

Swiss Competence Centers for Energy Research Competence Center for Research in Energy, Society and Transition



In cooperation with the CTI



Swiss Confederation

Commission for Technology and Innovation CTI

R&D policies and programmes with (and for) citizens – Approaches to understand and change individual energy consumption behavior in Switzerland

> EGRD Event "Towards a Consumer-Driven Energy System" (TU Denmark, Lyngby, 12-13 October 2017)

> > Dr. Annika Sohre (University Basel)

Dr. Iljana Schubert (University Basel), Paul Burger (University Basel)



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#### Swiss R&D Programmes – Setting National Priorities in Energy Research

Swiss federal energy research master plan ("Energy research concept")	<ul> <li>Top-down master plan for public research</li> <li>Stakeholder Consultation Process</li> <li>Carried out every 4 years, led by CORE</li> </ul>	
CORE (Federal Energy Research Commission)	<ul> <li>Consultative body for the Federal Council, supported by the SFOE (Swiss Federal Office of Energy)</li> <li>15 persons from industry, SME, associations, politics and universities</li> </ul>	
SwissEnergy national programme	<ul> <li>Since 1997, 50 b CHF/a</li> <li>Promotes energy efficiency and renewable energies</li> </ul>	
Action Plan for Coordinated Energy Research	Mandate for CTI (Commission for Technology and Innovation) to create and operate research networks (SCCERS)	

## SCCER – an innovative and interdisciplinary research concept

- Implementation of eight SCCERs (Swiss Competence Centers for Energy Research) by the CTI
- Funding 2013-2016: 71.5 mio. CHF; 2nd phase 2017-2020: 120 mio. CHF
- Background: Realisation of the Energy Strategy 2050 (withdrawal from nuclear energy; promotion of renewable energies and energy efficiency)



## 1. CREST – WP 2 The multi-disciplinary energy consumption Framework

**SCCER CREST (**Swiss Competence Center for Energy Research - Competence Center for Research in Energy, Society and Transition): The center brings together research groups from nine major Swiss research institutions



WP 2: Addressing the behavior of individuals to provide a better understanding of the decisions of energy consumers, of the determinants of energy consumption and of options for reducing energy demand

Who are we? Researchers from Psychology, Economics, Sociology, Business Science, Behavioral Sciences and Political Science





#### An Integrated Framework for Understanding Individual Energy Consumption Behavior and Its Change

(a) Individual Energy Consumption Behavior (ECB)	(b) Change of ECB		
(1) What is ECB?	(3) What is change of ECB?		
Explananda			
(2) Which factors determine ECB?	(4) Which factors explain changes of ECB?		
Explanantia			
(5) What are constituents to be taken into account to successfully govern change of ECB?			
Governance			







#### **The Meta-Model**

## SHEDS (Swiss Household Energy Demand Survey) - Background and Design

#### What?

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Swiss-wide survey on energy demand in households (2016-2019) Why?

- Provide a basis for understanding energy-related behavior and its change at household level
- Provide a reliable basis for new initiatives in policy, business and civil society to influence individual energy consumption behavior

#### How?

- Longitudinal: Rolling panel of about 5000 households  $\geq$
- Distinctive view on different energy domains and their relationships: electricity, heating, mobility
- Design flexibility and efficiency: Core and rotating modules
- Explore intervention strategies: Integration of choice experiments
- Integrated design: Consideration of multiple explanatory factors by different scientific disciplines (Psychological module, social context module, socio-economic module)



## SHEDS - Some Results: What matters? (Social-economic and psychological determinants)

Determinants	Electricity	Heating	Mobility (Fuel)	
Size of living (1-2 persons vs. >2 ps.)	+ 20%	+ <10%	+ <10%	
Ownership (Tenant vs. owner)		+ 19%	+ 9%	
Type of dwelling (House vs. flat dweller)	+ 35%		+ 15% (owners)	
Rural vs. urban	+ 10%		+ 28%	
Personal norm	can lower		can lower	
Egoistic values	raise		raise	
Hedonistic value	can lower			
Emotions	Positive: Promotes green investments KWH; Negative feelings like guilt can lower the electricity consumption			

→ Highest energy demand of high-income HH, residing in large single-family houses outside urban areas





### **SHEDS – Segmentation approaches (1)**

- Idea: more targeted, group specific intervention designs
   Different approaches: bottom-up, top-down segmentation
- Segmentation by e.g. cluster of energy consumption and facilities:
  - "Wise majority": 47% with moderate energy consumption
  - ② "The drivers": 37% with heavy private car usage
  - ③ "The heavy residential users": 10% with high private consumption in all 3 domains
  - ④ "The heavy users": 3% with high consumption, especially in heating and flight mobility



### **SHEDS - Segmentation approaches (2)**



Basel

CCFR CREST



## SHEDS – Choice Experiments, e.g. energy literacy (wave 1, 2016)

Assume that you need to replace your fridge. You expect that you live in your current residence for another 10 years. In a shop you find the following two fridges which are identical in terms of size and cooling service.

