Resource Adequacy

Case Study: Demand Response to cover Peak Demand in Southern Germany

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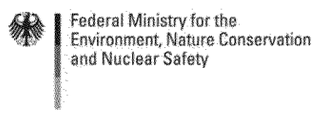
Workshop on Demand Response
October 15th, 2013

facilitated by the German Consulate in San Francisco
hosted by PG&E in San Francisco



Agora Energiewende – a Snapshot

- Berlin-based Energy Policy Think Tank
- Mission: How do we make the Energiewende in Germany a success story?

- Our ultimate goal: to support decision-makers to set the course towards achieving Germany´s long-term energy targets
- Driven by the question: What concrete legislation, initiatives or measures are required?

- Dialogue process with key decision makers and society
- Scientific and empirical expertise
- Independent and non-partisan

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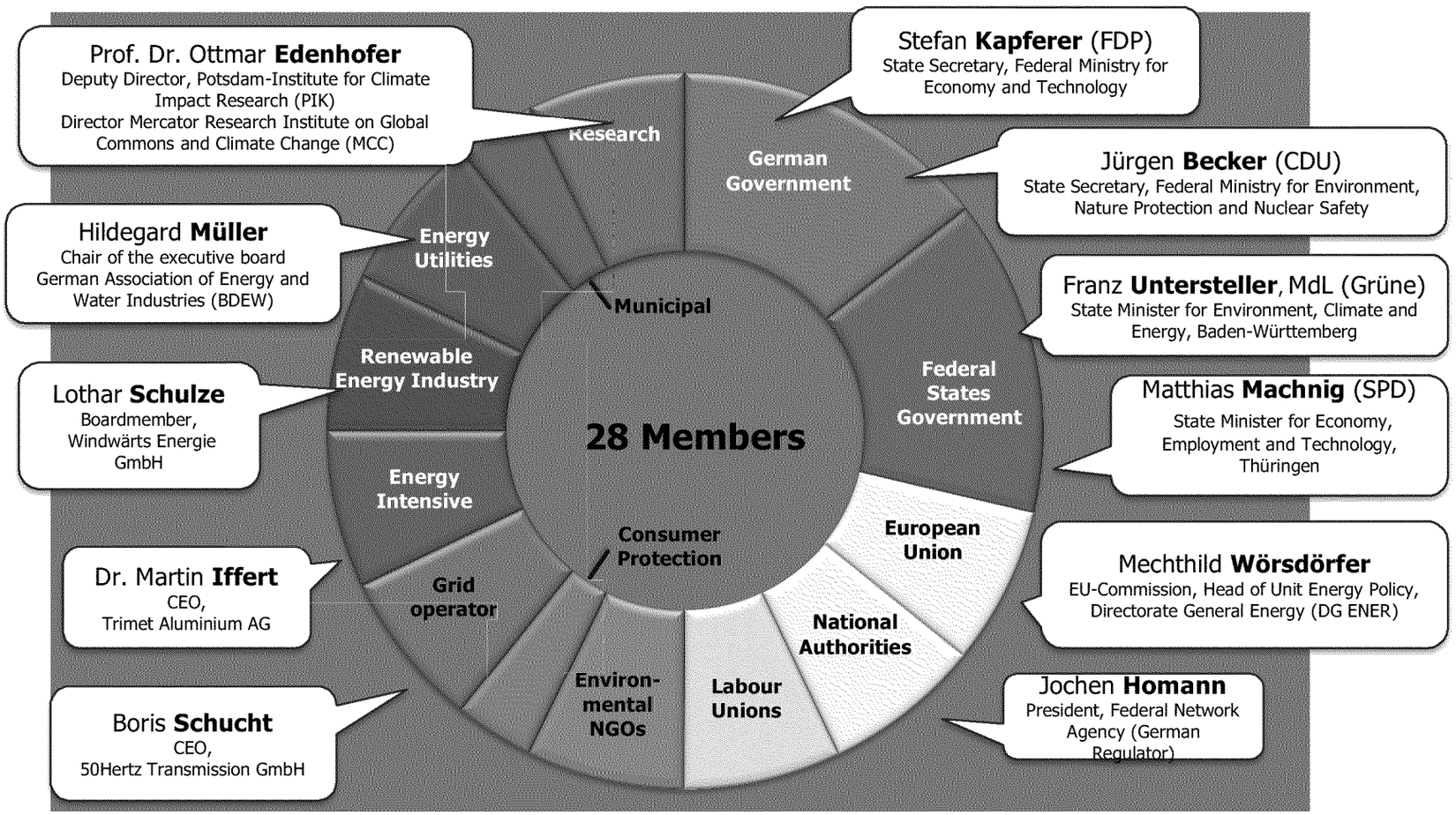
Key Decision Makers come together in the "Council of Agora Energiewende"



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Agenda

- State of Resource Adequacy and regulatory framework in Germany and Status Quo in the South
- What economic potential is there for shifting demand and how far can industry contribute to reducing peak demand, esp. large-scale industrial and commercial consumers?
- To what extent are the quantified potentials already exploited in practice and what are the hurdles that prevent their implementation?
- Follow-up: What kind of economic incentives are necessary to reap the benefits and what does a future market design look like that allows demand-side resources to actively participate as an alternative to generation and storage?

