Marktintegration intermittierender Elektrizitätserzeugung

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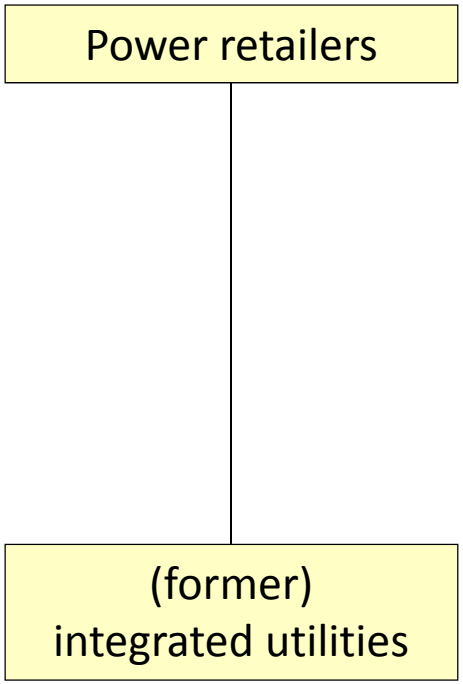
Agenda

- Basic properties of energy-only electricity markets
- Market impacts of politically forced / subsidized REN expansion
- The “missing money” problem and a politically designed / controlled capacity market
- The alternative: Market integration model (Balancing group model)

