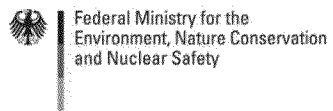


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# Market Integration of Demand Side Management The Discussion in Germany

Workshop on Demand Response  
October 15th, 2013

hosted by PG&E in San Francisco



# Outline

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The Transdisciplinary Panel on Energy Change at the Institute for Advanced Sustainability Studies (IASS) Potsdam.

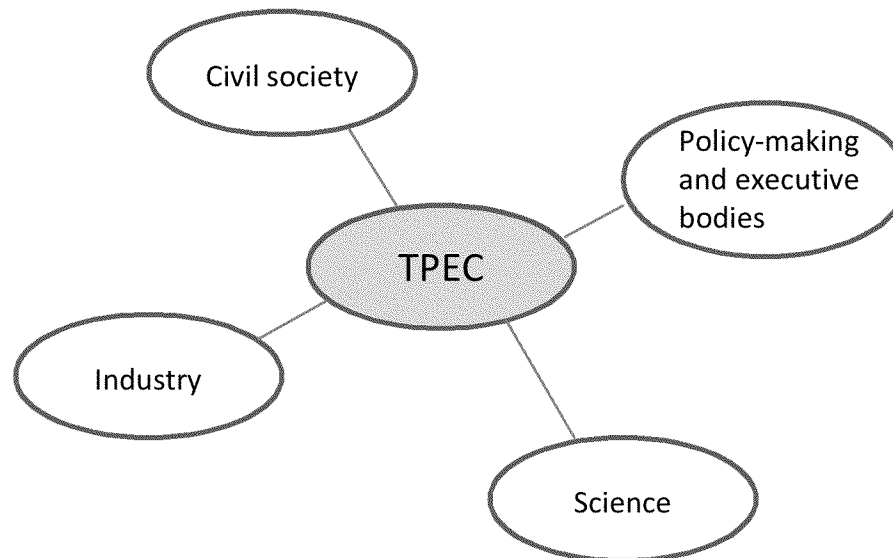
The discussion in Germany about...

- How to adjust the ancillary services market to the characteristics of demand-side capacities?
- How to change the ordinance governing industrial loads?
- Demand response in an electricity system dominated by fluctuating renewables

# Transdisciplinary Panel on Energy Change (TPEC)

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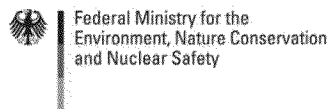
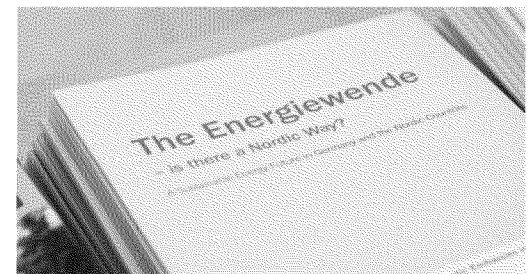
- TPEC was launched in **March 2012** as part of the Institute for Advanced Sustainability Studies.
- TPEC's **mission** is to help the Energiewende succeed by
  - providing independent scientific guidance
  - enabling a knowledge transfer between science, politics, civil society and industry



# Transdisciplinary Panel on Energy Change (TPEC)

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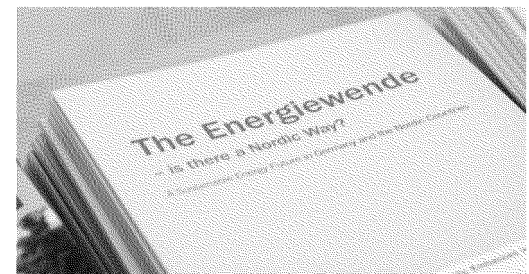
- Multi-disciplinary **team** with **academic backgrounds** in:
  - Economic engineering
  - Law
  - Political science
  - Geoscience/ Atmospheric Physics
  - Sociology
- ...and **work experience** in:
  - Research and science
  - Consulting
  - Management



# Transdisciplinary Panel on Energy Change (TPEC)

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- A diverse set of **methods**:
  - Original research
  - Thematic working groups and workshops
  - Conferences
  - Public expert hearings
- Priority **topics** in the first year:
  - Future of the renewables legislation
  - CO<sub>2</sub> emissions and the role of conventional power plants
  - Social balancing of the Energiewende
  - Demand-side management
  - European aspects



# Outline

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The Transdisciplinary Panel on Energy Change at the Institute for Advanced Sustainability Studies (IASS) Potsdam.