State of Resource Adequacy and Regulatory Framework in Germany

- **Current challenges regarding resource adequacy in Germany**
  - Phase out of nuclear power plants and the consequences for Southern Germany
  - Missing money problem as a result of reduced operating times of fossil-fueled power plants, low energy market prices and no capacity payments

- **Financial incentives to ensure resource adequacy in Germany**
  - Price volatility on the marginal-cost based Energy-Only Market
  - Ordinance governing grid reserves – reserve of 2.5 GW
  - Ordinance governing interruptible loads – reserve of max. 3 GW

- **Discussion on capacity markets**
  - Low DR participation in ancillary services markets due to low prices and market barriers
  - Issue of resource adequacy/ capacity markets becomes more urgent
  - A new Energiewende market is required which must actively engage the demand side
  - Role of demand response is unclear in all concepts

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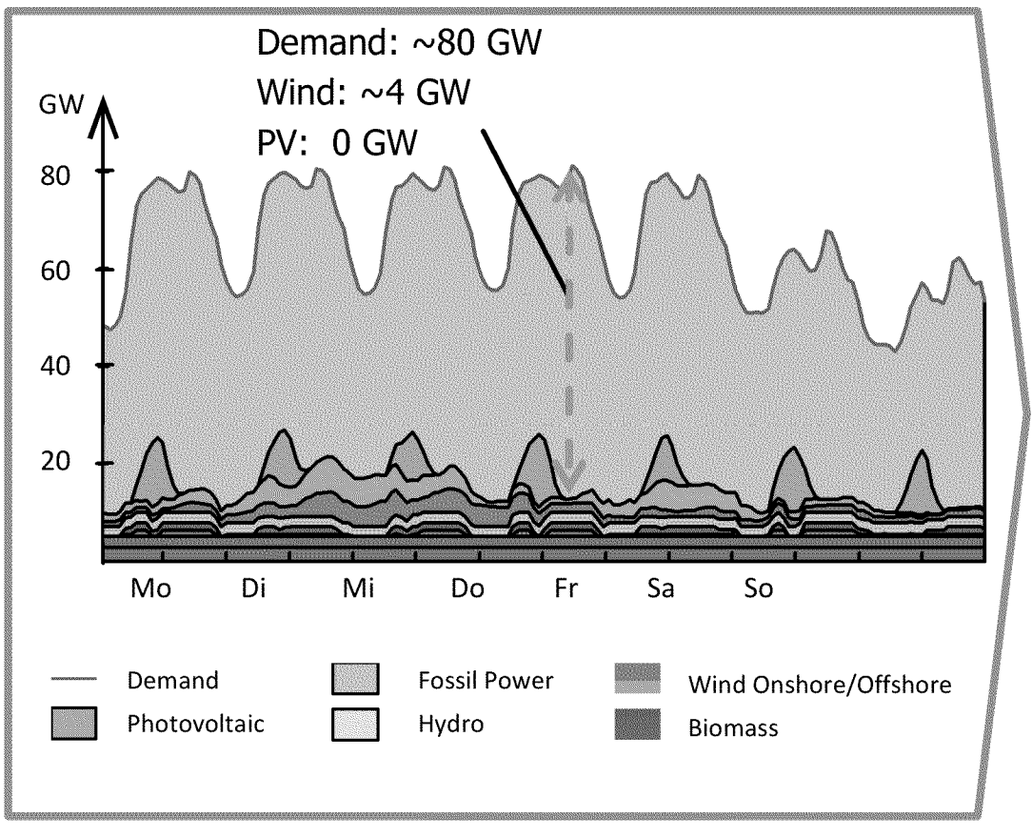
Illustration of Challenges of Securing Supply in times of Peak Demand, November 2022



- In 2022, 15-25 GW controllable resources are needed which operate less than 200 hours per year
- Open cycle gas turbines can meet this demand cheaply (35–70 million EUR per GW and year)
- Demand-side measures will further reduce costs

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Status Quo in Southern Germany

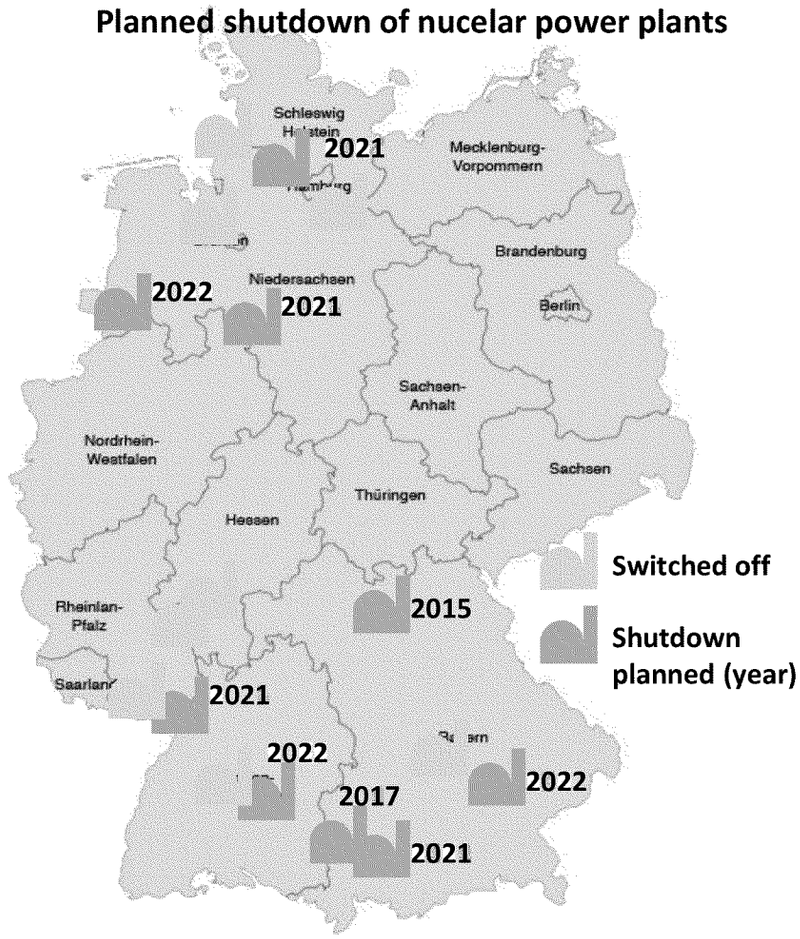
Power system reliability under stress in Southern Germany