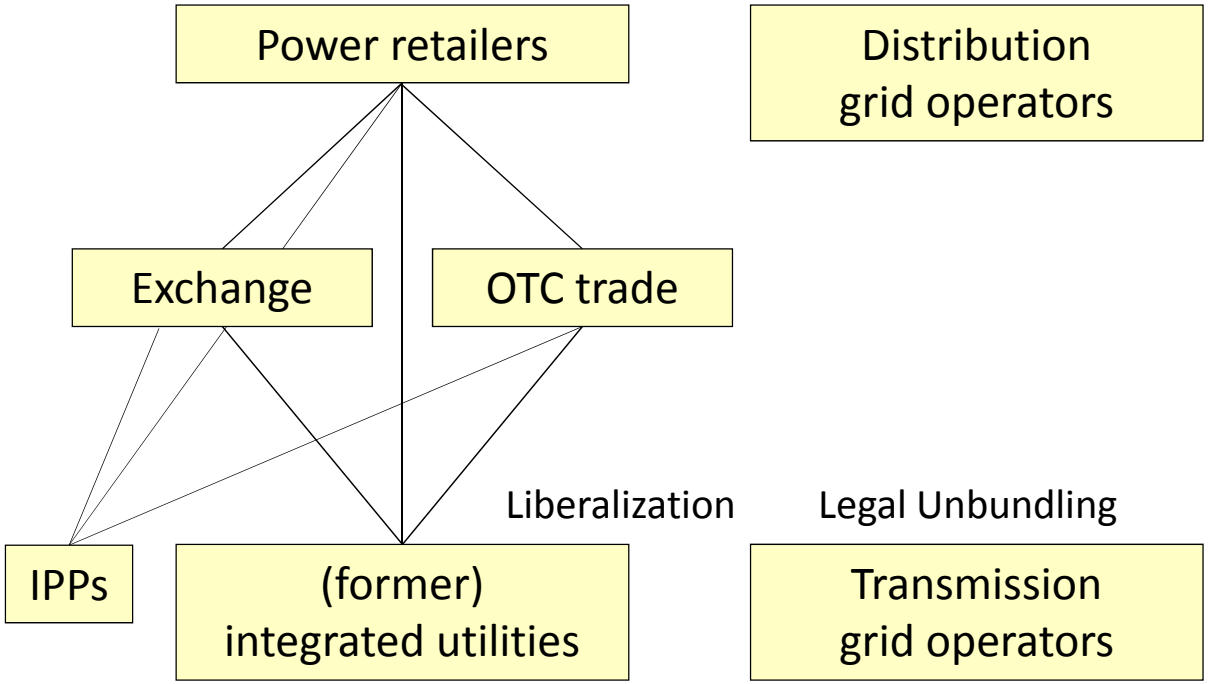
Pre Competitive Electricity Market

Vertical Monopoly
Duty of supply and
price control



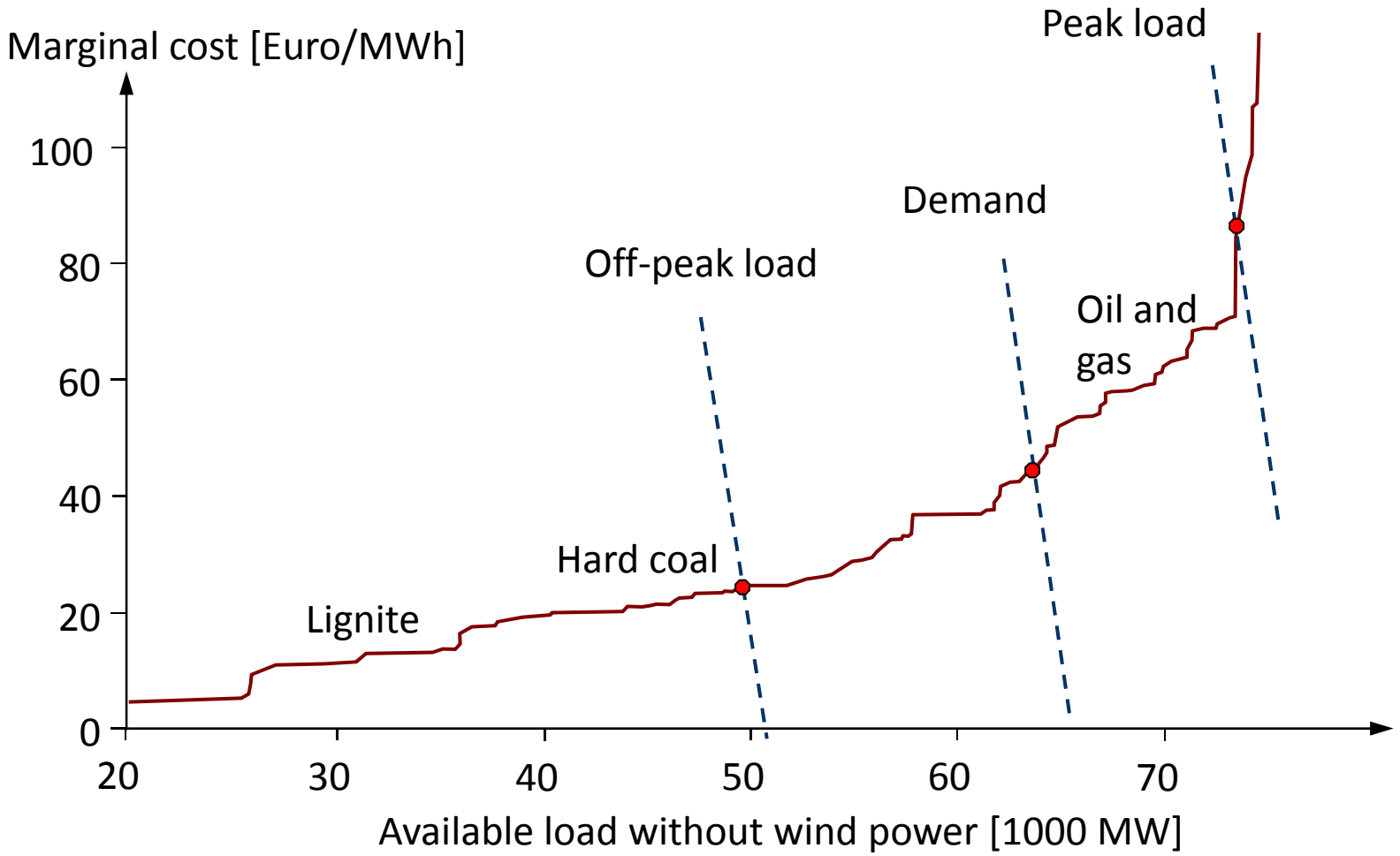
Competitive Power Market

Natural monopoly
Price regulation (BNetzA)
