



# Capacity Markets in Europe

Key Study Insights, 4 June 2014

# Overview of Study

## Background of Study

- A fresh approach to the topic of capacity markets – a study at a European level
- Involvement of 15 European stakeholders as members
- Year-long project started in January 2013
- Quantitative modelling supported by qualitative discussions in several workshops throughout the year

### Founding members



### Regulatory members



### Ordinary study members

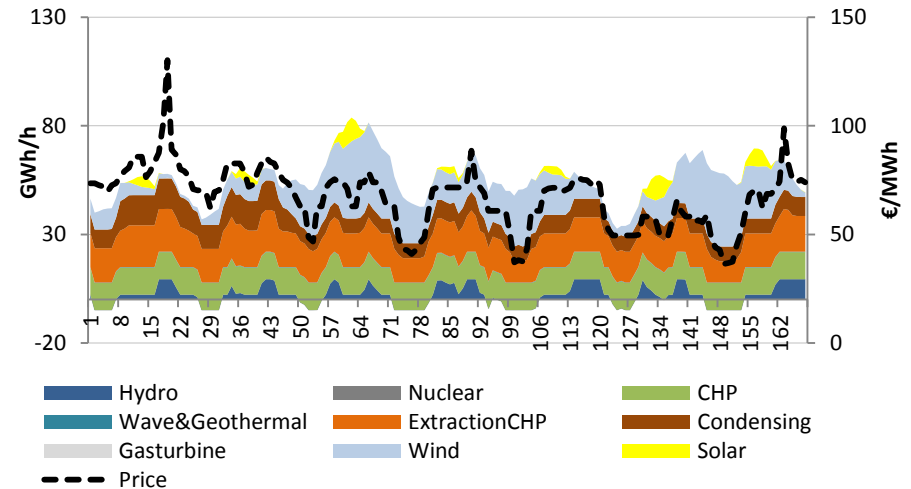


# Different motivations for discussing capacity markets

## Long-term challenges

- The push for a carbon neutral power sector and fast increase in renewables provides large challenge for the evolving European power market
  - Wind and solar less controllable and flexible – and dependent on weather
  - Significant contribution to energy production, but little firm capacity
  - Need for flexible generation and demand response
- Extra pressure on conventional flexible generation, which is still needed, but facing declining profits and challenges in financing