- 4.9 GW nuclear power switched off since 2011
- More shutdowns in 2015 and thereafter
- Limited construction of additional generation capacity (coal-fired power plants)
- Grid expansion until 2017 at the earliest, but further need thereafter
- Backup capacity of 2.5 GW for Southern Germany acquired

Key questions and set-up of case study

- Contribution of load management to reducing peak demand in Southern Germany
- Focus on industrial and commercial processes
- Supported by Environment Ministers of Baden-Württemberg and Bavaria
- Representatives from industry and trade associations, electricity utilities, network operators and regulation

Planned shutdown of nucelar power plants



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Potential in Energy-Intensive Processes

Application	Maximum load	Duration of shift	Total number of activations (year)	Economic potential based on AbLaV
Cement (raw meal and cement mills)	130 MW	Up to 4 hours, sometimes longer	20 – 50 times	Circa 50 MW
Paper (wood grinding)	Min. 90 MW	2 hours, sometimes longer	20 – 50 times	Circa 90 MW
Chlorine (electrolysis)	250 MW	Circa 2 hours	20 – 50 times	Circa 160 MW
Steel (electric furnaces)	200 MW	Circa 2 hours	20 – 50 times	Circa 150 MW
Total		**Circa 2 hours**	**20 – 50 times**	**400 - 450 MW**
Participation in ancillary services markets				76 MW
Optimized procurement of electricity				300 – 400 MW

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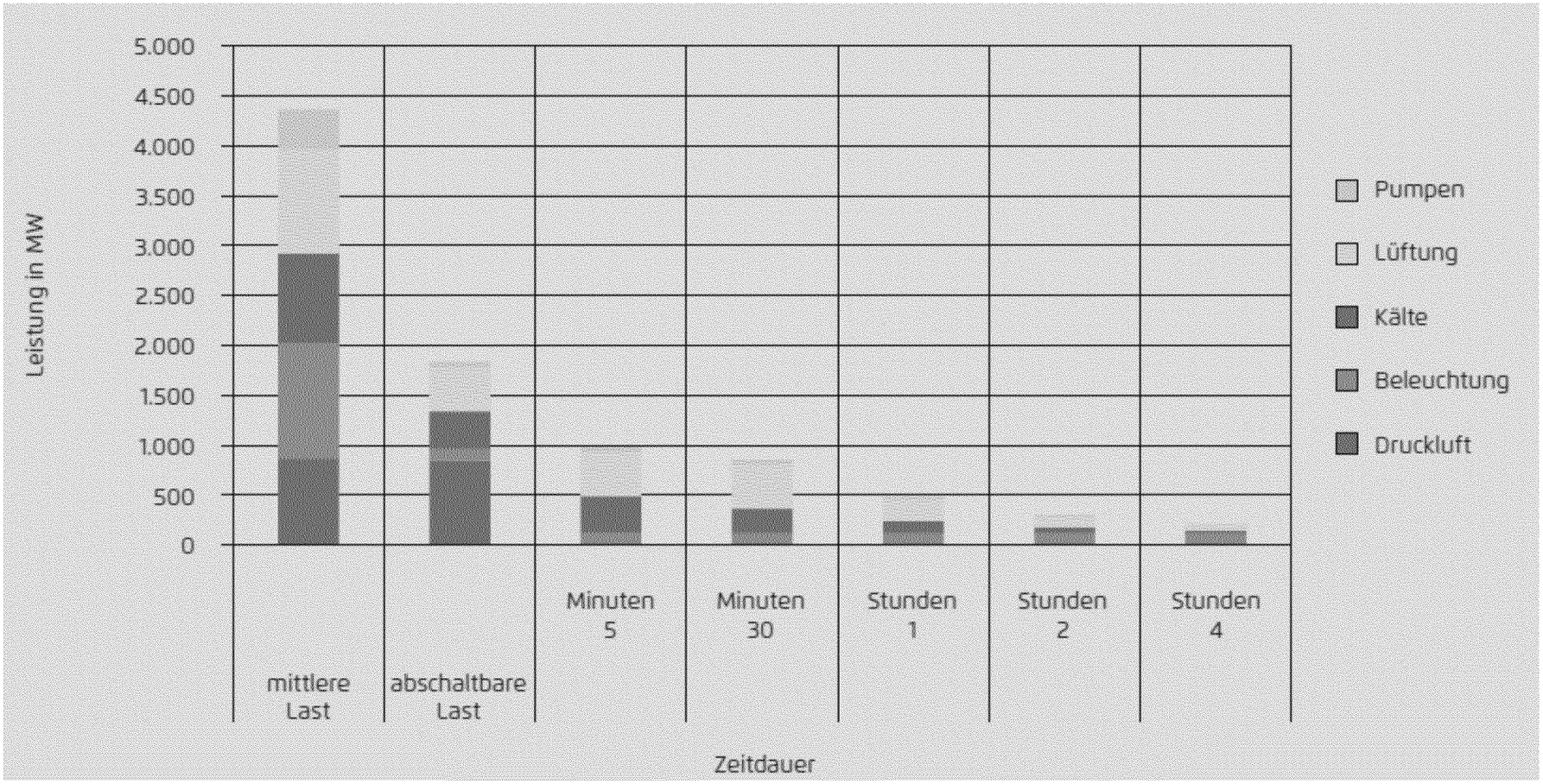
Potential for interruption of cross-section technologies relative to duration



