

DIW Berlin – German Institute for Economic Research

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# Capacity Mechanisms on the Central European Electricity Market: Effects on Prices, Profits, and Welfare

## Berlin Conference on Electricity Economics

Modeling and Policy in the Energy Transformation – Germany, Europe, and Beyond

Thure Traber, 10.10.2013, Berlin



Stiftung Mercator

1. Introduction and Policy Proposals
2. Modeling Approach and Scenarios
3. Results
4. Discussion

**Peak-Load-Pricing:**

Boiteaux 1949:  $MC + \beta$ , i.e. optimal pricing (under certainty)

Crew and Kleindorfer 1976 (uncertain demand),

Chao 1983 (uncertain supply)

**Market Failure related to security of supply**

(Müsgens and Peek 2011)

-Insufficiently elastic demand (not anticipated stochastic shocks)

-Security of supply as public good

(Non excludability: technical given metering; Non rivalry: No)

Cramton et. al (2013): Capacity market purpose is to

“Provide the amount of capacities that optimizes the duration of black-outs.”

	Strategic Reserve (SR)	Centralized Capacity Market (CCM)	Decentralized Capacity Market (DCM)
Regulator	defines <b>extrema</b>		
	sets capacity <b>target</b>		sets <b>supply obligation</b>
	estimates capacity		verifies capacity
	estimates demand		verifies demand
	<b>fee</b>		
Dispatch	<b>duty to serve only at extrema</b>	<b>duty to serve at extrema</b>	
			<b>not at normal peak</b>
Proposals	<b>temporary</b> measure until 2017 (minor size)	<b>broad</b> with mandatory price insurance <b>focused:</b> differentiated new/old PPs	<b>mandatory</b> (France) <b>voluntary</b> (VKU)
Model	<b>large with 2020 target</b>	<b>broad without price insurance</b>	<b>mandatory</b>
	<b>no penalties</b>		

Markets: Germany, Poland and France interconnected

Perfect foresight market equilibrium model with dispatch and investment decisions up to 2030

-Investment options: Gas GT and CC; Hard Coal; Gas Retrofit

Policies modeled as conditions for relation of peak load to firm capacities (dcm) or target capacities (sr,ccm): capacity margin 5%

3 representative demand + renewable output seasons

Winter (26%) +Schoulder (26%) +Summer (48%): Peak load 203 GW

+ extreme event Winter (0.3%) with a sixth of average wind availability

Demand elasticity scenarios

Extreme event always  $\varepsilon = -0,1$ ; Else a)  $\varepsilon = -0,5$ ; b)  $\varepsilon = -0,1$

