



Rationales for technology-specific RES support and their relevance for German policy[☆]



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ABSTRACT

In order to achieve cost-effective RES-E deployment it is often argued that technology-neutral support schemes for renewables are indispensable. Against this background, RES-E support policies making widely use of technology differentiation in remuneration settings, e.g. across the EU, are frequently criticized from a theoretical point of view. However, in this paper we provide a systematic critique of the technology neutrality concept as a foundation for designing policy support schemes in the RES-E technology field. Specifically, the main objective of the paper is to scrutinize the arguments for technology-neutrality, and discuss three conceptual arguments for why technology-specific support schemes could in fact help minimize the societal costs of reaching future RES-E targets. We also briefly address different political economy concerns, which could constrain the choice of cost-effective policy support schemes, and that have to be taken into account for economic policy advice. For empirical illustration of the key arguments we refer to the case of German RES-E policy-making. The central conclusion from this paper is that technology-specific RES-E support schemes may generate significant economic benefits, particularly if technology markets work imperfectly and in second-best policy settings with additional non-internalized market failures.

1. Introduction

An increased use of renewable energy sources is considered necessary for a transition towards a carbon-free and sustainable society, and many countries have introduced policy schemes (e.g., feed-in tariffs, certificate schemes, tendering procedures etc.) supporting the deployment of renewable energy technologies such as wind power and solar photovoltaics (PV). However, while there is still a controversial debate among economists on the general need for such policies (Fankhauser et al., 2010; Fischer and Preonas, 2010; Lehmann and Gawel, 2013; Söderholm and Klaassen, 2007), particularly, there exist different views on how the specific policy schemes, if ever implemented, should be designed in practice. In this paper we address the issue of whether the granted remuneration for renewables for electricity – i.e., a certain price premium per kWh – should be differentiated on the basis of inter- or intra-technology differences, or if it instead should be technology-neutral.¹

Many support schemes for electric power generated from renewable energy sources (RES-E) in Europe grant technology-specific support. The German scheme mandated by the Renewable Energy Sources Act (*Erneuerbare-Energien-Gesetz*, EEG) is a prominent example (see Table 1). It incorporates technology-specific deployment targets. The basic support scheme to attain these targets (administratively set tariffs vs. tenders, fixed tariffs vs. premium tariffs) also varies with technologies. Moreover, the support levels themselves are highly differentiated both under the recently introduced tender scheme as well as the administratively set tariff scheme. The differentiation of support levels is based on the energy sources employed, the specific technology, capacity and location of a plant as well as, for biomass, the substrates used in a plant.

However, this approach of technology-specific RES-E support has been criticized, primarily since it is argued to make the attainment of RES-E deployment targets unnecessarily costly (see, e.g., Frontier Economics, 2012; Frontier Economics, 2014; Frontier Economics

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¹ In practice, the implementation of technology-specific RES-E support may be based on differentiation across technologies as well as within a given technology (e.g., the latter with respect to size, geographical location, fuel use etc.). This paper primarily addresses the former, although we also recognize that various versions of some renewable energy technology may have reached different levels of technological maturity (e.g., onshore versus offshore wind power).

Table 1
Examples of technology differentiation in Germany under the 2017 Renewable Energy Sources Act (EEG 2017).

