

# change

## Energy Consumption in Organizations

# An intervention to Change Routines

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# Energy consumption in organizations – An intervention to change routines

- **Sustainable Energy Consumption in Public Buildings – High Potential in User Behavior**
- **Aim of the Research Project as a Whole**
- **First Project Phase – Analysing Potentials and Testing Intervention Packages**
- **Some Preliminary Results**
- **Perspectives**

## Energy Consumption

### A relevant domain of sustainable consumption

23% of CO<sub>2</sub>-emissions in Germany result from energy consumption in private households (Heating, Electrical Energy)

15% from energy consumption in the services sector and public administration

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38 % of all CO<sub>2</sub>-emissions in Germany  
(Statistisches Bundesamt, 2007)

# Energy Consumption

## A relevant domain of sustainable consumption

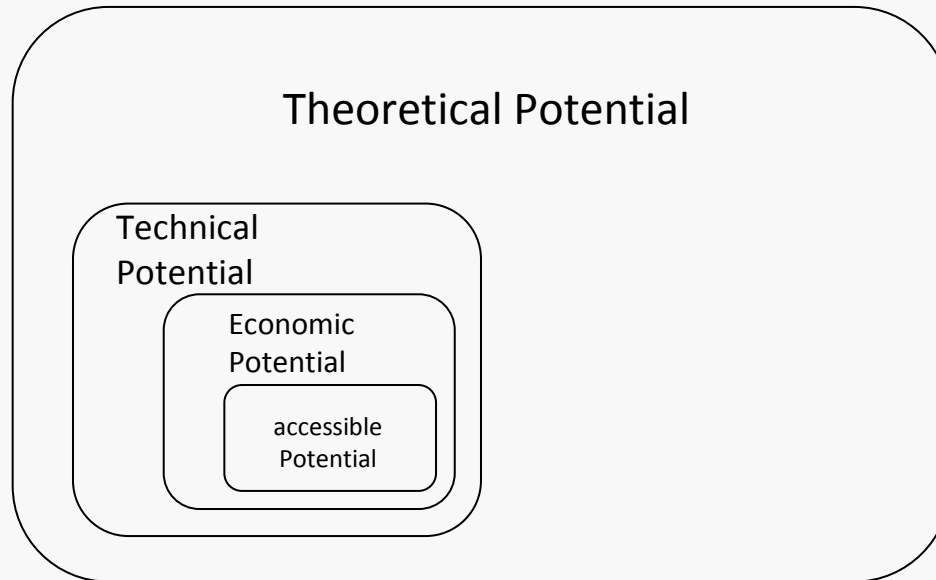
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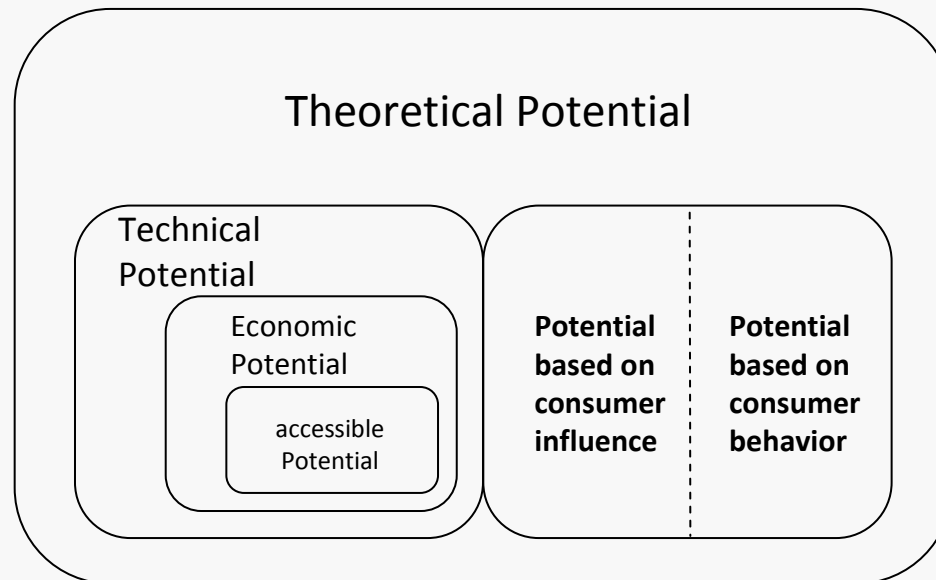
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# Energy Saving Potential in Public Buildings



