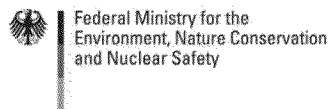

Resource Adequacy

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

Alexandra Langenheld, Agora Energiewende

Workshop on Demand Response
October 15th, 2013

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

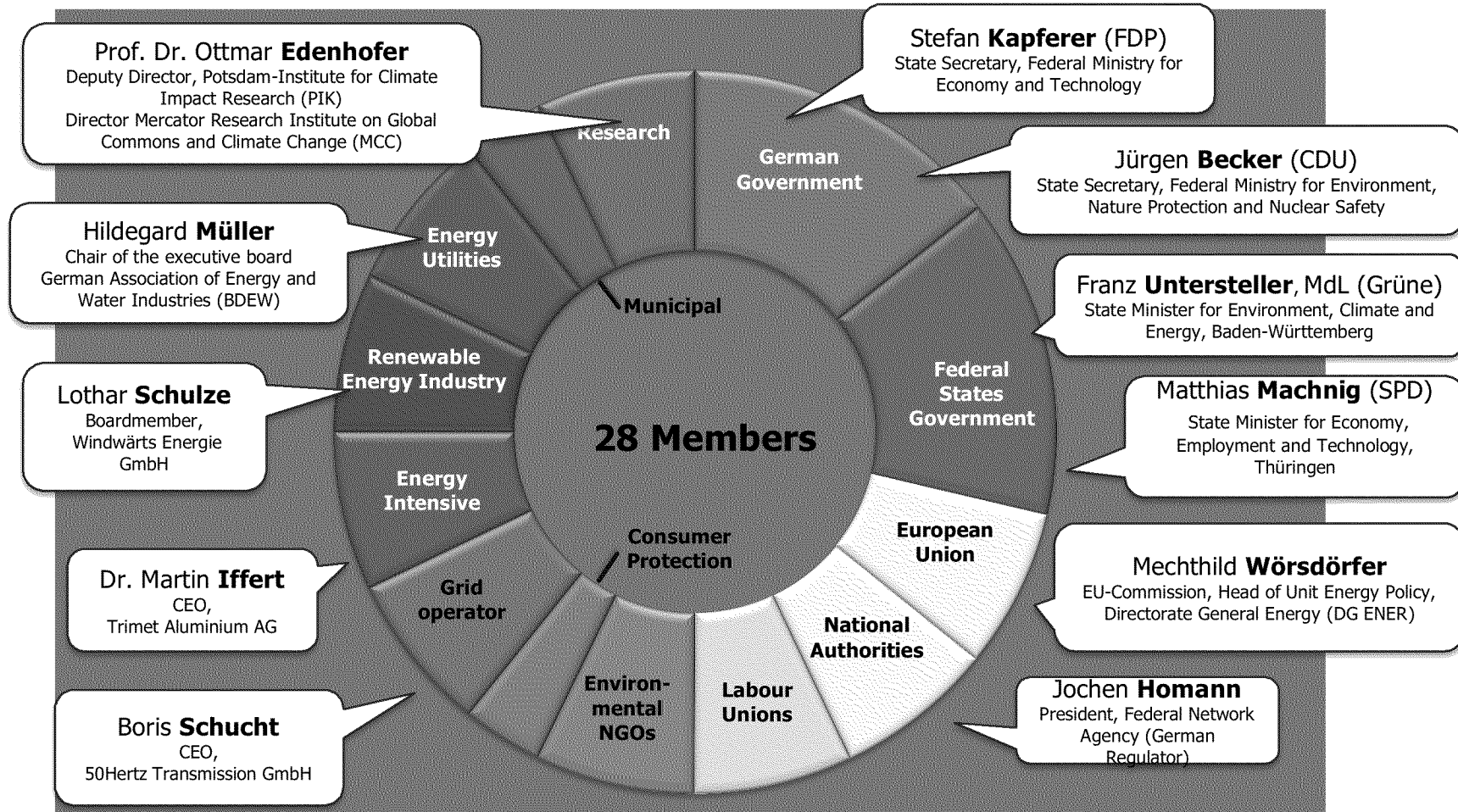


Agora Energiewende – a Snapshot

- 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