National grid plan (NEP)



German Merit Order Curve

[without CO_2 cost; Source: EU Sector Enquiry 2007, p. 260]



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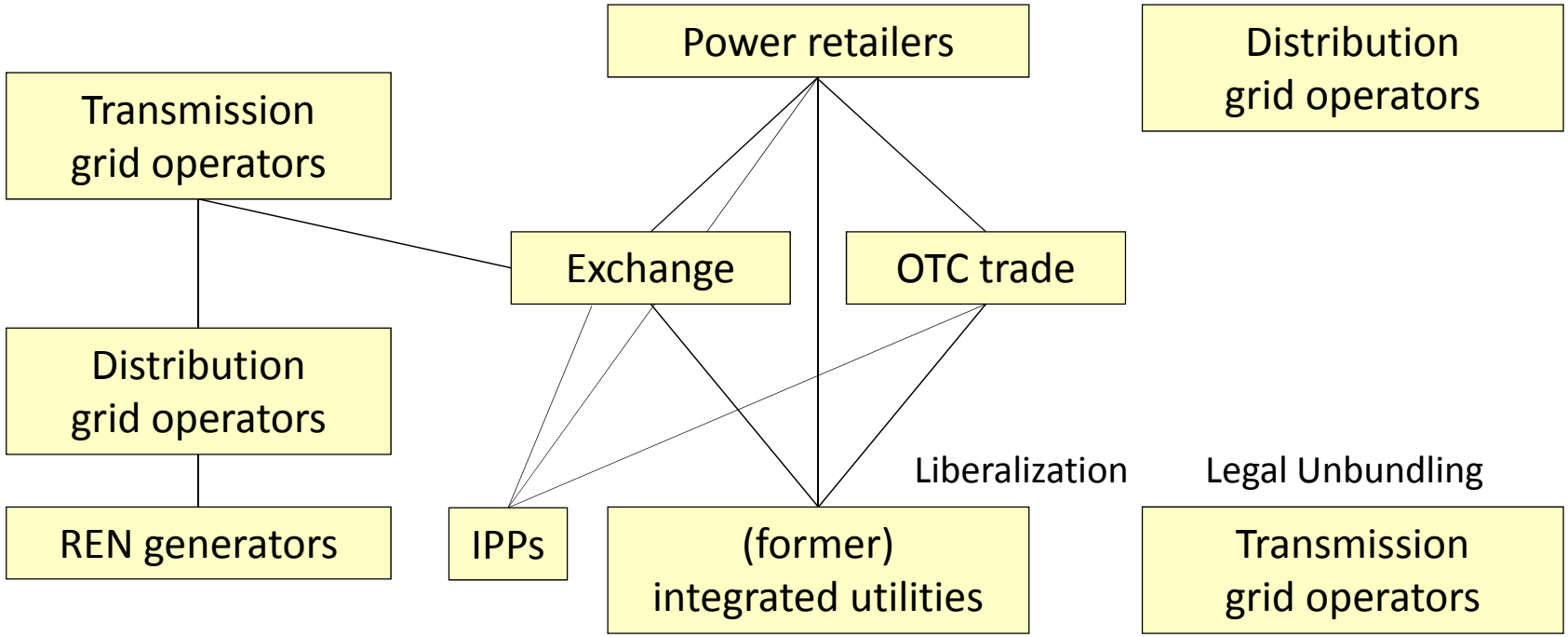
Forced REN Expansion

