Auctions for Renewable Energy Support

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Agenda

1. *What are Auctions for Renewable Energy Support? – Motivation*
2. *Where are such Auctions implemented and what are the Results? – Empirical Evidence*
3. *Work carried out in the AURES project – Scientific Research*
4. *Outlook on AURES II*

1. Motivation

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- Different forms of RE support
  - Administratively set feed-in-tarif
  - Certificate of origin / quota regulation
  - Auctions
- Pros and cons for every instrument
- EU State Aid Guidelines require member states to use auctions from 2017
  - Efficiency
  - Cost reduction
  - Controllability

1. Motivation

Auction process and design options

a. Procurement auction
b. Price-quantity-bids
c. Multi-unit auction with multi-project bidders
d. Sequential conduction of auctions (multiple auctions per year)
e. Common cost components and uncertainties
f. Asymmetric bidders
g. Prequalifications required and induce sunk costs
h. Possibility of non-realization and penalties

1. Motivation

Major challenges: Make „Energiewende“ a success

- Achieve expansion target – effectiveness
- Incentivize innovations and reduce costs – efficiency
- Respect the socio-political restrictions
- Consider local impacts
- Legal feasibility

2. Empirical Evidence

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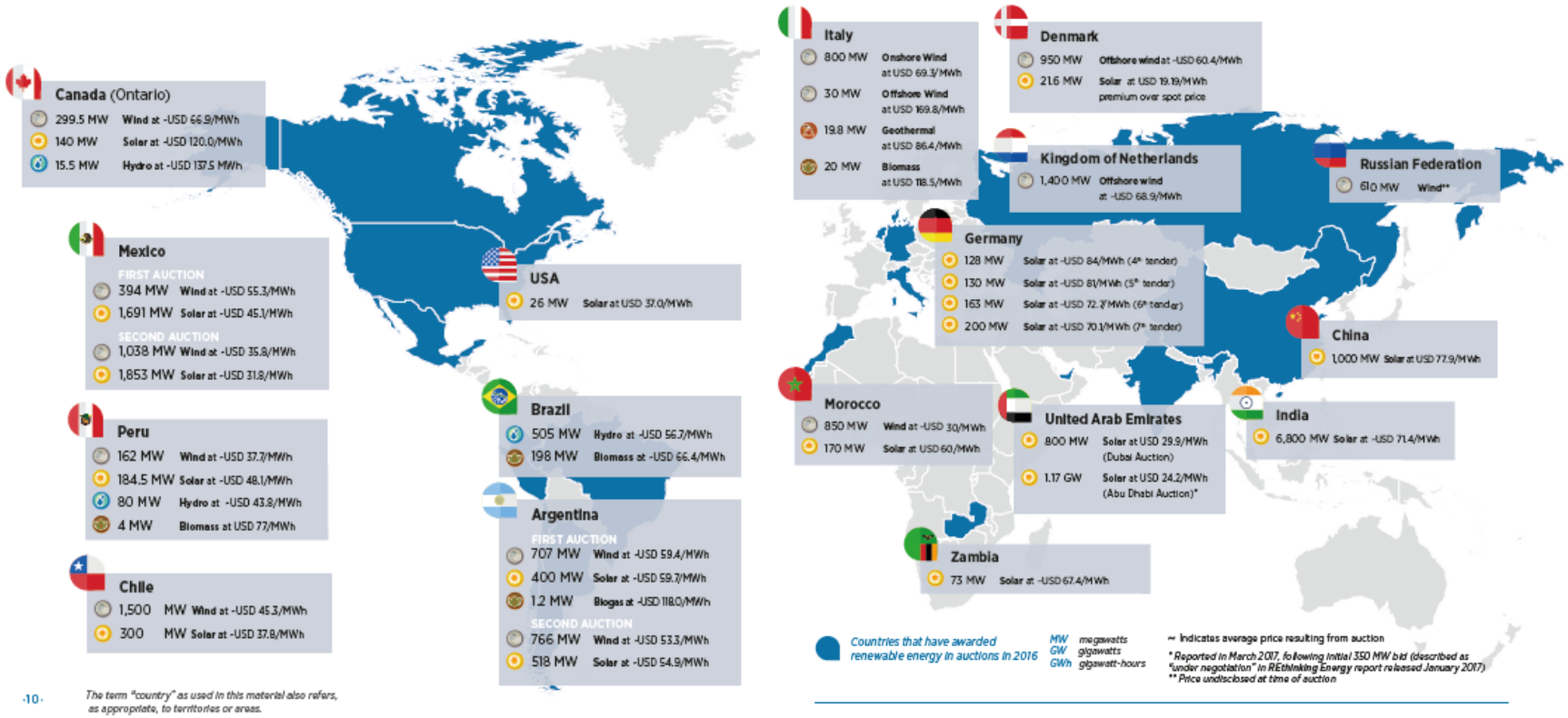
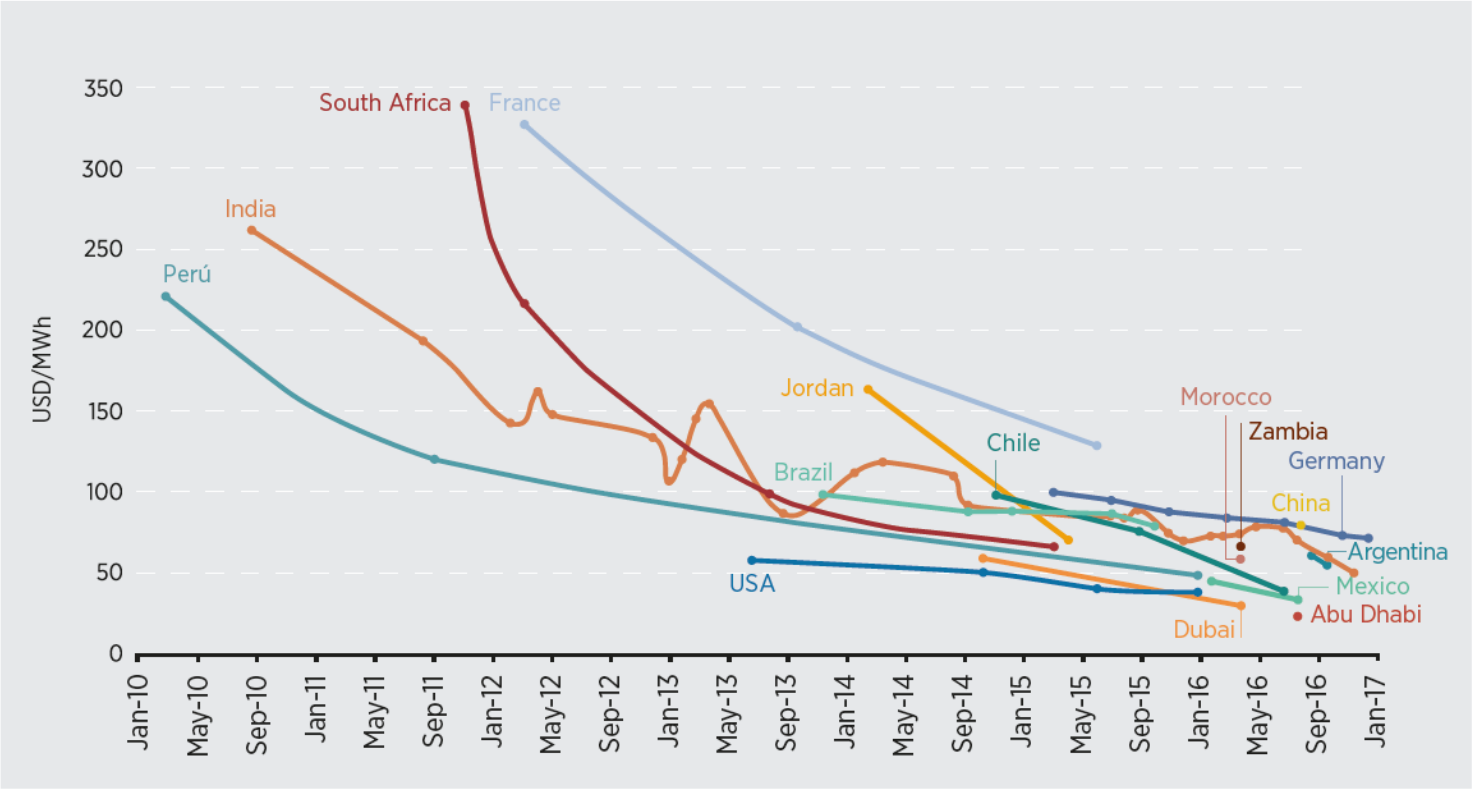


Source: IRENA (2017)