The discussion in Germany about...

- How to adjust the ancillary services market to the characteristics of demand-side capacities?
- How to change the ordinance governing industrial loads?
- Demand response in an electricity system dominated by fluctuating renewables

# Adjusting the ancillary services market

	Primary Reserve	Secondary Reserve	Tertiary Reserve
<b>Positive / negative Power</b>	Positive <u>and</u> negative	Positive or negative	Positive or negative
<b>Availability</b>	100%	100%	100%
<b>Voltage Level</b>	N/A	N/A	N/A
<b>Aggregation</b>		No limits within a „balancing region“	No limits within a „balancing region“

# Adjusting the ancillary services market

Positive or negative

Daily auctions  
Hourly schedules

	Primary Reserve	Secondary Reserve	Tertiary Reserve
<b>Positive / negative Power</b>	Positive <u>and</u> negative	Positive or negative	Positive or negative
<b>Availability</b>	100%	100%	100%
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# Adjusting the ordinance governing industrial loads

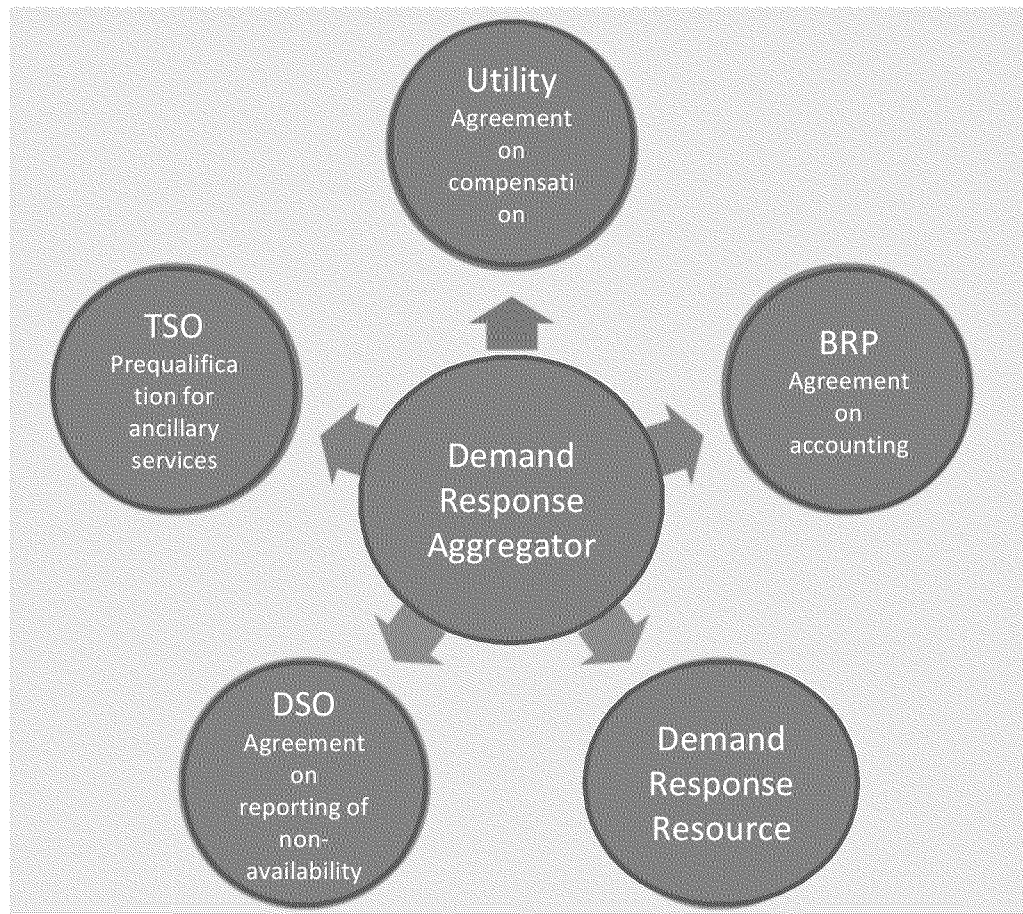
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	<b>SNL, 15 minutes, 1h</b>
	[REDACTED]
<b>Positive / negative Power</b>	Positive only
	[REDACTED]
<b>Availability</b>	100% except for 4 days/month
	[REDACTED]
<b>Voltage Level</b>	110kV
	[REDACTED]
<b>Aggregation</b>	Limited to 5 loads at the same high voltage connection point
	[REDACTED]