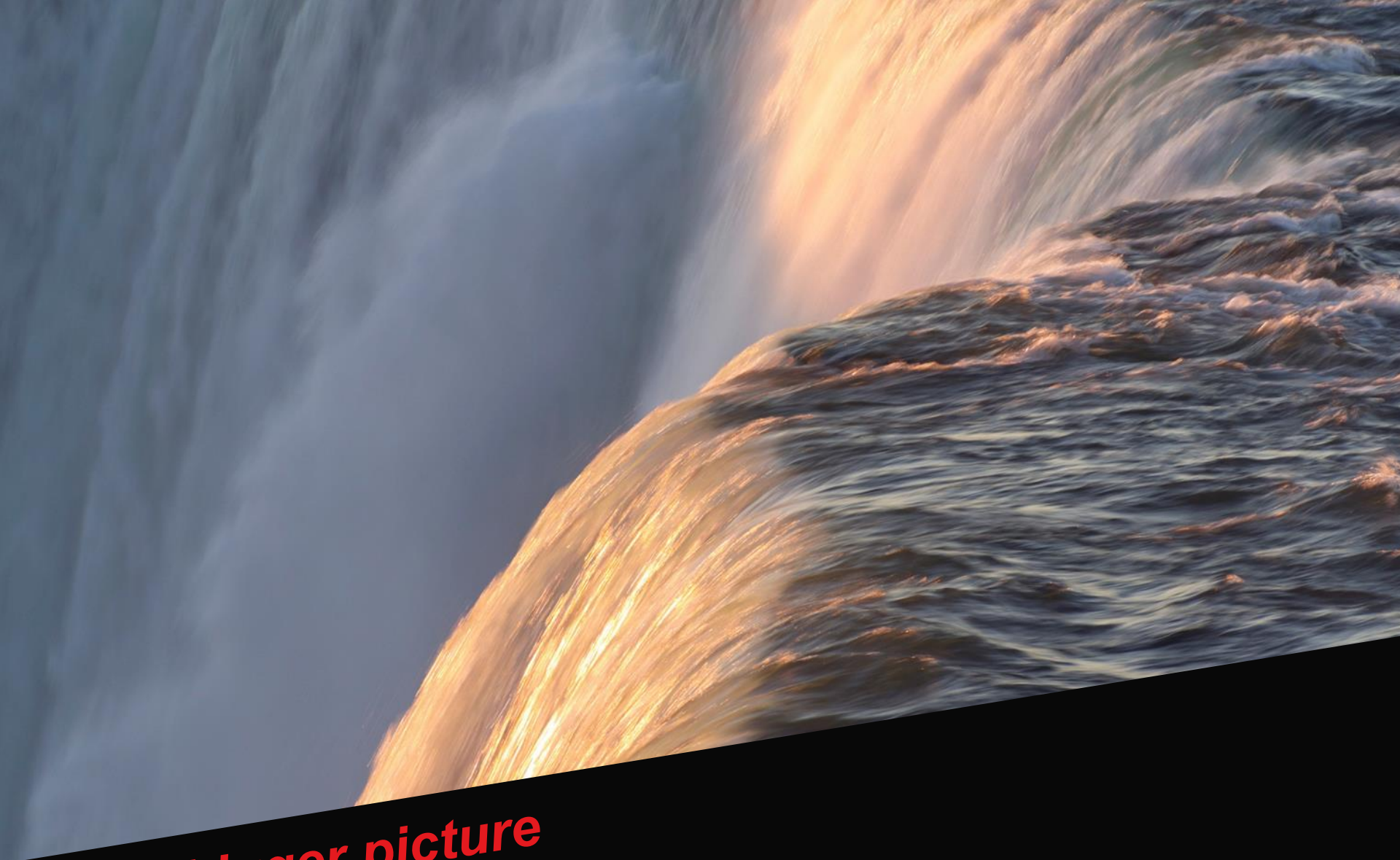
### Example week in January 2030, Germany



## Short-term problems

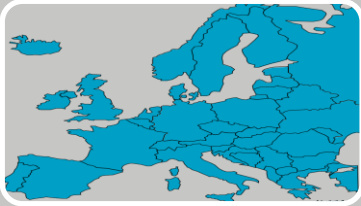
- Significant growth of subsidized RES generation
- Waning carbon market
- Financial crisis – downgrading of credit rating for many, decreasing share prices, lower demand across Europe
- Decreased profitability of flexible gas generation





**The bigger picture**

# Little need for new capacity in the coming years. There is time and need to think through the designs!



## Capacity markets are untested in integrated markets

- Capacity markets are tested in many markets, but virtually untested in highly integrated markets - Europe may be a testing ground for capacity markets under such conditions.
- Market features related to interconnected markets need to be carefully considered – risk of design failures



## Little need for new capacity in the coming 10 years

- In most of Europe need for investment in new capacity in the coming 10 years is small
- Low power prices and few hours of operation undermines the profitability of existing flexible generation
- Problems likely to be caused by lack of re-investment and closure/mothballing



## Other options are also available

- Exposure of subsidized technologies to short-term price signals
- Well functioning balancing and intraday markets
- Increased use of locational pricing will be needed in energy and/or capacity markets
- Increased transmission capacity to avoid local shortage situations



## But, is it a self-fulfilling prophecy?

- Will anyone invest in flexibility if there is a risk that market design changes will undermine the profitability of those investments?

# In the longer run there is need for new capacity. Policy uncertainty and new market fundamentals increase risk for investors.



## New capacity is needed in the longer run

- While RES technologies could cover significant share of the energy demand, there will at least be need for flexible generation capacity.
- The amount and type of new capacity depends on policy, technology and market developments.



## There is significant policy uncertainty affecting the profitability

- The policy mix will significantly impact the profitability of investments.
- Strictness of climate target.
- Carbon cap alone or targeted measures for renewables and energy efficiency?



