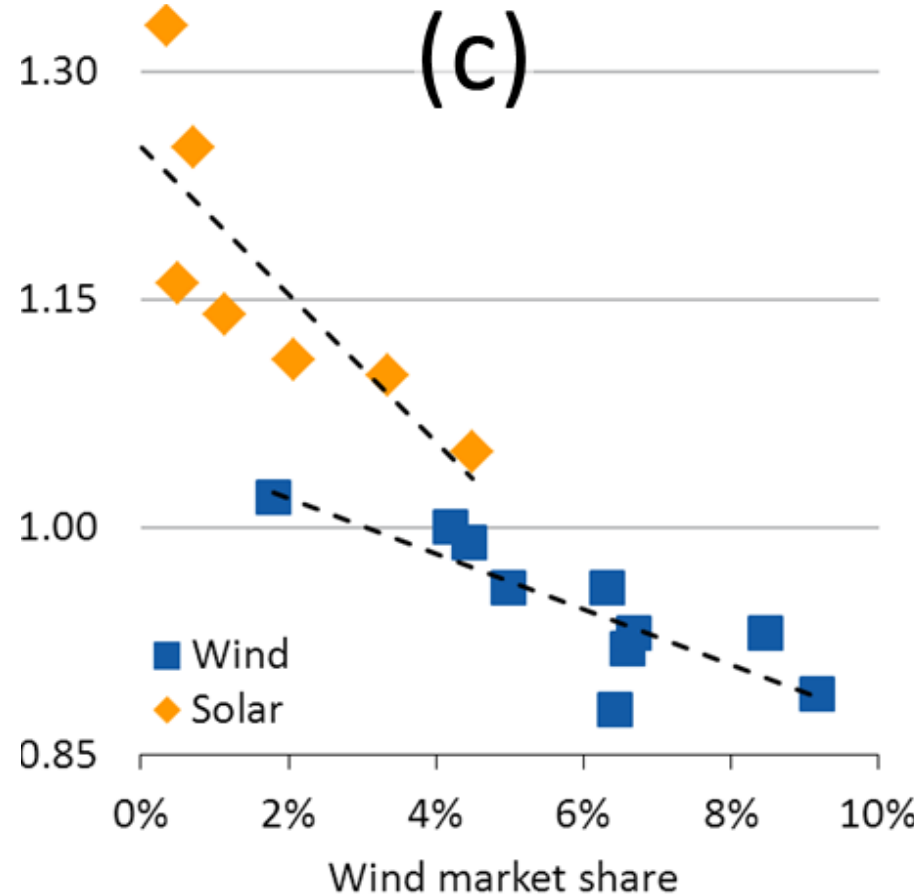
## Auction award prices PV, 2010-2017.

# COSTS OF ELECTRICITY GENERATION

- Costs of renewables (onshore wind, offshore wind and PV) are now below costs of most conventional power plants

