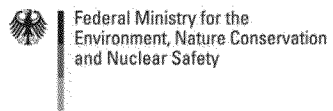

Market Integration of Demand Side Management The Discussion in Germany

Workshop on Demand Response
October 15th, 2013

hosted by PG&E in San Francisco



Outline

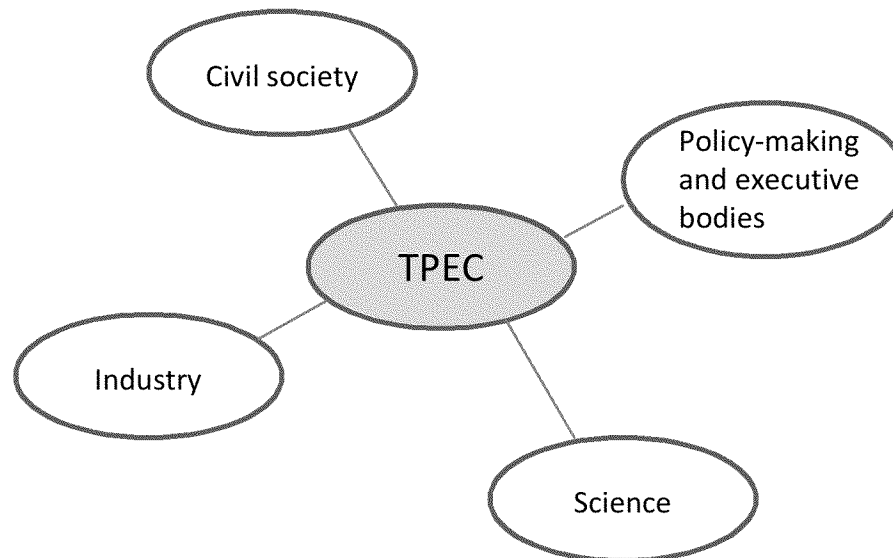
The Transdisciplinary Panel on Energy Change at the Institute for Advanced Sustainability Studies (IASS) Potsdam.

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

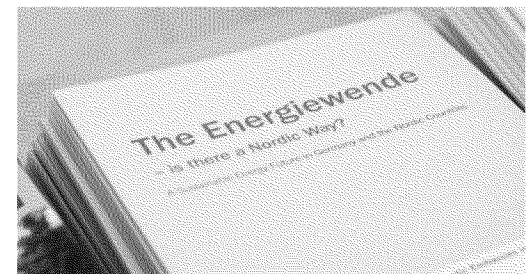
Transdisciplinary Panel on Energy Change (TPEC)

- 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



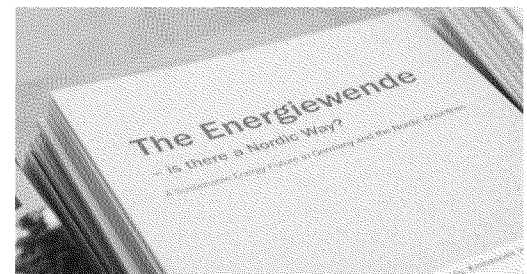
Transdisciplinary Panel on Energy Change (TPEC)

- 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)

- 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
 - CO₂ emissions and the role of conventional power plants
 - Social balancing of the Energiewende
 - Demand-side management
 - European aspects



Outline

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?
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Adjusting the ancillary services market