Object of differentiation		Base of differentiation	Specification in the 2017 German Renewable Energy Sources Act (Examples)
Deployment targets (Art. 4 EEG 2017)		Energy source	<ul style="list-style-type: none"> ● Wind onshore: 2800 MW p.a. (2017–2019), 2,900 (2020 and beyond) ● Wind offshore: 6500 MW by 2020, 15,000 MW by 2030 ● Solar: 2500 MW p.a. ● Biomass: 150 MW p.a. (2017–2019), 200 MW p.a. (2020–2022) ● Not defined for geothermal, mining, landfill and sewage gas, hydropower
Choice between basic support scheme (Art. 21, Art. 22 EEG 2017)		Energy source, plant size	<ul style="list-style-type: none"> ● Tenders mandatory for wind onshore (if commissioned after 2019 and plant size > 750 kW), wind offshore (if commissioned after 2021), solar (if plant size > 750 kW), and biomass (if commissioned after 2019 and plant size > 150 kW) ● Administratively set tariffs for all other plant sizes and energy sources
		Plant size	<ul style="list-style-type: none"> ● Premium tariff mandatory for plants larger than 100 kW ● Smaller plants can opt for fixed tariff
Tender scheme	Tender volumes (Art. 28, Art. 36c, Art. 38a EEG 2017)	Energy source	<ul style="list-style-type: none"> ● Wind onshore: Three to four annual tenders of 700–1000 MW each ● Solar: Three annual tenders of 200 MW each ● Biomass: One annual tender of 150–200 MW ● Wind offshore: determined by network regulator ● Wind onshore and solar: One joint annual tender of 400 MW
		Plant location	<ul style="list-style-type: none"> ● Wind onshore: network regulator can adopt additional restrictions on new installations in heavily congested transmission areas ● Solar: No support for plants in nature protection areas
	Tender price (Art. 36 h EEG 2017)	Plant location	<ul style="list-style-type: none"> ● Upward (downward) correction of tender price for wind onshore plants with a reference yield below (above) the yield at a reference location (reference yield model)
	Tender price cap in 2017 (Art. 36b, Art. 37b, Art. 39b EEG 2017)	Energy source	<ul style="list-style-type: none"> ● Wind onshore: 7.00 Cent/kWh ● Solar: 8.91 Cent/kWh ● Biomass: 14.88 Cent/kWh
	Tender price cap adjustment after 2017 (Art. 36b, Art. 37b, Art. 39b EEG 2017)	Energy source	<ul style="list-style-type: none"> ● Wind onshore: floating average of highest bids in the previous three tenders ● Solar: 0.5% per month, additional adjustments depending on actual deployment in the previous 12 months ● Biomass: 1% p.a.
	Contractual penalty for delayed or cancelled installation (Art. 55 EEG 2012)	Energy source	<ul style="list-style-type: none"> ● Wind onshore: 10–30 Euro/kW ● Solar: 25–50 Euro/kW ● Biomass: 20–60 Euro/kW
Administratively set tariff scheme	Tariff level (Art. 40–50b EEG 2017)	Energy source	<ul style="list-style-type: none"> ● Geothermal: 25.20 Cent/kWh ● Solar: 8.91–12.70 Cent/kWh ● Biomass: 5.71–23.14 Cent/kWh ● Landfill gas: 5.66–8.17 Cent/kWh ● Sewage gas: 5.66–6.49 Cent/kWh ● Wind onshore 4.66–8.38 Cent/kWh (after 2018, tariff equals tender price) ● Wind offshore: 3.90–19.40 Cent/kWh ● Mine gas: 3.69–6.54 Cent/kWh ● Hydropower: 3.47–12.40 Cent/kWh
		Plant technology	<ul style="list-style-type: none"> ● Higher support for solar energy plants mounted on buildings (11.09–12.70 Cent/kWh) than for ground-based plants (8.91 Cent/kWh) ● Premium for flexible biogas generation ● No support for hydropower plants with insurmountable dams
		Plant capacity	<ul style="list-style-type: none"> ● Stepwise decrease of tariff with increasing plant capacity for hydropower, mining, landfill, sewage gas, biomass, solar ● Example hydropower: <ul style="list-style-type: none"> ≤ 500 kW: 12.40 Cent/kWh ≤ 2 MW: 8.17 Cent/kWh ≤ 5 MW: 6.25 Cent/kWh ≤ 10 MW: 5.48 Cent/kWh ≤ 20 MW: 5.29 Cent/kWh ≤ 50 MW: 4.24 Cent/kWh > 50 MW: 3.47 Cent/kWh
	Substrate (for biomass)	<ul style="list-style-type: none"> ● Biogas from fermented manure: 23.14 Cent/kWh ● Biogas from fermented biological waste: 13.05–14.88 Cent/kWh ● Biomass according to Biomass Ordinance: 5.71–13.32 Cent/kWh ● Additional pre-qualification criteria apply for each type of substrate 	
	Tariff degression rate (Art. 40–50b EEG 2017)	Energy source	<ul style="list-style-type: none"> ● Solar: 0.5% per month, additional adjustments depending on actual deployment in the previous 12 months ● Geothermal: 5.0% p.a. (starting 2021) ● Biomass: 0.5% per half-year ● Wind onshore: 0.4–1.05% per quarter, additional adjustments depending on actual deployment in the previous 12 months ● Mining, landfill, sewage gas: 1.5% p.a. ● Hydropower: 0.5% p.a. ● Wind offshore: 0.5–1.0 Cent/kWh/a

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