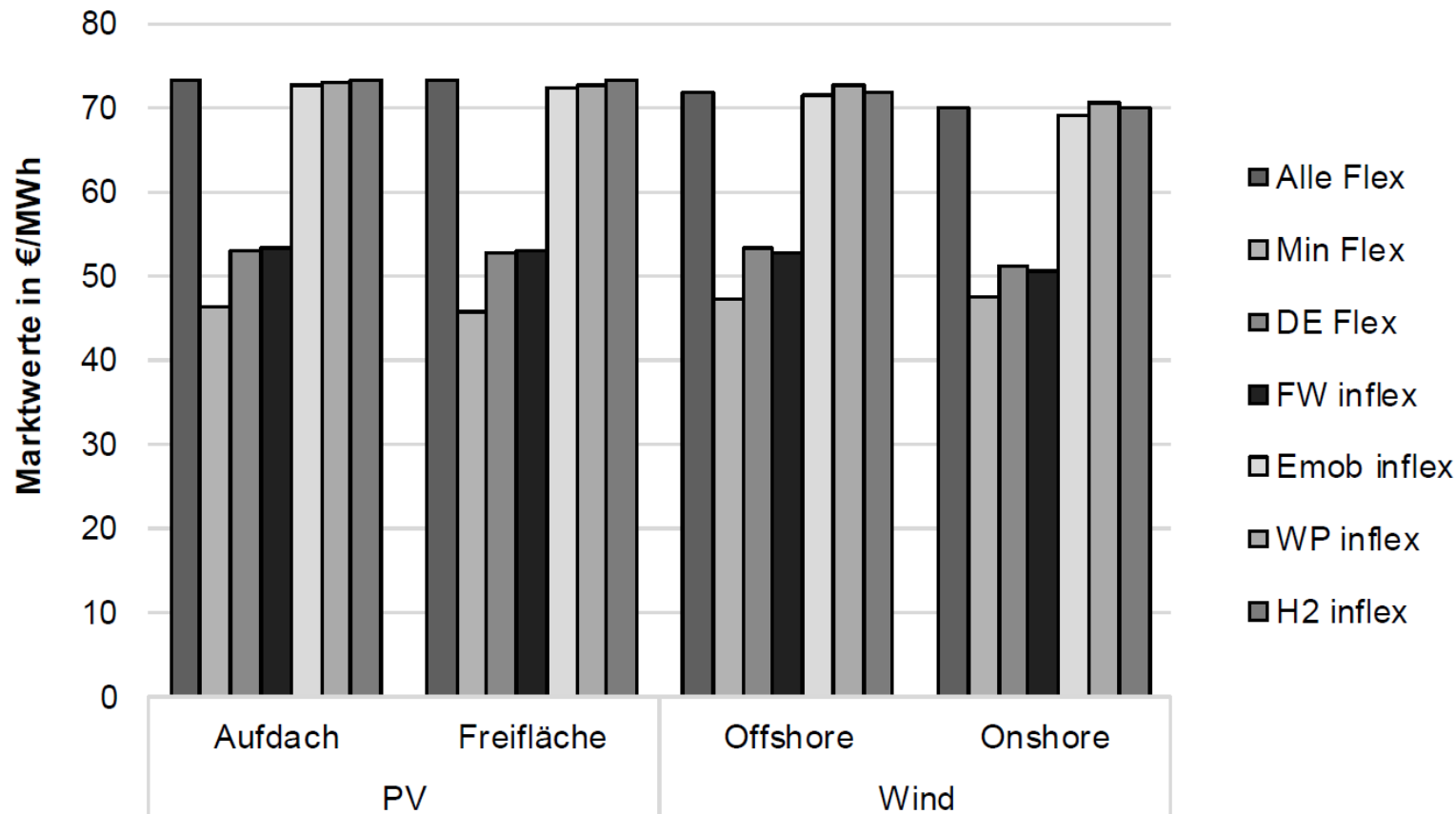


# REVENUES OF RENEWABLES – MARKET VALUES



- Revenues of (variable) renewables from regular electricity markets differ from revenues of (dispatchable) conventional power plants
- Higher shares of renewables imply lower relative market values (revenue renewables/ average base price)
- This is called “merit order effect” or “cannibalization effect”

# REVENUES OF RENEWABLES – MARKET VALUES



- Future market values are very uncertain
- System flexibility is a major driver for the profitability of renewables
- Other important factors include:
  - CO<sub>2</sub> prices
  - Gas prices
  - Mix of conventional power plants