## New price formation with significant share of low marginal cost technologies

- If low marginal cost technologies can cover demand in many hours there is a need for high price volatility with prices often being very low or very high – will this be accepted?
- Large share of revenues may be earned in a few high price hours => high risk



## Who should carry the risk – customers or producers?

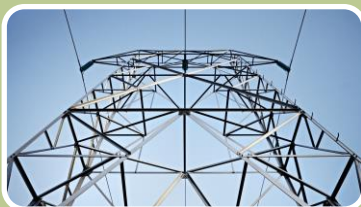
- Traditionally most of the risk has been carried by the customers – liberalisation shifted risk to producers?
- Capacity markets shifts risk back to customers

# Capacity markets implies risk of distorted investment incentives between generation technologies, demand side participation and interconnectors



Generation, demand side and interconnectors all contribute to solving capacity problems

- The different solutions are to a high degree substitutes.
- Capacity markets have different impacts on different technologies
- In particular risk of distortion between interconnectors and generation



First step: Assess the contribution of interconnectors and external capacity to security of supply

- Likelihood that an interconnector will contribute during a system stress situation
- Availability of the interconnector
- Differences in the system characteristics of the connected systems



Second step: Adequate remuneration to interconnectors and external capacity

- Remuneration should reflect actual contribution to security of supply
- Viability of new interconnector investments could be seriously undermined, if they should be based on energy market revenues alone.



Consider the institutional framework for interconnector investments

- Likely that merchant interconnector investments will become more difficult – increased importance that TSO:s undertake necessary investments.
- Differences in institutional setup, e.g. possibility of including interconnectors in regulated asset base, may provide challenges





**Quantitative findings**



# Generation & market design scenarios

## Generation scenarios

- Two generation, or supply, scenarios, inspired by EU 2050 Roadmap:
  - Current Policy Initiatives (CPI)
  - Diversified Supply Technologies (DST)
- Main differences in quantity of RES installed, and fuel and carbon prices

## Capacity market design policies

Capacity market	Countries with capacity mechanism	Policy design
Target Model (TM)	None	<ul style="list-style-type: none"> <li>▪ Plants can only earn revenue from wholesale market</li> </ul>
Integrated Capacity Market (ICM)	All	<ul style="list-style-type: none"> <li>▪ Target capacity related to peak demand</li> <li>▪ External capacity can participate, limited only by available transmission</li> </ul>
Coordinated Policy Scenario (CPS)	Case 1: France, Italy, Spain, Portugal, UK	<ul style="list-style-type: none"> <li>▪ Certain countries have national capacity markets</li> <li>▪ External capacity can participate in domestic markets, limited only by available transmission</li> </ul>
	Case 2: Same as case 1, plus Germany	
	Case 3: Same as case 2, plus Poland	
National Policy (NP)	France, Italy, Spain, Portugal, UK	<ul style="list-style-type: none"> <li>▪ External capacity <b>cannot</b> participate</li> <li>▪ An uplift function assigned to short-term trade in peak times</li> <li>▪ In line with EU guidelines?</li> </ul>

# The short-term solution for capacity problems may not be capacity markets

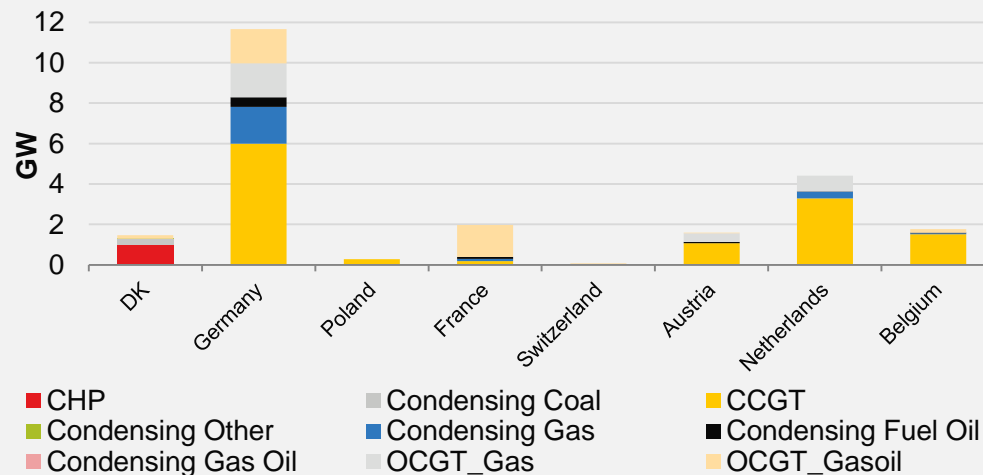
## Key message

- In the short term, excessive closure is a bigger challenge than new investments in many European power markets
- Capacity markets may not be the best solution to solve this challenge
- Market deficiencies should be solved before implementing long-term capacity market schemes