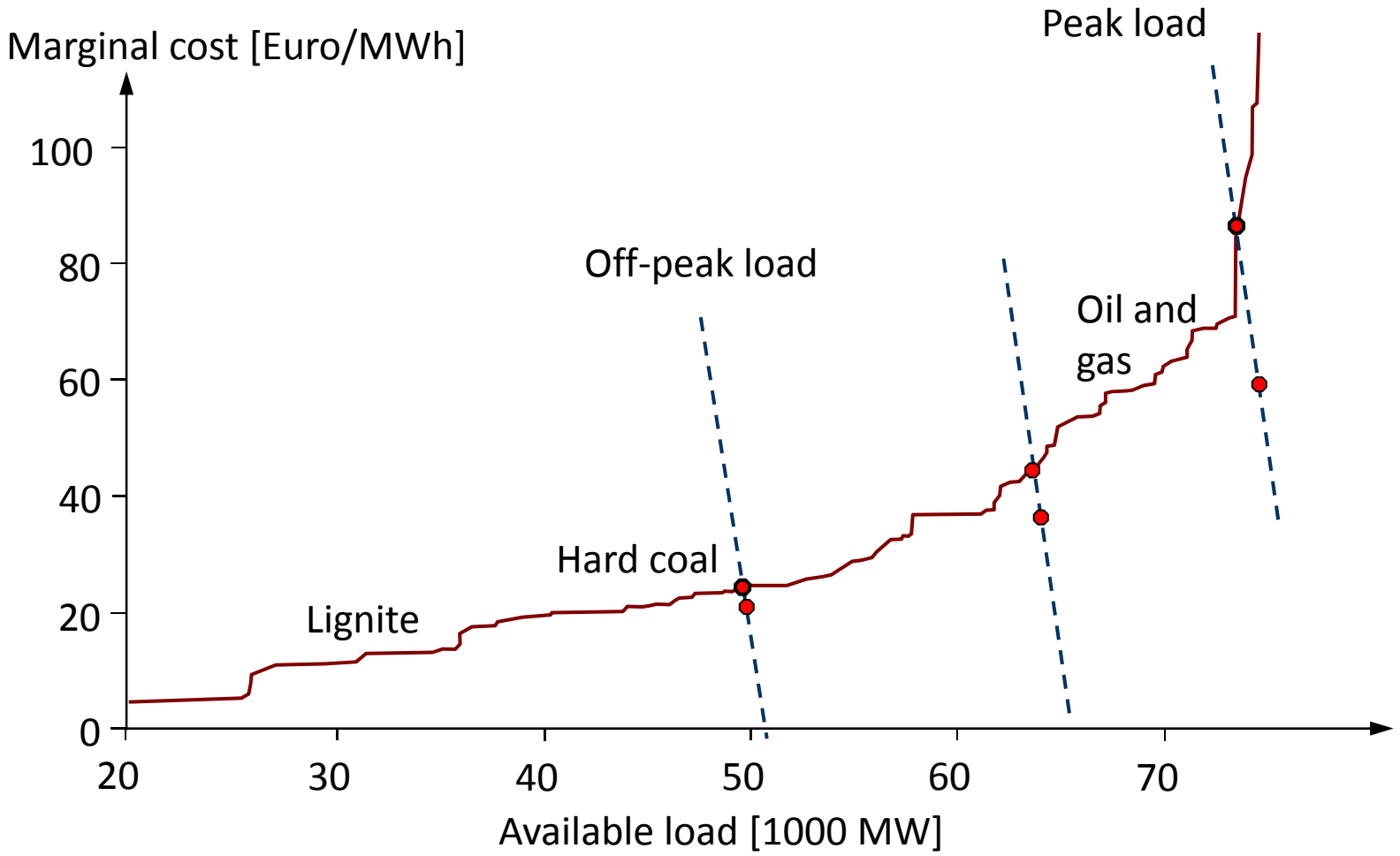
24%	Market share 2012	76%
35%	Target share 2020	65%
50%	Target share 2030	50%