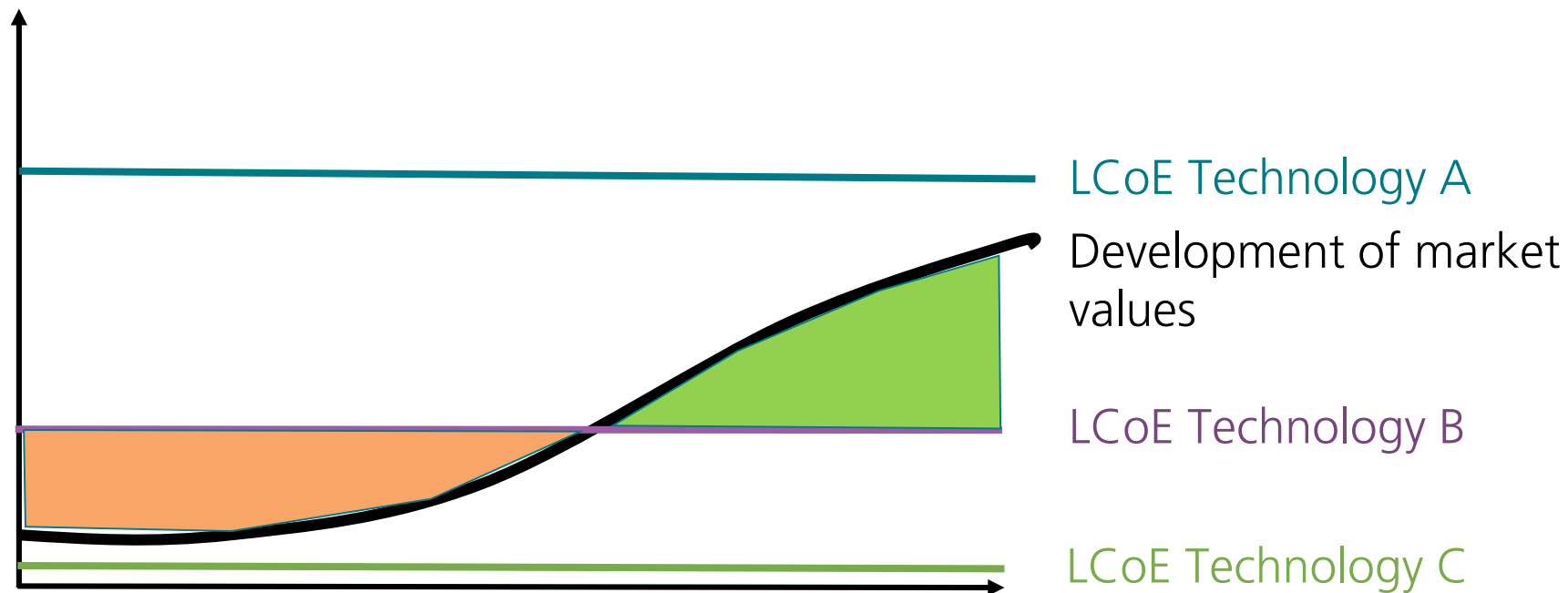
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# Supporting renewables



# DIFFERENT SITUATIONS POSSIBLE REGARDING THE RELATION BETWEEN COSTS AND REVENUES



- Technology A: Support clearly needed
- Technology C: Market values sufficient, support possibly for enabling cheap financing
- Technology B: Many uncertainties, potential profits in later periods

→ What kind of support is suitable in such a situation?

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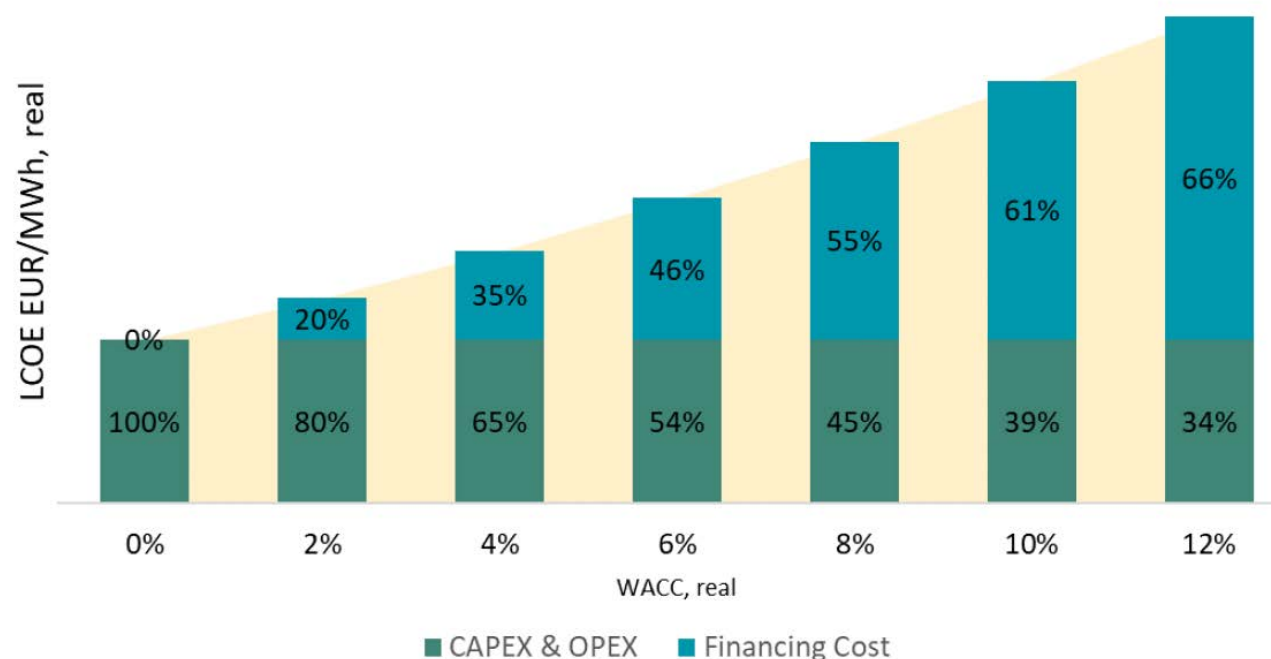
# REASONS FOR SUPPORTING RENEWABLES

