The recent revision of *Renewable Energy Act* in Germany

*Overview and results of the PV tendering scheme*

Christian Redl

PODGORICA, 17 SEPTEMBER 2016
The Energiewende targets imply fundamental changes to the power system, and in turn the entire energy system. 

**Phase out of Nuclear Power**
Gradual shut down of all nuclear power plants until 2022

**Reduction of Greenhouse Gas Emissions**
Reduction targets below 1990 levels:
- 40% by 2020;
- 55% by 2030;
- 70% by 2040;
- 80% to - 95% by 2050

**Development of renewable energies**
Share in power consumption to increase to:
40 - 45% in 2025;
55 - 60% in 2035;
≥ 80% in 2050

**Increase in efficiency**
Reduction of power consumption compared to 2008 levels:
- 10% in 2020;
- 25% in 2050
Policy targets required to enable the market to find efficient solutions and provide investor certainty

Renewable targets allow market actors to make efficient investment decisions – for both non-renewable and renewable investments.
## Nimble RES support policies adjusted along the way considering investment risks

### Renewable Energy Law (EEG) – reform steps 2000 to 2014

<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>First Feed-in Tariff (FiT) in DE</td>
</tr>
<tr>
<td>2000</td>
<td>Aim: double RES capacity by 2010; FiT started, priority dispatch, guaranteed grid access, grid follows generation paradigm, cost digression</td>
</tr>
<tr>
<td>2004</td>
<td>EEG 2004</td>
</tr>
<tr>
<td>2009</td>
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<tr>
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<tr>
<td>2014</td>
<td>EEG 2014</td>
</tr>
<tr>
<td>2017</td>
<td>EEG 2017</td>
</tr>
</tbody>
</table>

### Pre-EEG

**1991:** First Feed-in Tariff (FiT) in DE

- **Aim:** Double RES capacity by 2010; FiT started, priority dispatch, guaranteed grid access, grid follows generation paradigm, cost digression

### EEG 2000

- **Aim:** 20% RES in 2020; changes in FiT, curtailment regulation; feed-in management

### EEG 2004

- **Aim:** 30% RES in 2020; changes in FiT, curtailment regulation; feed-in management

### EEG 2009

- **Aim:** Min. 35% by 2020, FiT lowered, voluntary market premium (FiP); 52 GW cap on PV

### EEG 2012

- **Aim:** 40-45% in 2025; auctions for PV; obligatory market premium (FiP); breathing cap for wind and PV

### EEG 2014

- **Aim:** Min. 35% by 2020, FiT lowered, voluntary market premium (FiP); 52 GW cap on PV

### EEG 2017

- **Aim:** 40-45% in 2025; auctions for PV & wind; obligatory market premium (FiP)
Renewables are being installed and owned by citizens enabled by policies: Involvement, ownership and acceptance

Ownership distribution of renewable installations, 2011
Stable regulatory and political frameworks are a precondition for the cost-efficient increase in renewable energies

WACC for investments in wind onshore projects of EU Member States

Main factors creating uncertainty

- Future policy choices
- Administrative procedures
- Market design & grid access

DiaCore Project (2015)
Deployment policies caused falling module prices, PV feed-in tariffs dropped and the end of cost digression is not reached.

Average PV feed-in tariff for new installations 2005 - 2015

Expected cost digression for large-scale PV systems 2014 - 2050

ZSW et. al (2014), own calculations

Fraunhofer ISE (2015)
Key features of the Revised German Renewable Energy Act (EEG 2017)

1. RES-E deployment based on expansion corridor (since EEG 2014)
   → In order to reach the target of at least 80% of RES-E in electricity consumption by 2050, there are intermediate targets (indicated by a ”percentage corridor”) for 2025 and 2035

2. Keep costs for future RES-E deployment at a minimum
   → Increase of EEG surcharge until 2014. Awareness of cost debate for financing renewables is important for public acceptance of the Energiewende

3. Introduction of auctions
   → Introduction of auctions for onshore wind energy, solar PV, offshore wind energy and biomass
Expansion corridor for RES-E deployment:
RES-E share of 40 - 45% by 2025 and 55 - 60% by 2030

Share of renewable energies in gross electricity consumption 2000 - 2015 and targets 2025 - 2035

AGEB (2016), EEG (2014)

* preliminary
Introduction of auctions and annual deployment according to expansion corridor