International transmission scenarios

1) **Energy roadmap capacities**; 2) no transmission

**Reference**

Energy only market, a1) basic scenario used in the following

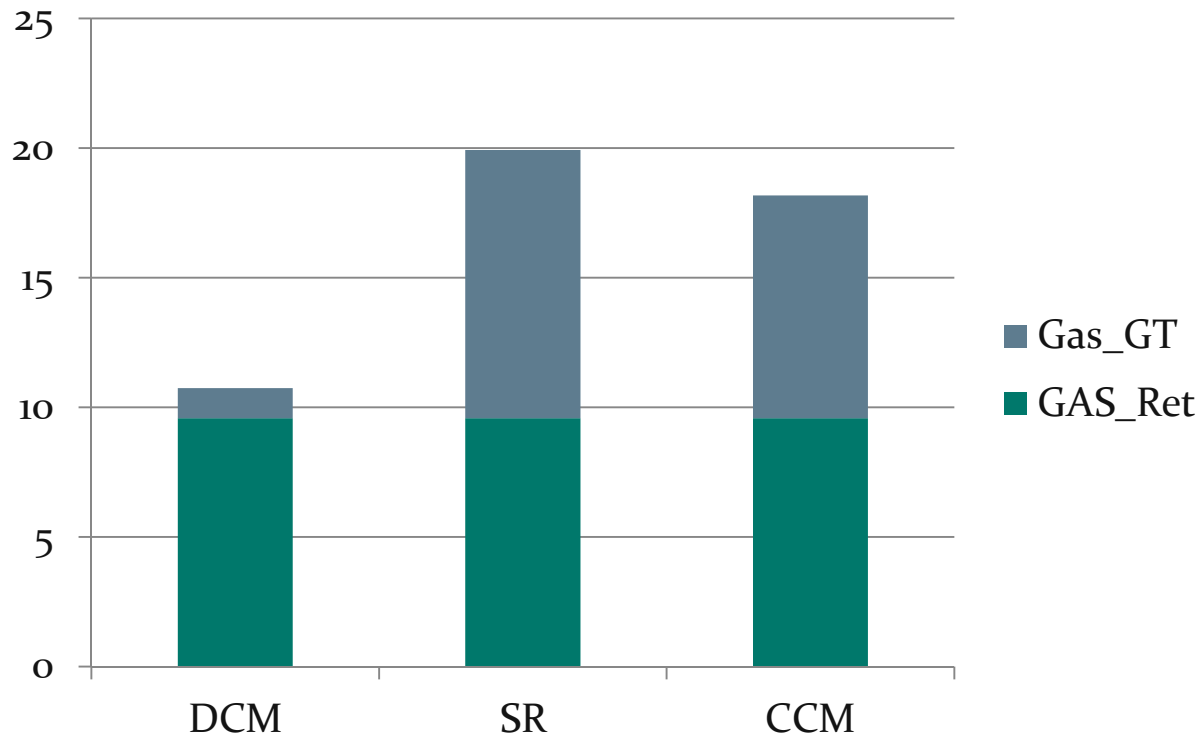
Investments by 2020 only in Gas retrofit (1.3 GW)