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- Two main reasons for supporting renewables:
  - In the European context: target achievement (share of renewables)
  - More generally: market uncertainties and financing costs

# FINANCING COSTS OF RENEWABLES

- Financing costs depend on Weighted Average Costs of Capital (WACC) (Mix of rates of returns for debt and equity)
- Equity has typically higher rates of return than debt
- High debt rates require secure revenue streams
- Possible alternatives to support schemes: futures trading, PPAs

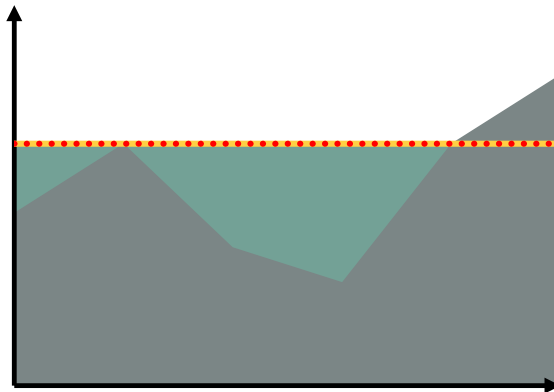


# ADEQUATE SUPPORT SCHEMES FOR RENEWABLES – GENERATION BASED SUPPORT

MARKET INTEGRATION

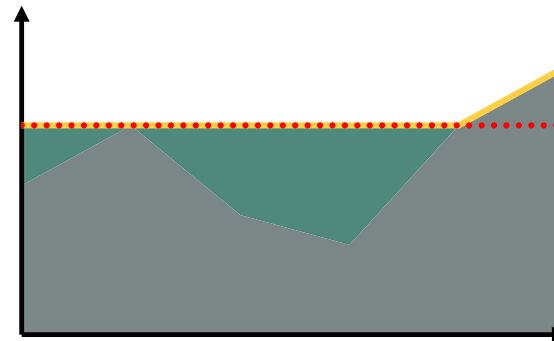
RISK

Feed-in tariff



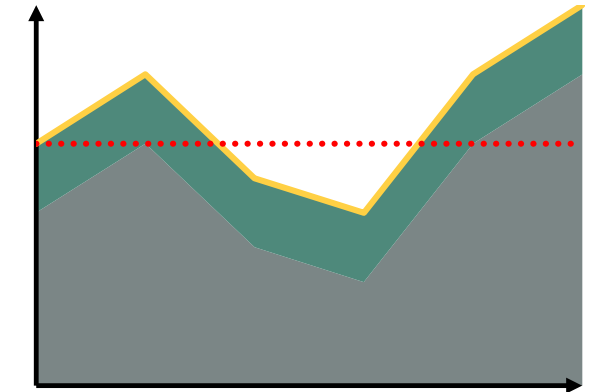
- Support payment
- Electricity market income
- Total income
- Strike price (LCOE)

Sliding feed-in premium



- Support payments
- Electricity market income
- Total income
- Strike price (LCOE)