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>As of 2017:</th>
<th>Additional remarks on auctions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore wind energy</td>
<td>2,800 MW p.a.</td>
<td>As of 2020, increase to 2,900 MW p.a.</td>
</tr>
<tr>
<td>Solar PV</td>
<td>2,500 MW p.a.</td>
<td>600 MW of these 2.5 GW to be allocated via auctioning scheme (e.g. ground-mounted solar PV).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.9 GW receive EEG remuneration (small- and medium-scale rooftop installations &lt; 750 kW)</td>
</tr>
<tr>
<td>Offshore wind energy</td>
<td>6.5 GW until 2020.</td>
<td>In case of higher deployment by 2020 (e.g., 7.7 GW instead of 6.5 GW) there will be a reduction</td>
</tr>
<tr>
<td></td>
<td>15 GW until 2030.</td>
<td>of the deployment target for later auctions</td>
</tr>
<tr>
<td>Biomass</td>
<td>150 MW p.a. in 2017-2019.</td>
<td>Existing biomass installations may be included in auctioning scheme</td>
</tr>
<tr>
<td>Hydropower, Geothermal, Landfill,</td>
<td>No participation</td>
<td>No participation in auctioning scheme</td>
</tr>
<tr>
<td>sewage treatment and mine gas</td>
<td>in auctioning scheme</td>
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</table>
Some basics regarding the introduction of auctions in Germany (EEG 2017) 1/2

The auctioning scheme...
→ ... encompasses more than 80% of newly installed renewable generation capacity

→ ... includes **technology differentiation** for the level of remuneration, including technology specific prequalification criteria

→ ... includes the following technologies:
  • Onshore wind energy > 750 kW (calculation of support based on reference yield model)
  • Solar PV, offshore wind energy > 750 kW
  • Biomass > 150 kW (including already existing installations)
Some basics regarding the introduction of auctions in Germany (EEG 2017) 2/2

- **Exempted** from auctioning scheme:
  - Geothermal, hydropower; landfill, sewage treatment and mine gas
  - Pilot projects onshore wind energy (cumulative capacity of 125 MW)

- **Level of support** determined by auctioning scheme (pay-as-bid)
- **Direct marketing of electricity** (Contract for Difference scheme)

- Transition period:
  - No retroactive effect for RES-E installations already in operation (previous "EEG" still applies)
  - Exemption for onshore wind energy & biomass installations with permit until end of December 2016 and in operation until end of 2018 (do not have to participate in auction)
Other important facts on auctions for RES-E

New aspects included to gain additional experience:

• *Joint* auctions for onshore wind energy and solar PV: 400 MW p.a. from 2018 to 2020 (Ordinance by May 2018)

• Auctions for *innovations*: no limitation to specific RES-E technologies, also combination possible. 50 MW p.a. from 2018 to 2020 (Ordinance by May 2018). Focus on system and grid benefits induced by technological innovation

• *Cross-border* auctions: joint auctions with one or more EU Member States for up to 5% of annually auctioned capacity (Ordinance will follow)
Main principle: market-based competition for setting support levels;
Broad spectrum of design features (*DE EEG 2017 provisions are underlined*)

<table>
<thead>
<tr>
<th>→ <strong>Product</strong> – what should be tendered?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Required support level; Remuneration: FiT, FiP (sliding or fixed); Payment per kWh or per kW;</td>
</tr>
<tr>
<td>• Technology-neutral vs. technology-specific; De-minimis exemptions</td>
</tr>
</tbody>
</table>

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<tr>
<th>→ <strong>Auction procedure</strong> – how to award the contract?</th>
</tr>
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<tr>
<td>• Format (sealed bid/descending clock); Sealed bid: Pay-as-bid/pay-as-cleared; Periodicity &amp; timing</td>
</tr>
</tbody>
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<table>
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<tr>
<th>→ <strong>Project realisation</strong> – how to reach expansion goals?</th>
</tr>
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<tbody>
<tr>
<td>• Auctioning of &quot;excess&quot; quantity; Prequalification criteria (e.g. Permits, concessions, deposits)</td>
</tr>
<tr>
<td>• Penalties, expiration of support (in case of not built); Transfer support rights (secondary market)</td>
</tr>
</tbody>
</table>

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<th>→ <strong>Enabling actor variety</strong></th>
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<tr>
<td>• Simplified prequalification / lower penalities for e.g. local cooperatives, private citizens</td>
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<tr>
<th>→ <strong>Geographical aspects</strong> – how to achieve a balanced deployment? E.g. Spatial planning, reference yield models for onshore wind; location-specific compensation as a function of wind map</th>
</tr>
</thead>
</table>
Trade-offs between the objectives of the German RES-E auctioning scheme

