

University of Stuttgart IRR Insitute of Energy Economics and Rational Energy Use



Audrey Dobbins audrey.dobbins@ier.uni-stuttgart.de Heßbrühlstr. 49a, D-70565 Stuttgart, GERMANY Audrey Dobbins The significance of energy poverty on the assessment of residential energy demand and emissions in Germany

Motivation and analysis

Consumers at the heart of the energy transition are key to unlocking the potential to achieve energy and climate change targets. Households are not a homogenous group and several key factors (such as income) influence how they are able to participate in the energy system.



Significant consumers of energy:

Households consumed ~28% of the final energy consumption in 2013. Together with personal *transport*, households are responsible for 47% of final energy consumption.

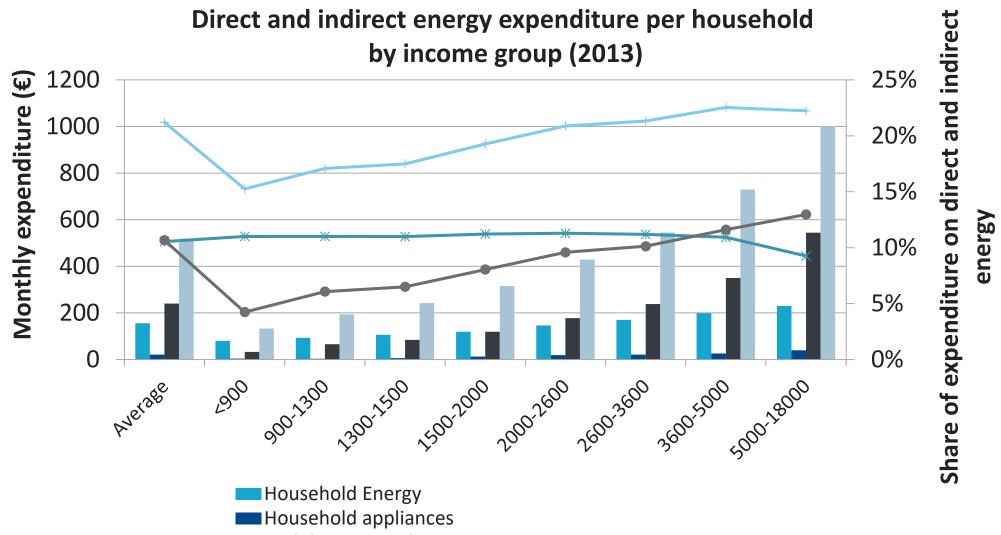
Households

The majority of the household energy budget is for transport (42%) followed by space heating (40%).

Energy poverty on the rise:

Estimates put **11-21%** of the population vulnerable to or in **energy poverty** due to high energy bills (increasing energy prices and low

Case for a disaggregated assessment



Energy Poverty	efficiency), low income (incomes increasing energy prices and low efficiency), low income (incomes increase slower than energy prices) and poor energy efficiency (in buildings and appliances).		 Mobility materials Total Share of expenditure on direct energy expenses Share of expenditure on indirect energy expenses 	
	 <u>Households key to successful energy transition and to</u> <u>contribute to 2020 targets with:</u> 14% heating with renewables 		Pote 3000 - 2500 -	ntial to afford high upfront investment costs by income and household composition (2013)
Energy Transition	 10% renewables in transport -10% electricity demand (compared to 2008) -20% heating demand -10% transport demand (compared to 2005) 	savings (€)	2000 - 1500 - 1000 -	
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Methodology

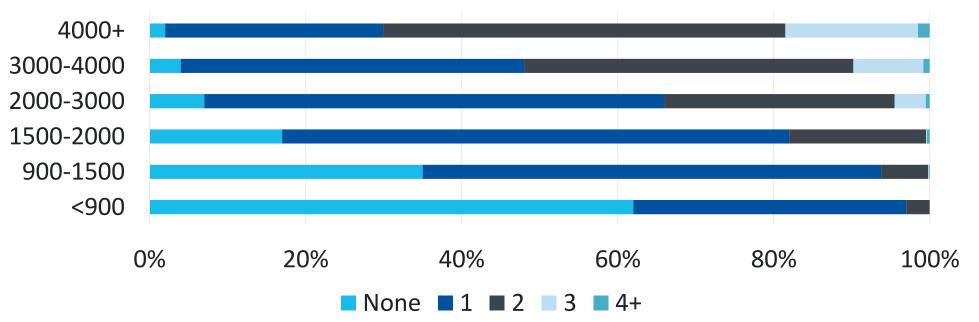
Adaptation of the TIMES-Germany model with disaggregated representation of households into heterogenous groups based on socio-economic characteristics. The model will account for budget constraints and investment decision making profiles in a two-step process (investment + operation) through a mix of capacity constraints and discount rates.

Reference Energy System for model

Energy supply		Energy demand		
Energy Carriers	Income specific technologies/ energy services/ measures	Building types/ tenureship	Population/ income/ location	
Electricity	• Lighting	 Single family house 	 Population 	
• Gas	Cooking	Multi-family house	disaggregated into	
Biomass	 Refrigeration 	• Pre-1990	income groups	
• Solar	Other appliances	• Post 1990	(heterogenous society	
• District heating	Warm water	• Existing	included in model)	
Petrol	 Space heating 	Renovated	• Urban/rural	
• Diesel	Cooling	• New	classification	
Biofuels	Mobility	 Owner-occupied 		
	 Policies and measures 	• tenant		

me group homeowners 45% 35% 25% σ Month 500 Ø of households 5% income -5% 900-1300 _900 -500 per -15% -1000 -1500 **Total share** -2000 Household income groups by monthly income (€) Average household Single Single parent Couple w/ children Couple w/o children Other • Total share of households Total share of homeowners

Share of household car ownership by income group



Next steps and expected outcomes

Scenario analysis

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Reference	ence arios	Status Quo	Aggregated household sector, baseline, business as usual, all expected policies implemented
	Reference scenarios	Reference	Disaggregated, household sector, baseline, business as usual, all expected policies implemented
		Investment costs	Constraints for financial ability of households to invest in technologies (budget constraints for each income group plus disposable income for energy)
	nvestment scenarios	Measures	 Including additional measures, such as: Energy Savings Check (Stromsparcheck) Building renovation

- Renewable and energy efficient heating and household appliances
- Subsidies

- The majority of households (have insufficient funds or do not have the decision-making power to invest in energy efficient and renewable upgrades and technologies (i.e., not homeowners)
- As income increases, so does the indirect energy expenditure (e.g., investment in appliances, home improvements)
- 39% of all households have higher than average disposable income (>239€ monthly) available for potential investments
- 24% of all households have higher than average disposable income available and are home owners
- Space heating and transportation (largest consumption) needs vary greatly depending on income and require a differentiated analysis
- Recognition of and accounting for energy poverty in a holistic energy system analysis towards an integrated policy response
- Improved representation of households providing income group specific insights into expected contribution towards targets
- Exploring the significance of household energy and emissions and energy poverty on achieving the objectives of the energy transition by accounting for budget constraints per income group
- Exploring the improvement of the energy welfare of low income households through policies and measures through differentiated policy response