# Energy Saving Potential in Public Buildings



estimated 5 - 20 % of the whole consumption

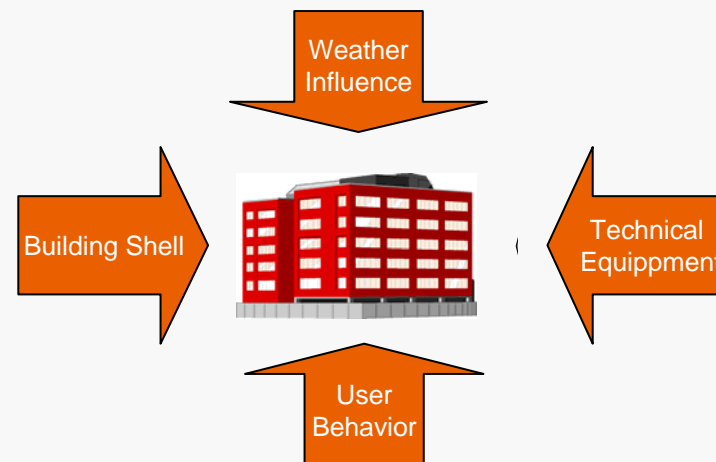
(HessenEnergie, 2007; Kattenstein et al., 2005)

# User Behavior as a Resource for Saving Energy

## Why is it often not made use of?

Assessment of saving potential is difficult because of:

- Problems to estimate the potential for the specific building



# User Behavior as a Resource for Saving Energy

## Why is it often not made use of?

Assessment of saving potential is difficult because of:

- Problems to estimate the potential for the specific building
- Lack of knowledge about effectiveness of the various techniques to tap the potential (e.g. Abrahamse et al., 2005).



## Review by Abrahamse et al. (2005)

38 interventions studies in energy user behavior (1977 – 2003)

- Information only strategies are not recommendable
- Information strategies effective in combination with feedback, rewards, and commitment

## Interventions for Routine Behavior

Behavior that is performed regularly in a stable context becomes automatic, i.e. it is not chosen/initiated deliberately (Wood et al., 2002; Aarts et al., 1998; Aarts & Dijksterhuis, 2000).

Techniques that are assumed to have effect on habitualized behavior:

- Temporary change of the situation, e.g. prompts, immediate feedback (break up associations of situation and behavior)
- commitment (makes motives/aims more salient)

## Techniques to change user behavior as reported by German universities (N = 36)

Implemented Measures		Number of Universities	
		N	%
Information Only	e.g. Brochure, Flyer, Circular Letter, Departmental Note	26	81
Techniques that exceed simple information distribution	Incentives/Rewards on organization level	6	17
	Habit Focused (Feedback, Prompts)	1	3

# Aim of the research project “change”

## Step 1

- assess the potential in user behavior for typical buildings
- develop an appropriate bunch of instruments to effectively induce energy efficient user behavior in public buildings -based on intervention knowledge in the domain of energy use behavior and on knowledge about habitualization
- test the instruments and assess their potential

## Step 2

- develop a counselling tool for universities to help decision makers to tap the potential in user behavior
- Transfer the tool to other public buildings

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# Selection Criteria for Test Buildings

15 University buildings (two campus universities, two old universities with diverse buildings)

- office buildings (no laboratories)
- heat and electricity consumption for the specific buildings (monthly data) available
- airing behaviour observable from outside of the building (objective behavior measure)
- staff business address list available

university	building	experimental condition	<i>n</i>
Dortmund	GBI	h	128
	GB II	h	118
	GB III	s	182
Münster	Am Stadtgraben 13	h	72
	Röntgenstr. 17	h	19
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	<b>control</b>	<b>1128</b>	

**legend**

h	habit-focused intervention
s	standard intervention (non-habit-focused)
control	no intervention

# Energy Saving Potential

## User Behavior

## Potential

### ELECTRICITY

18 %

Energy efficient adjustment of all devices (e.g. powermanagement);  
switching off all devices with switchable multiple socket power strips

