

Energy Economics

Model system with different power plants

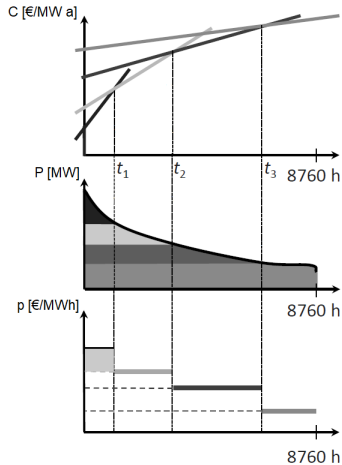


Figure: Model system with an optimal power plant mix resulting from total costs; taken with adjustments from Schwintowski *et al.* (2021).

Spot market

- day ahead (auction), intraday (continuously)
- price range -1000 € till +3000 €

hour\price	0	6,9	7	16,9	17	17,1	17,2	149,9	150	3000
1	200,0	200,0	100,0	100,0	0,0	-75,0	-75,0	-75,0	-275,0	-275,0
2	154,9	154,9	42,6	42,6	6,3	6,3	0,0	0,0	-20,0	-20,0
3	-57,0	-57,0	-100,0	-100,0	-100,0	-175,0	-175,0	-175,0	-325,0	-325,0
4	200,0									200,0

Figure: Exemplary bid at the day ahead market skipping negative prices; taken with adjustments from Schwintowski *et al.* (2021).

Supply at the electricity market

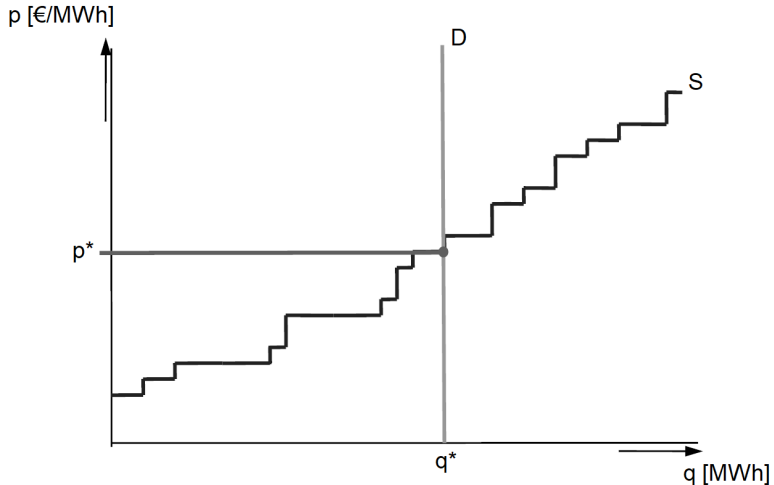


Figure: Schematic illustration of electricity supply (MC-curve); taken with adjustments from Schwintowski *et al.* (2021).

Electricity indexes

- **Phelix Base**

→ Physical Electricity Index Base

→ arithmetic average of all base load hours within the observed time period

- **Phelix Peak**

→ Physical Electricity Index Peak

→ arithmetic average of all peak load hours within the observed time period

Electricity markets - exercise

b1	hour	0	110	3000	b6	hour	0	185	3000
	12	0	-5000	-5000		12	0	-3000	-3000
b2	hour	0	40	3000	b7	hour	0	120	3000
	12	0	-6000	-6000		12	0	-6000	-6000
b3	hour	0	15	3000	b8	hour	0	45	3000
	12	0	-6000	-6000		12	0	-11000	-11000
b4	hour	0	20	3000	b9	hour	0	125	3000
	12	0	-9000	-9000		12	0	-3000	-3000
b5	hour	0	200	3000	b10	hour	0	65	3000
	12	0	-4000	-4000		12	0	-10000	-10000

Table: Summary of bids

- Draw the merit order with demand and equilibrium price.
- What is the equilibrium price for a demand of 47 GWh?
- Calculate the producer surplus of each bidder.

Exercise – merit order

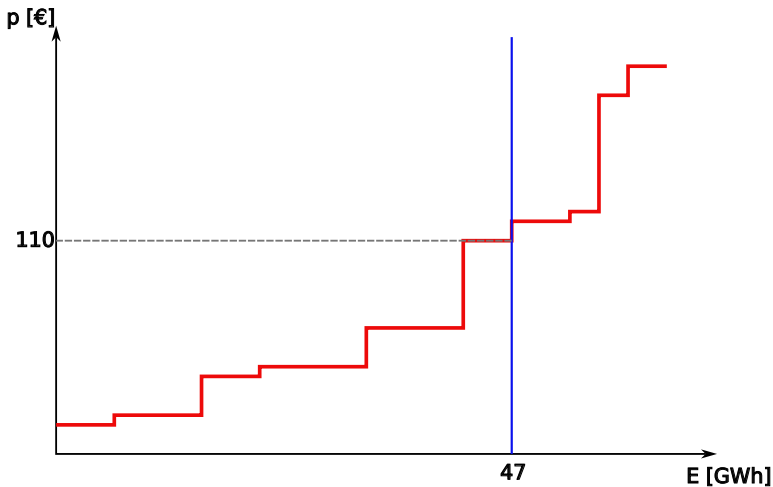


Figure: Schematic illustration of merit order and equilibrium price.