	Fridge - A	Fridge - B
Purchase Price:	3300 CHF	2800 CHF
Electricity Consumption:	100 kWh/year	200 kWh/year

Assuming that one kilowatt hour (kWh) of electricity will cost about 20 Rappen on average during the next 10 years and that the value of 1 CHF in 10 years is the same as the value of 1 CHF today:

Which of the two fridges minimizes your expenditure for cooling food and beverages during the lifetime of 10 years?

The fridge for 3300 CHF

The fridge for 2800 CHF

### Conclusions

- Benefits of integrated and interdisciplinary energy research networks
- Very diverse findings about what drives energy consumption behavior and its change
- Implications for intervention strategies: need of targeted interventions on target-groups, types of behavior and determining factors
- Cooperations welcome





### Thank you for your attention

## annika.sohre@unibas.ch University Basel, Sustainability Research Group



# Number of respondents and structure of waves 1 and 2





### **SHEDS - Structure**

#### Core modules:

- Dependent variables: Information about equipment and usage in three energy domains
- Determinants:
  - Psychological module (norms, attitudes, values, emotions, self- and outcome efficacy, etc.)
  - Social context module (routines, lifestyles, information uptake, trust, etc.)
  - Socio-economic module (household size and composition, working status, income, etc.)

#### Additional modules:

Choice experiments on intervention strategies:

- -Randomly for returning respondents (2017 one out of 5)
- -Focus on different energy domains in every wave



Choice experim.	Research topic	Method	Main design variables	# respond.
Home owners'	Effects of information and	Discrete choice	Technology; Investment	511
heating <u>system</u>	incentives, effective design	experiment with	costs; Energy labels;	
replacement	of labels and carbon taxes	several treatment	Annual heating costs; $CO_2$	
decision		groups	tax	
Tenants'	Impact of information and	Multiple price lists with	Monthly rents; Energy	406
willingness to pay	incentives on tenants'	several treatment	labels; Annual heating	
for new heating	contribution in energy	groups	costs; CO <sub>2</sub> tax	
systems	investments			
Households'	Social segmentation of	Vignette experiment	Communication	970
acceptance of	consumers with respect to	with conjoint analysis	organization (state, peer	
initiatives to	life style and attitudes;		etc.); Channel/Medium;	
reduce energy	Impact of socio-economic		Social value frame	
demand	determinants			
Consumer	Decision-making processes	Discrete choice	A. Reduction target;	574
preferences for	and purchase choices;	experiment composed	Bonus size; Bonus	
electricity utilities'	Impact of prior commitment,	of two distinct	type; Fine size;	
innovative tariffs	information and product	experiments (A/B),	Improved inform.	
and saving plans	designs	with several treatment	B. Electricity cons.	
		groups	reduction/increase;	
			Bonus/malus	
			magnitude; Pre-	
			selected default ch.	
Trade-offs	Impact of perceived effort	Incentivized	Priming with a writing	256
between energy-	on the willingness to	contingent behavior	task: actions to reduce	
saving and	contribute in climate	experiment with	energy consumption;	
climate mitigation	mitigation projects	several treatment	Willingness to donate for	19
		groups	climate protection	

VARIABLES	Electricity		Heating		Mobility	
	(1)	(2)	(3)	(4)	(5)	(6)
HH income (log)	0.0858**	0.0235	0.2593***	0.2190***	0.2280***	0.1974***
Age under 30	ref.	ref.	ref.	ref.	ref.	ref.
Age 30 to 54	0.1107***	0.1016**	0.2148**	0.2293**	-0.0441	-0.0745
Age 55 to 65	0.2017***	0.1982***	0.2964***	0.2956***	-0.1641**	-0.1699***
Age over 65	0.2226***	0.1565**	0.4398***	0.4235***	-0.1236	-0.0781
Sex of head (1 if female)	0.0008	0.0112	-0.0106	-0.0196	-0.0678**	-0.0676**
French speaking	-0.1222*	-0.1221*	0.1387	0.0457	0.0906	0.0798
Primary edu	ref.	ref.	ref.	ref.	ref.	ref.
Secondary edu.	0.2755	0.3276*	0.0408	0.0049	0.1762	0.1371
Tertiary edu.	0.2388	0.3229*	0.0554	0.0295	0.1101	0.0989
1 person HH	ref.	ref.	ref.	ref.	ref.	ref.
2 person HH	0.1882***	0.1339***	0.0800	0.0541	0.0789	0.0668
3+ person HH	0.4062***	0.2536***	0.1579***	0.1056	0.1793***	0.1440***
City	ref.	ref.	ref.	ref.	ref.	ref.
Agglomeration	0.0485	0.0036	-0.0056	-0.0012	0.1961***	0.1069***
Countryside	0.1083***	0.0843**	0.0096	0.0485	0.2770***	0.1557***
Owner	-0.0347	-0.0338	-0.0755**	-0.0595	-0.0853***	-0.0710**
House (0 if flat)	0.3556***	0.3260***	0.0791	0.2411***	0.0899**	0.0539
Size of dwelling in m <sup>2</sup> (log)	0.2046***	0.1048***	0.1976***	0.1404**	-0.0017	-0.0338
Age of house (log)	-0.0175	0.0320*	0.1223***	0.0561*	-0.0182	0.0087
Constant	3.7432***	4.4673***	1.5871**	1.4145*	2.7228***	2.2083***
Observations	2,628	2,322	1,750	1,618	2,612	2,612