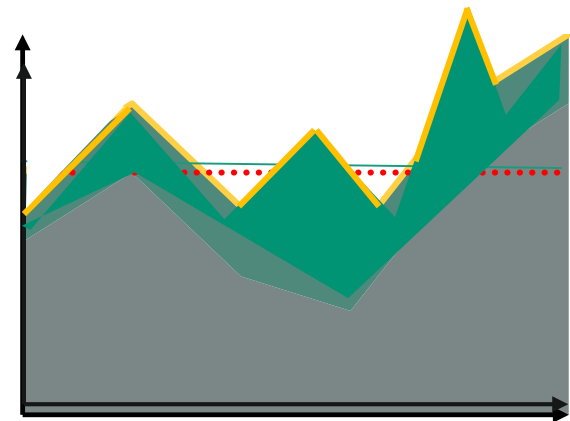
Fixed feed-in premium



- Support payment
- Electricity market income
- Total income
- LCOE

# ADEQUATE SUPPORT SCHEMES FOR RENEWABLES – GENERATION BASED SUPPORT

Quota scheme



- Support payment
- Electricity market income
- Total income

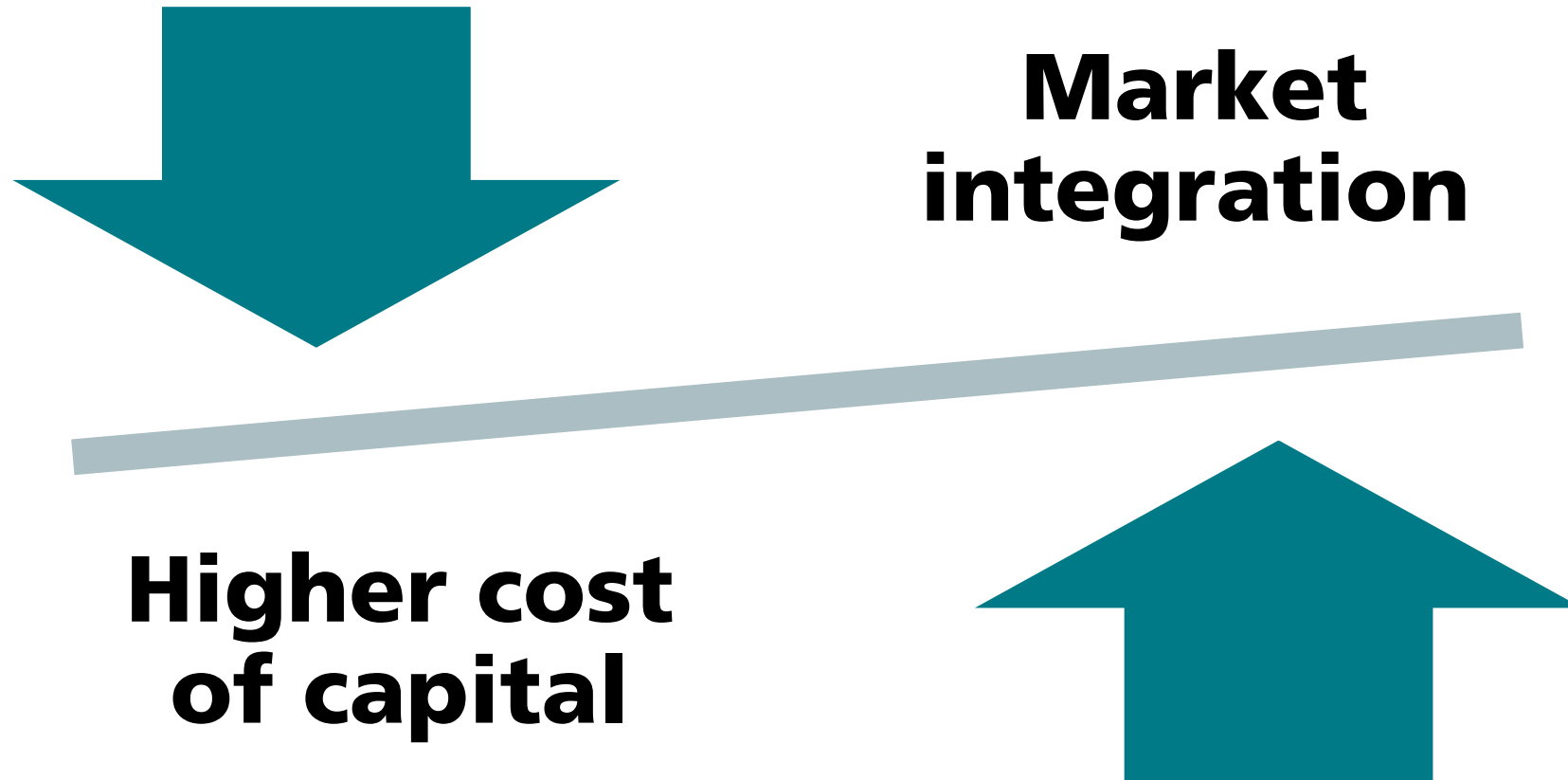
Quota scheme:

