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Energy saving measures and their distributional effects

A study of households in Germany

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Focus and main questions

- Energy savings potentials (behavioural change)
  - Changes in individual behaviour,
    - are considered rather „unbending“ in terms of personal choice/preferences
    - have large potentials for reducing absolute energy consumption.
  - A better understanding is needed of behaviour, its dynamics and environment
- Distributional analysis of these potentials in German households
- Main questions:
  - Which households (or groups) show the highest potentials for reducing energy consumption through individual changes?
  - How are energy and monetary savings distributed across household groups?
  - How might these groups be reached?

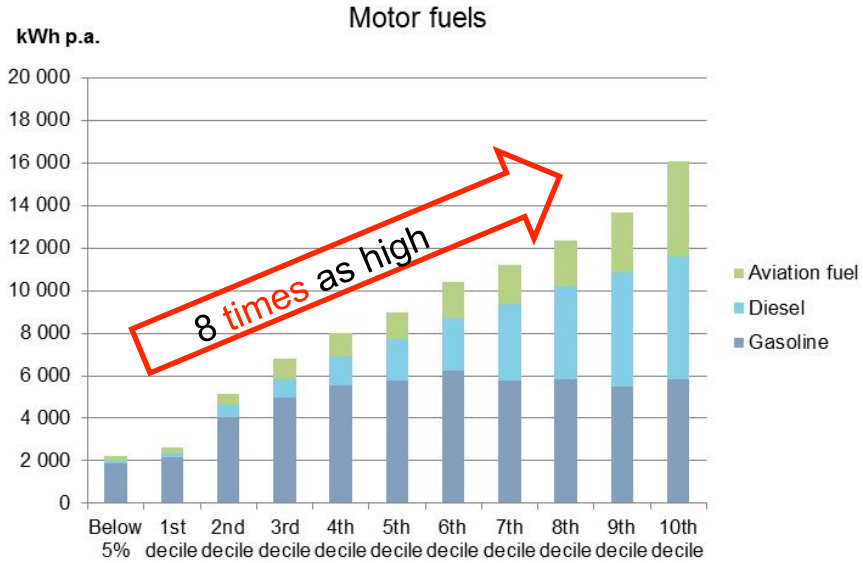
Research project for Fed. Environm. Ministry Germany

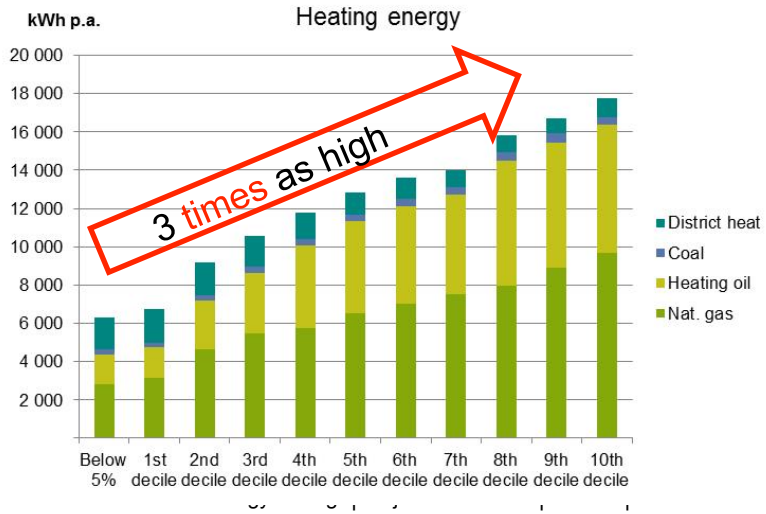
- „Possibility for reducing energy demand via behaviour-related measures in individual households“
- Structure of project
  1. Selection of promising energy saving measures
  2. Assessment of energy saving potentials
  3. Economic evaluation (efficiency and distribution)
  4. Evaluation of existing policy instruments.
  5. Proposal of new policy instruments.
- Goal of whole project: inform public policy and develop adequate levers to help achieve energy savings goals