14 %

Switching off the lights when leaving the office

4 %

### HEAT ENERGY

9 % \*1

Energy efficient ventilation instead of permanently „tilting“ windows

7 %

Lowering the room temperature by one degree

6 %

\*1 potential considers the interaction between tips

# Intervention Packages

## Standard Package

Posters

Flyer

Website

E-mails

Staff intervention package

- Letter of the rectorate
- Information brochure



# Posters/Flyers

**Drück mich zum  
Abschied!**  
Energiebewusst Handeln



Trennen Sie Ihre elektrischen Geräte – PC, Drucker, Scanner usw. – zum Feierabend und bei längerer Abwesenheit immer mit einer abschaltbaren Steckerleiste vom Stromnetz! Ganz einfach zu beziehen über Name Beschaffungseinrichtung der TU Dortmund.

Durch richtigen Umgang mit elektrischen Geräten kann der Stromverbrauch der TU Dortmund um bis zu 18% gesenkt werden. Ersparen Sie unserer Umwelt 2.600t des Klimakillers CO<sub>2</sub> – das entspricht 15 Millionen gefahrenen Pkw-Kilometern! \* 616 kg CO<sub>2</sub>/MWh (Strommix BRD; VDI (2007))

[www.change-energie.de](http://www.change-energie.de)

← Mehr Infos zum Energiesparen

**Einfach mal runterdrehen!**  
Energiebewusst Handeln



Jedes Grad weniger spart ganze 6% Heizenergie ein. Überprüfen Sie, ob Ihre Heizung zu hoch eingestellt ist - ideal sind 20 bis 21°C- und drehen Sie den Regler schrittweise herunter. Eine optimale Wärmeverteilung erreichen Sie, indem Sie Ihr Mobiliar 30 cm von den Heizkörpern abrücken.

Durch richtiges Heizen und Lüften kann der Energieverbrauch der TU Dortmund um bis zu 9% gesenkt werden. Ersparen Sie unserer Umwelt 900 t des Klimakillers CO<sub>2</sub> – das entspricht 5 Millionen gefahrenen Pkw-Kilometern. \* 230 kg CO<sub>2</sub>/MWh (Erdgas, 65% Wirkungsgrad; UBA (2005))

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**Stoßlüften, bitte!**  
Energiebewusst Handeln



Lüften Sie, indem Sie Ihr Fenster für ca. 5 Minuten weit öffnen. Drehen Sie dabei möglichst die Heizung ab. So geht wenig Wärmeenergie verloren und ein optimaler Luftaustausch ist garantiert.

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Design: S. Brinschwitz

# Posters/Flyers

**Drück mich zum  
Abschied!**  
Energiebewusst Handeln

*Press me / Hug me  
before you leave!*



**change**  
Uni Dortmund  
tu technische universität  
dortmund

Trennen Sie Ihre elektrischen Geräte – PC, Drucker, Scanner usw. – zum Feierabend und bei längerer Abwesenheit immer mit einer abschaltbaren Steckerleiste vom Stromnetz! Ganz einfach zu beziehen über Name Beschaffungseinrichtung der TU Dortmund.

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**Einfach mal runterdrehen!**  
Energiebewusst Handeln

*Simply Turn Down!*



**change**  
Uni Dortmund  
tu technische universität  
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Jedes Grad weniger spart ganze 6% Heizenergie ein. Überprüfen Sie, ob Ihre Heizung zu hoch eingestellt ist - ideal sind 20 bis 21°C- und drehen Sie den Regler schrittweise herunter. Eine optimale Wärmeverteilung erreichen Sie, indem Sie Ihr Mobiliar 30 cm von den Heizkörpern abrücken.

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**Stoßlüften, bitte!**  
Energiebewusst Handeln

*Power Airing,  
Please!*



**change**  
Uni Dortmund  
tu technische universität  
dortmund

Lüften Sie, indem Sie Ihr Fenster für ca. 5 Minuten weit öffnen. Drehen Sie dabei möglichst die Heizung ab. So geht wenig Wärmeenergie verloren und ein optimaler Luftaustausch ist garantiert.