2. Empirical Evidence

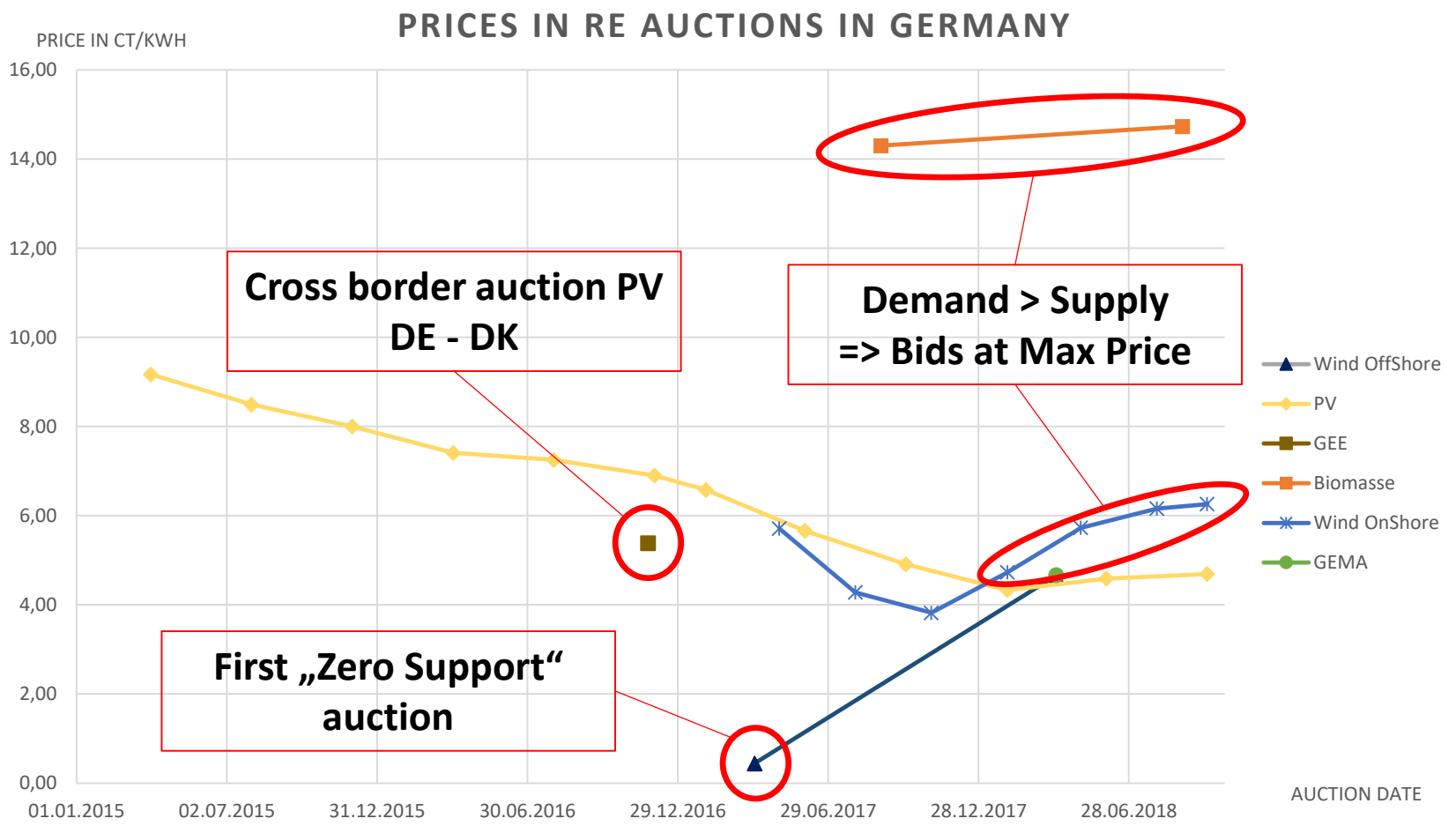
Figure 2.3 Evolution of average auction prices for solar PV, January 2010-February 2017



Notes: Prices are averages. On the rare occasion when multiple auctions occurred within the same month, the average price of those auctions is shown. In case of ambiguity regarding the auction's date, the date when the winning bids were selected and announced was taken as the main reference.

Source: IRENA (2017)