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



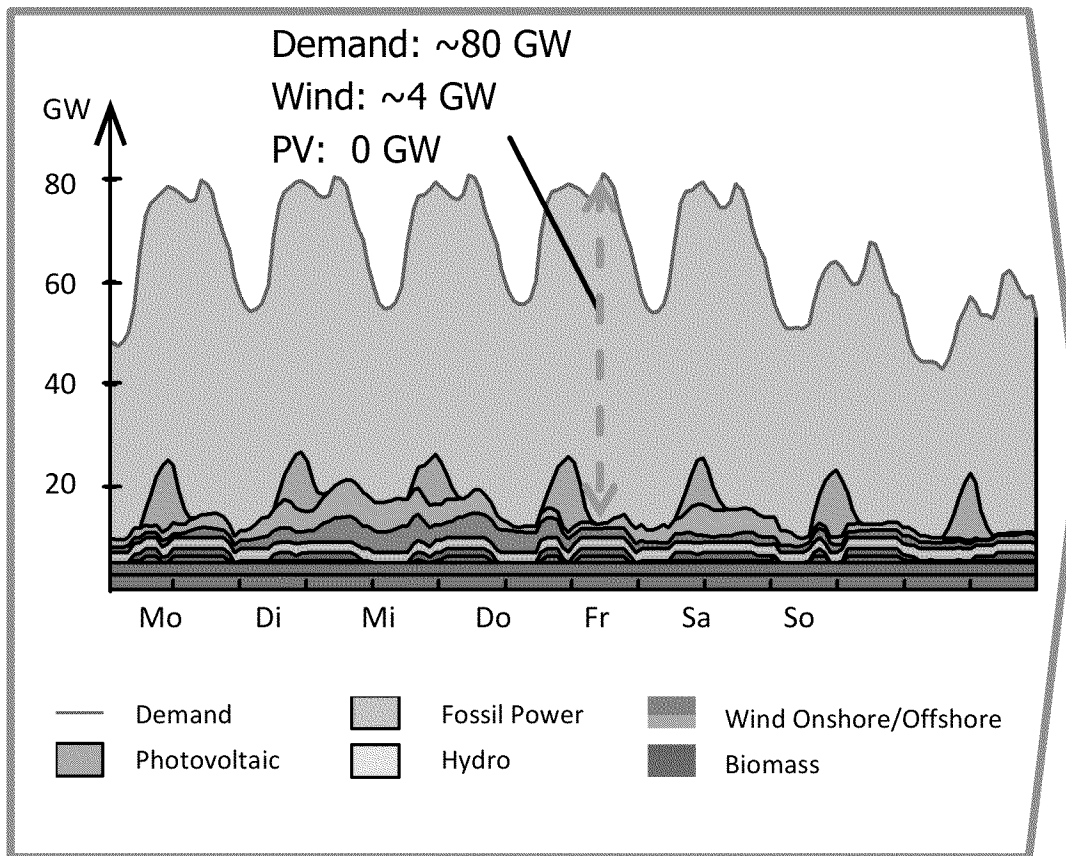
Agenda

- 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

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

Status Quo in Southern Germany

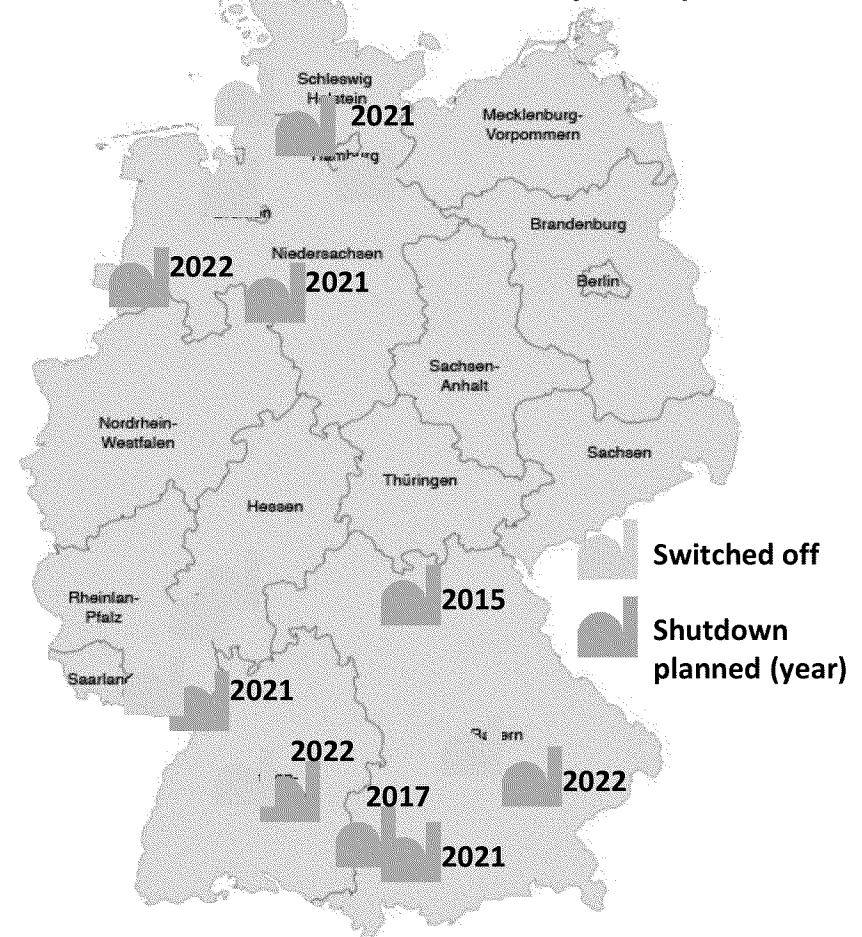
Power system reliability under stress in Southern Germany