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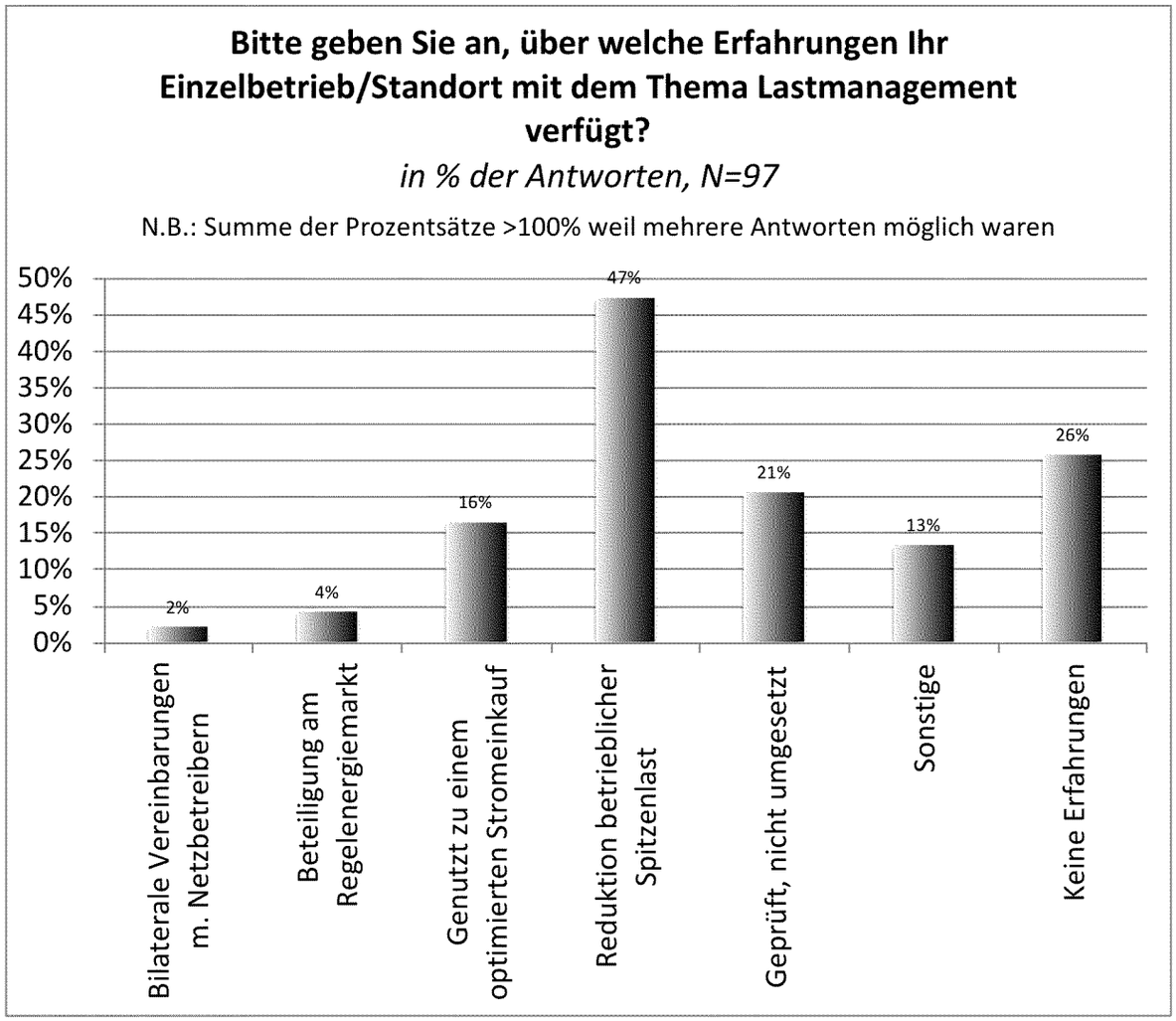
Experience with Load Management

Contribution to Resource Adequacy

- Reducing Peak Demand
- Participation in Ancillary Services Markets
- Re-Dispatch



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Assessment of Realizable Potential

- **Typical load size**
  - From several 100 kW to a few MW
  - Very few exceeding 10 MW
- **Duration of shift (product runtime)**
  - Usually 0.5 - 2 hours
  - With 20% of respondents over 2 h
- **Full activation time (advance notice)**
  - Group 1: < 1 hour
  - Group 2: > 8 h up to 1 day
- **Total number of activations (year)**
  - Up to 50 activations per year
  - With 10% of respondents more than 100 activations
- **Financial incentives**
  - 15% of companies with 3 - 5% electricity cost savings
  - In addition absolute level of relevance

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Current Obstacles that prevent Implementation

For Companies

- Disturbances of production processes and the impact on product quality
- Restrictive technical conditions and prequalification criteria for participation in load management programs (ancillary services markets, AbLaV):
  - Minimum load size, product runtime and activation times too high
  - Important pre-conditions: Voluntary participation and ability to react to short-term changes in production
- Financial incentives currently insufficient

For Service Providers

- Not clearly defined market role for demand response aggregators

Conclusions

	Duration of shift/ Potential	
Sector/ application	30 minutes	1-2 hours
Industrial cross-section technologies	> 850 MW	> 480 MW
Energy-intensive processes	> 400 MW	> 400 MW
Total	> 1.250 MW	> 880 MW