2. Empirical Evidence



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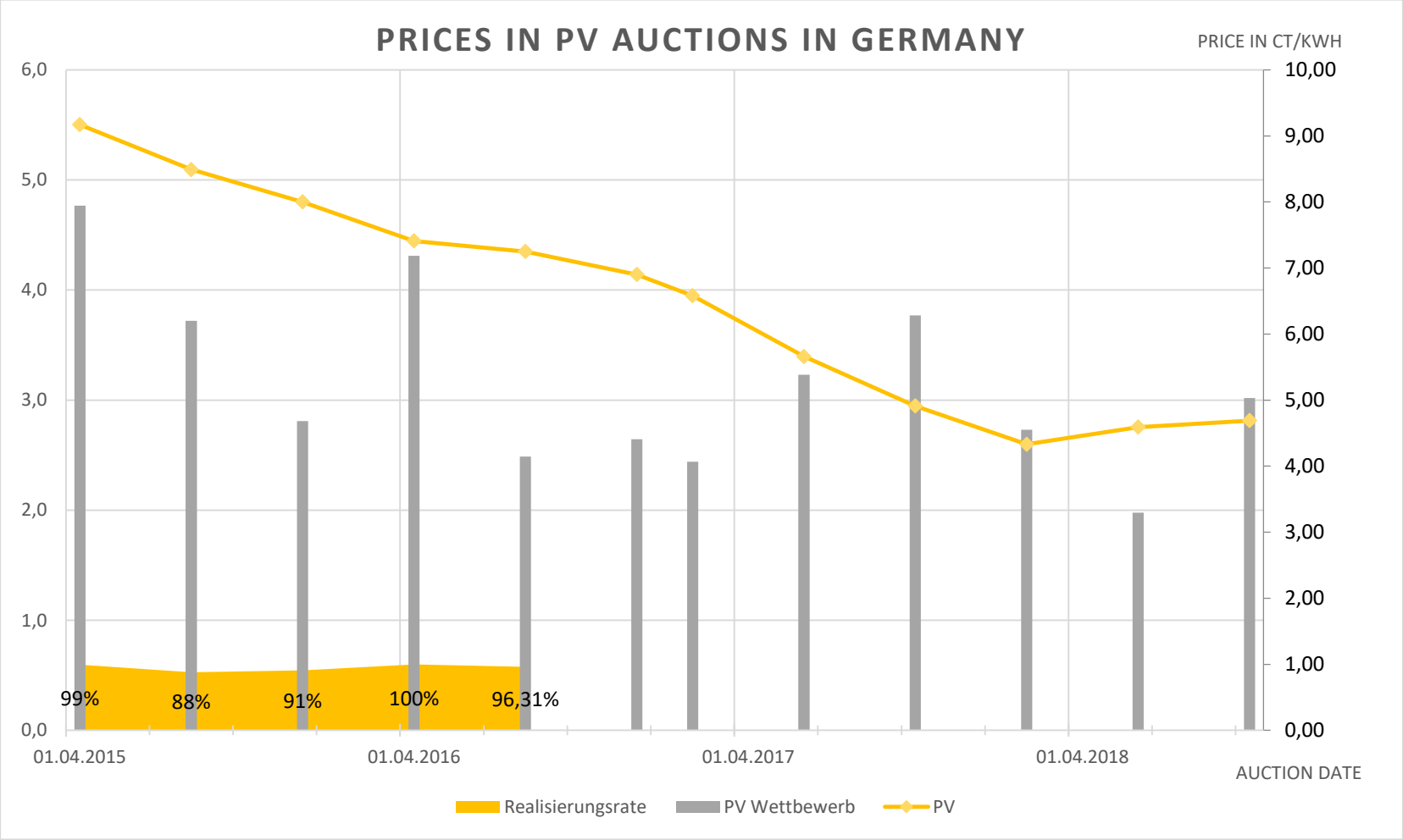