## Assumptions versus Reality

- Plants not covering their fixed opex from the wholesale market are closed or mothballed
- Revenues from ancillary markets are not included
- In reality, such closure would unlikely happen, as TSOs would step in with additional measures to avoid closure that threatens security of supply, but this comes at a cost

## Capacity to be mothballed, year 2020, CPI



## Main conclusions

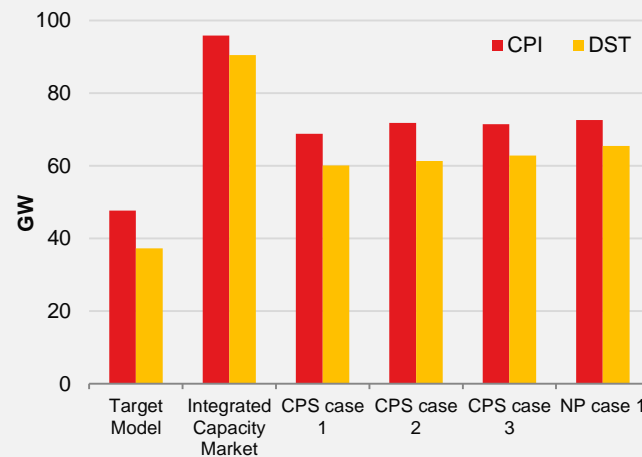
- Lack of re-investments and excessive closure of older plants likely to be main problem in the coming decade.
- Uncertainty about market developments in the shorter term could cause too much closure from a system perspective
  - Increased price volatility possibly physical shortages
- Several market changes possible :
  - Expose subsidised technologies to short-term price signals
  - Balancing and intraday markets in place
  - Locational pricing in large areas with very different supply-demand
- Targeted mechanisms, e.g. strategic reserves, could be considered for the short-term problems.
- Capacity markets, depending on their design, are primarily a tool to reduce the risk faced by investors in **new** investments in the longer term

# In the longer term new investments are needed. The risk is high under the Target Model policy

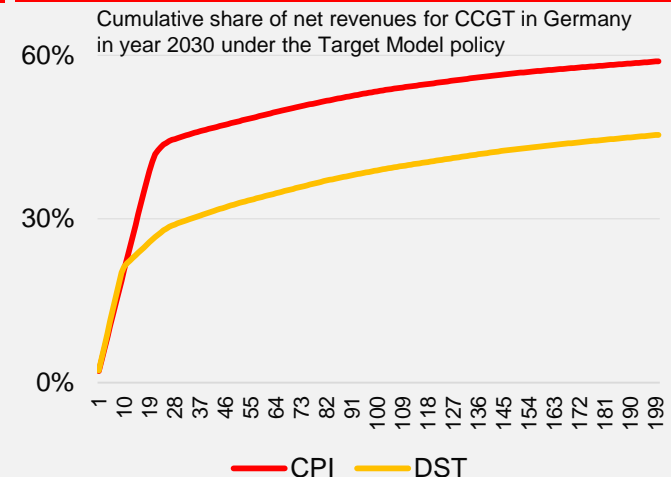
## Key message

- Investments in conventional generation is needed in the longer run.
- Substantial risk related to revenues being highly dependent on peak hours, even under policy certainty.
- Capacity markets could help to reduce investor risk, shifting risk to customers.