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Design: S. Brinschwitz

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## Habit Focused

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- Letter of the rectorate
- Information brochure
- Prompts
- Commitment/Lottery
- Thermometer
- Coupon for multiple socket power strip

Kick-off day

# Mailed Staff Intervention Packages



Design: S. Brinschwitz

## Standard Intervention

- Letter of the rectorate
- Information brochure

## Habit-focused Intervention

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# and Data Recording

## Pre- and Post Staff Survey (n = 1128 )

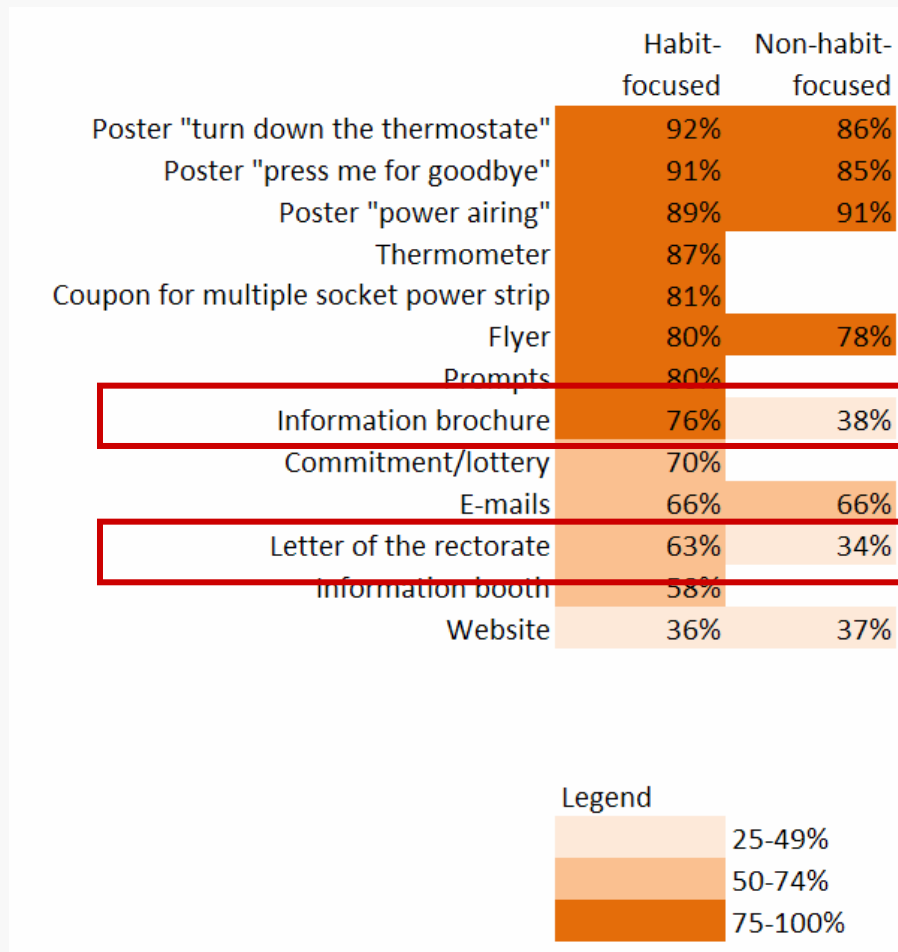
- Self Reported Behavior
- Reaction to the intervention

## Observation of Airing Behavior

## Consumption Data (Heating Energy; Electrical Energy)



## Post Staff Survey; $n=356$ [25% return rate])

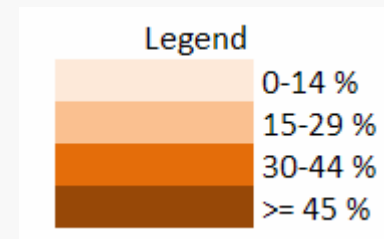


Which elements of the campaign „change“ **do you remember** and how do you evaluate them?

