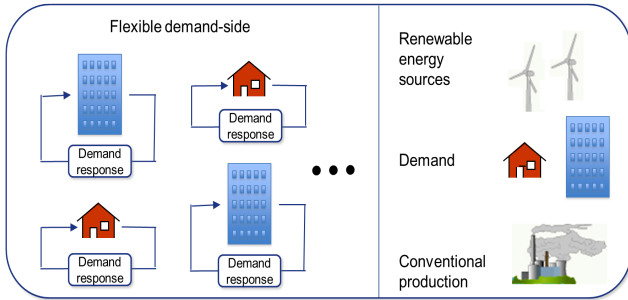


## HeatReserves: Demand Response for Ancillary Services

By  
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**Project Duration**  
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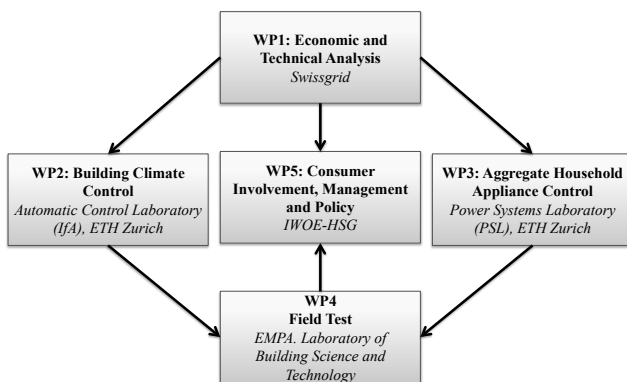
### RESEARCH OBJECTIVE

**HeatReserves is a joint four-year research project funded by nano-tera.ch in which partners from the ETH Zürich, Swissgrid, EMPA and the University of St.Gallen investigate solutions for electrical energy storage**

### BACKGROUND

Major promises of smart grids are to boost energy efficiency and to match supply and demand. Important in this regard is electricity storage. However we need new business models, which feature solutions that are feasible from a technology and economic perspective and which provide value to customers. The project focuses on electricity storage using thermal loads and appropriate demand response schemes.

### PROJECT STRUCTURE



#### The team at the University of St.Gallen is leading WP5: Consumer involvement, management and policy

In WP5 we will experimentally test the mechanisms that help consumers to adapt their daily routines in energy usage such that the demand response scheme developed in Work Packages 2 and 3 can be implemented. For that we broadly review and test different psychological theories which propose a wide range of insights in how to change customer behaviour and consumer decision making regarding participation in demand response programs. We will investigate which psychological interventions - e.g. the influence of induced hypocrisy under different construal mindsets - are most effective for engaging consumers in demand response programs. Based on our findings we develop implications for demand response contract design, incentive schemes, business model design and energy policy.

### RESEARCH APPROACH (WP5)

Task 5.1: Behavioural experiments	Literature Review and Selection of appropriate Interventions	
	Experiment 1 Incentive (punishment/reward)	Experiment 2 Psychological Intervention (hypocrisy)
	Dependent variables: Willingness to take part in DR/ Willingness to shift load	
Evaluation of results of Task 5.1		
Task 5.2: Design phase	Conceptual design of feedback system based on results from WP1	
	Implementation workshop I Feasibility Assessment through Expert and Lead Users	
	Physical and technical design	
Task 5.3: Field experiments	Installation at end-customer site	
	Implementation and test of feedback-system developed in Task 5.2 in field experiment with approximately 200 households	
	Implementation workshop II Evaluation and Interpretation of Results of Task 5.3	

### FIRST RESULTS

Due to the common assumption that rewards are the appropriate intervention to increase customer acceptance of DR (Hancher, 2013; DOE, 2006) which is in line with established views in environmental behaviour (Osbaldiston & Schott, 2012; Kazdin, 2009; Steg & Vlek, 2009; Iyer & Kashyap, 2007; Abrahamse et al. 2005; Geller, 1995), electric utilities are inclined to design DR based on rewards. However, in an experimental study with 151 undergraduate students in their role of energy consumers at a business school in Switzerland, we find that DR schemes based on punishments are more effective in increasing customer participation in the program compared to DR schemes based on rewards. These findings can be explained with prospect theory and loss aversion (Kahneman & Tversky, 1984). We also find that there is no significant effect of punishments and rewards on customer loyalty towards the firm and attitude towards joining the DR. Thus, punishments are more effective in increasing customer participation without jeopardizing the loyalty of a company's customer base and the consumer's attitude towards joining DR. Additionally, they appear more efficient from an economic point of view as they result in lower costs (Balliet et al., 2011; Gächter, 2012): whereas the variable costs for reward-based DR increase with each participating customer, there are no variable costs for punishment-based DR. Based on our findings we encourage firms, policy makers and research not to be afraid of environmental fines and optimize the design of their customer intervention measures.



Figure 1: Means of Intention to join for sub groups of manipulation and a control group without manipulation

DV: INTENTION

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	179,229 <sup>a</sup>	5	35,846	50,666	,000
Intercept	,019	1	,019	,027	,870
ATTITUDE	160,726	1	160,726	227,176	,000
Reward_punishment	4,737	1	4,737	6,695	,011
reasons	5,244	1	5,244	7,411	,007
Reward_punishment * reasons	1,193	1	1,193	1,686	,196
Error	100,464	142	,707		
Total	4618,444	148			
Corrected Total	279,694	147			

a. R Squared = ,641 (Adjusted R Squared = ,628)