## Total generation capacity added by 2030



## Dependence on peak hours



## Main conclusions

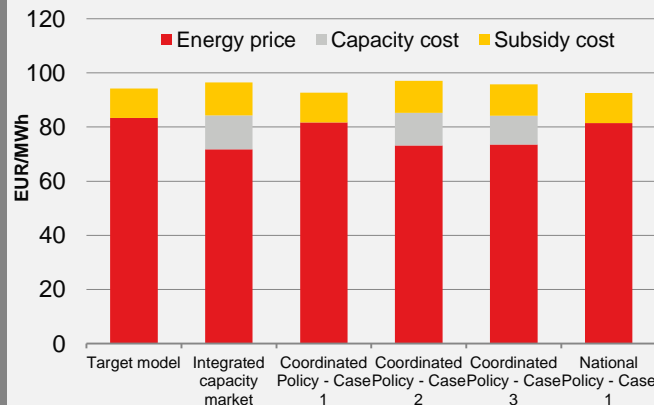
- Substantial amount of new capacity is needed in the longer term
- Under the Target Model there will remain a small probability of shortages, even under optimal investments.
- Revenues for conventional generation are highly dependent on a few high price hours
  - 25-45% of annual net revenues are earned during only 20 hours for a modern CCGT plant in Germany in the year 2030 under the TM policy
- Capacity markets, depending on their design, are a tool to reduce the risk faced by investors in **new** investments in the longer term, and other mechanisms or market adjustments should be considered for these short-term issues

# The overall cost similar across policies, but distribution of cost between countries differs

## Key message

- Capacity markets encourage investments in generation, which lead to lower wholesale prices and lower price volatility, but higher capital cost
- National capacity markets can have spillover effects to neighbouring regions, both positive and negative

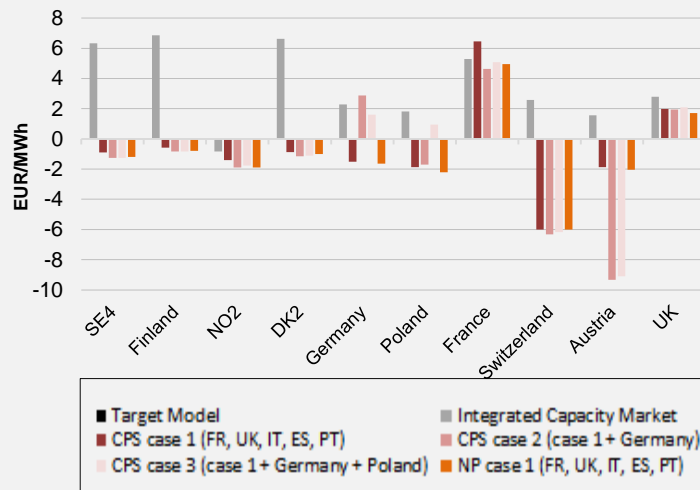
## Customer cost, Germany 2030, EUR/MWh



## Assumptions vs Reality

- Investments unlikely to be optimal
- Risk of under-investment perhaps more likely than over-investment, with under-investment possibly carrying a higher social cost
- Stochasticity in reality could lead to more high peak prices than experienced here

## Customer cost per country relative to TM (2030)



## Main conclusions

- Higher level of installed capacity under the capacity market policies dampens price volatility and lowers wholesale prices in the capacity market regions
- Customer cost, including wholesale power price, RES subsidies, and capacity cost, generally increases when capacity markets are introduced in a region.
- There can be several spillover effects in neighbouring countries who do not have capacity markets, most notably:
  - Lower wholesale prices in neighbouring markets
  - Lower customer costs in neighbouring regions
  - Investments crowded out in neighbouring regions with no capacity market

