

Impact of RES support schemes on short-term market outcomes

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Outline

- Scenarios underlying the studies
- Main hypotheses about RES support schemes
- Results: impact of RES support schemes on short-term market outcomes
- Next steps: impacts of the deployment of demand flexibility on short-term market outcomes
- Conclusions



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Scenarios underlying the studies

- To compare the impacts of different market design options in a robust manner, scenarios have to be chosen
 - Support to sensitivity analyses with different features of the electric system
- Three scenarios are proposed
 - A **reference scenario** mimicking the current situation (2013-2014)
 - A standard 2020 scenario corresponding to the official publications regarding the expected situation at 2020
 - A more ambitious scenario at 2020 in terms of RES penetration (RES+ scenario)



Scenario	Ther	mal gener	ation	RES		Transmission
name	Installed capacities	Flexibility	Economic parameters	generation	Demand	network
Reference scenario						
2020 standard scenario						
2020 RES+ scenario						





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Reference scenario	Current installed capacities	Current flexibility level	Current CO ₂ price and fuel costs	Current installed capacities	Current level of peak demand	Current cross- border capacities
2020 standard scenario						
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2020 standard scenario	Installed capacities at 2020 as foreseen today	Current flexibility level	Foreseen values at 2020	2020 RES objectives	Level of peak demand at 2020 as foreseen today	2020 cross- border capacities as foreseen today
2020 RES+ scenario						





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2020 standard scenario	Installed capacities at 2020 as foreseen today	Current flexibility level	Foreseen values at 2020	2020 RES objectives	Level of peak demand at 2020 as foreseen today	2020 cross- border capacities as foreseen today
2020 RES+ scenario	Significant decrease in thermal installed capacities	Higher flexibility of thermal units	Higher CO ₂ price (impact on merit order curve)	Additional RES capacities	Level of peak demand at 2020 as foreseen today	2020 cross- border capacities as foreseen today





Scope of the studies

Geographic scope of the studies



• Period studied = 6 months from February to July

Data for the 3 scenarios

Main sources of data

- ENTSO-E
 - Scenario Outlook and Adequacy Forecast (SO&AF)
 - Ten Year Network Development Plan (TYNDP)
 - Transparency platform https://transparency.entsoe.eu/
- National Renewable Energy Action Plans (NREAPs)
- European Commission (Trends to 2050 Reference Scenario)
- OPTIMATE embedded data
- Updates and complements provided by Market4RES partners (EWEA, SolarPower Europe, EEG, ...)

Installed capacities and peak load in the 3 scenarios



Market RES

	2013	2020 standard	Evolution 2020 / 2013	2020 RES+	Evolution RES+/ standard
CO ₂	4.38 €/t	10 €/t	+128%	40 €/t	+300%
Gas	28.26 €/MWh	37.03 €/MWh	+31%	37.03 €/MWh	+0%
Coal	61.67 €/t	108.2 €/t	+75%	108.2 €/t	+0%
Oil	109 \$/bbl	115 \$/bbl	+6%	115 \$/bbl	+0%

Overview of the 3 scenarios



Overview of the 3 scenarios



Market **RES**

Overview of the 3 scenarios



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Main hypotheses about RES support schemes

- Within OPTIMATE, support schemes are configured
 - Per country
 - Per type of energy (wind or solar)
- For each, the user can define
 - The percentage of generation sold under price premium; the rest of this generation is considered as sold under feed-in tariff
 - The premium average price (€/MWh)
 - The Feed-in tariff average value (€/MWh)

Main hypotheses about RES support schemes

- Features of Feed-in-Tariffs implemented within OPTIMATE
 - Fixed regulated price per MWh fed into the grid (whatever the electricity market price)
 - **Priority dispatch** granted to subsidized energy
 - → RES production is integrated as a "must-run"
 - → Since within OPTIMATE the whole generation is offered to the day-ahead market, this is modelled as if RES producers submit bids at the minimum authorized price (-500 €/MWh)

Main hypotheses about RES support schemes

- Features of Price Premium scheme implemented within OPTIMATE
 - RES producers receive the electricity market price and a fixed regulated premium (extra bonus) over the electricity market price for the feed-in of renewable energy
 - No priority dispatch
 - → RES producers have positive income as long as the market price is not more negative than the premium amount
 - → This is modelled as if RES producers submit bids at "minus price premium"

- Current support schemes (simplified)
 - Source: EWEA

	AT	BE	FR	DE	GB	Π	NL	PT	ES	СН
Percentage of wind generation sold under feed-in tariff	100%	0%	1 00%	0%	0%	1 00%	0%	100%	100%	100%
Wind Feed-in tariff average value (€/MWh)	94	-	82	-	-	122	-	74	81	146
Percentage of wind generation sold under premium prices	0%	1 00%	0%	100%	100%	0%	1 00%	0%	0%	0%
Wind premium average price (€/MWh)	-	82	-	94	77	-	98	-	-	-