# Adjusting the ordinance governing industrial loads

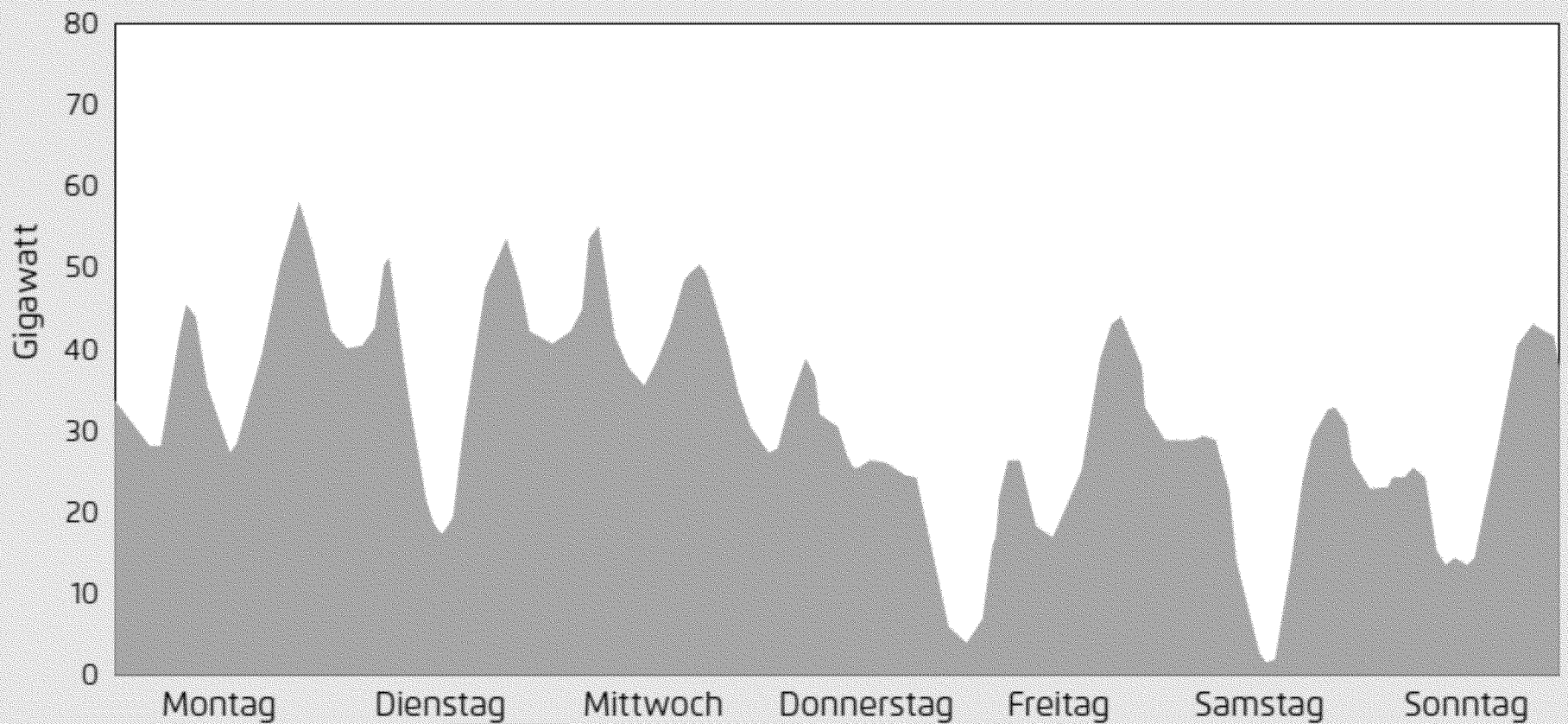
	<b>SNL, 15 minutes, 1h</b>	
<b>Positive / negative</b>	Positive only	← Increase activation time
<b>Power</b>		
<b>Availability</b>	100% except for 4 days/month	← Shorter product runtime
<b>Voltage Level</b>	110kV	← Integration of lower voltage levels
<b>Aggregation</b>	Limited to 5 loads at the same high voltage connection point	← Reduction of minimum load size ← Unlimited pooling

# The role of demand-response-aggregators



- Standardizing the role and strengthening the position of demand-response aggregators to integrate medium-size capacities