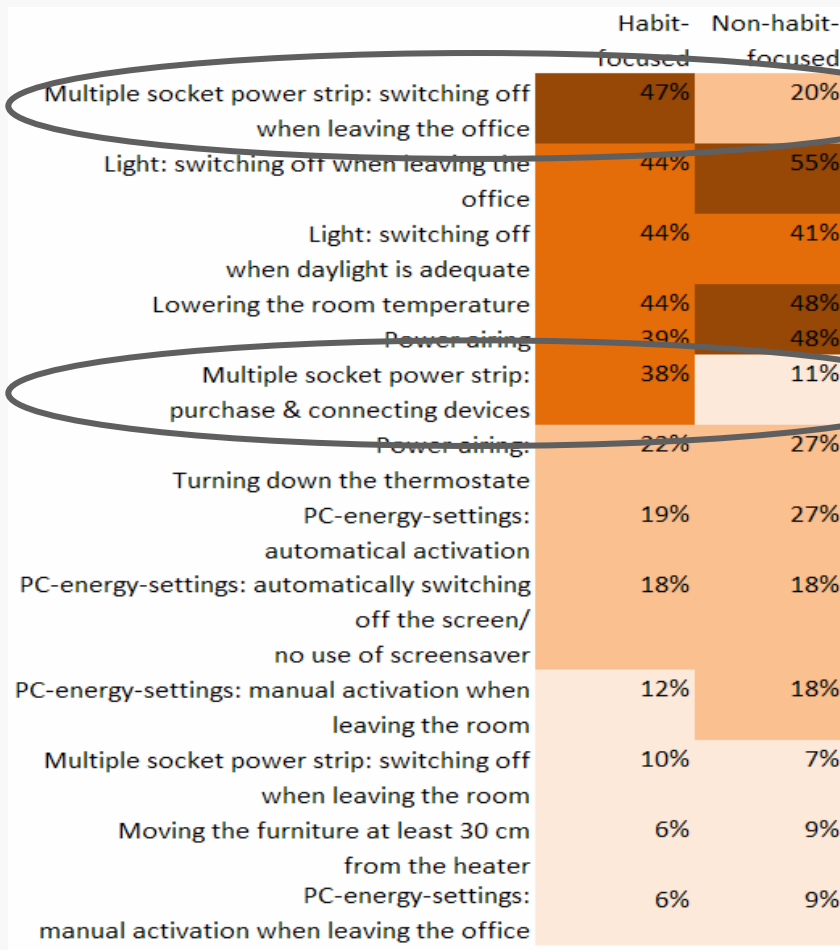
## Post Staff Survey; $n=356$ [25% return rate])

	Habit-focused	Non-habit-focused
Multiple socket power strip: switching off when leaving the office	47%	20%
Light: switching off when leaving the office	44%	55%
Light: switching off when daylight is adequate	44%	41%
Lowering the room temperature	44%	48%
Power airing	39%	48%
Multiple socket power strip: purchase & connecting devices	38%	11%
Power airing:	22%	27%
Turning down the thermostate		
PC-energy-settings: automatical activation	19%	27%
PC-energy-settings: automatically switching off the screen/ no use of screensaver	18%	18%
PC-energy-settings: manual activation when leaving the room	12%	18%
Multiple socket power strip: switching off when leaving the room	10%	7%
Moving the furniture at least 30 cm from the heater	6%	9%
PC-energy-settings: manual activation when leaving the office	6%	9%

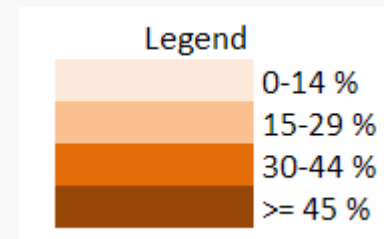
Which of the following energy-saving tips did you realize **either for the first time or more than usually** as a consequence of the campaign „change“?



