



KIT
Karlsruhe Institute of Technology

MeRegio Mobil

IKT FÜR ELEKTROMOBILITÄT

ICT for sustainable homes
How do consumers perceive ICT-based load management measures?

Nice, 18.11.2010
Alexandra-Gwyn Paetz

This work was supported by the German Federal Ministry of Economics and Technology (Grant 01ME09005)

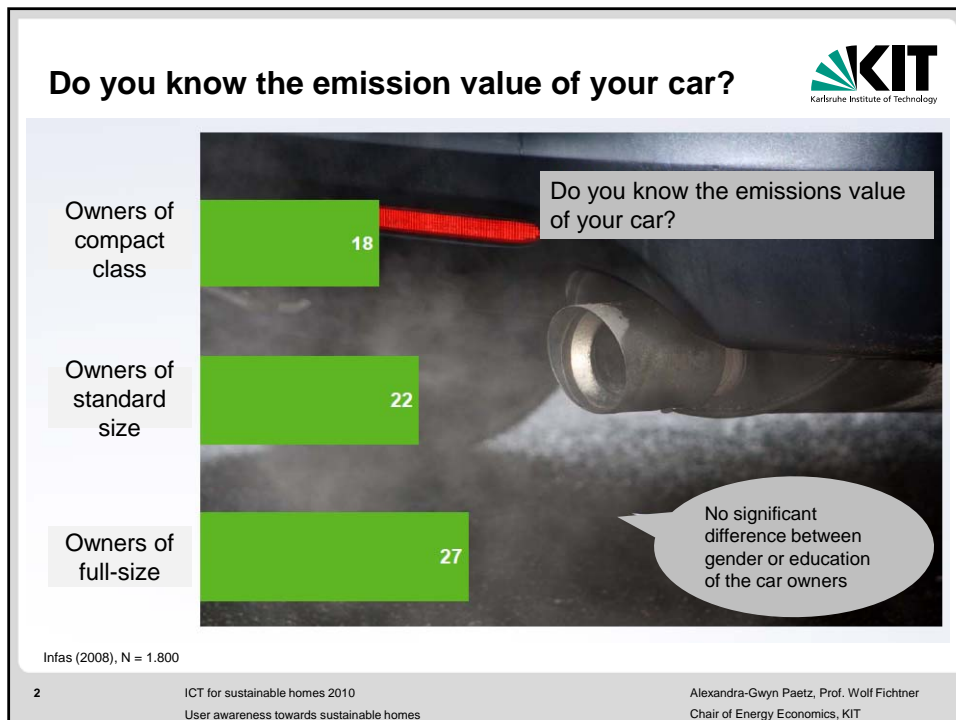
aufgrund eines Beschlusses des Deutschen Bundestages

Gefördert durch:
Bundesministerium für Wirtschaft und Technologie

INSTITUTE FOR INDUSTRIAL PRODUCTION (IIP)
Chair of Energy Economics (Prof. Fichtner)



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Do you know the emission value of your car?

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Do you know the emissions value of your car?

Owners of compact class	18
Owners of standard size	22
Owners of full-size	27

No significant difference between gender or education of the car owners


Infas (2008), N = 1.800

2


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Will Smart Technologies change...




2010
➤
2020?




3

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... change consumer behaviour?



2010
➤
2020?

- **Low Involvement**
"Power is simply available. I don't even think about it".
- **Little control of electricity consumption**
"I pay little attention to my consumption. I switch off the lights when not needed, but I keep my notebook running all day."
- **No feedback**
"When the electricity bill arrives at the end of the year, I pay attention to my consumption for a short time period."

→Lack of knowledge


- **High Involvement**
- **Regular control of electricity consumption and costs**
- **Responsible use of electricity**
- **Active participation in electricity trading**

→Detailed knowledge

4

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Agenda

- Five theses about consumer awareness
- MeRegioMobil and the study of consumer perception of ICT-based load management measures
- The Karlsruhe Institute of Technology (KIT)

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Five theses about consumer awareness

- 1. The fully responsible consumer doesn't yet exist, but the awareness of electricity consumption has risen.**
- 2. Consumers are primarily interested in advice on saving electricity and reducing costs.**
- 3. The cognitive effort to adopt new technologies and behavioral patterns has to be kept low.**
- 4. Monetary savings remain the key driver.**
- 5. New products have to offer integrated solutions.**

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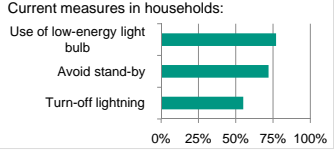
1. The fully responsible user doesn't yet exist, but the awareness of consumption has risen



The consumption pattern...