Envisaged support schemes for 2020

- All 'new' capacities are supposed to be under PP
- All 'old' capacities are supposed to keep their current support scheme

	AT	BE	FR	DE	GB	IT	NL	ΡΤ	ES	СН
Percentage of wind generation sold under feed-in tariff	50%	0%	41%	0%	0%	71%	0%	83%	88%	5%
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Wind Feed-in tariff average value (€/MWh)	94	-	82	-	-	122	-	74	81	146
Percentage of wind generation sold under premium prices	50%	100%	59%	100%	100%	29%	100%	17%	12%	95%
Wind premium average price (€/MWh)	Need to assess price premiums at 2020!									



Method to assess price premiums at 2020



Envisaged support schemes for 2020

- All 'new' capacities are supposed to be under PP
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Wind Feed-in tariff average value (€/MWh)	94	-	82	-	-	122	-	74	81	146
Percentage of wind generation sold under premium prices	50%	1 00 %	59%	100%	100%	29%	1 00%	17%	12%	95%
Wind premium average price (€/MWh)	19	51	48	41	74	10	50	44	43	20

Parameters for the solar support schemes

- Current support schemes
 - Difficulties in assessing the average support schemes:
 - Market segmentation very complex and country-dependant
 - Regular revisions in Feed-in-Tariffs

	AT	BE	FR	DE	GB	IT	NL	ΡΤ	ES	СН
Percentage of solar generation sold under feed-in tariff	1 00%	100%	1 00%	88%	1 00%	100%	100%	1 00%	1 00%	100%
Solar Feed-in tariff average value (€/MWh)	250	-	250	-	-	250	-	250	250	250
Percentage of solar generation sold under premium prices	0%	0%	0%	12%	0%	0%	0%	0%	0%	0%
Solar premium average price (€/MWh)	-	-	-	107	-	-	-	-	-	-



Parameters for the solar support schemes

Envisaged support schemes for 2020

- All 'new' capacities are supposed to be under PP
- All 'old' capacities are supposed to keep their current support scheme
- Same reasoning than for wind, based on LCOE foreseen at 2020

	AT	BE	FR	DE	GB	IT	NL	ΡΤ	ES	СН
Percentage of solar generation sold under feed-in tariff	30%	76%	45%	59%	34%	72%	25%	23%	44%	31%
Solar Feed-in tariff average value (€/MWh)	250	-	250	-	-	250	-	250	250	250
Percentage of solar generation sold under premium prices	70%	24%	55%	41%	66%	28%	75%	77%	56%	69%
Solar premium average price (€/MWh)	84	84	105	84	83	75	83	108	108	85



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Impact of RES support schemes on shortterm market outcomes

- Approach:
 - For each scenario, compare the situation with RES support schemes (FiT, PP) to a fictitious situation with no support to RES generation (default cases)
 - This allows isolating the impacts of RES support schemes irrespective of the other features of the different scenarios
- Five families for the indicators studied:
 - Generation mix
 - Costs and profits
 - Market prices
 - Sustainability
 - Cross-border market integration



Impact of RES support schemes on generation mix

RES support schemes have very little impact on the generation mix

Even if support schemes impact the way renewable generation is offered on the market, they hardly have an impact on the generation mix

However, there is a more significant impact of support schemes on wind and solar generation in Portugal and Spain

This is because these two countries combine the following features: repeated situations with negative residual load (consumption < nondispatchable generation) and limited cross-border capacities

Impact of RES support schemes on generation mix – Spain and Portugal

	2013 sce	enario	2020 st scei	tandard nario	2020 RES+ scenario		
	With current RES SS	Variation / default case	With foreseen RES SS	Variation / default case	With foreseen RES SS	<i>Variation /</i> default case	
Vind production							
Portugal	3.7 TWh	+7.0%	5.4 TWh	+5.9%	6.1 TWh	+9.0%	
Spain	18.1 TWh	+6.0%	23.9 TWh	+3.1%	26.3 TWh	+4.3%	
Solar production	-						
Portugal	0.31 TWh	+2.1%	1.4 TWh	+1.2%	2.4 TWh	+3.2%	
Spain	4.2 TWh	+3.1%	13.3 TWh	+0.9%	20,3 TWh	+1.8%	



Impact of RES support schemes on generation mix – Spain and Portugal

Number of hours, per country and per month, with negative residual load (over 6 months)