Reduction potentials – investigated measures

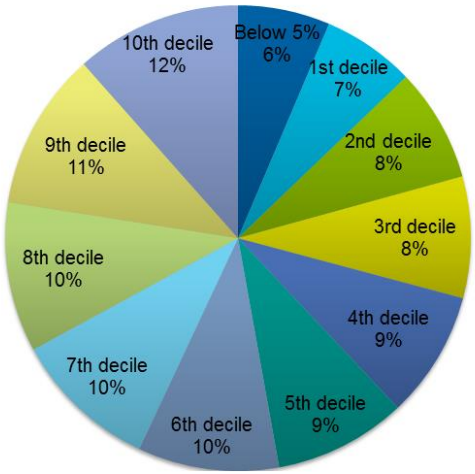
- Screening based on literature review and expert judgement
- Short-list of measures was investigated in more details wrt
  - savings potentials, induced behavioural change, economics, political feasibility, previous attention by energy policies and measures
- Only measures that are additional to those in other scenarios.
- Selection of 18 measures

Distribution of energy consumption in 2014





Share of electricity consumption by income group



More even distribution: less than two times as high

Distribution of energy consumption in 2014 in bullets

- By income group
  - absolute energy consumption increases with income
  - relative differences in consumption between rich and poor increases from electricity use (basic need) over heating fuels to motor fuels (most pronounced for luxury good aviation fuel)
- By household type
  - Larger households use more energy
  - Scale effects for households with more than two members
  - Noteworthy in light of current demographic development: Scale effect limited between one and two person households
  - Interesting: Male singles use considerably more motor fuels while female singles use more space heating energy!

Investigated measures

Measure/Activity	Description
1 – Reduction living space	to 40 m^2 per capita (by 2030) – projection at 45.1 m^2
2 – Reduction hot water use	average hot water use by 10% (from 45 l/d per capita to 41 l/d) and average hot water temperature by 2K
3 – Reduction room temperature	average reduction of room temperature by 1K (differentiating by energy-refurbished and non-refurbished buildings)
4 – Investment in automation	average energy savings potential through automation of about 4% for heating and hot water use in residential buildings
5 – Insulation of heat distribution	average savings potential of 3% of final energy use for heating in buildings in 2020 and 1.5% in 2030
6 – Modal shift from car to bike	shift of 40% for distances below 5km, 30% for 5-10km, 20% for 10-15km, 10% for 15-20km and 0% beyond, including electric bikes (about 50%) and carrier bikes.
7 – Tele-meetings	Avoidance of 30% of work related travel by 2030 (spread across all modes, equally short and long term distance)
8 – Purchase of smaller size cars	60% smaller size new car purchase in 2020
9 – Reduction private air travel	by 50% in 2030 (longer trips rather than more frequent ones)
10 – Reduction multiple endowment with equipment	one TV and one refrigerator/freezer per household, baseline of about 1.53 for TVs and 1.65 refrigerators/freezers in 2020/30
11 – Absolute consumption limit for TVs	no TV consumes more energy in absolute terms than a medium sized TV
12 – Campaign: change in use patterns	clothes dryers use only 8 months p.a., TV only 2 hours per day on average (compared to currently 4)