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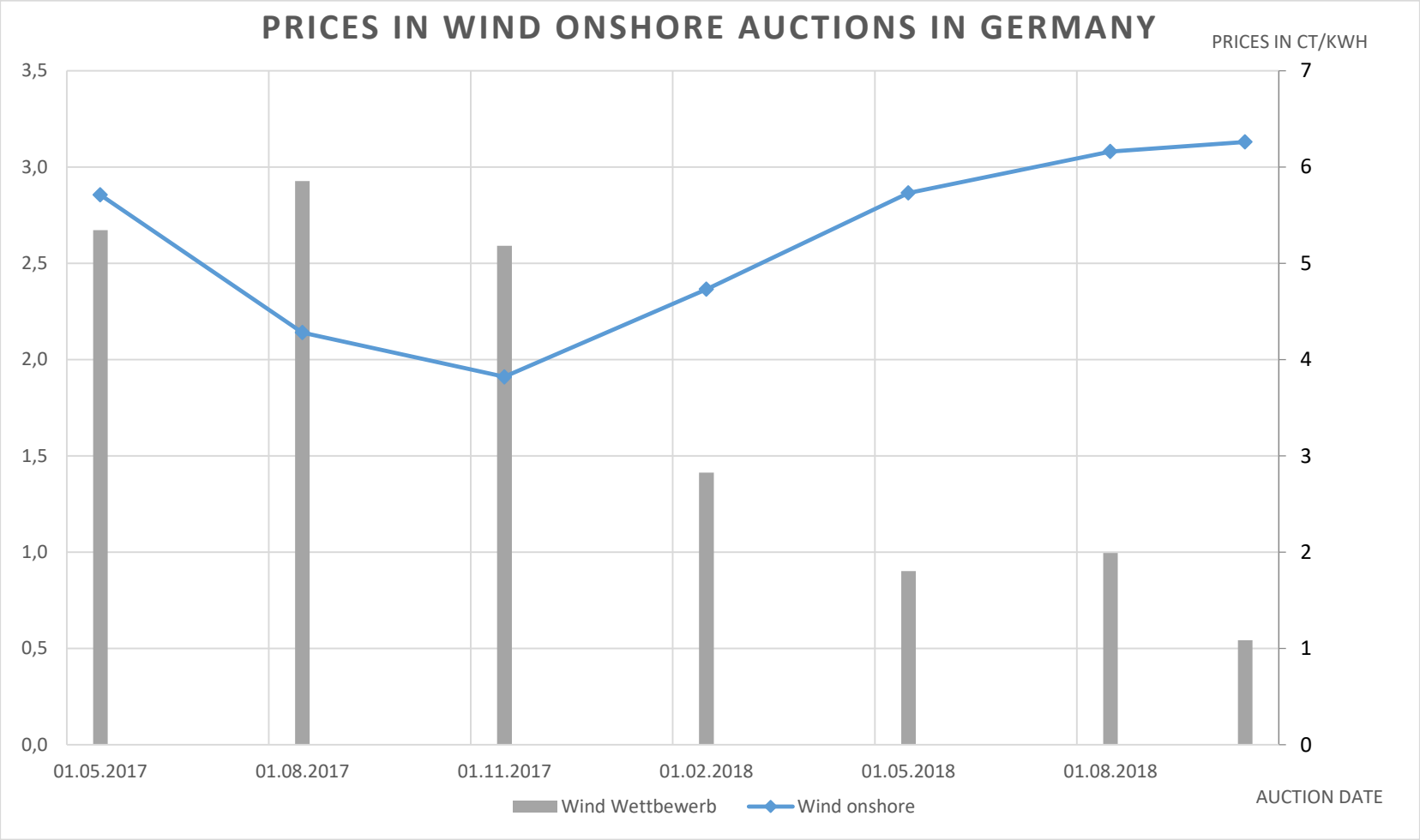
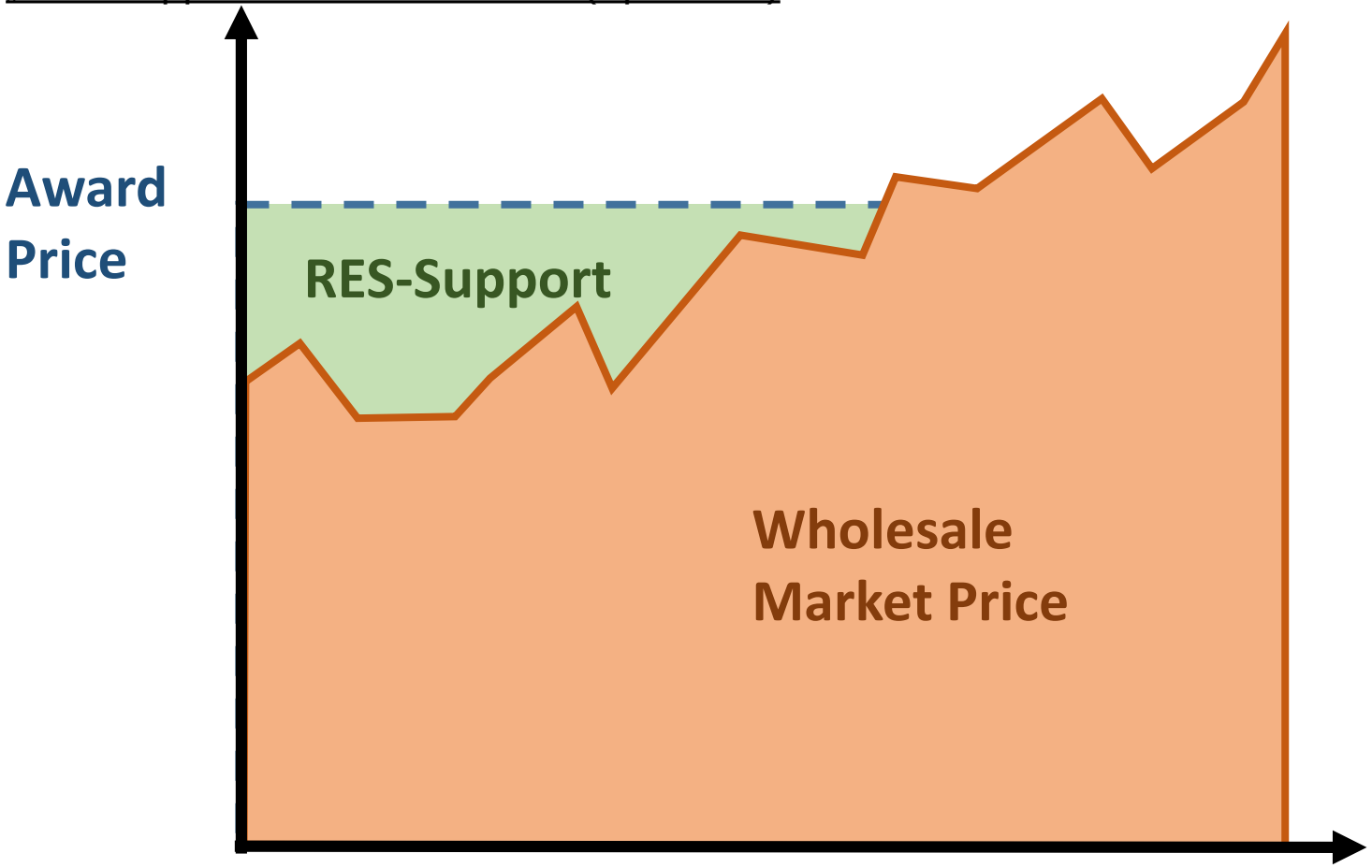