Prices by 2020 in €/MWh:

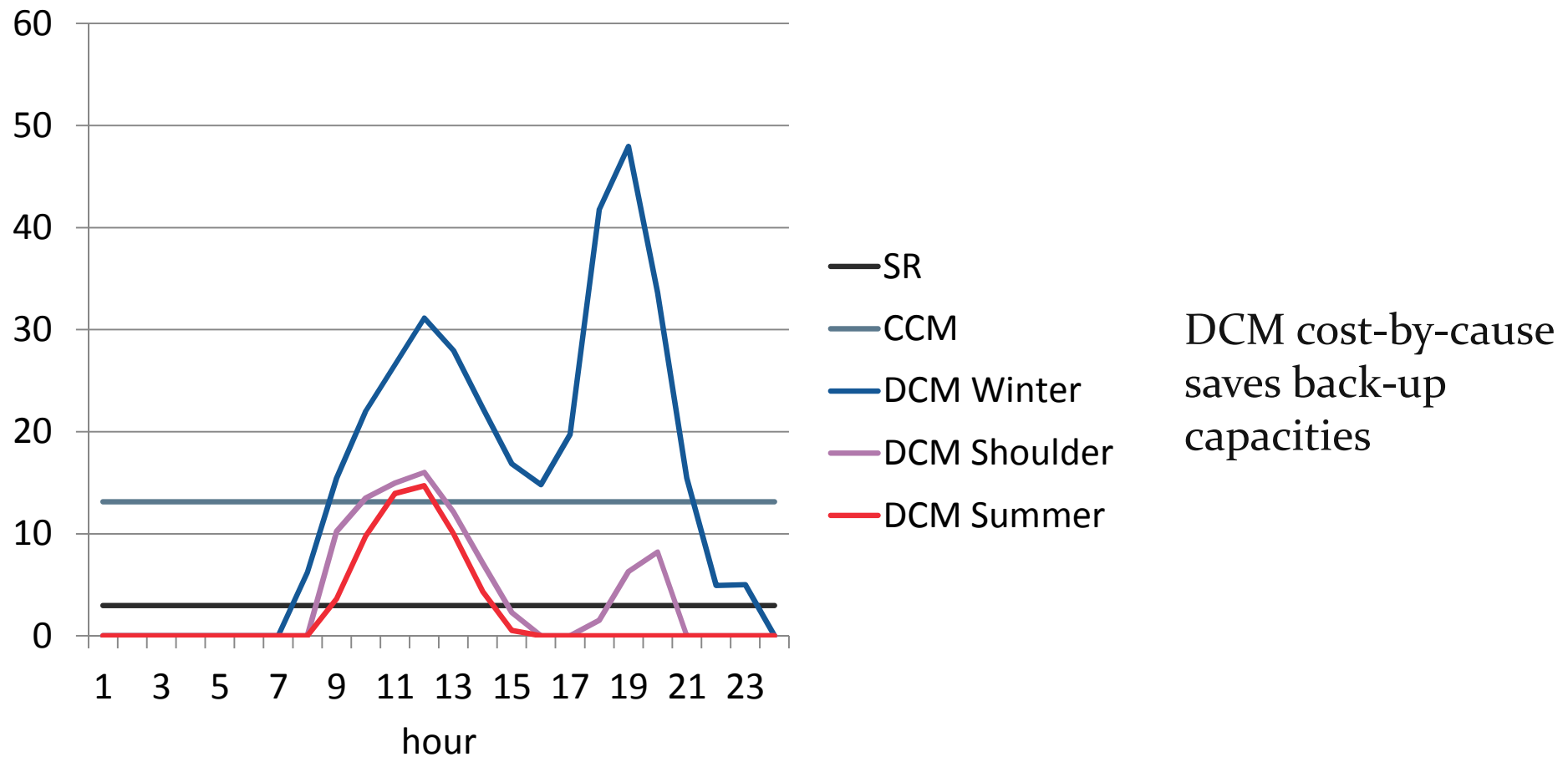
		Winter	Shoulder	Summer	Extreme
De	Mean	64	55	51	287
	Max	93	73	55	<b>1112</b>
Fr	Mean	63	48	38	275
	Max	93	68	50	<b>1038</b>
Pl	Mean	55	51	50	106
	Max	77	58	50	<b>217</b>