	Primary Reserve	Secondary Reserve	Tertiary Reserve
Positive / negative Power	Positive <u>and</u> negative	Positive or negative	Positive or negative
Availability	100%	100%	100%
Voltage Level	N/A	N/A	N/A
Aggregation		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
Positive / negative Power	Positive <u>and</u> negative	Positive or negative	Positive or negative
Availability	100%	100%	100%
Voltage Level	N/A	N/A	N/A
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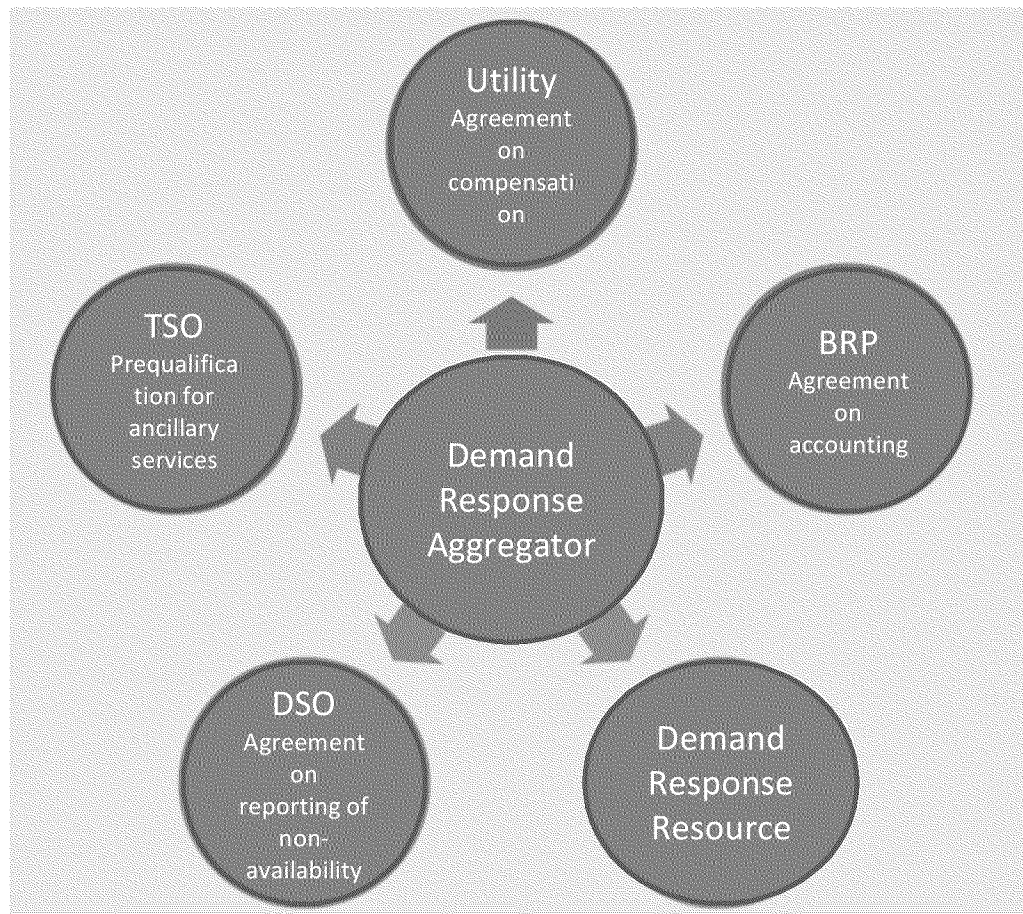
Adjusting the ordinance governing industrial loads