2. Empirical Evidence

„Zero Support“ Offshore Auction (Apr. 2017)



2. Empirical Evidence

„Zero Support“ Offshore Auction (Apr. 2017)

- Previous Offshore Wind Auctions
  - The Netherlands: Borssele 1 & 2; DONG Energy; 72.70 €/MWh
  - The Netherlands: Borssele 3 & 4; Consortium Shell; 54.50 €/MWh
  - Denmark: Kriegers Flak; Vattenfall; 49.90 €/MWh
- 4 awarded projects with 1490 MW
- Average award price: 4.40 €/MWh

Bidder	Project	Location	Volume	Award price	Realization
EnBW	He Dreiht	North Sea, Cluster 7	900 MW	0.00 €/MWh	2025
DONG	OWP West	North Sea, Cluster 1	240 MW	0.00 €/MWh	2024
DONG	Borkum Riffgrund West 2	North Sea, Cluster 1	240 MW	0.00 €/MWh	2024
DONG	Gode Wind 3	North Sea, Cluster 3	110 MW	60.00 €/MWh	2023

- New auctions for Offshore wind mostly without support payments (NL, USA)

2. Empirical Evidence

Recent trends in RE Auctions:

1. „Technology-neutral“ Auctions
   - Different technologies participate in same auction
   - Goal: Award most efficient projects across all technologies
   - Examples: UK, Spain, Slovenia, Mexico, NL, Germany
   - Challenges: What is „neutral“ and how to achieve it?
2. „Cross-border“ Auctions
   - Auction open to participants from different countries
   - Goal: Award most efficient projects across different countries
   - Examples: DE – DK (2016)
   - Challenges: Different legal frameworks in different countries

3. Research Project AURES

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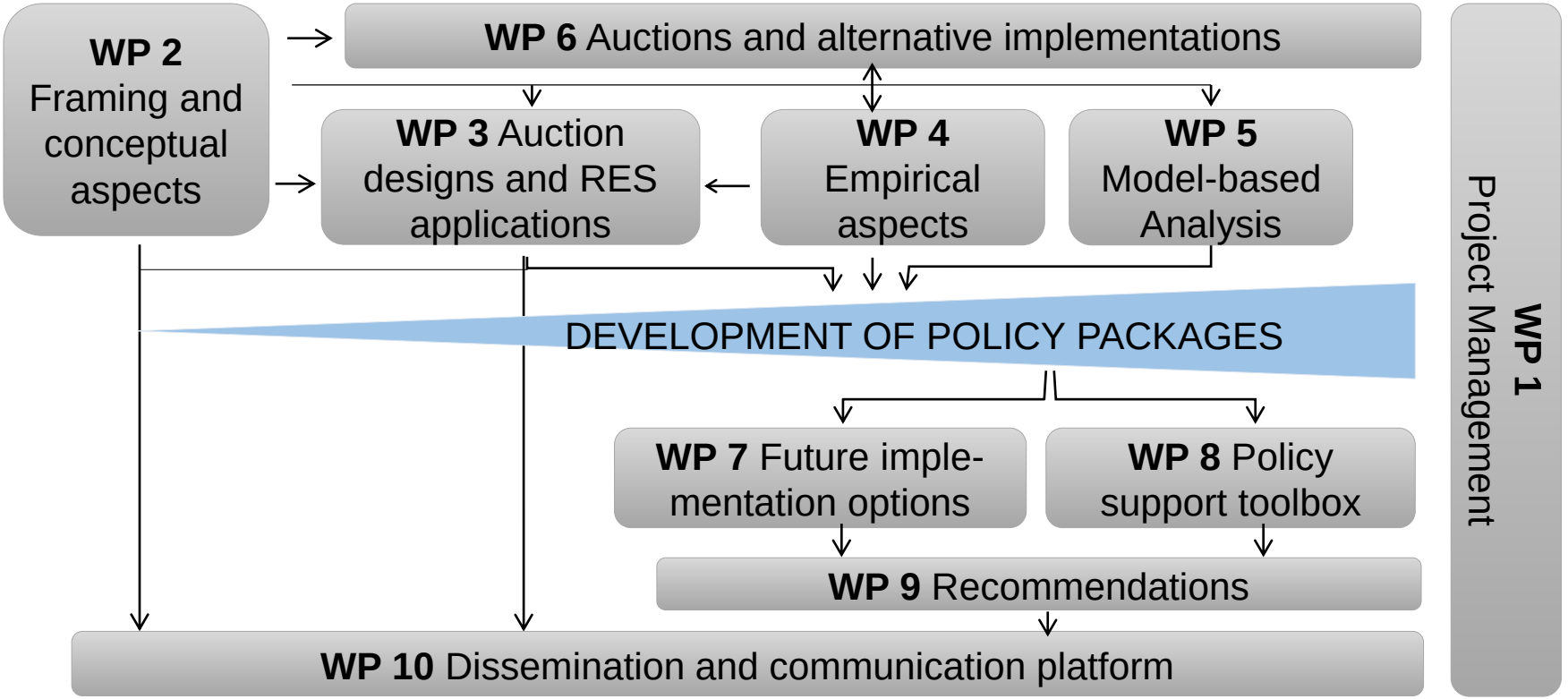