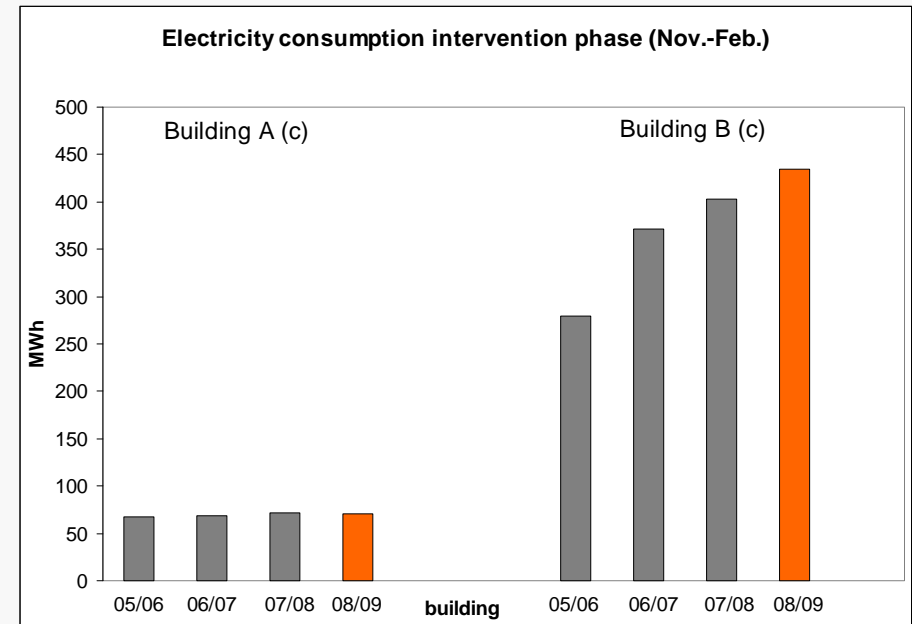
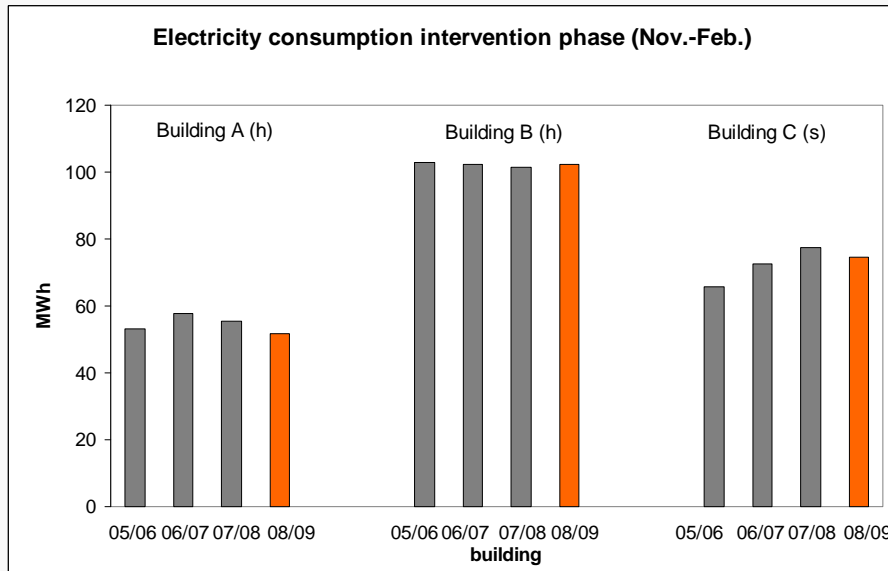
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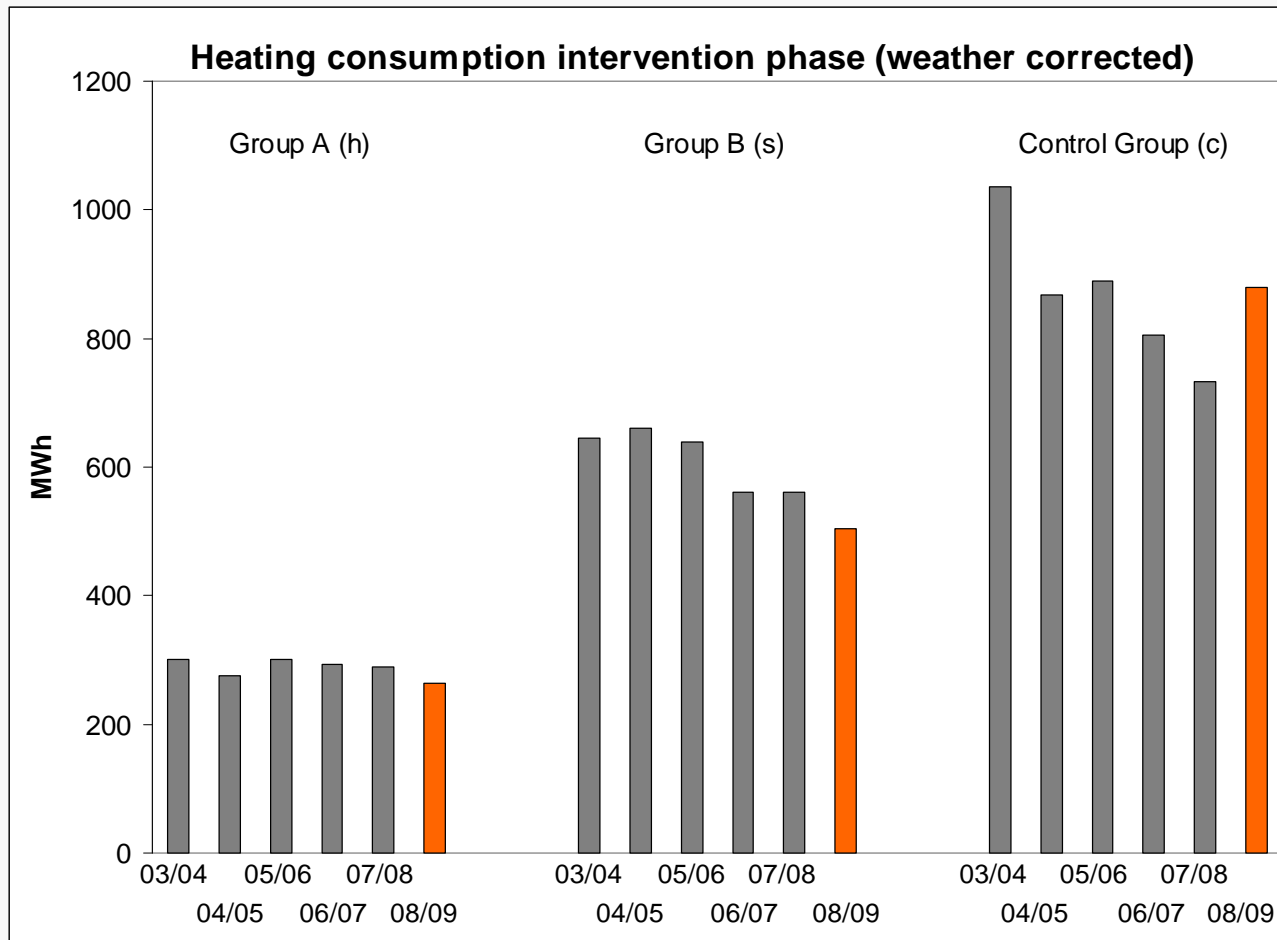
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# Consumption Data – Electricity (Uni Dortmund, Uni Siegen)