Natural monopoly
Price regulation (BNetzA)
National grid plan (NEP)



Merit Order-Effect of REN expansion

[without CO_2 cost; Source: EU Sector Enquiry 2007, p. 260]

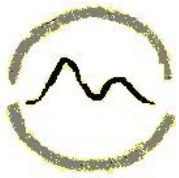


Recent Model Results for Hourly Day-ahead Prices 2011-2013

Method: Pooled Least Squares
Sample (adjusted): 1/01/2011 8/02/2013
Included observations: 770 after adjustments
Total pool (balanced) observations: 18’480

R-squared	0.852
Adjusted R-squared	0.850
Mean dependent variable	46.629
S.D. dependent variable	16.872
S.E. of regression	6.539
Durbin-Watson statistic	1.662

SUMMERTIME	1.21
CHRISTMAS-TIME	-1.35
DAYAHEAD(DAY-7)	0.05
SEASON2	0.44



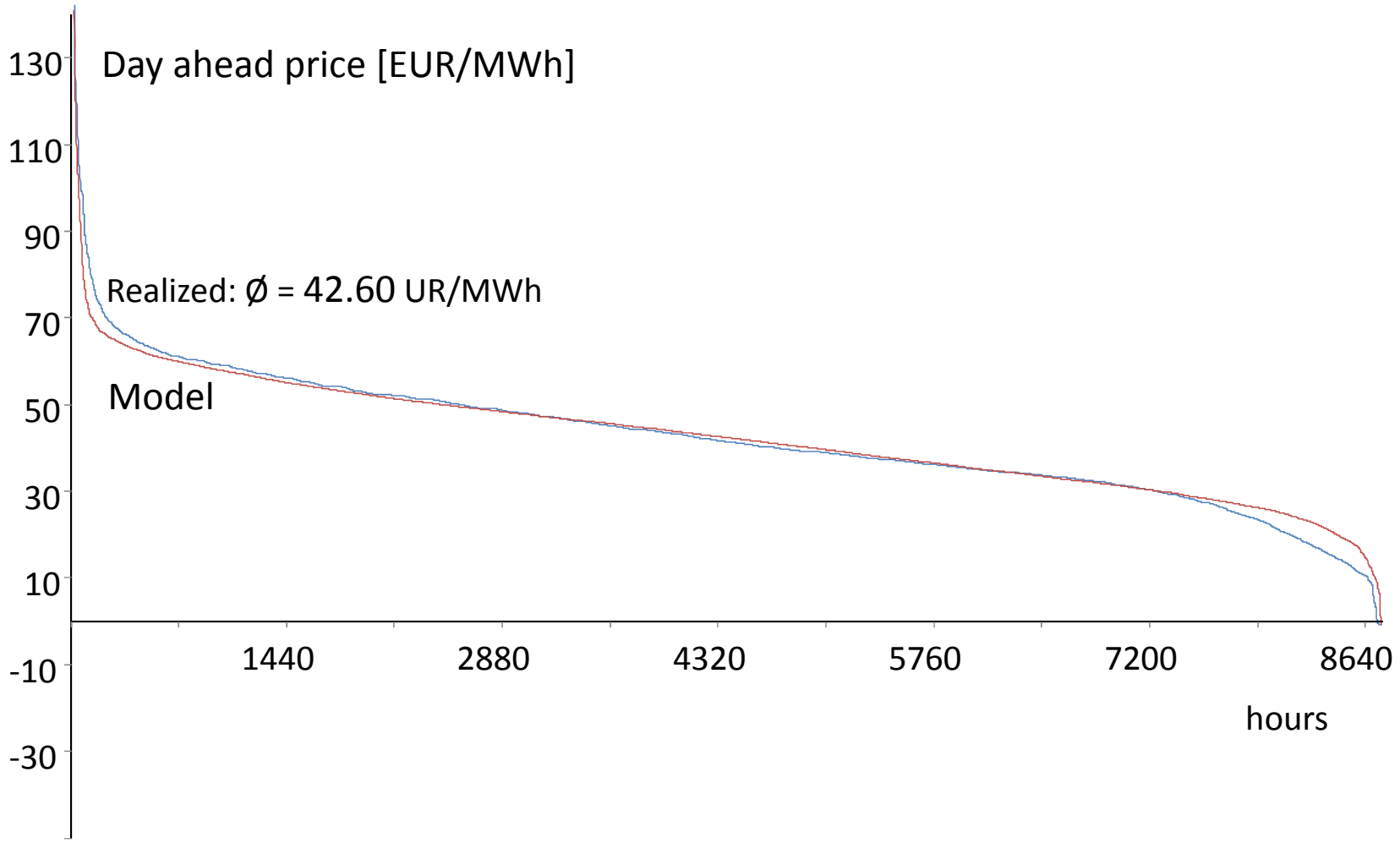
Insignificant at 5%

Insignificant at 10%

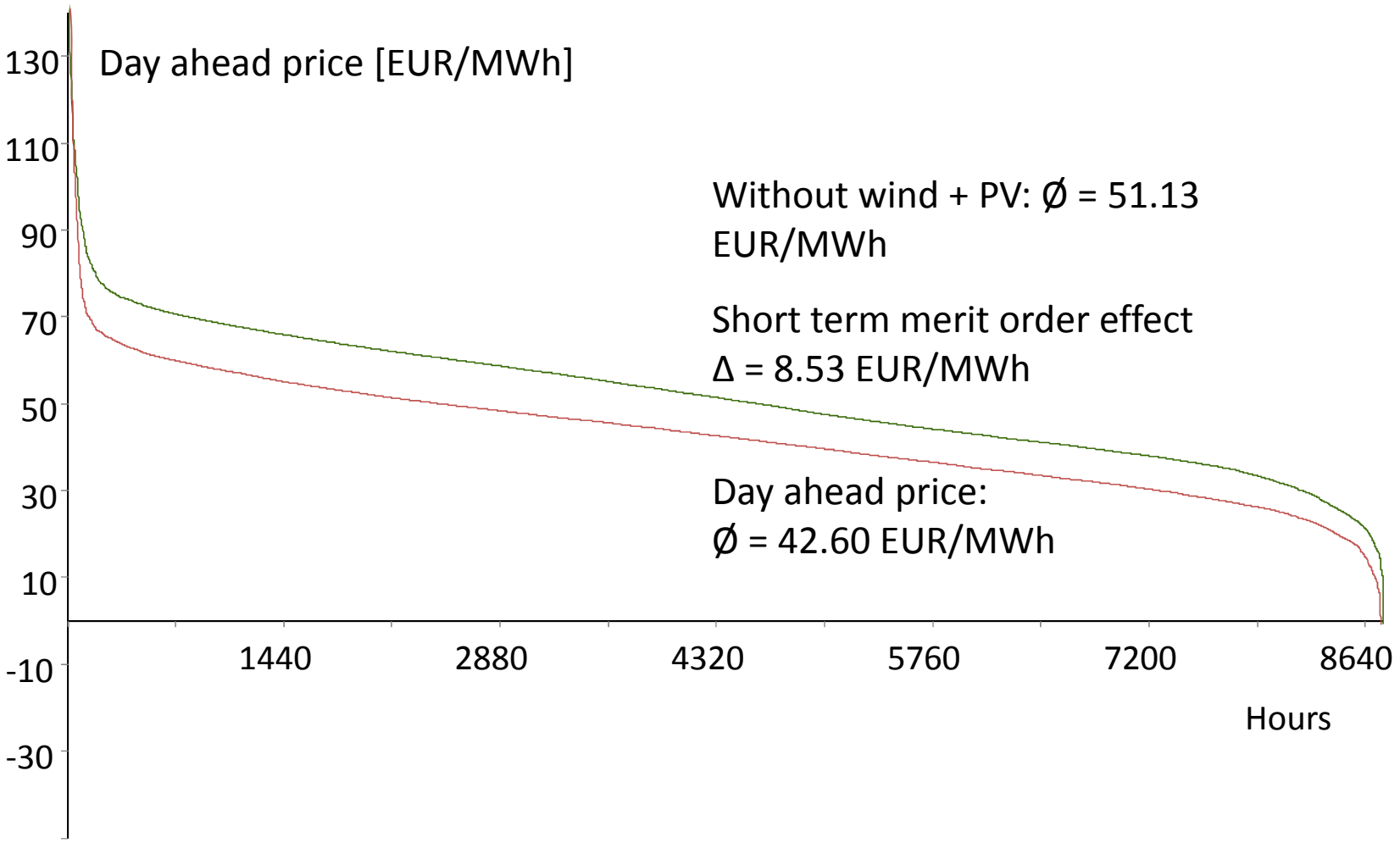
Model Results (Cont.)