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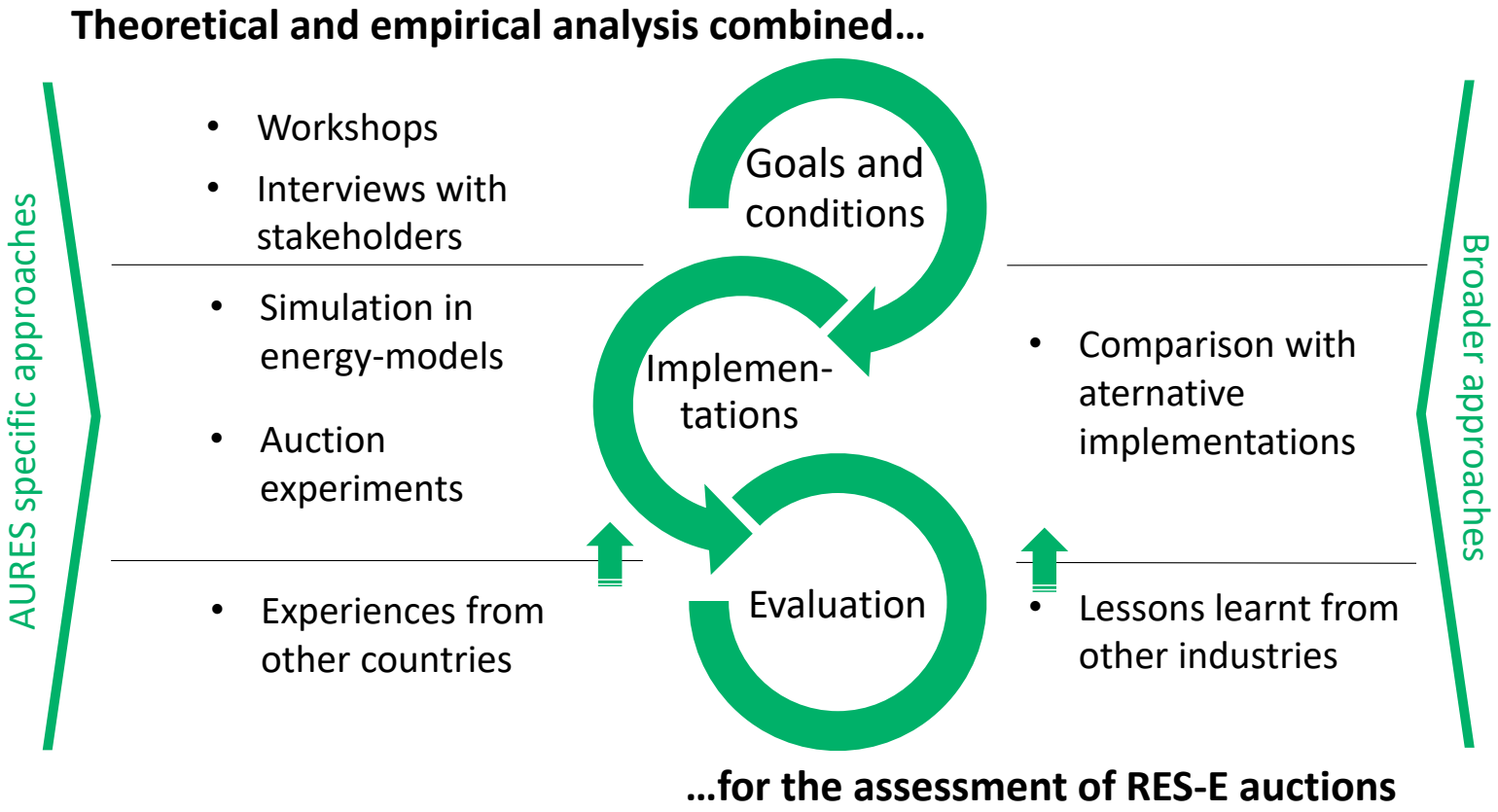