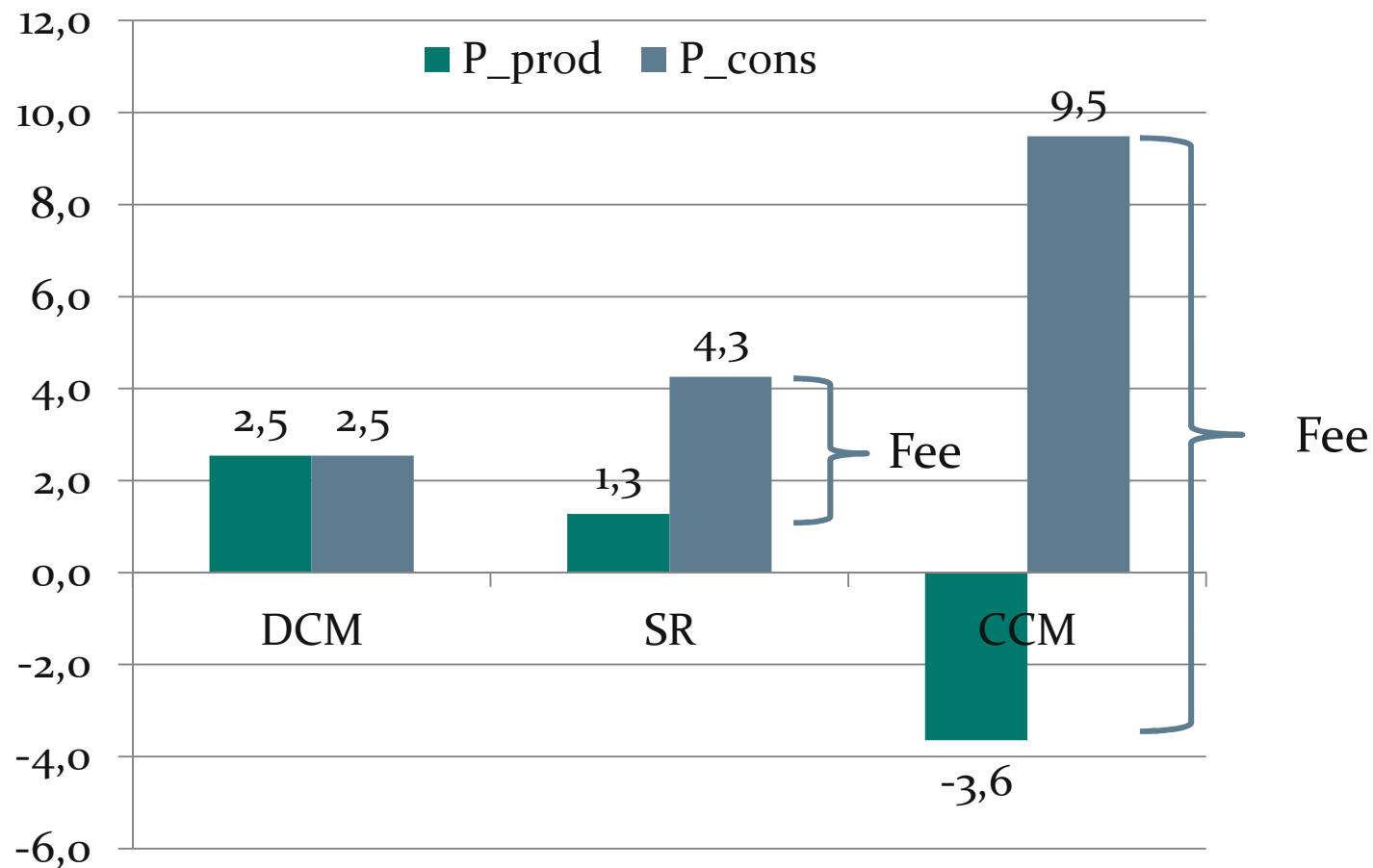
## 6

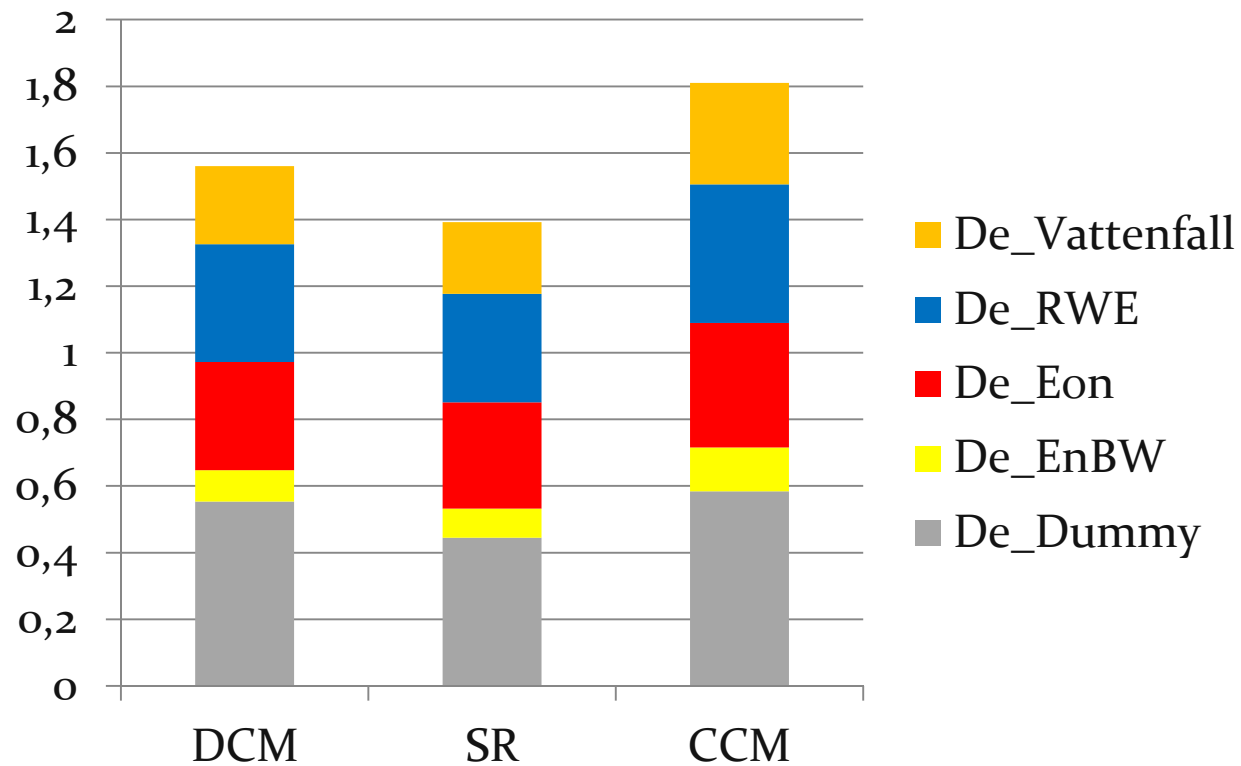
## Impact of capacity mechanisms: Investment