## Simulated residual load in a week in April 2022



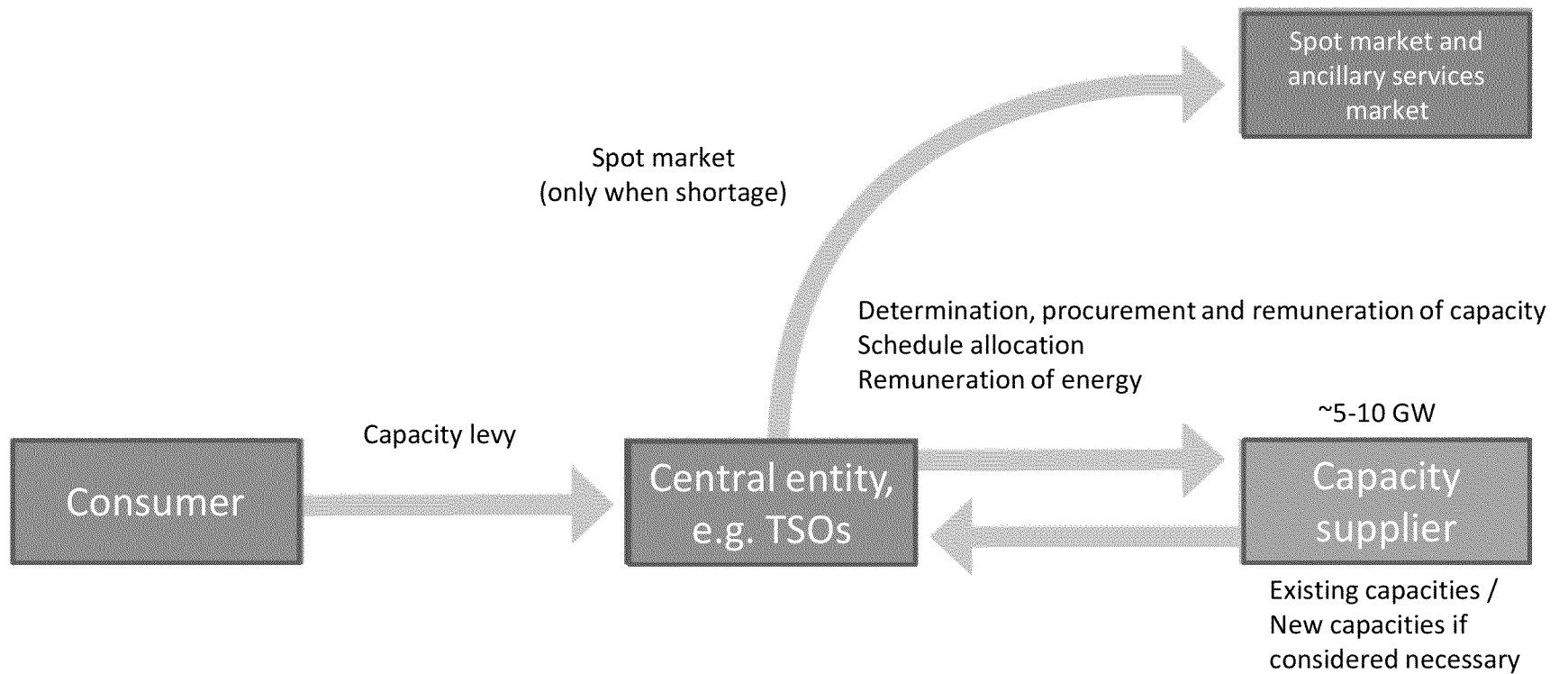
- Large-scale demand side management can potentially lower residual load peaks and decrease residual load gradients. Costs for conventional power plants can be reduced and security of supply increased.

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How to activate the demand-side in a system with high share of fluctuating renewables?