HOUR	02-03	06-07	09-10	12-13	13-14	18-19	21-22	22-23
DAYAHEAD(DAY-1)	0.23	0.10	0.04	0.08	0.06	0.25	0.21	0.15
WIND	-1.10	-0.90	-0.84	-0.83	-0.84	-0.66	-0.74	-0.77
PHOTOVOLTAIK	287.91	-0.47	-0.07	-0.08	-0.09	-0.29	-0.05	-306.82
SPIKES-UP$^{0.9}$	12.94	22.33	205.92	129.86	117.41	327.04	67.80	59.83
SPIKES-DOWN$^{0.3}$	-16.24	-27.61	-18.69	-15.51	-15.31	-11.24	-8.10	-6.16
COAL+0.75·EUA	0.22	0.27	0.34	0.39	0.38	0.21	0.31	0.37
GAS+0.2·EUA	0.44	0.87	1.21	0.91	0.94	1.23	0.57	0.41
SATURDAY	1.14	-12.55	-10.52	-8.59	-11.08	-6.49	-5.74	-3.04
SUNDAY	-4.42	-19.01	-19.79	-13.04	-16.38	-10.36	-2.67	-0.58
HOLIDAY	-6.36	-11.59	-14.16	-9.70	-12.27	-6.09	-1.94	-0.07
VACCATIONS	-5.03	-5.74	-6.11	-2.08	-2.01	-3.22	-2.03	-1.84
NEGATIVPRICE	-98.80	-103.19	6.48	2.73	4.10	0.37	-4.36	-4.66

Ordered Price Curve in 2012



Simulated Ordered Price Curve in 2012 Without Wind und Photovoltaic



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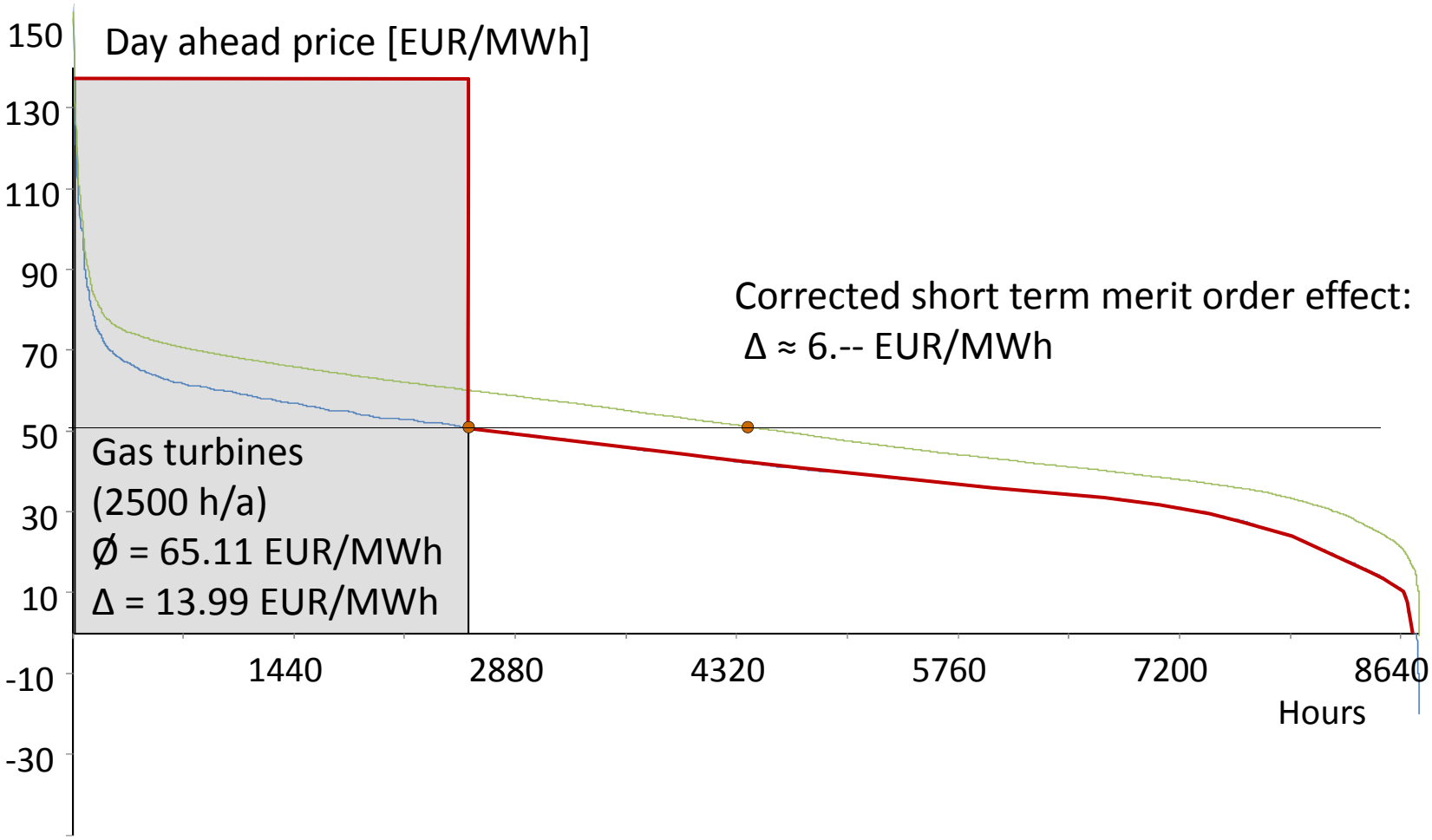
Ordered Price Curve in 2012 Necessary to Finance New Gat Turbines