Multi-unit bidders

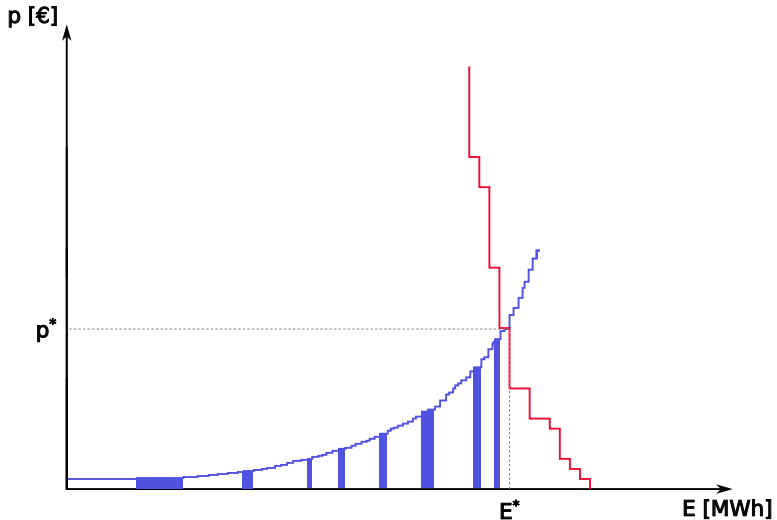


Figure: Schematic illustration of the merit order after capacity of two power plants is withdrawn.

Multi-unit bidders

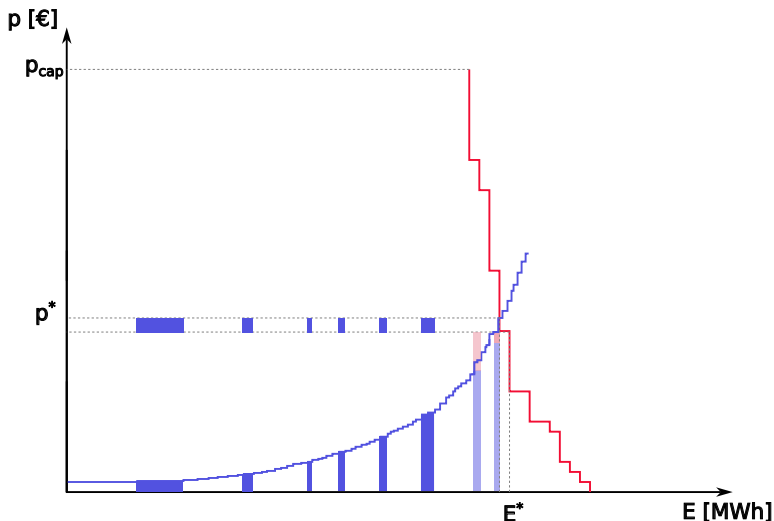


Figure: Schematic illustration of the merit order after capacity of two power plants is withdrawn.

Available capacity

There are different reasons why capacity is not available

- maintenance
- power plant is broken
- non-linear ramping costs
- strategic bidding

⇒ the regulator does not know the reason (asymmetric information)

⇒ introduction of a price cap (e.g. 3,000 €)

Multi-unit bidders - exercise

b1	hour	0	20	40	120	3000
	12	0	-9000	-15000	-21000	-21000
b2	hour	0	15	45	110	3000
	12	0	-6000	-17000	-22000	-22000
b3	hour	0	65	125	2900	3000
	12	0	-10000	-13000	-13000	-13000
b4	hour	0	185	200	2900	3000
	12	0	-3000	-7000	-7000	-7000

- Use the merit order of the preceding task to illustrate which power plants belong to bidders $b_1 - b_4$.
- Calculate the market shares of bidders $b_1 - b_4$ in hour 12.
- Which bidders can generate an additional producer surplus by withholding capacity?
- Calculate the additional producer surplus of all possible strategies
- What may prevent bidders from withholding capacity?

References

- DE MIERA, G. S., DEL RIO GONZALEZ, P. and VIZCAINO, I. (2008). Analysing the impact of renewable electricity support schemes on power prices: The case of wind electricity in Spain. *Energy Policy*, **36** (9), 3345–3359.
- EEX (2022). EEX German Power Futures Base. Available at: <https://www.eex.com/de/marktdaten/strom/futures#%7B%22snippetpicker%22%3A%2228%22%7D>, accessed December 18, 2022.
- INFORMATION PLATFORM OF THE GERMAN TRANSMISSION SYSTEM OPERATORS (INFORMATIONSPLATTFORM DER DEUTSCHEN ÜBERTRAGUNGSNETZBETREIBER – NETZTRANSPARENZ.DE) (2018). EEG-Jahresabrechnungen. Available at: <https://www.netztransparenz.de/EEG/Jahresabrechnungen>, accessed April 1, 2018.
- SCHWINTOWSKI, H.-P., SCHOLZ, F. and SCHULER, A. (eds.) (2021). *Handbuch Energiehandel*. Erich Schmidt Verlag, 5th edn.
- SENSFUSS, F., RAGWITZ, M. and GENOESE, M. (2008). The merit-order effect: A detailed analysis of the price effect of renewable electricity generation on spot market prices in Germany. *Energy Policy*, **36** (8).
- TRADINGECONOMICS.COM (2023). EU natural gas. Available at: <https://tradingeconomics.com/commodity/eu-natural-gas>, accessed November 19, 2022.
- WORKING GROUP ON ENERGY BALANCES (ARBEITSGEMEINSCHAFT ENERGIEBILANZEN E.V) (2018). Bruttostromerzeugung in Deutschland ab 1990 nach Energieträgern. Available at: https://ag-energiebilanzen.de/index.php?article_id=29&fileName=20171221_brd_stromerzeugung1990-2017.xlsx, accessed September 4, 2018.