1. **Load management programs must be tailored to the companies´ requirements -> The design decides what potential is realizable, to what extent and at what cost!**

   Shorter auction/ bidding process, smaller minimum load size and shorter product runtime increase potential for flexible loads

2. **The regulatory framework should be reviewed and the market role of demand response aggregators be defined**

3. **The financial incentives are currently insufficient**

<u>Follow-up</u>:

- In how far can companies profit from new business models associated with load management?
- What does a future market design look like that allows demand-side resources to actively participate as an alternative to generation and storage?
- **Pilot activities and a National DSM Action Plan!**

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Case Study: Load Management as a Way of Covering Peak Demand in Southern Germany

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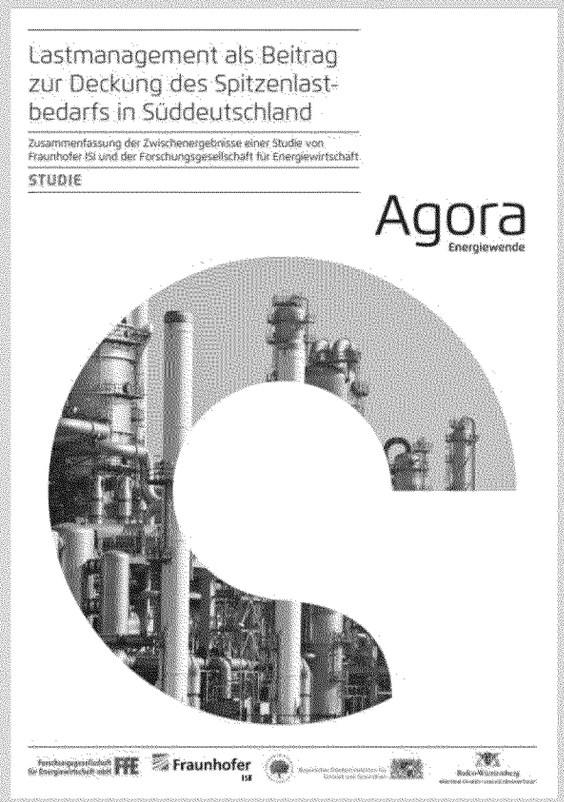
- In cooperation with Ministries of the Environment of Baden-Württemberg and Bavaria
- Authors: Fraunhofer ISI and Forschungsgesellschaft für Energiewirtschaft
- Supported by industry and trade associations, electricity utilities, network operators and regulators
- Download under: http://www.agora-energiewende.org/topics/efficiency-and-load-management/



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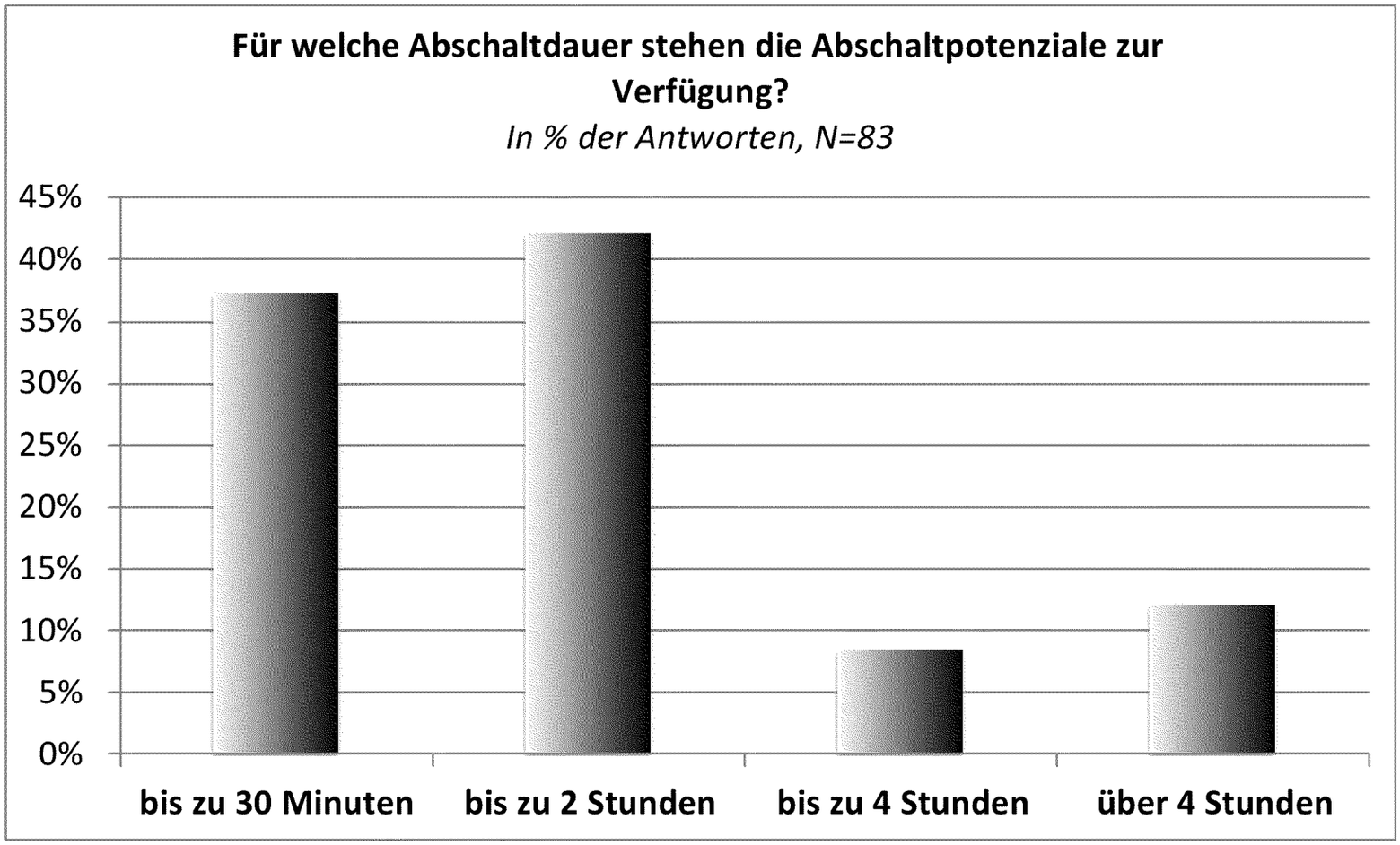
Back-up: Duration of shift