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

Adjusting the ordinance governing industrial loads

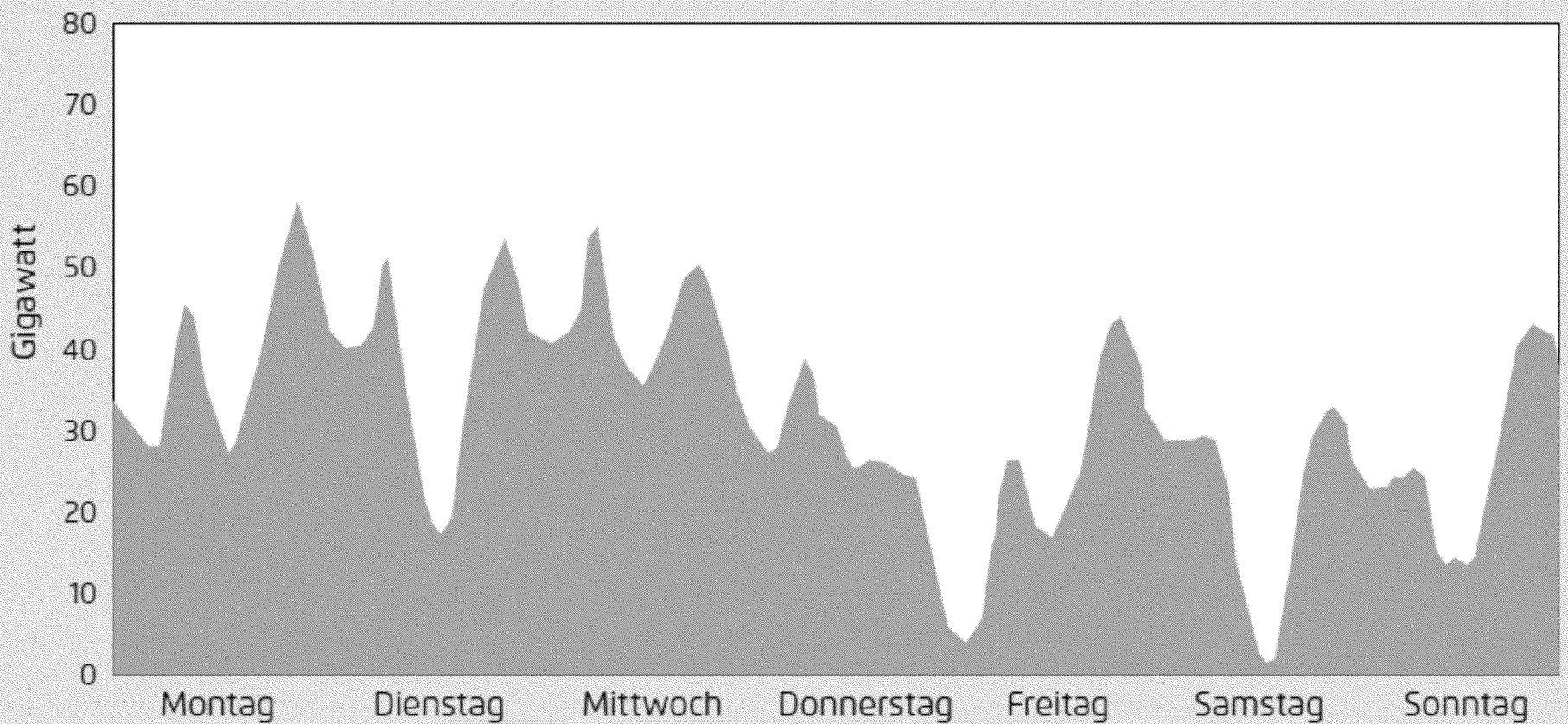
	SNL, 15 minutes, 1h	
Positive / negative	Positive only	← Increase activation time
Power		← Shorter product runtime
Availability	100% except for 4 days/month	
Voltage Level	110kV	← Integration of lower voltage levels
Aggregation	Limited to 5 loads at the same high voltage connection point	← Reduction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