- Consumption is natural
- Perception: consumption-reduction is not possible (futility)
- Use of traditional energy saving methods

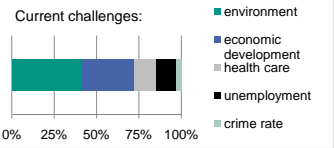
Current measures in households:



is challenged by current development and public opinion...

- Sociopolitical debate on climate change and reduction of CO₂-emissions
- Electricity costs burden the household-budget

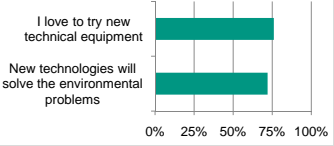
Current challenges:



...and creates new reasons why.

- General interest in reducing energy cost with new technology

I love to try new technical equipment




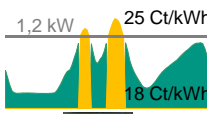
n = 29

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2. Consumers are primarily interested in advice on saving electricity and reducing costs





Dynamic Tariff Models

Smart Metering

Smart Appliances

Home Automation

Smart Mobility

Consumer requirements

- Consumption and cost transparency
- Permanent cost control
- Identification of electricity guzzlers
- Explode myths
- Environmental contribution
- Integrated supplementary functions

„Electricity becomes visible.“

„I'd like to check if all electricity guzzlers are turned off before I leave home.“

„When does an investment in new and more efficient devices pay-off? “

„With a statement of emissions I could directly recognize the impact of my behavior.“

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3. Cognitive effort for adopting new technologies and behavioral patterns has to be kept low



Main reasons

- Monetary incentive
- Contribution to environmental protection
- Transparency and information
- Convenience
- Innovativeness
- Cognitive effort
- Technical complexity (standards)
- Confirmed habits
- Expenses for new technologies
- Rebound effects
- Data privacy protection

"It all depends on the amount of monetary savings. I wouldn't adapt my behavior for a couple of cents."

"If I can credibly contribute to integrating renewable energy, I'm in."

"Everything has to work automatically. I don't want to give a thought to optimizing electricity consumption."

"It's not worth turning on the dish washer 50 times in low-peak periods instead of 30 times in high-peak periods. I'd use a lot more energy."

"The last thing I want is 'customized' advertisement."

9

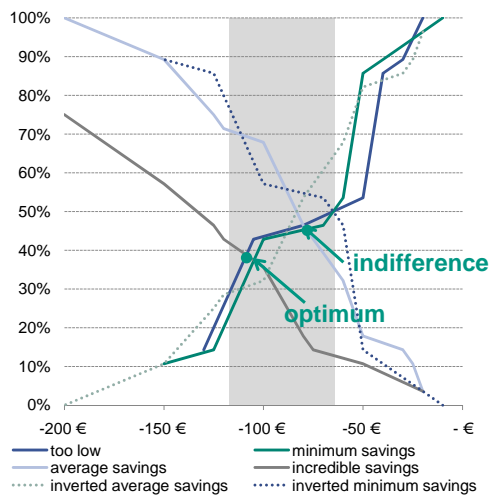
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4. Monetary savings remain the key driver



Price Sensitivity Meter



Price Evaluation

- Dynamic Tariff Models:
 - Preference for low price spread (→ low risk)
- Smart Metering:
 - 100 € maximum one-off payment
 - Main expectation: utility offers and installs smart meters free of charge
- Smart Appliances:
 - 20% surcharge acceptable
 - On condition: smart appliances offer possibilities for compensation (eg. dynamic tariffs)


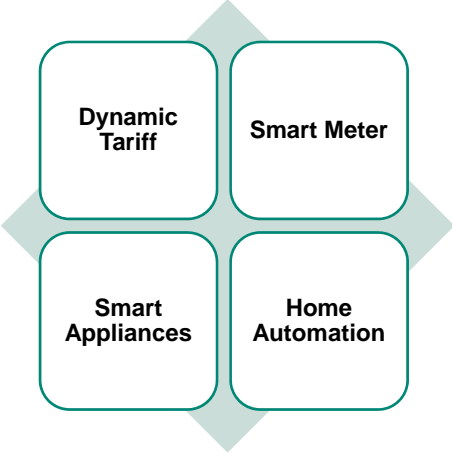
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10