3. Research Project AURES

Effectiveness

Legal feasibility

Static efficiency

Socio-political feasibility

Dynamic efficiency

Local impacts

Support costs

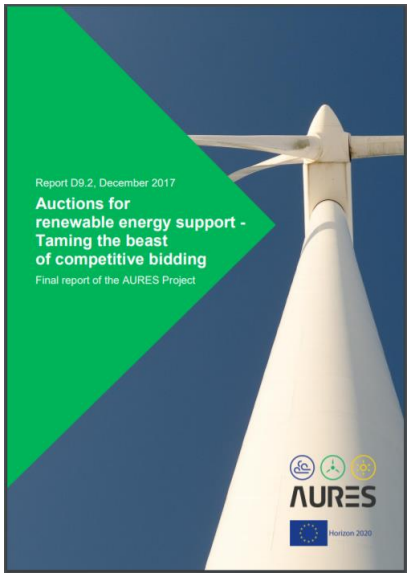
3. Research Project AURES

Auction Designer

http://auresproject.eu/auctiondesigner

http://www.auresproject.eu/auction-tools

Reports



http://www.auresproject.eu/publications

3. Research Project AURES

Takon in AURES

1. Haufe, M.-C. and Ehrhart, K.-M. (2018): Auctions for Renewable Energy Support - Suitability, Design, and First Lessons Learned, Energy Policy, Vol. 121, October 2018, 217-224, DOI:10.1016/j.enpol.2018.06.027.
   - Design options and evaluation for auctions for RE support
2. Kreiss, J., Ehrhart, K.-M. and Haufe, M.-C. (2017): Appropriate Design of Auctions for Renewable Energy Support - Prequalifications and Penalties, Energy Policy, Vol. 101, February 2017, 512-520, DOI: 10.1016/j.enpol.2016.11.007.
   - Implications of prequalifications and penalties on the auction outcome

Theoretical guidance on how to design auction for renewable energy support.

3. Research Project AURES

Key Insights:

Different auction formats perform equally well regarding expected auction revenue (i.e. support costs) and allocative efficiency in theory, even if the optimal bidding behaviour differs in the particular auctions.

However, there is certain ambiguity of auction formats under changing market conditions. Hence, a profound market analysis is necessary before the implementation of auctions in order to find potential chances and risks with regard to relevant auction formats.

Examples from other industries are only partly comparable, thus lessons are not directly transferrable

Non-realization risk identified as a major risk for RES-E auctions

3. Research Project AURES

Key Insights:

- The possibility not to realize decreases prices.
  - ➢ Bidders incorporate this option in their bids.
- Non-realization probability depends on degree of uncertainty and (negative) consequences in case of non-realization.

Auction design option	Desired effects	Undesired effects
Financial prequalification	• higher expected realization probability	• higher expected support level
Physical prequalification additive to financial prequalification	• reduced cost uncertainty • higher expected realization probability	• sunk costs • reduced competition level • higher expected support level
Penalties additive to financial prequalification	• higher expected realization probability	• higher expected support level • potentially inefficient
Penalties substitutive to monetary equivalent financial prequalification	• lower expected support level	• lower expected realization probability • potentially sunk costs
Second-price auction compared to first-price auction	• lower expected support level	• lower expected realization probability

3. Research Project AURES

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3. Ehrhart, K.-M., Haufe, M.-C. and Kreiss, J. (2018): Discrimination in Auctions for Renewable Energy Support: Three Theoretically Equivalent but Practically Different Concepts - Design options and evaluation for auctions for RE support
4. Kreiss, J., Ehrhart, K.-M., Haufe, M.-C. and Rosenlund Soysal, E. (2018): Different cost perspectives for renewable energy support: Assessment of technology-neutral and discriminatory auctions

- Theoretical analyses of discriminatory instruments in auctions with asymmetric bidders
- In particular focus on auctions for renewable energy support
- Practical relevance for either technology-neutral or cross-border auctions

3. Research Project AURES

Key Insights:

Political conflict: Minimum aid and non-discriminatory

Auctioneer can increase value of Renewable Energy (and hence reduce support costs) through discriminatory auctions.

Auctioneer can reduce overall costs (support costs) through discriminatory auctions.

A quota, a bonus and a maximum price can be equivalent regarding the auction outcome if certain conditions are satisfied.

3. Research Project AURES

Takon in AURES

5. Experimental and theoretical analysis on multi-unit common value procurement auctions and the winner's curse
   - RE sources have high common cost component (PV module prices, wind turbines, spot market price,…)
   - With common costs and high uncertainties regarding future developments there is a high risk of the winner's curse
   - Experimental analysis suggests higher probability of winner's curse than theoretically predicted

4. Outlook AURES II

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- Horizon 2020 research project started 01/11/18
- Project Overview
  1. Database / Monitoring
  2. Effects of auctions on RES sector
  3. Impact on Cost of Capital (DiaCore)
  4. International auctions
  5. Future of Auctions
  6. Modelling

4. Outlook AURES II

Takon share

1. Database
   - Which information are important for database
   - Empirical analyses how design and framework parameters influence the auction outcome
2. Further theoretical analyses on auction design
3. Experimental analysis of auctions with asymmetric bidders
   - Add insights to what happens in technology-neutral and cross-border auctions
   - Which design parameters are important to achieve successful outcome

Thank you for your attention.

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