- → In Spain and Portugal, the existence of wind and solar support schemes (even with the gradual move from FiT to PP) safeguards wind and solar sources from generation curtailments in case of negative residual load
- Austria is not impacted despite numerous hours with negative residual load because of high interconnection capacities





Within all scenarios, the total RES subsidies outweigh the thermal generation costs incurred in the 11 countries by several billions of euros over the 6-month period despite the gradual move from Feedin-Tariffs (FiT) to Price Premium (PP)

Feed-in-Tariffs would remain a major source of revenues for solar producers at 2020

Impact of RES support schemes on costs and profits

Thermal generation costs and RES subsidies over 6 months

Thermal generation costs



RES subsidies

Notes:

16,485

With current SS

(2013)

• The focus shall be on the **trends** rather than on detailed figures, since simplifying assumptions have been taken to assess the current support schemes (in particular the solar FiT)

• Thermal generation costs do not include subsidies or CRM revenues: there are based only on short-term variable costs

Market •• RES

M€

30,000

25,000

20,000

15,000

10,000

5,000

Impact of RES support schemes on costs and profits

12.453

Solar

Amount of (net) RES subsidies per type of support scheme, over 6 months

2013 scenario with current support schemes



2020 standard scenario with foreseen support schemes 2020 RES+ scenario with foreseen support schemes



Total cost of Feed-in-Tariff

8,135

Wind

Total cost of Price Premium

Note: The total cost of FiT has been calculated as the difference between the "gross FiT subsidies" and the market value of the corresponding generation:

• By construction, the gross FiT subsidies are stable from 2013 to 2020

M€

16,000

12,000

8.000

4.000

0

• To be fair regarding the global cost of the FiT, the market value of the corresponding generation must be deducted from the gross FiT subsidies

Note: The focus shall be on trends rather than on detailed figures, since simplifying assumptions have been taken to assess the current support schemes (in particular the solar FiT)





Solar producers' revenues per country, over 6 months

2013 scenario with current support schemes



2020 standard scenario with foreseen support schemes



2020 RES+ scenario with foreseen support schemes



Solar Feed-in-Tariff revenue Solar producers revenues from the market

Additional revenue from solar Price Premium

Note: The focus shall be on trends rather than on detailed figures, since simplifying assumptions have been taken to assess the current support schemes (in particular the solar FiT)

Impact of RES support schemes on market prices

RES support schemes are responsible for a growing occurrence of negative prices between 2013 and 2020

Impact of RES SS on the market prices' global indicators over 6 months (compared to the default cases)

	2013 scenario	2020 standard	2020 RES+
		scenario	scenario
	With current RES	With foreseen RES	With foreseen RES
	SS	SS	SS
Average market price	-3%	-2%	-2%
Occurrence of negative prices	+701	+684	+1,356
Average daily spread	+75%	+18%	+11%



Impact of RES support schemes on market prices

Occurrence of negative prices when RES support schemes are applied



Important notes:

- In Spain and Portugal, negative prices are not allowed (while within OPTIMATE the same price boundaries are defined for the whole geographical area under study). Therefore, situations with negative prices in Spain and Portugal occurring with OPTIMATE correspond in reality to generation curtailments.
- The occurrence of negative prices is strongly linked to the wind and demand profiles (situations combining high wind and low demand). In reality, negative prices regularly occur for instance in Germany, even if the combination of wind and demand profiles used within our scenarios does not show it.





RES support schemes in general and the gradual move from FiT to PP in particular have little impact on the sustainability indicators (CO_2 emissions and share of RES)





RES support schemes in general and the gradual move from FiT to PP in particular have little impact on cross-border flows, except at the borders of the Iberian Peninsula



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- Within OPTIMATE, demand flexibility is modelled as follows:
 - A flexible proportion of demand can be voluntarily shed when prices reach a certain level;
 - No demand shift
- Approach within Market4RES:
 - 'Mid' variant: in this case, 5% of the load is shed during the 5% of the hours with the highest prices (in other words: when prices reach the 95th centile)
 - 'High' variant: in this case, 10% of the load is shed during the 10% of the hours with the highest prices (in other words: when prices reach the 90th centile)





Complements:





Note:

- On this graph (green dotted curve) it is considered that the load shed at hour H will be shifted to the hours immediately after
- A longer shift may be considered: for instance for a load shedding at 19:00, part of the corresponding energy may be consumed between 2:00 and 4:00 during the following night



- Other possible complements
 - Model an heterogeneous deployment of demand flexibility in the different countries
 - Need a reliable source to justify such heterogeneous scenario





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- Next OPTIMATE studies are being performed from November to January
 - Your inputs are welcome to specify the studies on demand flexibility!
- Results of the studies to be presented in spring 2016
- Final recommendations to be issued in spring 2016



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Thank you very much for your attention



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CONTACT

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