- 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

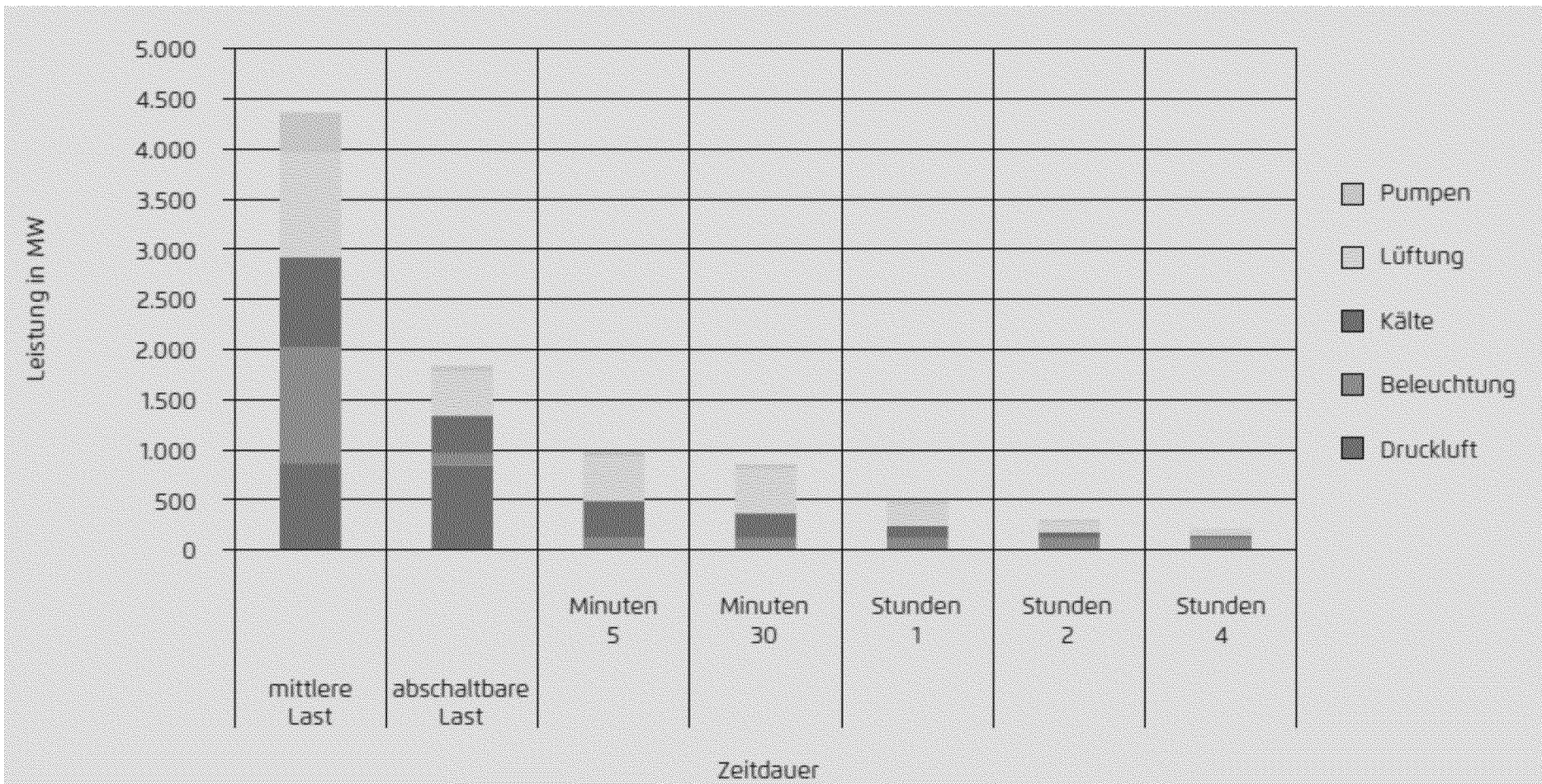
Planned shutdown of nuclear power plants