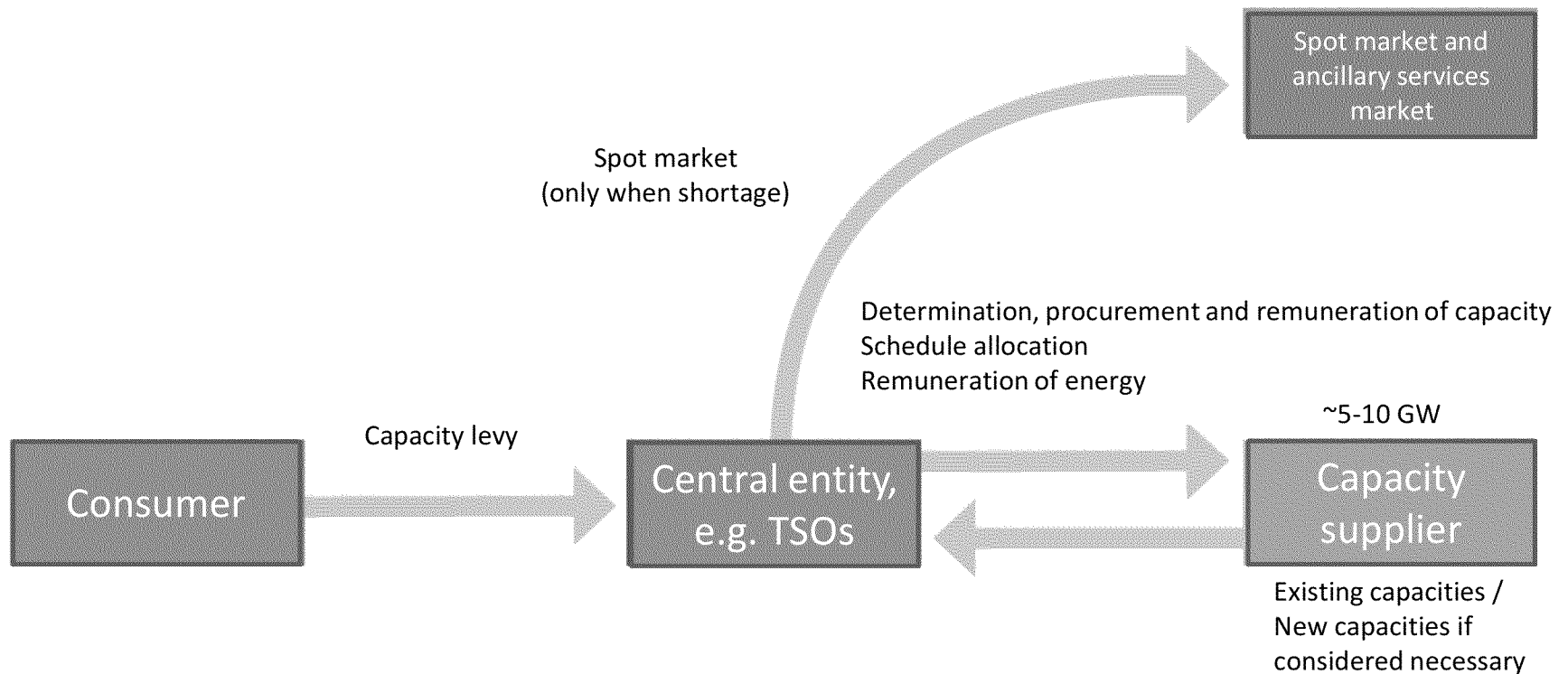


- Large-scale demand side management can potentially lower residual load peaks and decrease residual load gradients. Costs for conventional power plants can be reduced and security of supply increased.

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

Security of supply discussion in Germany – two models

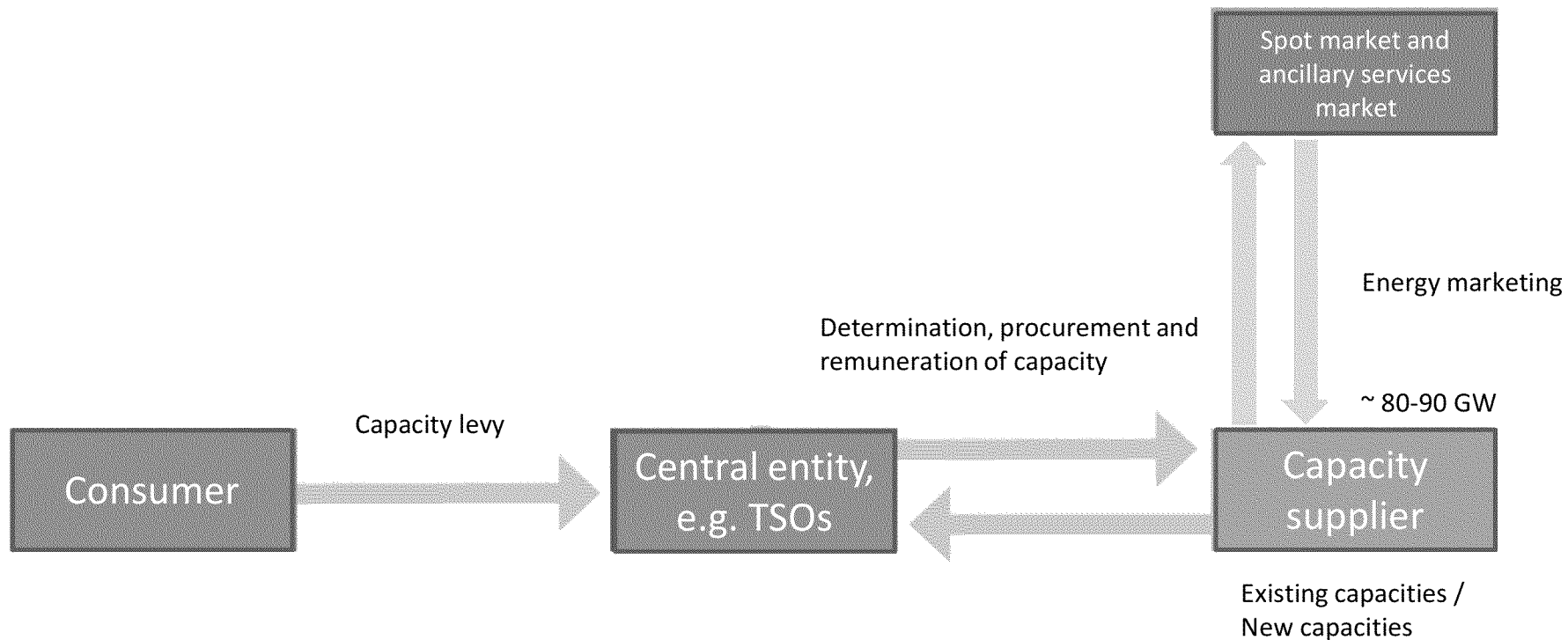
“Strategic reserve” – Energy only market will make it



