Environmental Assessment

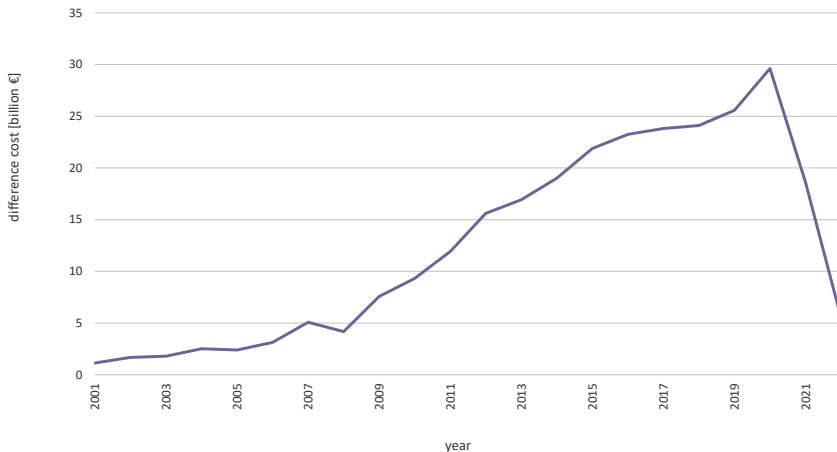# Subsidies for RES-based electricity generation

Figure: Difference costs induced by subsidies for electricity generation by RES in Germany. Own illustration based on data provided by Information Platform of the German Transmission System Operators (2018,b).

Promotion of RES

regulator's assumption

- subsidies for RES are "too high"
- ⇒ high additional profits of RES-based operators
- ⇒ undesired redistribution electricity consumers to electricity producers

idea

- → redution of additional profits
- → increase **efficiency** without deteriorating **effectiveness**

- reverse auctions for RES
- ⇒ shift from price-based promotion scheme to a quantity-based promotion scheme

Auctions

usual auction

→ the auctioneer wants to sell a good for the highest price possible

→ the bidder wants to buy the good as cheap as possible

→ efficiency is achieved if the bidder with the highest willingness to pay acquires the good

reverse auction

→ the auctioneer wants to buy a good for the lowest price possible

→ the bidder wants to sell the good as expensive as possible

→ efficiency is achieved if the bidder with lowest cost sells the good

- In a reverse auction the roles of bidder and auctioneer are reversed

Reverse auctions for RES

- the regulator is the auctioneer who wants to "buy" certain RES-based generation capacity
- → example: the regulator wants 1,000 MW wind capacity to be built
- → there are bids for 1,200 MW
- → bidders with lowest bids are awarded until the demand of 1,000 MW is satisfied

- → **repeated multi unit sealed bid reverse auction**

Multi unit reverse auctions

uniform pricing

→ all successful bidders receive the highest successful bid

pay-as-bid (discriminatory) pricing

→ all successful bidders receive their bid as payment

Excursus – LCOE

Levelized **C**ost **o**f **E**lectricity (LCOE)

$$LCOE = \frac{\sum_{t=0}^{n} \frac{C_{I,t}+C_{O\&M,t}+C_{F,t}+C_{CO2,t}+C_{D,t}}{(1+i)^t}}{\sum_{t=0}^{n} \frac{E_t}{(1+i)^t}} \tag{1}$$

- $C_{I,t}$ investment cost in year t
- $C_{O\&M,t}$ operation and maintenance cost in year t
- $C_{F,t}$ fuel cost in year t
- $C_{CO2,t}$ CO_2 emission cost in year t
- $C_{I,t}$ decommissioning cost in year t
- E_t electricity generation in year t
- i interest rate (discount factor)

LCOE – exercise

Levelized **C**ost **o**f **E**lectricity (LCOE)

$$LCOE = \frac{\sum_{t=0}^{n} \frac{C_{I,t}+C_{O\&M,t}+C_{F,t}+C_{CO2,t}+C_{D,t}}{(1+i)^t}}{\sum_{t=0}^{n} \frac{E_t}{(1+i)^t}}$$

- assume $LCOE=4.5$ €-cents/kWh, an annual electricity generation of 15 GWh, a project lifetime of 20 years, an interest rate i of 5 %

- Calculate the investment cost $C_{I,0}$ assuming there are no other cost

- Calculate the profit as nominal and real value assuming an average remuneration of 7 €-cents/kWh

- Calculate nominal average rate on return and the real average rate on return

Strategic behavior – exercise

You are a project developer of a 6 MW wind turbine

- your power plant generates 15 GWh per year for 20 years
- your LCOE (without profit margin) is 4.5 €-cents/kWh for 4–7, 5 €-cents/kWh for 8–9, 5.5 €-cents/kWh for 10, 4 €-cents/kWh for 2–3, 3.8 €-cents for 1
- the maximum bid is restricted to 7 €-cents/kWh
- the deposit is 30 €/kW (returned after realization)
- unsuccessful bidding means a loss of 90,000 €/year
- with a debt of 500,000 €/project you are bankrupt ☺
- the interest rate is 5 %

Strategic behavior – exercise

Place a bid in the reverse auction under uniform pricing

- Calculate your loss/(nominal) profit
- Calculate your (nominal) average rate on return (if there is any profit)
- place bids via www.menti.com (Code: 6360 6528)
- → for every successful project you get a new project for the next round
- → the bidder with the highest rate on return receives one additional project
- → you bid 3 rounds (1 round each year)

Strategic behavior – exercise

Place a bid in the reverse auction under pay-as-bid pricing

- Calculate your loss/(nominal) profit
- Calculate your (nominal) average rate on return (if there is any profit)
- place bids via www.menti.com (Code: 6360 6528)
- → for every successful project you get a new project for the next round
- → the bidder with the highest rate on return receives one additional project
- → you bid 3 rounds (1 round each year)

Strategic behavior – exercise

You still place bids under pay-as-bid pricing but receive a random number of projects.

- Calculate your loss/(nominal) profit
- Calculate your (nominal) average rate on return (if there is any profit)
- place bids via www.menti.com (Code: 6360 6528)
- → for every successful project you get a new project for the next round
- → the bidder with the highest rate on return receives one additional project
- → you bid 6 rounds (1 round each year)

BUNDESNETZAGENTUR (2023). Statistiken: Windenergieanlagen an Land – Ausschreibungen. Available at: https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen_Institutionen/Ausschreibungen/Statistiken/Statistik_Onshore.xlsx?__blob=publicationFile&v=28, accessed October 29, 2023.

FA WIND (2023). Analyse der 28. Ausschreibung für Windenergieanlagen an Land. Available at: https://www.fachagentur-windenergie.de/fileadmin/files/Veroeffentlichungen/Analysen/FA_Wind_Analyse_28_Ausschreibung_Wind_an_Land.pdf, accessed October 29, 2023.

FEDERAL MINISTRY FOR ECONOMIC AFAIRS AND ENERGY (2017). State Secretary Baake: "Citizens' energy wins first onshore wind auction". Available at: https://www.bmwi.de/Redaktion/EN/Pressemitteilungen/2017/20170519-staatssekretaer-baake-buergerernergie-gro%C3%9Fe-gewinner-der-ersten-ausschreibungsrunde-wind-an-land.html, accessed August 31, 2018.

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.