# Security of supply discussion in Germany – two models

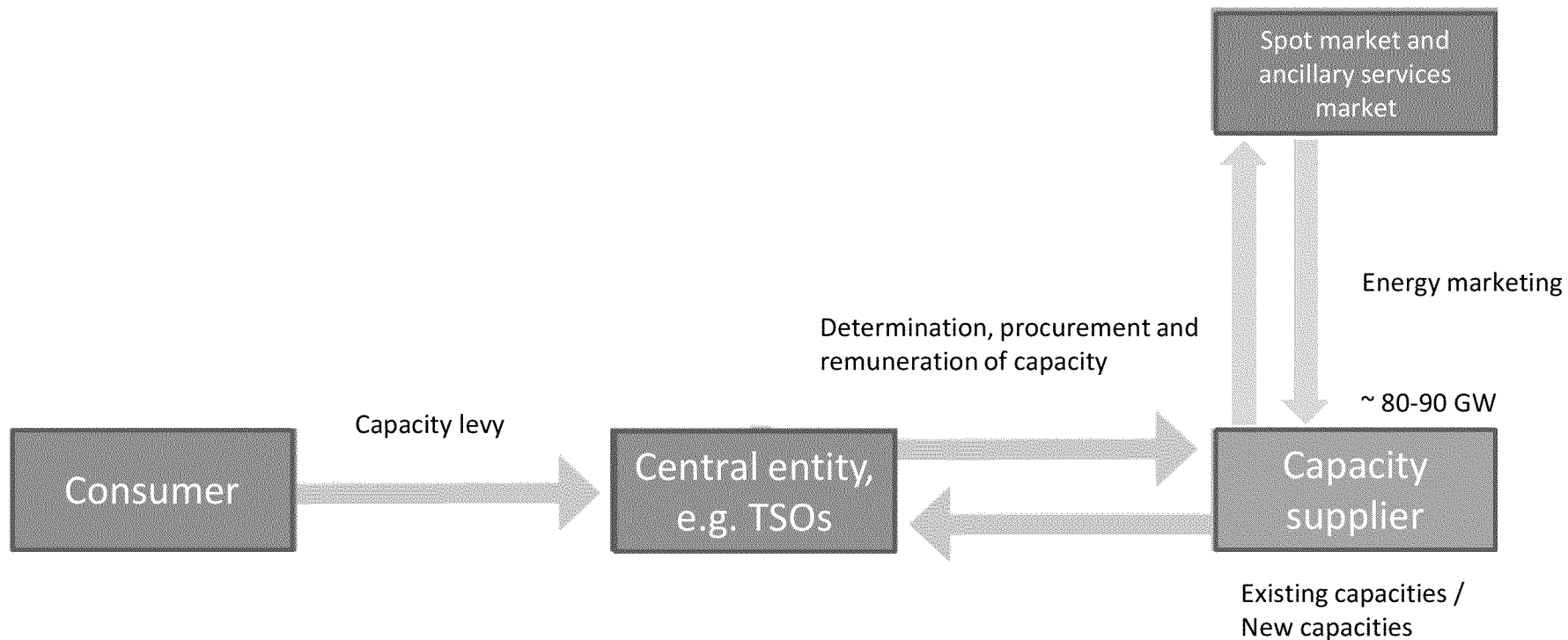
## “Strategic reserve” – Energy only market will make it



- Large EOM price spreads can activate demand-side resources
- Security of supply is guaranteed by means of reserve capacity which is used in shortage situations only -> minimum distortion of existing markets

