DEMAND RESPONSE IN THE SERVICE SECTOR

SETTING COURSE FOR ENERGY FLEXIBILITY AND EFFICIENCY

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Introduction and focus of research

Demand Response (DR) :=

change of consumption pattern “behind the meter” (load shift/ reduction) to support grid stability

Why the service sector?

- More common in industry – large consumption at one site
- Potentials of the service sector “almost everywhere” – fragmented and spread, but untapped (estimated DR potential 5-10 TWh flexible energy)*

Research questions:

- Which technologies and subsectors of the service sector are most promising for DR?
- Which conditions and barriers affect the realisation of the potential?
- What can be done to tap them?

* Klobasa 2007, VDE 2012, Dena, 2010

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Outline

- Database and method
- Results
  - Identification of relevant technologies and subsectors of the service sector
  - Results of stakeholder survey
  - Market conditions: (very brief) introduction of German regulatory aspects
- Conclusions

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Database and Methods

Quantitative Data:

- Data from study „energy consumption of the tertiary sector in Germany“ (Schlomann et al, 2015)
- Identification of relevant subsectors and rough estimation of potentials

Qualitative Data:

- Stakeholder interviews with

  aggregators, energy service providers, technology suppliers and regulators

  + representatives of the subsectors trade, hotels/ restaurants, offices
- Semi-standardized telephone interviews
- Identification of conditions, barriers and options in the relevant sectors

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Flexible appliances

List of flexible applications in the service sector

- cold storage
- retail cooling
- hotel/restaurant cooling
- ventilation
- air conditioner
- electric water heating
- storage heater
- heat pump/ recirculation pump

Compilations by: Klobasa (2007), VDE (2012) and Gils (2014)

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Relevant technologies and subsectors

2013 **Electricity** consumption (TWh/a)	Lighting	Mech. power	**Hot water**	Other process heat	**Process cold**	**AC**	ICT	**Space heating**	Total	Sum of relevant shares
Construction industry	1.8	0.7	**0.5**	0.1	**0.0**	**0.1**	0.3	**0.3**	3.8	0.9
Office-like enterprises	13.3	1.3	**0.9**	0.4	**0.7**	**0.9**	10.9	**1.1**	29.5	3.6
Small manufacturing enterprises	1.5	1.6	**0.2**	0.0	**0.0**	**0.0**	0.4	**0.2**	3.9	0.4
Retail trade	11.0	2.1	**0.7**	0.6	**4.2**	**0.5**	1.9	**1.4**	22.5	6.8
Hospitals	1.2	1.7	**0.3**	1.7	**0.1**	**0.3**	0.6	**0.1**	6.1	0.8
Schools	2.9	0.1	**0.1**	0.1	**0.0**	**0.0**	0.4	**0.1**	3.9	0.3
Baths	0.2	1.1	**0.0**	0.0	**0.0**	**0.0**	0.0	**0.0**	1.4	0.0
Hotels, restaurants, homes	5.3	4.8	**1.3**	2.1	**2.5**	**0.2**	1.0	**1.4**	18.5	5.4
Foodstuff (bakers, butchers, other)	0.2	0.1	**0.0**	0.4	**0.1**	**0.0**	0.0	**0.0**	0.9	0.3
Laundries	0.1	0.0	**0.0**	0.2	**0.0**	**0.0**	0.0	**0.0**	0.3	0.0
Agriculture	1.1	1.8	**0.5**	0.0	**0.1**	**0.4**	0.2	**0.2**	4.3	1.3
Horticulture	0.2	0.0	**0.1**	0.0	**0.0**	**0.0**	0.0	**0.0**	0.4	0.1
Airports	0.5	0.4	**0.1**	0.1	**0.0**	**0.1**	0.1	**0.1**	1.3	0.3
Textile, clothing, leather	0.6	0.1	**0.0**	0.0	**0.0**	**0.0**	0.2	**0.2**	1.1	0.2
Remaining groups*	1.1	7.9	**0.1**	0.4	**2.9**	**0.0**	4.1	**0.2**	16.8	3.3
Other	5.8	8.6	**0.2**	0.2	**0.1**	**0.1**	1.0	**0.0**	15.9	0.4
Total	46.7	32.5	**5.0**	6.2	**11.0**	**2.7**	21.1	**5.4**	130.6	24.1