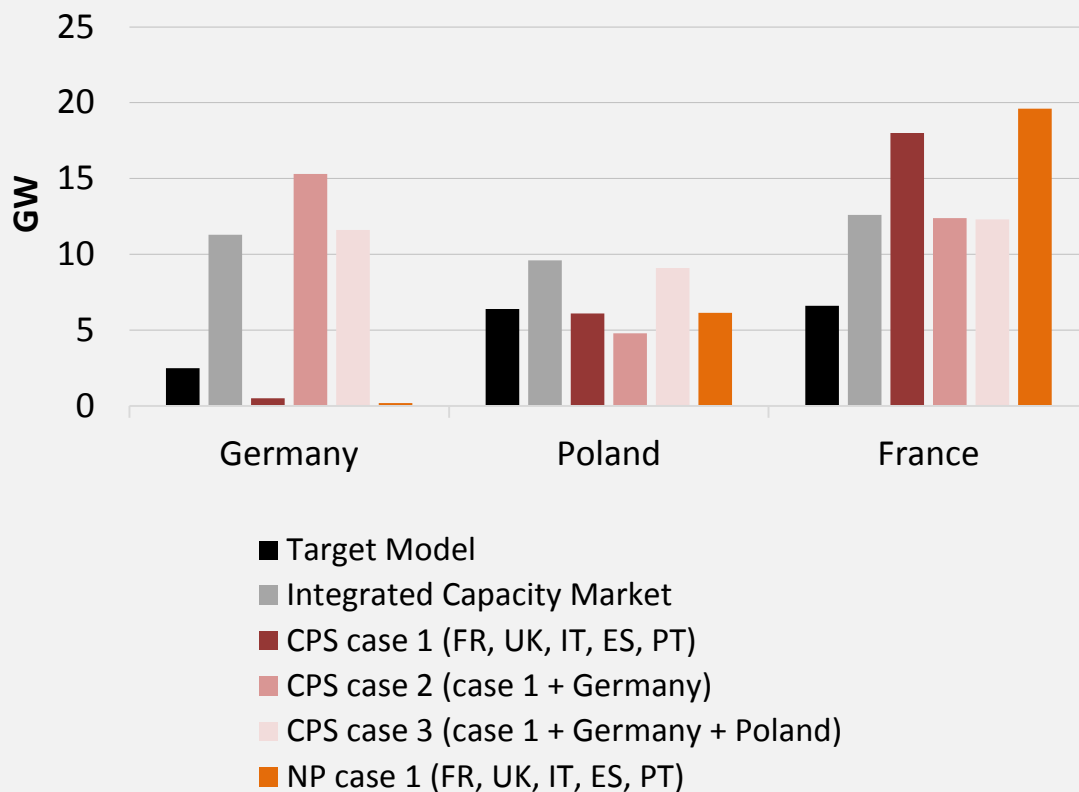


# Substantial generation capacity needed by 2030, market design scenarios significantly impact location of investments

## Key message

- National capacity markets can have spillover effects to neighbouring regions, both positive and negative
- Generation investments can be expected to be relocated if national capacity markets are introduced.

## New investments in generation capacity (selected countries)



# Capacity markets crowd out investments in neighbouring countries, potential negative impact on security of supply

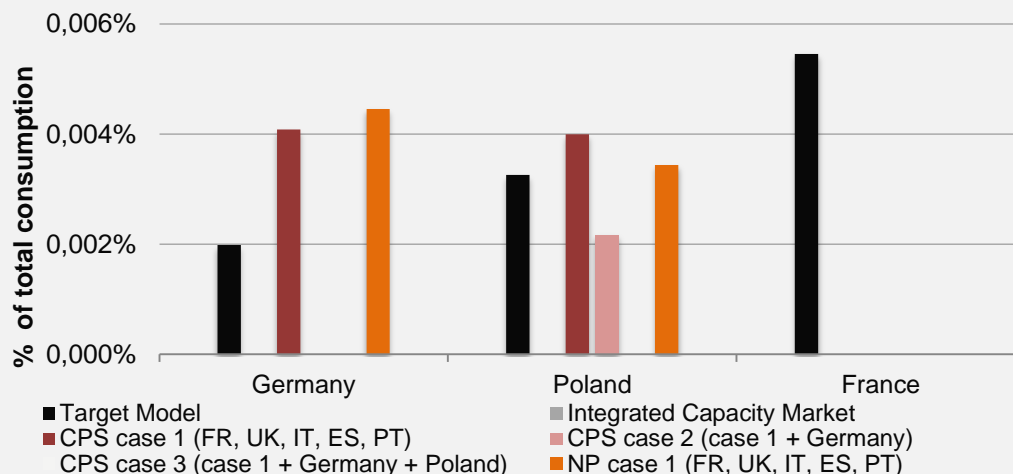
## Key message

- Capacity markets should not be introduced too quickly
- Europe is highly interconnected and cannot rely on models from other parts of the world
- If capacity markets are introduced, they should be as coordinated as possible, and not undermine other policies