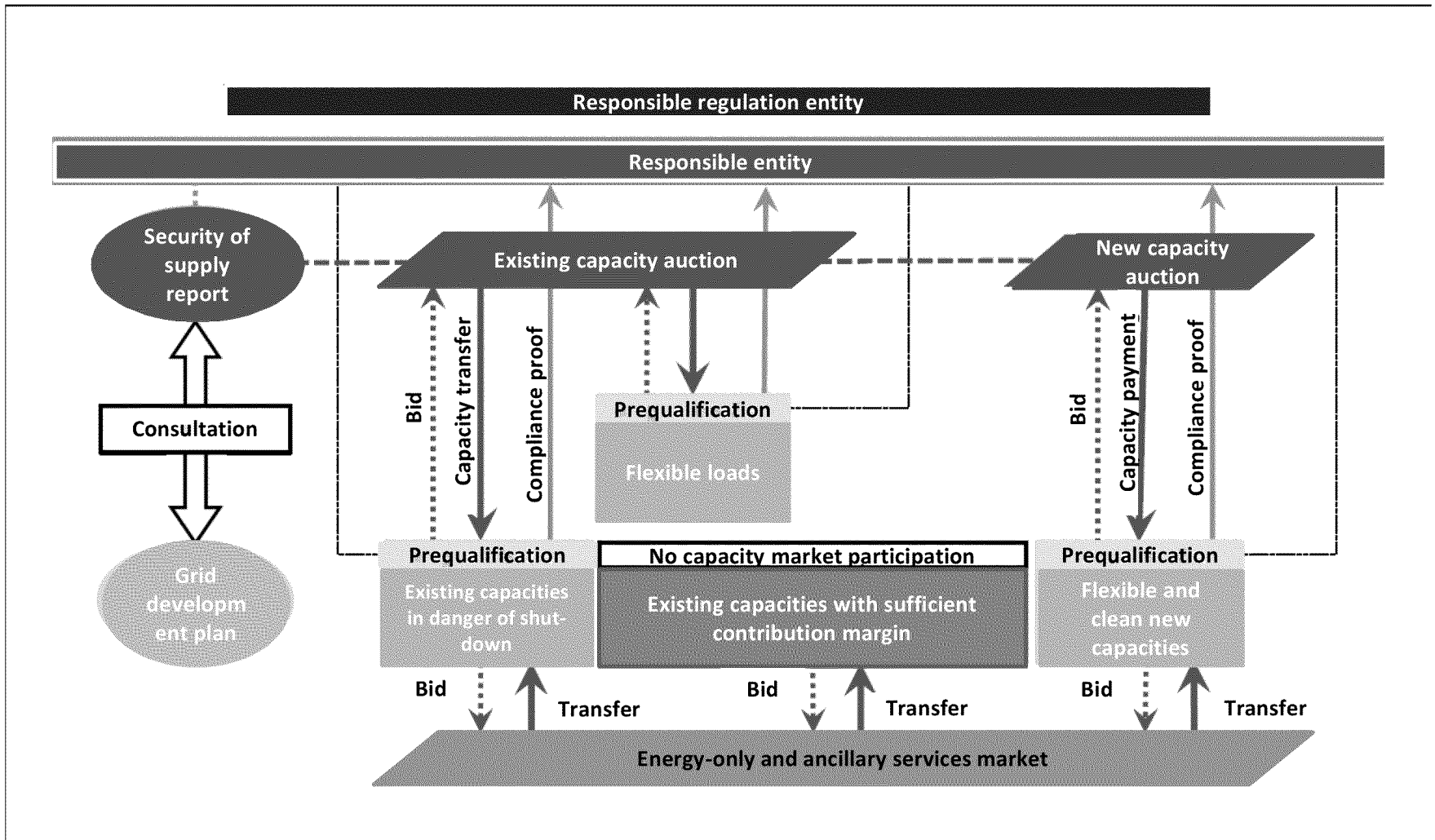
# Security of supply discussion in Germany – two models

## Capacity market – additional remuneration for capacity is needed



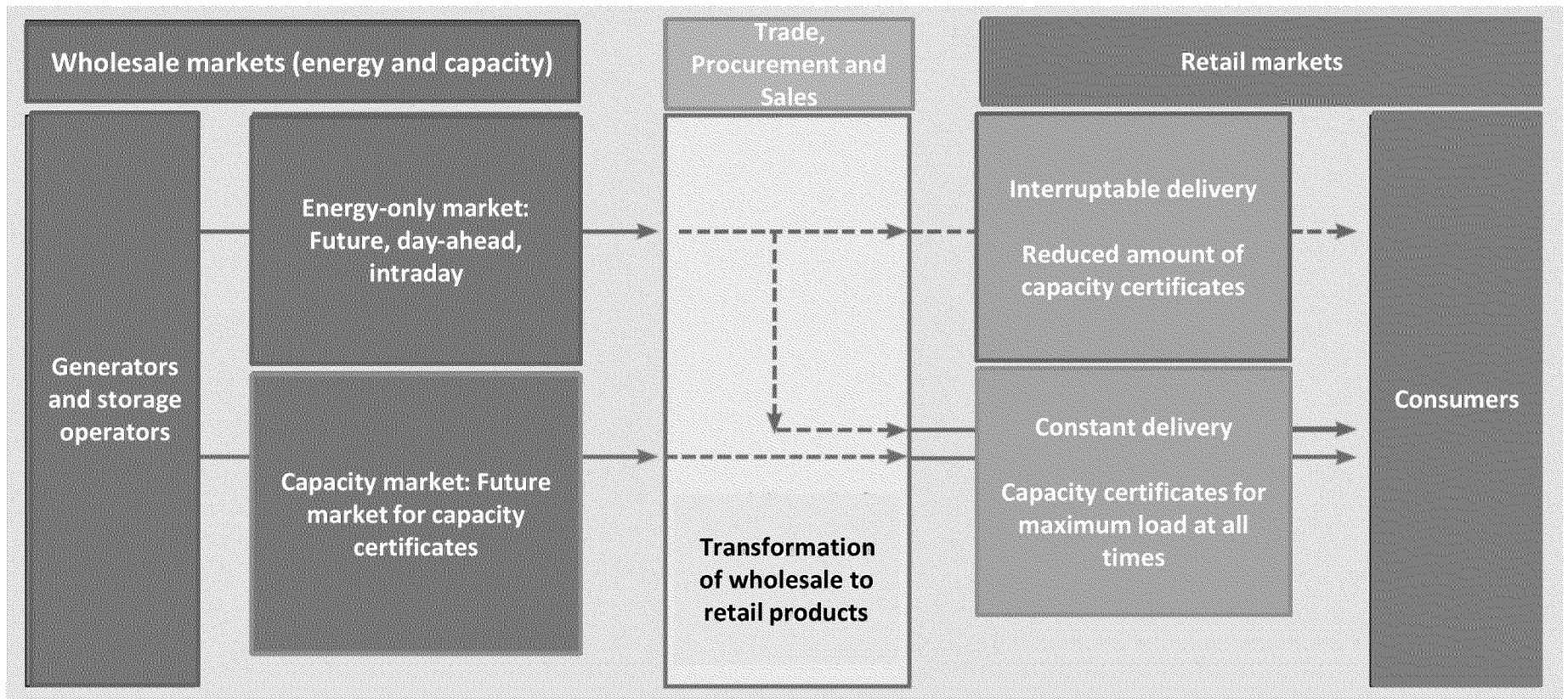
- Lower refinancing risk when not only relying on infrequent high shortage prices (economic, political)
- Risk of abuse of market power in high demand situations can be lowered