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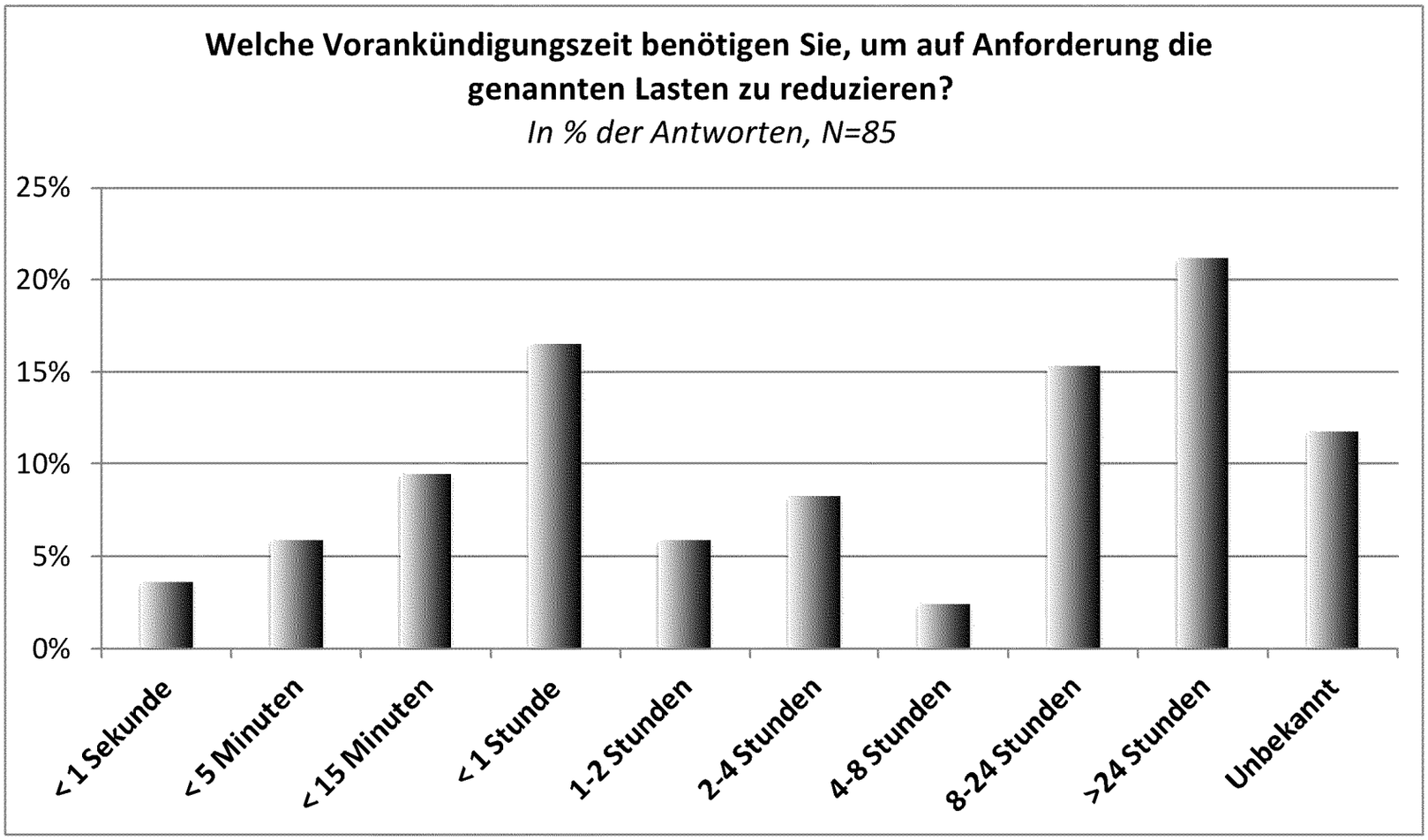
Back-up: Full activation time (advance notice)