Design Problems of Capacity Markets

Aspect	Solution
Free riding	Selective capacity payments
Selection criteria	Strategic reserve or new capacities? Which types of reserve capacities (power plants, storage devices …) Properties of power plants (minimum/maximum size, CO_2-emissions, ownership/market concentration)? Location of capacities (north or south, domestic or foreign)? Until when the capacities shall be available? (what happens if not?) For how long the capacities shall be available? (“)
Market power	Government supervision (BKartA)
Justice	Discrimination of old power plants
Money raising	Capacity levy on use-of-grid payments (like German EEG levy)
Lags and cycles	Long term planning to overcome cycles (like *Netzentwicklungsplan*)
Auction manager	Administration (BNetzA) , TSO, market actors
Who shall plan?	Parliament, administration, market actors (which?)

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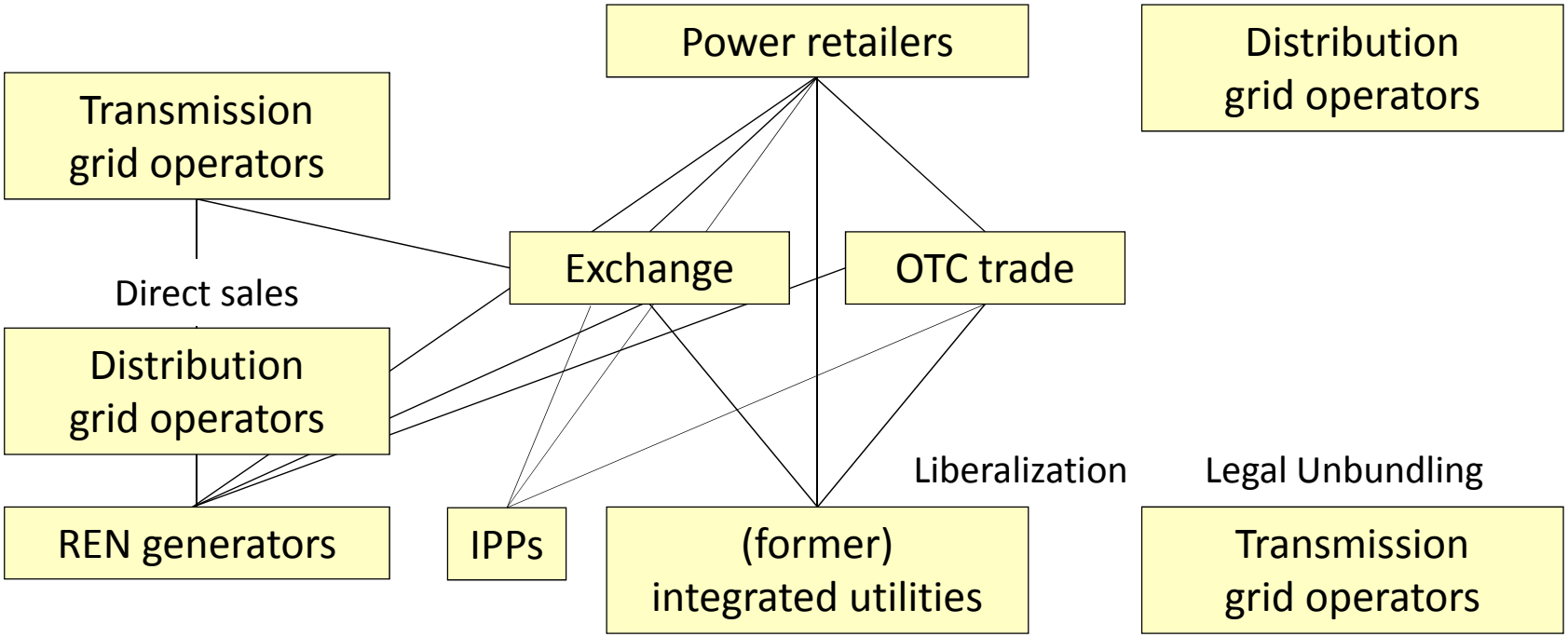
REN System or REN Market Integration

≈ 13 bn. EUR
support (net of merit order effect)