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5. New products have to offer integrated solutions





- *“As a first step I think choosing a dynamic tariff model is a good and simple way to start with.”*
- *“A smart meter itself has no value, but combined with a load-dependent tariff, it becomes a crucial device.”*
- *“Smart Appliances are interesting if the investment pays-off. I think there should be some promotional program for this.”*
- *“Home Automation is the cherry on top. The utilities should start ‘peu à peu’ by switching the smart meters, offering dynamic tariffs then promote smart appliances.”*

→ Smart Metering seems a good starting point for ICT in homes

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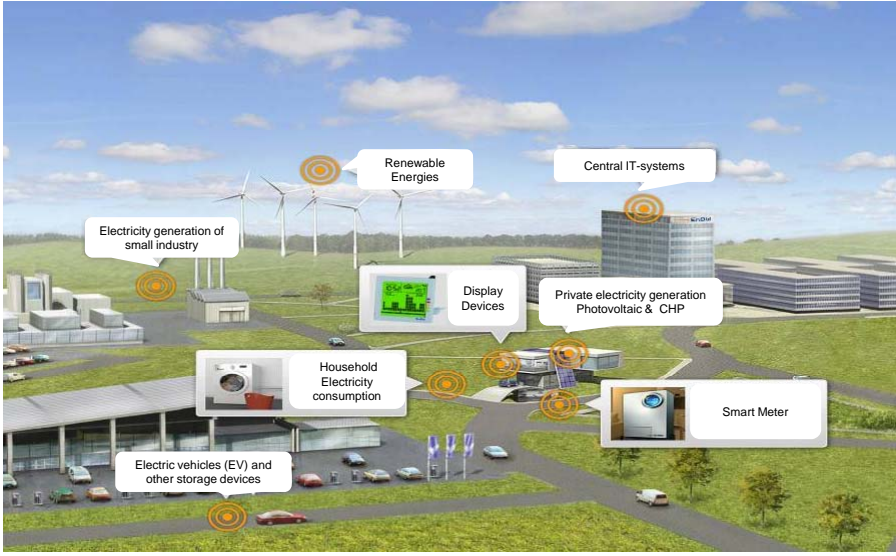
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MeRegio & MeRegioMobil explore holistically the changes in the energy system



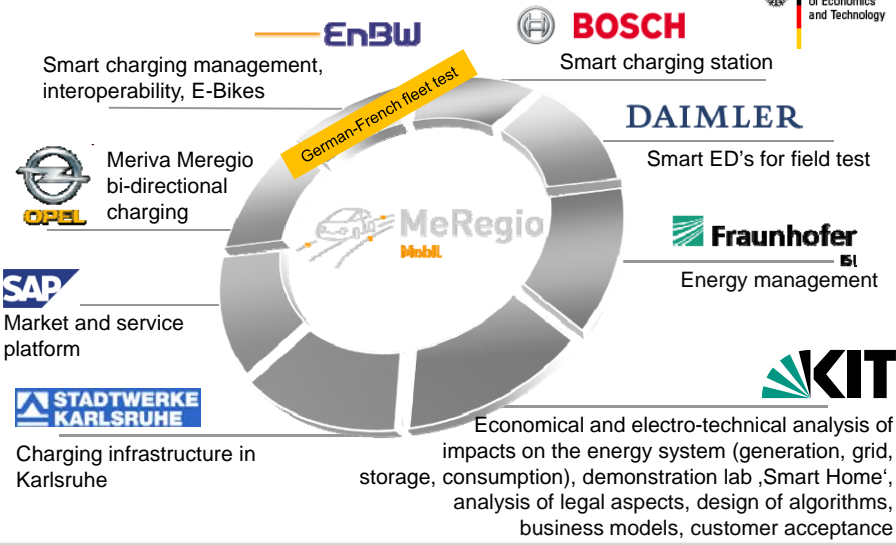



13

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The study is part of the project MeRegioMobil funded by the Federal Ministry of Economics


14

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Economical and electro-technical analysis of impacts on the energy system (generation, grid, storage, consumption), demonstration lab 'Smart Home', analysis of legal aspects, design of algorithms, business models, customer acceptance

Why is the analysis of e-mobility on a household level important?