- market-based determination of support level (on market for green certificates)
- selling of electricity on electricity markets

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# COMPARISON OF SUPPORT SCHEMES

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- FIT: no incentive to respond to market price signals
  - in the EU: now used mainly for small installations
  - low risks imply low financing costs
  
- FIP: incentives to curtail at low prices and invest in plants with high full load hours/ favourable profiles
  - similar effects of sliding and fixed FIP, if reference period of sliding FIP  $\gg$  1h
  - higher risk under fixed FIP and thus higher financing costs

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# COMPARISON OF SUPPORT SCHEMES

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- Capacity-based support:
  - very good in terms of market integration (curtailment at 0 €/MWh)
  - incentives for generation and degree of risk depend on percentage of costs covered by capacity payment
  
- Quota schemes:
  - high risk due to two prices (electricity market and certificate prices)
  - degree of market integration similar to FIP and worse than capacity-based support



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- Quota schemes:

- high risk due to two prices (electricity market and certificate prices)
- degree of market integration similar to FIP and worse than capacity-based support

NOT RECOMMENDED

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# AUCTIONS AND RENEWABLES SUPPORT

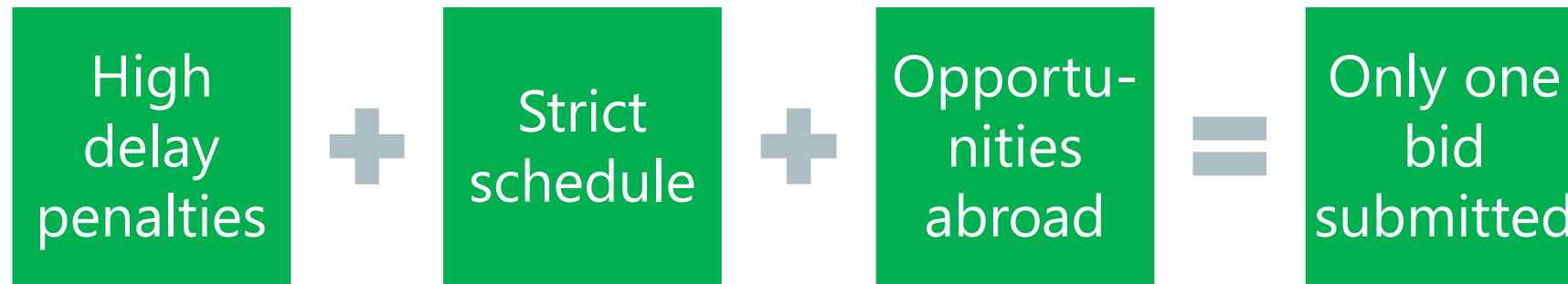
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- All support payments can be auctioned
- Auctions can increase or decrease risks for investors depending on previous situation
- Degree of competition and auction design are crucial for results