## Consumption Data – Heating Energy Nov 08 – Feb 09



## Preliminary Conclusions

Consumption data (on an aggregated level) indicate that the interventions were effective (electricity: ca. - 2% vs. +5%; heating: ca. - 6% vs. - + 2%)

Effects differ with respect to aggregation procedures and reference periods

The habit focused intervention package was significantly better remembered and led to a focus on electricity consumption (self reported)

## Perspectives

- Empirical findings support that there is a high energy saving potential based on consumer behavior in public buildings (here: universities)
- This potential can be tapped effectively by using psychological intervention techniques
- **A valid and reliable monthly measuring of energy consumption (in high resolution) is a crucial precondition** for an adequate appreciation of measures to improve user behavior (for evaluation, for feedback, for incentives, cost-output-accounting)

# Literatur

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Kattenstein, T., Junge, A. & Wagner, H.-J. (2012). *Hilfungspraxisratte zur wirtschaftlichen Optimierung des Energiebezugs und der Energieversorgung der Ruhr-Universität Bochum: Abschlussbericht zum Vorhaben: IV A4-20600298 Optimierung der bestehenden Energieversorgung der Ruhr-Universität Bochum*. Bochum: Ruhr-Universität Bochum, Lehrstuhl für Energiesysteme und Energiewirtschaft.

**Thank you for your attention!**

# Links

Project homepage „change“: <http://www.change-energie.de/projekt>

Homepage Environmental Psychology and Cognition: <http://eco.psy.ruhr-uni-bochum.de>

Homepage LEE: <http://www.lee.rub.de/>

HIS GmbH: <http://www.his.de/>