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

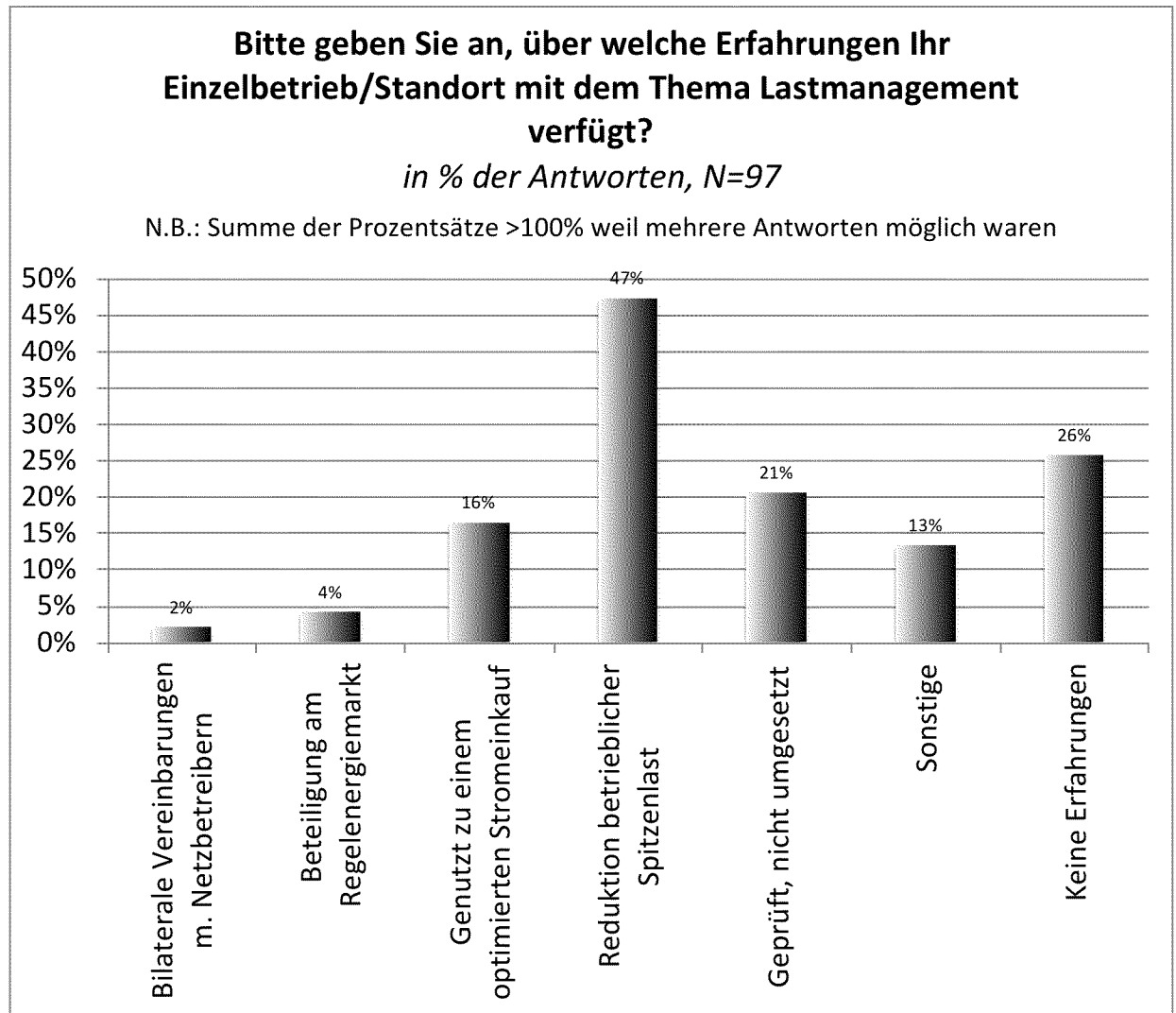
Potential for interruption of cross-section technologies relative to duration



Experience with Load Management

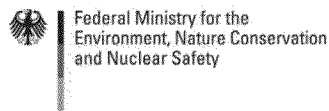
Contribution to Resource Adequacy

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



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



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

Sector/ application	Duration of shift/ Potential	
	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