## Assumptions vs Reality

- No market design or policy failures
- Target Model could result in more shortages in reality
- Capacity markets remove some risk for future revenues but perhaps introduce another policy risk

## Non-served demand, CPI 2030



## Main conclusions

- Europe is highly interconnected, with a wide range of institutional set-ups and national policies. Models of other capacity markets cannot be taken to the same effect here
- If capacity markets are introduced, they should be as coordinated as possible.
- Patchwork designs can have both positive and negative effects on neighbouring regions without capacity markets, for example:
  - ❑ Positive – spillover of lower prices to customers, who do not pay for increased capacity
  - ❑ Negative – security of supply decreased as investments are crowded out, increasing the quantity of unserved demand

# Capacity markets can also distort investments between interconnection and generation

## Key message

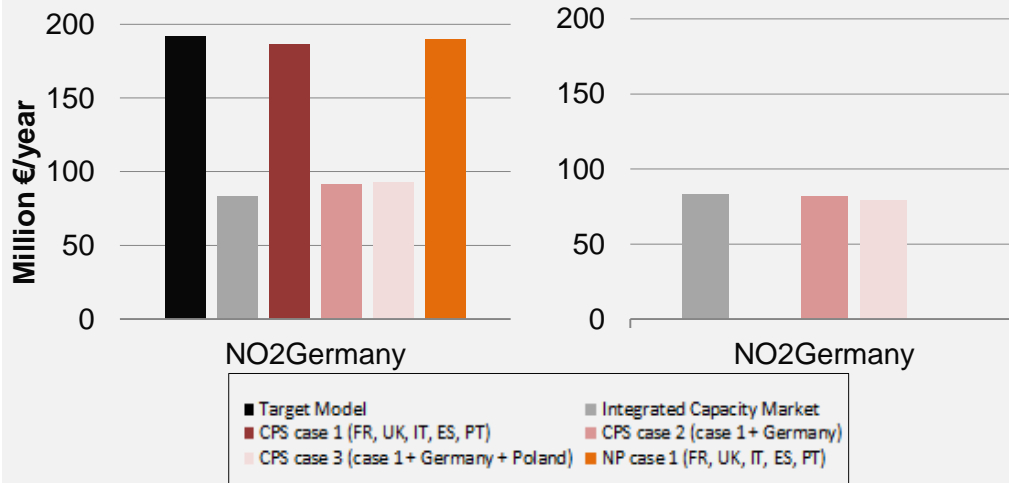
- The introduction of capacity markets risks the distortion of incentives between building capacity in interconnectors and generation
- Their inclusion in capacity market designs must be considered, but doing so is far from simple

## Assumptions vs Reality

- Interconnectors are generally regulated. Actual profits may deviate from calculated congestion rents.
- Profitability depends on how social costs and benefits are judged