Type of appliance	**Flexible appliance**
Cooling	cold storage
	retail cooling
	hotel/restaurant cooling
AC/ Ventilation	ventilation
	air conditioner
Warm water	electric water heating
Room heating	storage heater
	heat pump/ recirculation pump

Offices, retail trade and hotels/ restaurants…

…together account for >50% of total electricity consumption of the sector

…14% of total electricity consumption in Germany

…have large shares of flexible technologies

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Results of stakeholder survey I
General Findnigs

- Most appropriate for larger companies
  - Higher load level
  - Energy managers/ EMS available
- Possible starting points:
  - Experience with energy-efficiency measures/ installed control technologies can promote DR
  - Refurbishments as chance for upgrades
  - Audits can be extended for DR measures
- Barriers:
  - Reluctance to change
  - Avoid investments
  - Fear of interference with companies' workflow/ quality of work

Results of stakeholder survey II

Specific findings for sectors

	Retail trade	offices	Hotels/ restaurants
Most appropriate technologies	Ventilation, AC, cooling/ cold storage	AC, ventilation	AC, ventilation, refrgerators, kitchen devices
Drivers	• Cooling and AC for DR already evaluated • Competition between corporate chains (competitive advantage)	• Low-hanging fruits	• High loads (esp. in kitchen) • Load management common for kitchen devices in large companies • Possible gains in comfort due to controlling software
Barriers	• Feeling of discrimination against industry • Customer might impede DR • Competition between corporate chains (pooling)	• Habits of staff • Fear of loss in quality • No handing over of control	• DR may not impose routines/ comfort of customers
Starting points	• Regular phases of refurbishment • Chains/ assiciations faciiitate roll-out	• Indvidual contracts with providers • Flagship projects • Modern buildings already dispose of control software for facility management	• Available controlling systems in kitchens

Regulatory aspects and market conditions in Germany

Trading of flexible loads:

- Balancing market
  - Three submarkets (different minimum loads and reaction times), pooling is possible
  - Requires prequalification
- Sheddable loads act (AbLaV)
  - Only shedding, conditions comparable to balancing
  - Immediate (within seconds) or quickly (<15 min) available loads, min. 5MW
- Spot market
  - Optimized purchasing of energy
- Other (indirect) agreements
  - Flexible tariffs
  - Aggregators
- Impeding acts: Electricity access charge ordinance (StromNEV)
  - Lower grid fees in case of atypical or intense grid use

Participants from industrial sector → Requirements hard to meet

No standardised process / contracts for third party market players (pooling, aggregators)

DR can result in losing privileges

Regulatory conditions reflect energy generation with constant loads → unattractive for DR

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Conclusions

- (Technical) potentials are available and mostly untouched yet
- Compartmentalized , spread structure of the service sector:
  - Smaller potentials per company
  - But: Availability of cross-sectional technologies might be less critical
  - And: Advantage regarding (regional) load balancing
- Start with large enterprises and those which can easily be accessed (associations/ chains)
- Experiences with energy efficiency and availability of control systems as facilitating factors
- Regulatory situation needs to be improved

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Open Issues/ Further Research

Open Issues

- Acceptance of using appliances for DR
- Identifying target groups (potentials, appliances, circumstances, …)
- Payback expectations of companies

Further Research

EnSys-FlexA (6th Energy Research Programme of the Federal Government)

- Quantitative survey of sectors of interest
    - Availability of appliances and willingness to use them for DR
    - Technical Status Quo (control technology)
    - Knowledge and experiences with DR
    - Choice experiment to estimate payback expectations

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Thank you for your attention !

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Backup
interviewed Stakeholders

Scope	Stakeholder	Organisation of interviewee
superordinate	aggregator	EnerNOC
	energy services	Next Kraftwerke (Virtual power plant operator) Beegy (energy service provider) EnBW (energy provider south Germany) Tübingen SW (Local communal energy provider) EnQS (consulting, public services on energy management) Transnet BW (TSO south-west Germany)
	technology suppliers	Sicotronic (load management solutions for hotels/ restaurants)
	regulator	BNetzA (Bundesnetzagentur, German regulator for electricity grids/ networks)
subsectors	Retail trade	HDE (German association of retail trade enterprises) EHI (Research institute for retail trade)
	Hotels/ restaurants	Adelphi (project management; managing energy section for the German hotel and gastronomy association DEHOGA)
	office-like enterprises	PWC (consulting enterprise with own energy management section) Vollack (project management and planning office for builders)