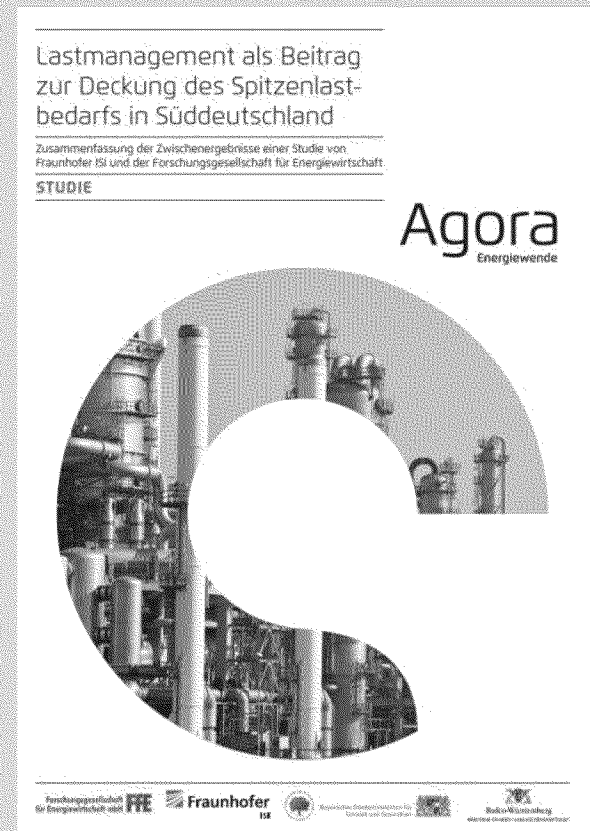
- 1. Load management programs must be tailored to the companies' requirements -> The design decides what potential is realizable, to what extent and at what cost!**
Shorter auction/ bidding process, smaller minimum load size and shorter product runtime increase potential for flexible loads
- 2. The regulatory framework should be reviewed and the market role of demand response aggregators be defined**
- 3. The financial incentives are currently insufficient**

Follow-up:

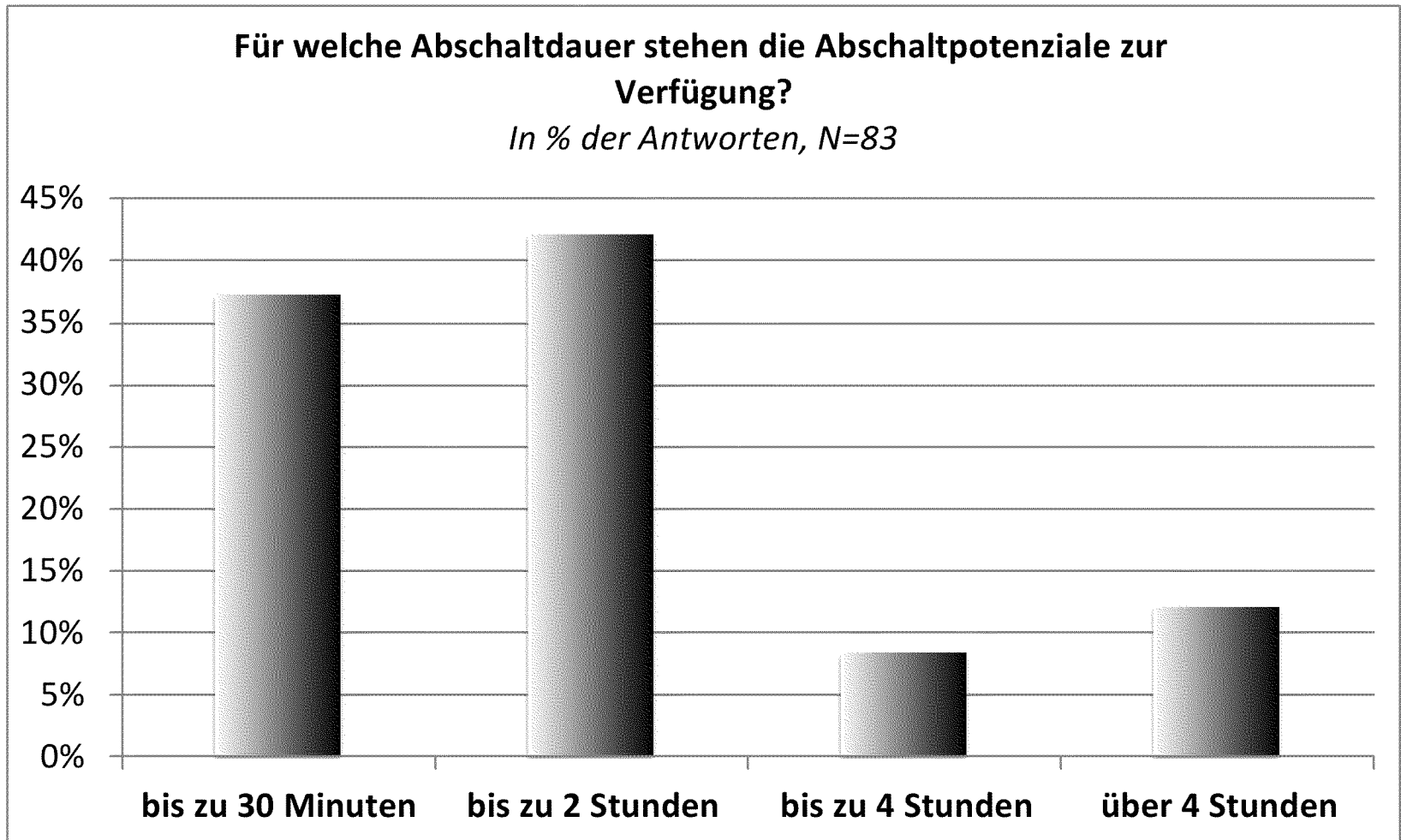
- In how far can companies profit from new business models associated with load management?
- What does a future market design look like that allows demand-side resources to actively participate as an alternative to generation and storage?
- **Pilot activities and a National DSM Action Plan!**