- 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

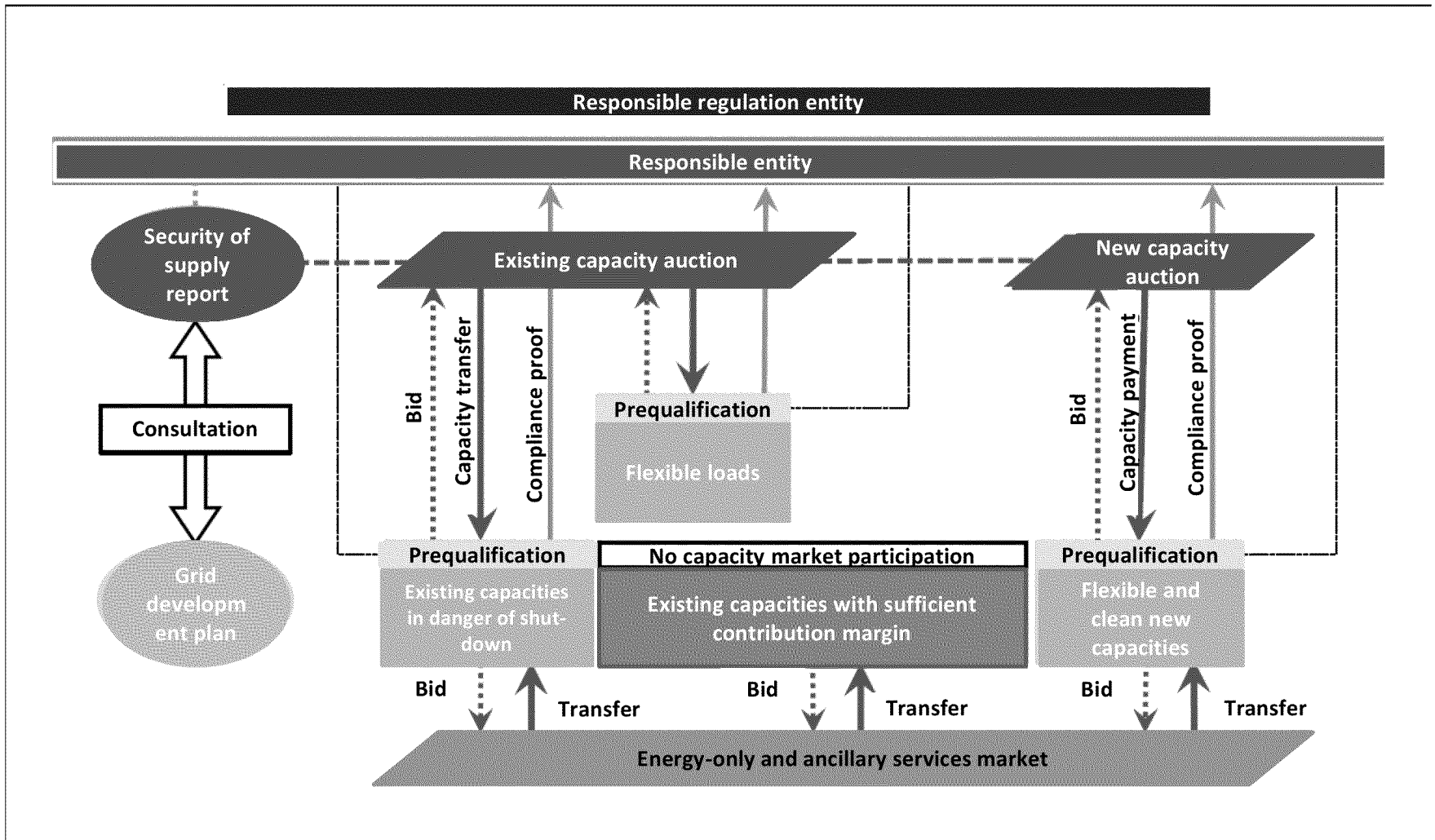
Security of supply discussion in Germany – two models