# Capacity market design „Focused capacity market“





# Capacity market design „Decentralized capacity market“



# Capacity market design options discussed in Germany and the role of demand response

	Capacity demand	Market differentiation	Contract duration	Demand response
<b>Strategic Reserve</b>	<ul style="list-style-type: none"> <li>• Central entity</li> <li>• Descending clock auction</li> </ul>	<ul style="list-style-type: none"> <li>• Single auction</li> </ul>	1-2 years	<ul style="list-style-type: none"> <li>• Not defined in detail</li> <li>• Limitation of activation duration (e.g. 6 hours) and number of activations (e.g. 10 per year)</li> </ul>
<b>Comprehensive capacity market / Reliability contracts</b>	<ul style="list-style-type: none"> <li>• New central entity</li> <li>• descending clock auction</li> </ul>	<ul style="list-style-type: none"> <li>• Single auction, existing capacities have to bid at 0 €/MW</li> <li>• Creation of single product by means of power credits</li> </ul>	<ul style="list-style-type: none"> <li>• 1 year for existing capacities</li> <li>• 15 years for new capacities</li> </ul>	<ul style="list-style-type: none"> <li>• Competition with all capacities</li> </ul>
<b>Focused capacity market</b>	<ul style="list-style-type: none"> <li>• Central entity (Grid regulator, new entity)</li> <li>• Descending clock auction</li> </ul>	<ul style="list-style-type: none"> <li>• Existing capacities in danger of shut-down (&lt;2000 operation hours) + Demand response</li> <li>• New flexible and clean capacities</li> </ul>	<ul style="list-style-type: none"> <li>• 1 or 4 years for existing capacities</li> <li>• 15 years for new capacities</li> </ul>	<ul style="list-style-type: none"> <li>• Competition with existing generation capacities</li> </ul>
<b>Decentralized capacity market</b>	<ul style="list-style-type: none"> <li>• Load serving entities</li> <li>• Future market</li> </ul>	<ul style="list-style-type: none"> <li>• Single future market for capacity certificates</li> </ul>	<ul style="list-style-type: none"> <li>• Future market, different products</li> </ul>	<ul style="list-style-type: none"> <li>• Do not act as capacity suppliers</li> <li>• Individual consumer contracts: costs for capacity certificates part of retail price</li> </ul>

and nuclear safety



Energiewende

# Key questions on the activation/integration of demand-side resources

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- Which of the suggested market designs is favorable?
- Is a separate market segment necessary?
- Which products are needed? (Contract duration, product runtime, product delivery duration, minimum load, activation time)
- How should demand response resources be activated? By the demand response provider based on spot market price signals or by the system operator?