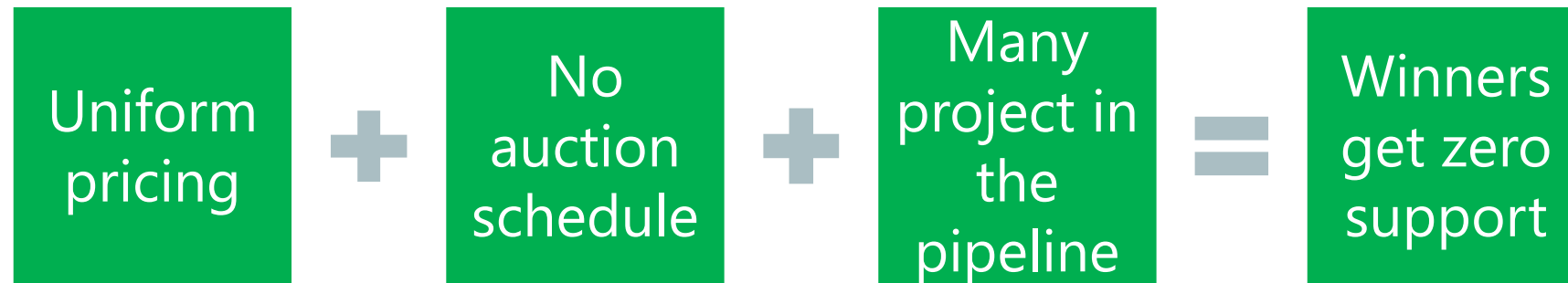
# AUCTIONS AND RENEWABLES SUPPORT



Off-shore wind auction, Anholt (2009/10)

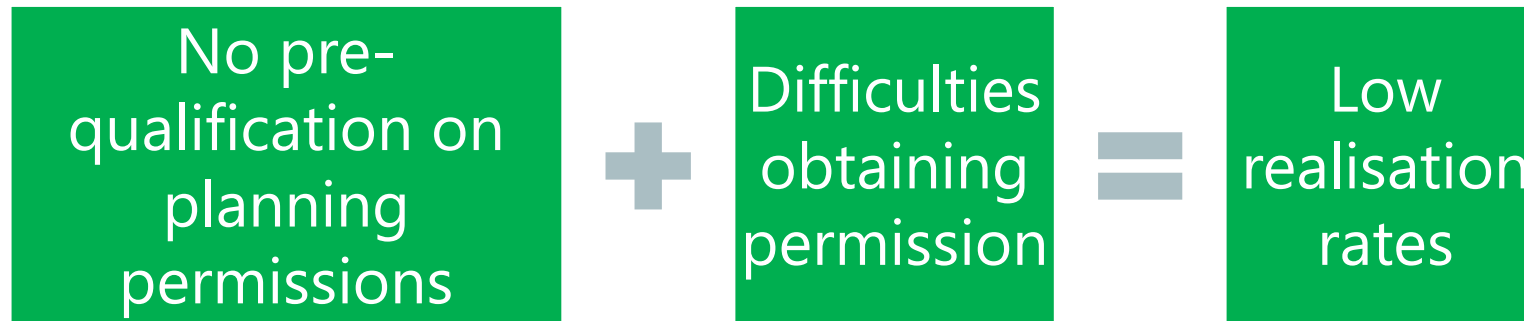



Onshore wind and biomass auction (2016)

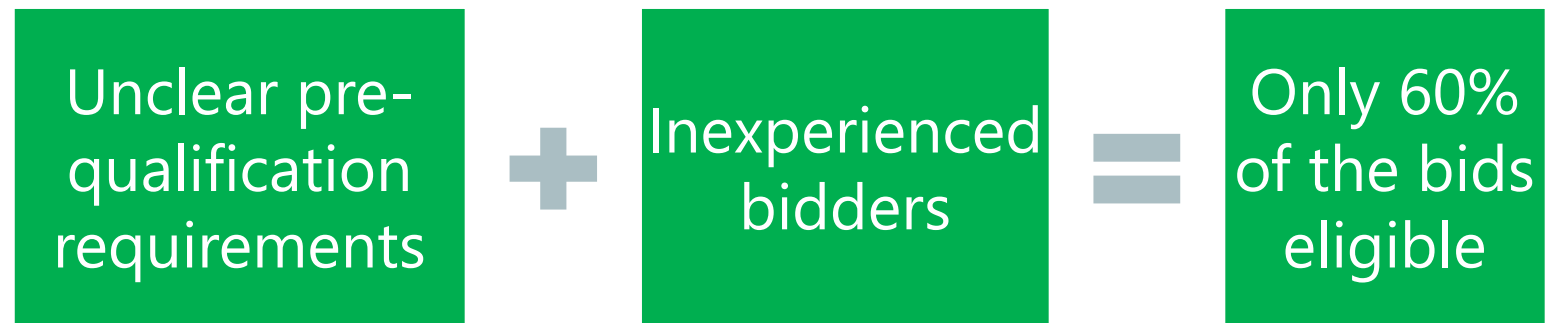


# AUCTIONS AND RENEWABLES SUPPORT

 AER III auction, mainly onshore wind (1997/98)



 Solar PV, 100-250 kW (2012)



**Thank you for your attention!**

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