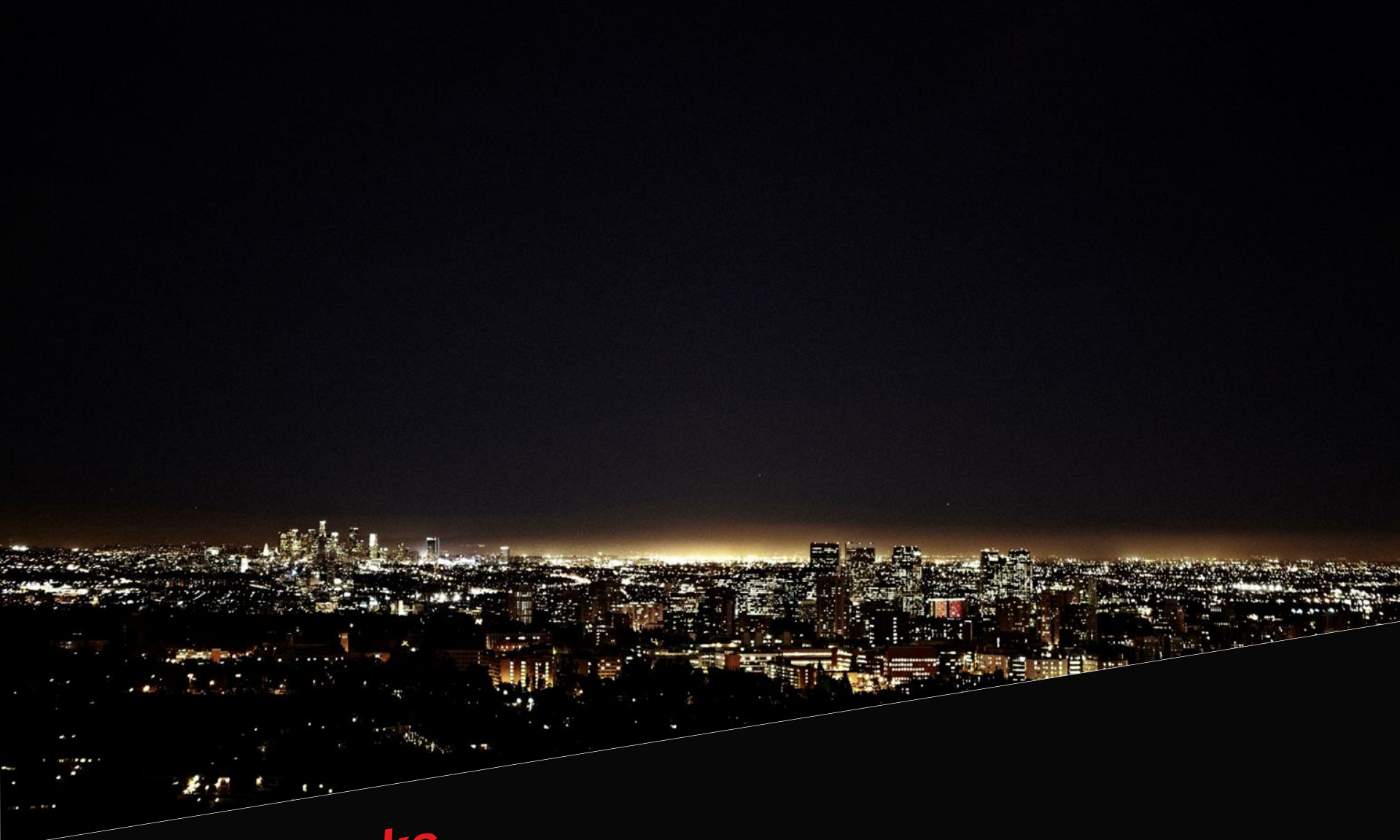
## Energy market congestions rents

## Potential capacity market revenues for interconnectors



## Main conclusions

- A European-wide capacity market decreases congestion revenues of interconnectors from the wholesale market
- National capacity markets in most cases reduce congestion revenues:
- Participation in capacity markets may, partly or fully, off-set the reduced congestion rent
- When investment in an interconnector is considered, there are two stages to the assessment:
  - Assess security of supply benefits
  - Remuneration of benefits
- An interconnector in a capacity market would have to be derated according to the added benefit to security of supply that it could offer.



**Final Remarks**



# Some final remarks...



## Limited short term need for new capacity – time to think it through

- Reinvestments, and possible excessive closure of existing plants., main short term problem.
- Complexities call for a well thought design
- But risk of a self-fulfilling prophecy



## Remember that Europe is a very integrated system

- Capacity markets have not been implemented across larger highly integrated systems
- Cross border effects need to be considered carefully
- Impact on transmission investments of particular importance



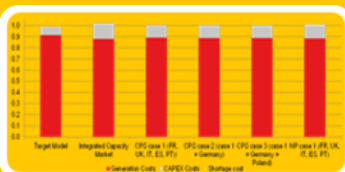
## No turning back

- It will be difficult to back out of
- Investors need to believe in the longevity of the scheme for it to be effective



## Consider the alternatives

- Long term stable policy framework
- Correct for existing market design flaws: subsidization models, well-functioning balancing & intraday markets, locational pricing, regulated prices



## Our analysis indicate that the cost difference between the different market design policies are small if well implemented

- Without significant market or regulatory failures different market designs can work well
- But risk of significant regulatory failures and underinvestment due to excessive risks







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