- Low entry barriers
- Low participation risk
- Equal treatment of bids & bidders

- Level & type of prequalifications
- Penalties

- Special rules for „small players“

- Simple general rules
- Clear definitions

Source: BNetzA (2016)
The new tender scheme for large-scale PV has yielded average remuneration levels decreasing from 92 to 73 EUR/MWh from April 2015 to August 2016

Average remuneration for large-scale PV in the 1st five PV auction rounds in Germany (PV receives the difference between the tender remuneration and the wholesale price as a sliding premium)

BNetzA (2016)
Some first lessons-learnt from German PV auctions and open questions

- Explorative process of “learning by doing”
- Pilot projects with different designs to explore
- Large-scale PV seems particularly suitable for tendering (short planning periods, rather low investments required during project planning)
- Transparent and simple auction scheme design, yet no “one size fits all” solution
- Limited applicability of insights to other technologies; Pilots for all technologies required
- Is competition possible (scarcity in the auction)? How to avoid strategic behavior?
- How to maximize realization rate?
- Optimal design of penalties / prequalification requirements / deadlines for project realization?
- How to ensure actor variety?
- How to minimize financing costs to enable efficient auctions?
Montenegro: Current and future cost of solar energy

Levelised cost of electricity (LCOE) from large-scale solar PV in Montenegro

Full load hours: 1100 - 1350 kWh/kWp p.a., Cost of capital (WACC): between 5% and 15%

Calculation based on Fraunhofer ISE (2015); Ranges include differences in irradiation within the country and scenarios of technology and global market development; global market for modules, inverters and other cost components is assumed, short-term effects of higher cost in new markets (e.g. 1st GW in a specific country) not considered.
Stable regulatory and political frameworks are a precondition for the cost-efficient increase in renewable energies

Main factors creating uncertainty

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WACC for investments in wind onshore projects of EU Member States

DiaCore Project (2015)
Thank you for your attention!

Questions or Comments? Feel free to contact me:
christian.redl@agora-energiewende.de

Agora Energiewende is a joint initiative of the Mercator Foundation and the European Climate Foundation.
Cost competitiveness and EEG surcharge

Initial experience was gained by implementing auctions for large-scale ground-mounted solar PV in 2015 (500 MW in total).

- Initial phase, only for ground-mounted solar PV: 3 rounds of auctions were carried out in 2015.

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<th>April 2015</th>
<th>August 2015</th>
<th>December 2015</th>
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<tr>
<td>Price for support (average)</td>
<td>9.17 ct/kWh</td>
<td>8.48 ct/kWh</td>
<td>8.00 ct/kWh</td>
</tr>
<tr>
<td>Capacity auctioned</td>
<td>150 MW</td>
<td>150 MW</td>
<td>200 MW</td>
</tr>
<tr>
<td>Auction volume awarded</td>
<td>157 MW</td>
<td>159 MW</td>
<td>204 MW</td>
</tr>
<tr>
<td>Auction volume submitted</td>
<td>715 MW</td>
<td>558 MW</td>
<td>562 MW</td>
</tr>
<tr>
<td>Excluded bids</td>
<td>144 MW (20%)</td>
<td>33 MW (5%)</td>
<td>33 MW (5%)</td>
</tr>
<tr>
<td>Pricing method</td>
<td>Pay-as-bid</td>
<td>Uniform pricing</td>
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Expansion corridor for RES-E deployment
... broken down into gross deployment for the different technologies

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### Auctions – when and how much?

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<th>Energy Type</th>
<th>When? How much?</th>
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| Onshore wind energy      | 2017: 3 rounds (2.8 GW in total)  
2018 and 2019: 3 rounds (2.9 GW in total)                                                                                                                                                                      |
| Solar PV                 | As of 2017: 3 rounds (600 MW in total)                                                                                                                                                                          |
| Biomass                  | 2017-19: 1 round (150 MW in total)  
2020-22: 1 round (200 MW in total)                                                                                                                                                                              |
| Offshore wind energy     | As of 2021: installations to become operational in 2026 (on pre-investigated sites) will participate in auctioning scheme.  
Annually 700-900 MW auctioned (target: annual deployment of 840 MW as of 2026). Bids will be submitted for pre-investigated offshore wind sites ("Danish model").  
2017-18: 1,550 MW auctioned (only projects that have concluded permitting procedure); to turn into operation between 2021-2025. |