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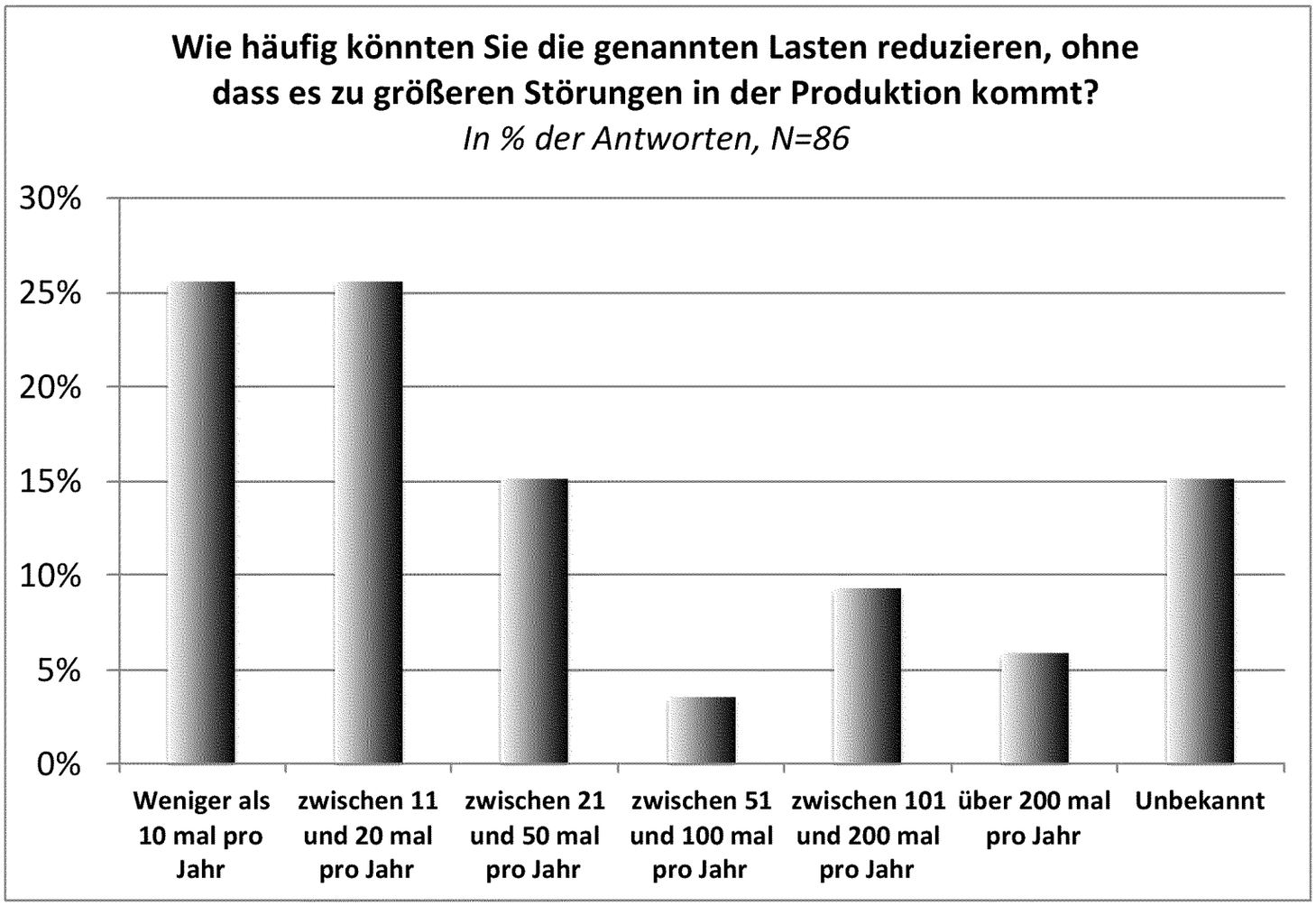
Back-up: Total number of activations (year)



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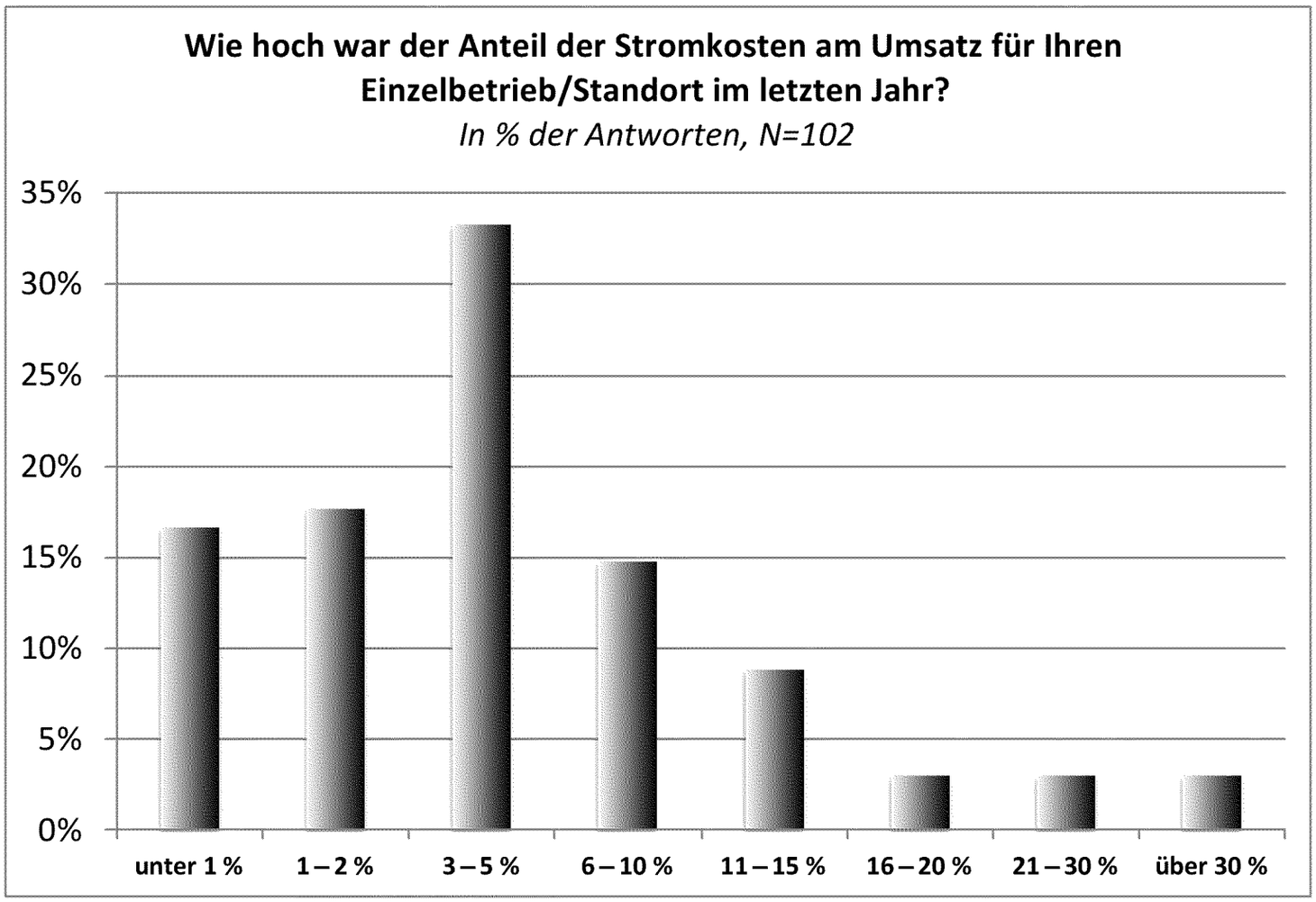
Back-up: Financial incentives