3.000 kWh / a



+

3.000 kWh / a




15

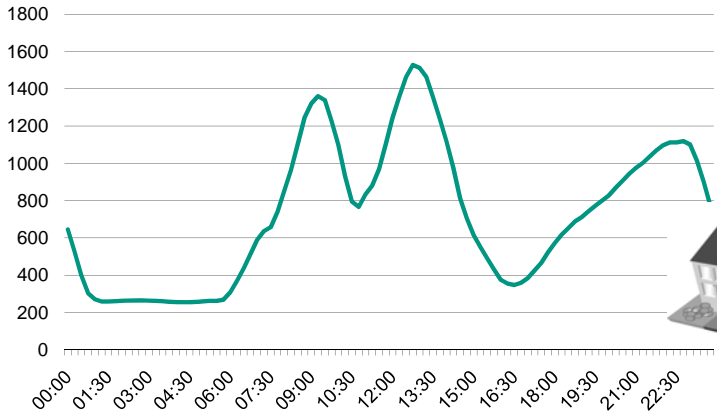
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Currently we find load-peaks in the grid after 6 p.m.



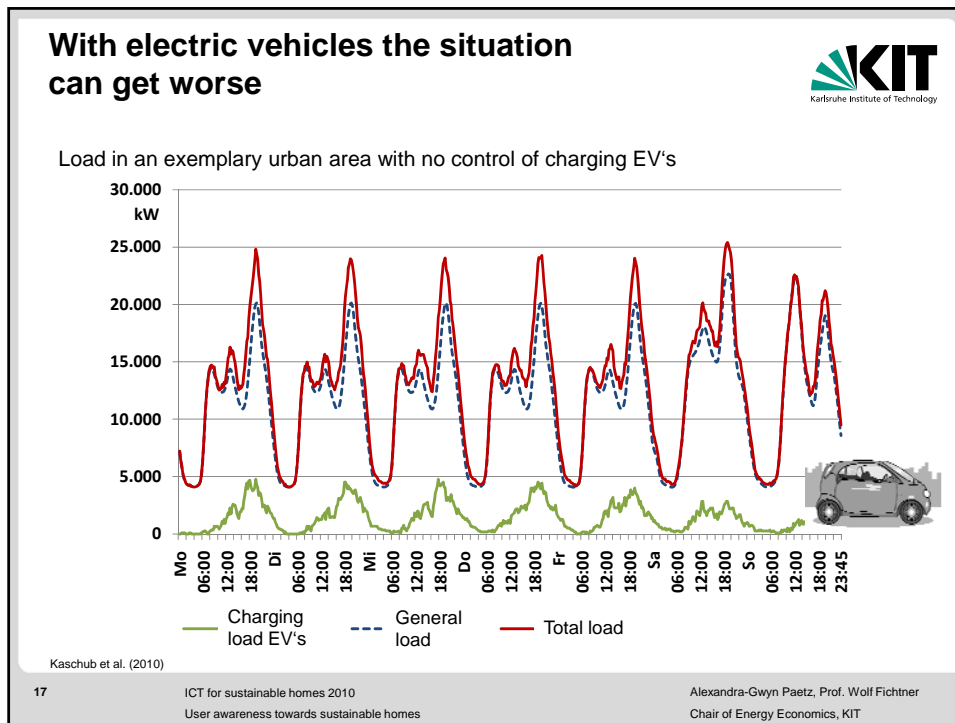
Load [W] during the course of a day in April 2010,
Household of three persons in Karlsruhe




16


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Analysis what potential current and future measures on household level have for e-mobility




Measure on household-level 

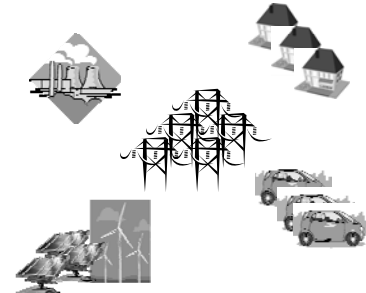
Objectives

- Energy efficiency improvement
- CO2-emissions reduction
- Information on individual energy consumption

Measures

- Smart Metering (technological innovations)
- Dynamic tariffs that motivate private consumers to save electricity or shift loads


Impact on the energy system and integration of EV 







→ Effectiveness depends on willingness of consumers to adapt

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A Smart Home on KIT's campus is at the core of our research




- Objective: ICT-based solution for the integration of EV in the energy system
- Decentralised energy supply (PV & CHP), intelligent devices (white goods), mobile power storage (EV) and control box (visible: touch screen displays)
- Platform for tests, simulations and surveys
 - Grid situations
 - Algorithm methods
 - EV behavior
 - Pricing models
 - User interaction
- Practical testing by test-residents