≈ 40 bn. EUR
without taxes but with merit order effect

≈ 7 bn. EUR
use-of-grid payments



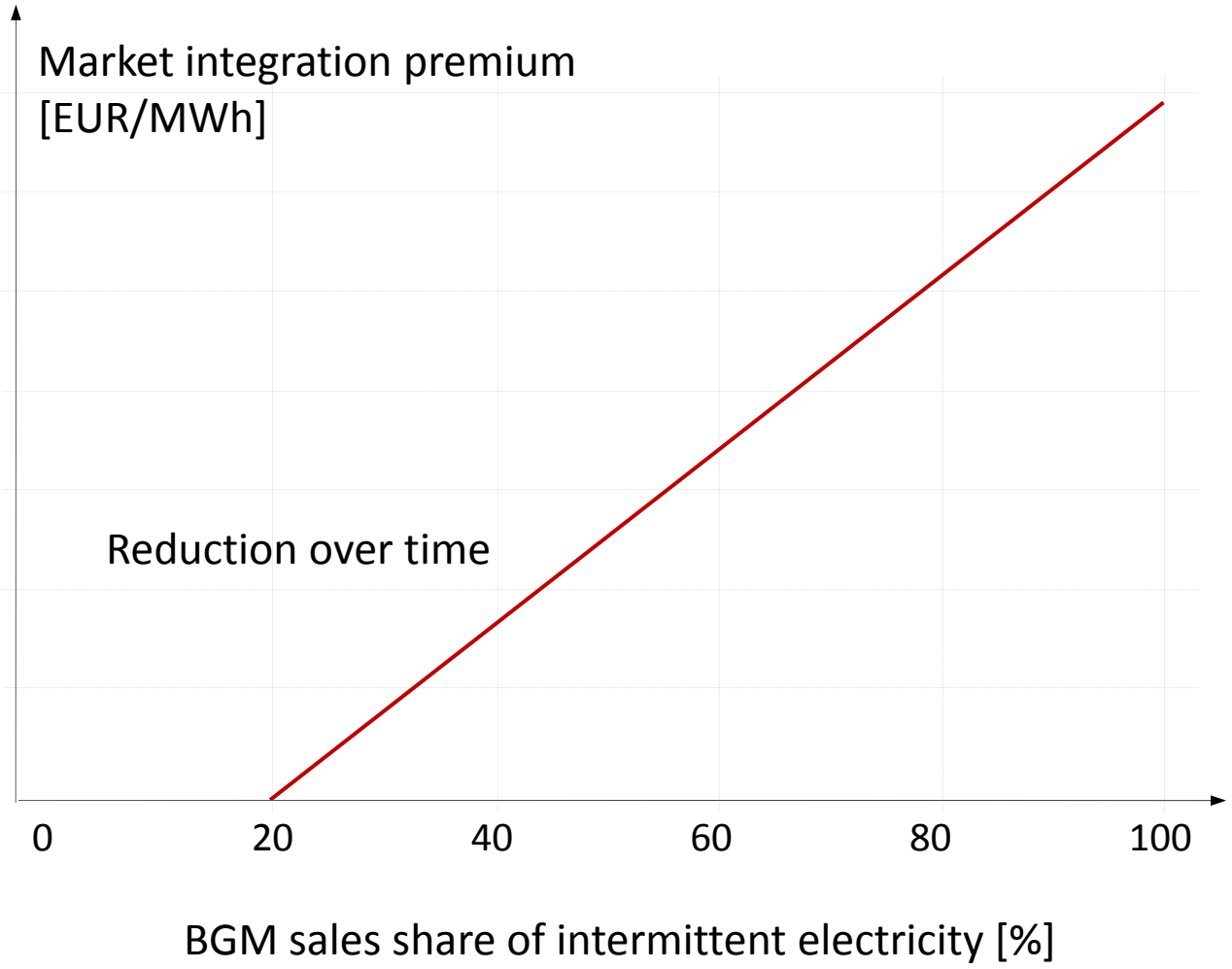
Technology Specific REN Support

	Wind & PV generators	Other REN generators	Grid operators	Balancing groups
REN feed-in support	Fixed feed-in fee (§ 16 EEG)	Fixed feed-in fee (§ 16 EEG)	Purchase obligation (§ 8 EEG) + sales on spot markets (AusglMechV)	
REN direct sales	Market price + REN premium + management premium (§ 33 EEG)	Market price + REN premium + management premium + FLEX premium (§ 33 EEG)		Green power privilege (§ 39 EEG)

REN direct sales in GER in 2013:

80 % of onshore wind
37 % of biomass power
8 % of photovoltaic

Concept of a Market Integration Premium



Role of Balancing Group Managers (BGM)

- Market integration of intermittent renewable power by using the generated electricity in schedules to supply customers

- Therefore the BGM needs to purchase backup capacities:
  - Contracts on Energy-only Markets
  - Capacity purchase agreements with generators and storage capacities
  - Interruptible load contracts with certain customers
  - Investing into capacities (distributed generation, heat storage, batteries, …)

- Compatibility with the European single market if an EU wide register of certified intermittent power REN capacities exists (its aim is to prevent unjustified subsidies)
  - Market integration premium when purchasing REN abroad
  - REN premium when selling intermittent power to foreigners

Central vs. De-central Capacity Market

Coordination	**Centrally planned**	**De-central, self organized**
Efficiency / costs	Static efficiency due to Economies of scale	Costs of redundancies, but efficiency through competition, innovation and selection
Origin of the capacity demand	Determined by the state planner, with sanctions	Sustainability of the BGM business model (if BGM cannot deliver customers he will drop out of the business)

Conclusions concerning a de-centralized self organized capacity market

- Equilibrium between the expansion of intermittent REN capacities and backup capacities (of all types and concepts) is necessary
- Equilibrium is discovered through markets not through a state planning authority
- Market integration premium controls the equilibrium