Capacity market – additional remuneration for capacity is needed

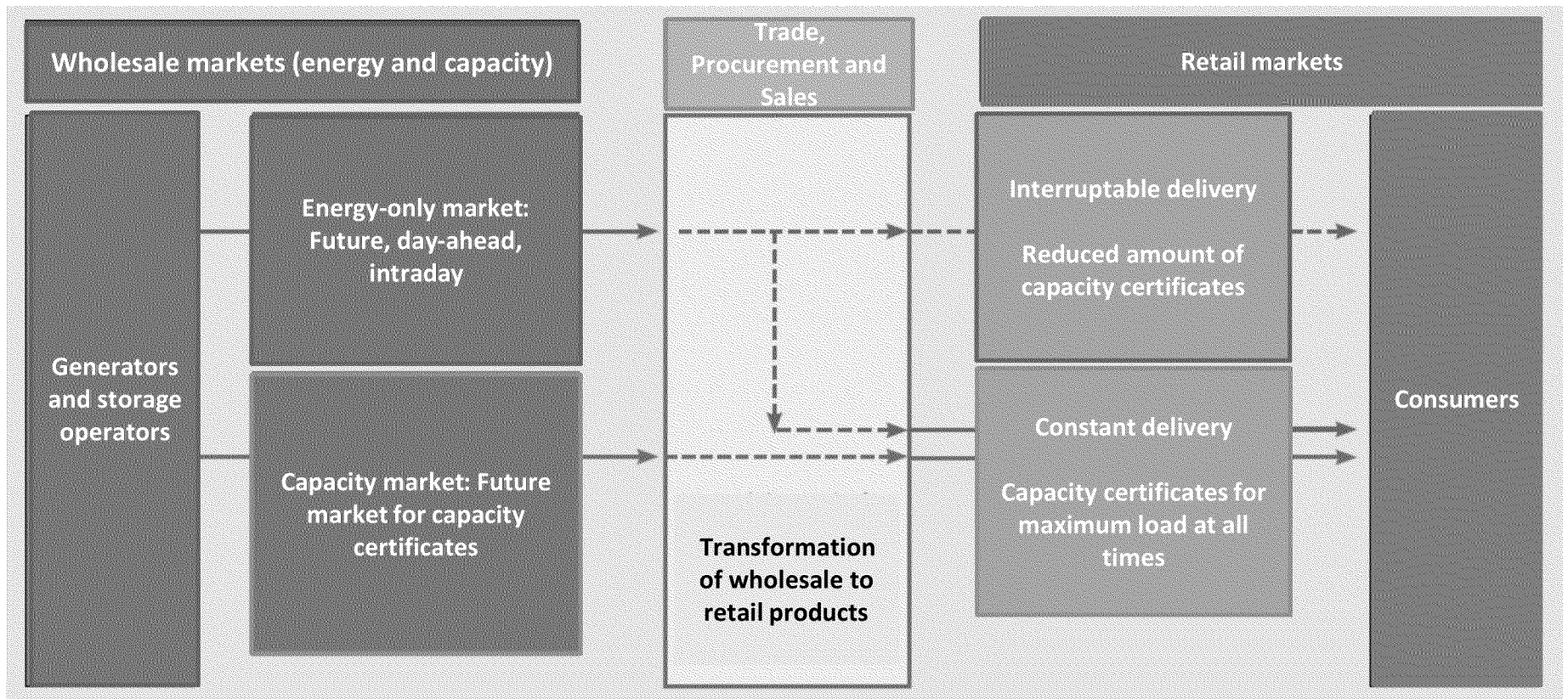


- Lower refinancing risk when not only relying on infrequent high shortage prices (economic, political)
- Risk of abuse of market power in high demand situations can be lowered

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

and nuclear energy



Energiewende

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

- 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?