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

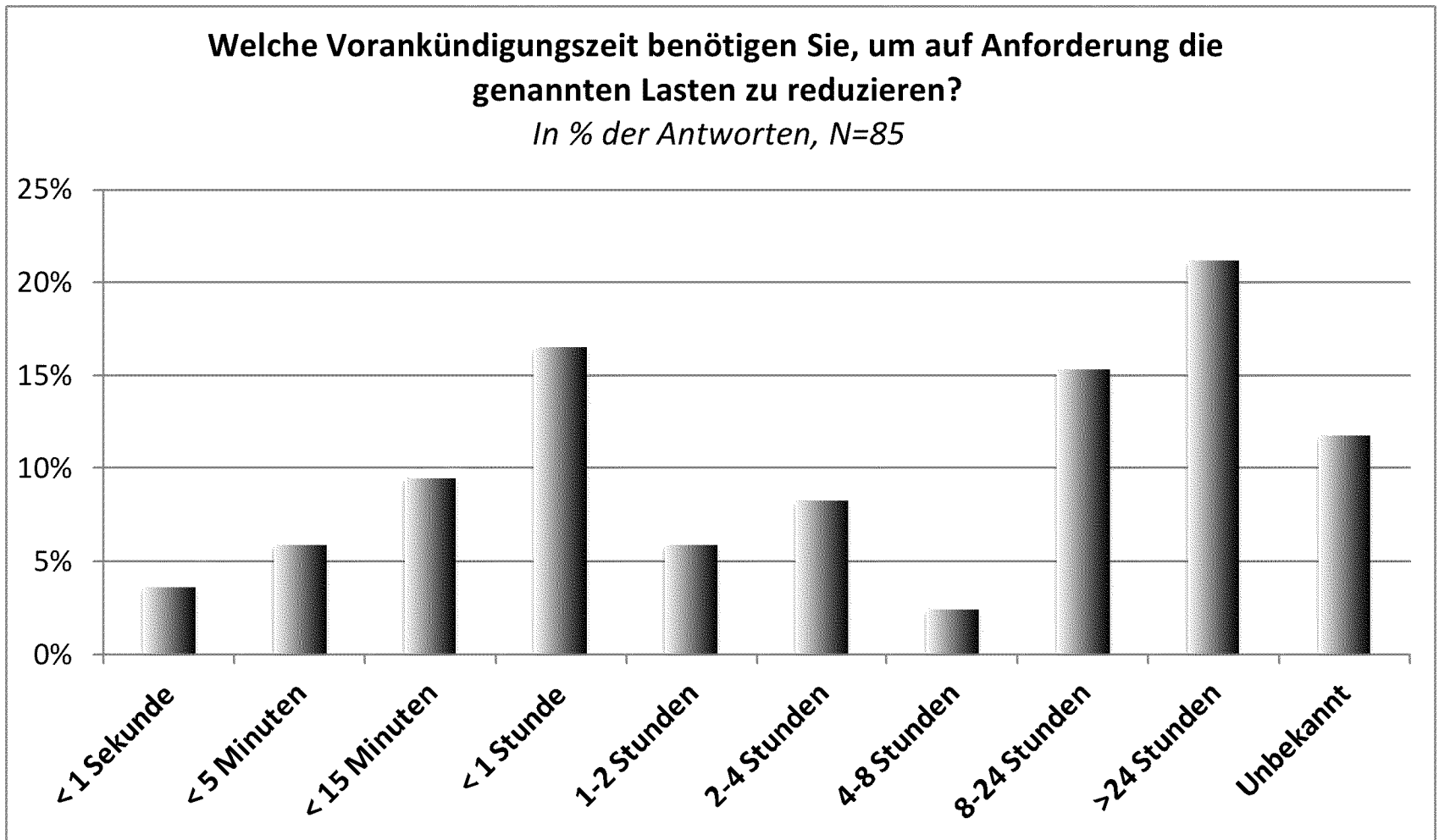
- On behalf of Agora Energiewende, project director: Alexandra Langenheld, alexandra.langenheld@agora-energiewende.de
- In cooperation with Ministries of the Environment of Baden-Württemberg and Bavaria
- Authors: Fraunhofer ISI and Forschungsgesellschaft für Energiewirtschaft
- Supported by industry and trade associations, electricity utilities, network operators and regulators
- Download under: <http://www.agora-energiewende.org/topics/efficiency-and-load-management/>