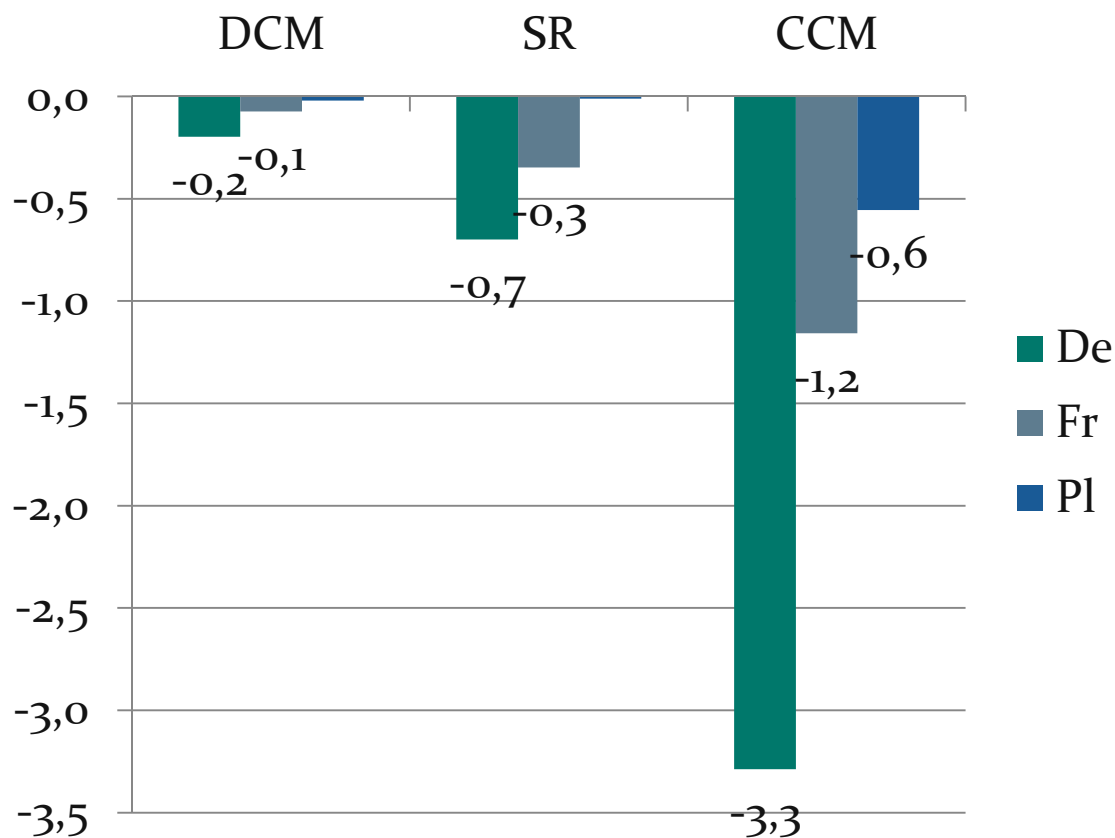
- By 2020 additional investment needs 10 GW Retrofit and between 1 and 10 GW open cycle gas turbines
- Lowest necessary investment under DCM







# Welfare effects in Germany, France and Poland in Bio. € per year



All instrument with welfare losses, since reduced black-outs are not modeled

Best instrument DCM:  
Instrument ranking robust:  
across countries

+  
across scenarios not shown  
(No transmission + inelastic demand)

Instrument ranking: DCM>SR>CCM

Limitations and future research:

- Regional problems in Germany not addressed
- Black-out probabilities needed for complete assessment
- EOM not ruled out
- Market power under a decentralized market approach

Vielen Dank für Ihre Aufmerksamkeit.

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