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The initiative „ICT for electric mobility“




- Involves a field test in which seven model projects test crucial new ICT-based technologies and services for integrating electric vehicles into existing energy and transportation systems
- A program funded by the Federal Ministry of Economics and Technology, in cooperation with Federal Ministry for the Environment

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aufgrund eines Beschlusses des Deutschen Bundestages



- GridSurfer
Weser-Ems, Niedersachsen
- Harz.EE-mobility
Harz, Sachsen-Anhalt
- e-mobility
Region Rhein-Ruhr, Nordrhein-Westfalen
- Smart Wheels
Aachen, Nordrhein-Westfalen
- Future Fleet
Region Rhein-Neckar, Baden-Württemberg
- MeRegioMobil
Stuttgart, Karlsruhe, Baden-Württemberg
- eE-Tour Allgäu
Allgäu, Bayern

20 ICT for sustainable homes 2010
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21

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KIT– One Institution, Two Missions



- **Mission of a state university with research and teaching**
- **Mission of a research institution of the Helmholtz Association with program oriented provident research**



22

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Initial Situation



October 2006:
Universität Karlsruhe wins the 2006
Excellence Initiative launched by the
Federal Republic of Germany and the
federal states and is awarded the elite
status.

Reason of the judgment of the experts:
The concept for the future, **KIT** – the merger
of Forschungszentrum and Universität
Karlsruhe in to an excellent research
campus ranking among the top institutions
worldwide.

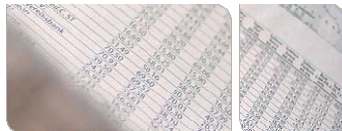
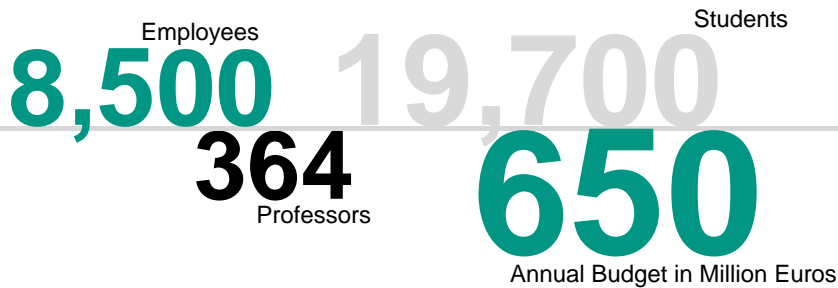


23

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Figures



24

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Common Objective

Positioning as an institution of excellent research and teaching in natural and engineering sciences on an international scale, with scientific excellence and worldwide top level in



■ Research




■ Teaching



■ Innovation

Prerequisite:
Excellent infrastructure and service units.

25
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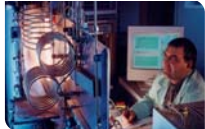
Centers and Focuses


KIT centers and KIT focuses are organizational units bundling research projects. They give KIT research its profile and allow for the strategic planning of research.

Characteristics:

- Closed, coherent research contents
- Quality of research: Depth rather than width
- Regular internal review
- Promotion of young scientists







26
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Centers and Focuses

KIT Centers:

- Energy
- Nano & Micro Science and Technology
- Elementary Particle and Astroparticle Physics
- Climate and Environment

KIT Focuses:


- COMMputation
- Mobility Systems
- Optics and Photonics
- Humans and Technology

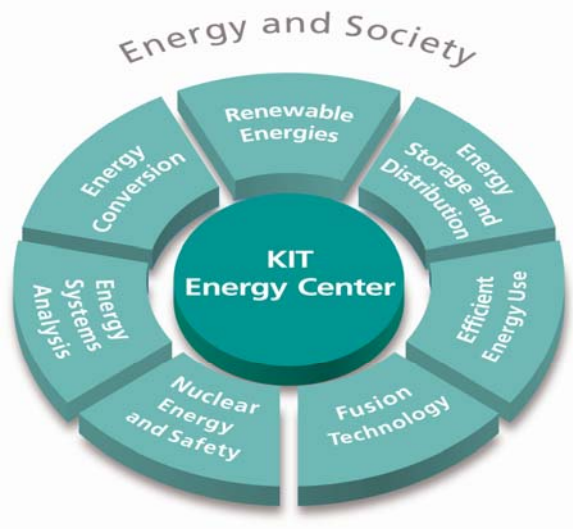



27
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Example: KIT Energy Center


Research Topics






28
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Thank you for your attention!

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