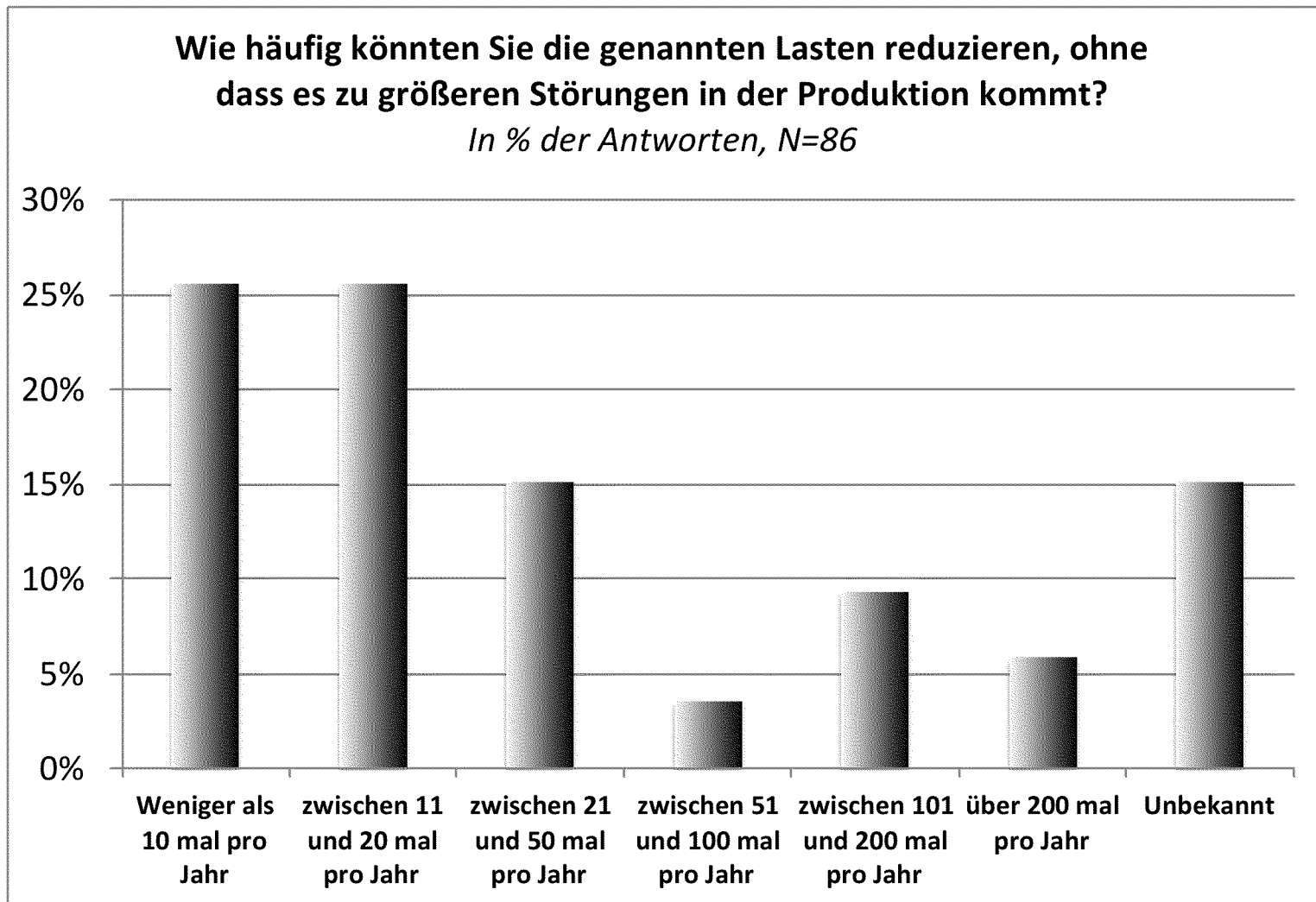
Back-up: Duration of shift



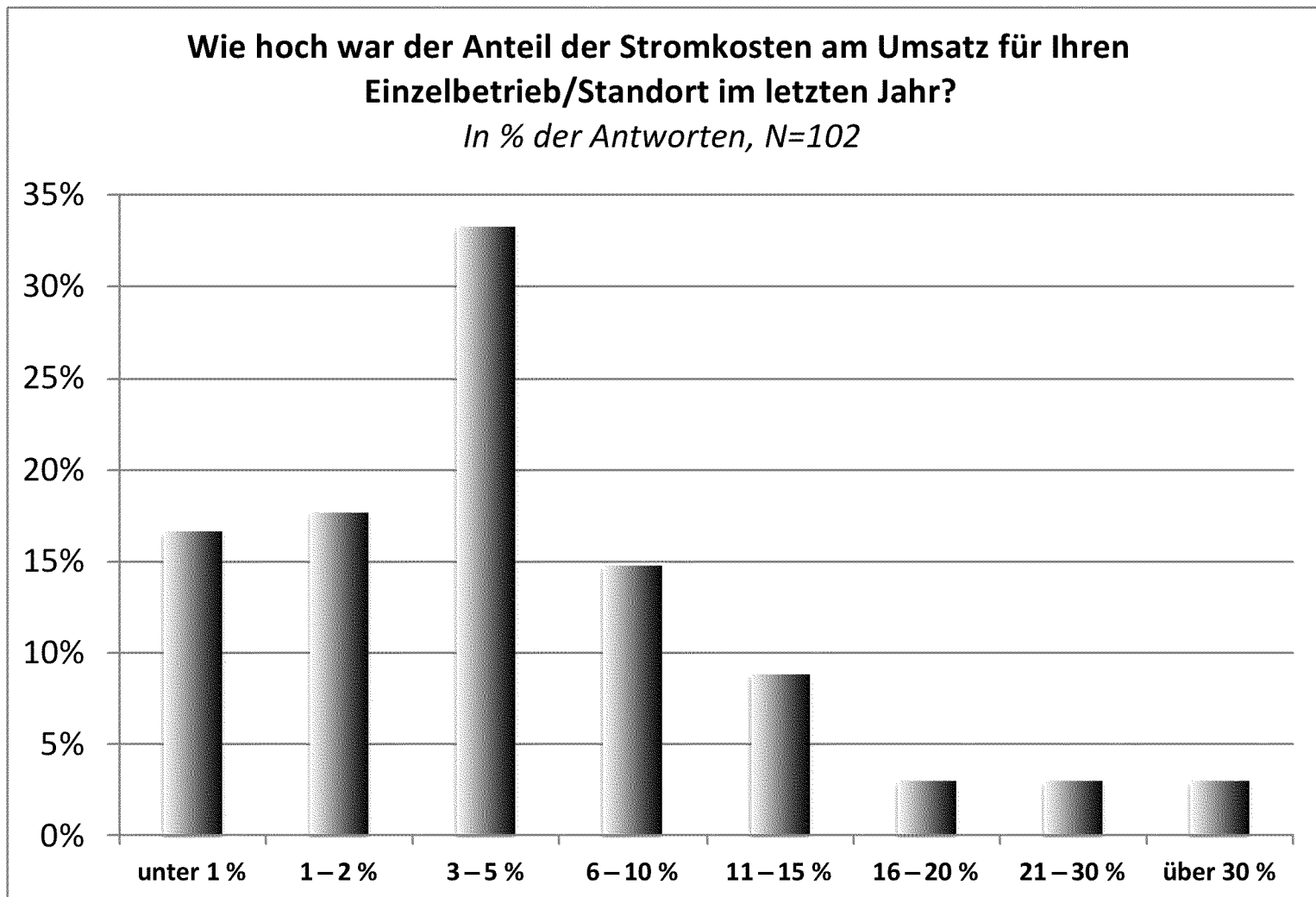
Back-up: Full activation time (advance notice)



Back-up: Total number of activations (year)



Back-up: Financial incentives



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