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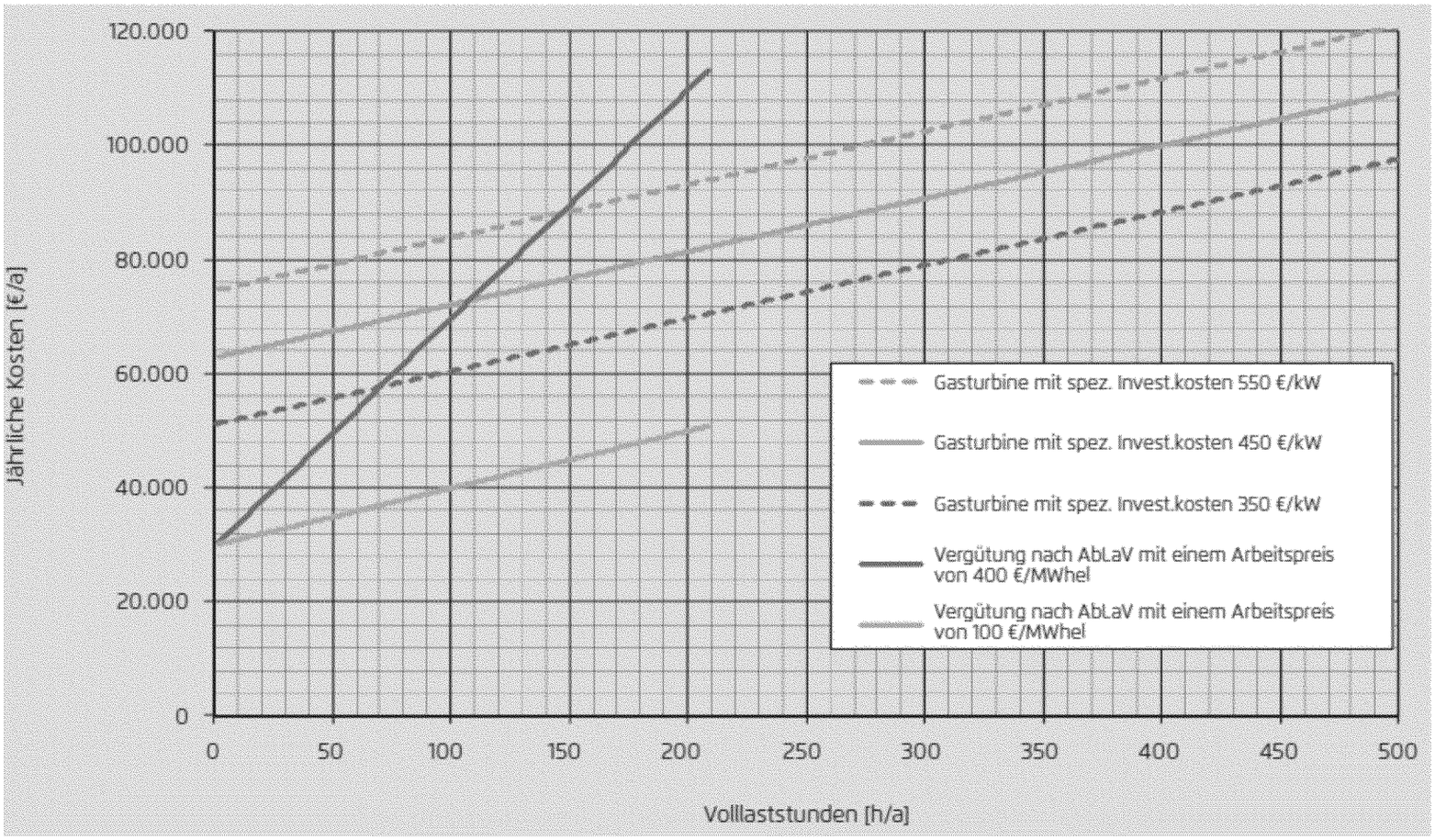
Back-up: Cost comparison open cycle gas turbine vs. demand-side measures based on AbLaV



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