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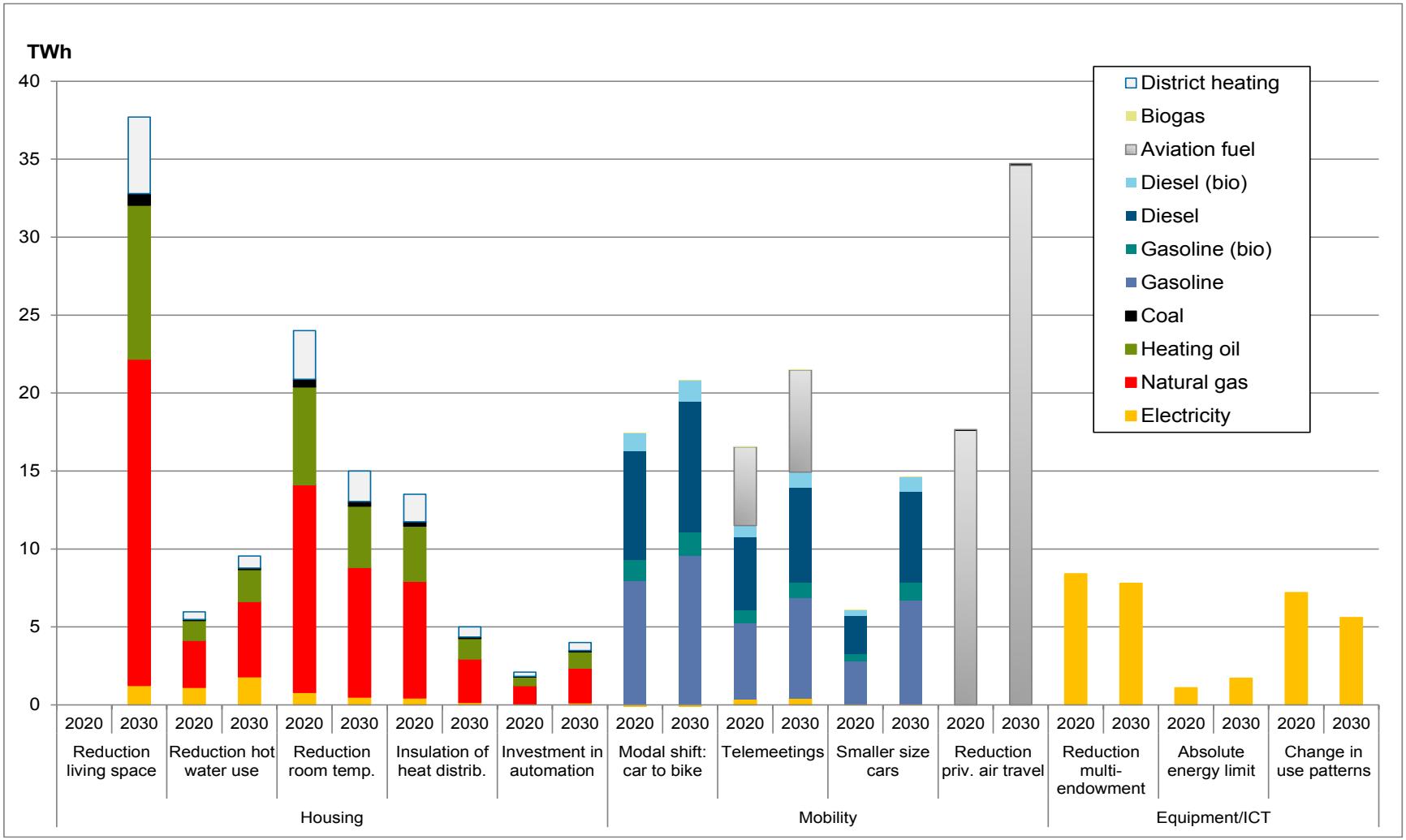
Reduction potentials German HH in 2020 and 2030



Distribution of reduction potentials

- Who is affected (target groups) and in how far?

Measure/Activity	Main target group
1 – Reduction living space	**Retirees and singles with more than 40 m^2 per capita**
2 – Reduction hot water use	All (per person)
3 – Reduction room temperature	**All (per household)**
4 – Investment in automation	House owners (one and two family homes)
5 – Insulation of heat distribution	House owners (one and two family homes)
6 – Modal shift from car to bike	All car owners
7 – Tele-meetings	Only employed people (usually associated with higher income)
8 – Purchase of smaller size cars	All (with at least 1 car and highest 50% consumption expenditure)
9 – Reduction private air travel	**All who travel by plane**
10 – Reduction multiple endowment with equipment	Mainly higher income households (with more than 1 TV and fridge)
11 – Absolute consumption limit for TVs	All with TVs
12 – Campaign change in use patterns	Only those with clothes dryers. All for TVs.

Tackling savings potentials

- How to address savings potentials?
- How to make use of financial incentives if they play a role? Do financial penalties work? And if so how?
- How to differentiate household groups so they can be most effectively and fairly tackled by policy measures?

- Next steps:
  - Take a deeper look into measures with highest potentials
  - Identify specific target groups
  - Design measures to provide incentives to these specific target groups

Distribution of reduction potentials and incentives

- Measures that affect households uniformly (e.g. reduction of hot water usage, reduction of room temperature, change of use patterns)
  - Physical savings are highest for high income households
  - Monetary savings (percent of net income) for low income households are more than three times those of high income households
  - Þ monetary savings (in absolute terms) might provide incentives for low income households
- Measures that affect higher income households more (larger size cars, travel frequency, tele-meetings)
  - Þ physcial and monetary savings for higher income households are relatively higher than for low income households (3 to 4 times). BUT: monetary savings all in all quite low (~0.1% of net household income)
  - Þ monetary savings are too small to be of any „value“ to higher income HH – no incentive

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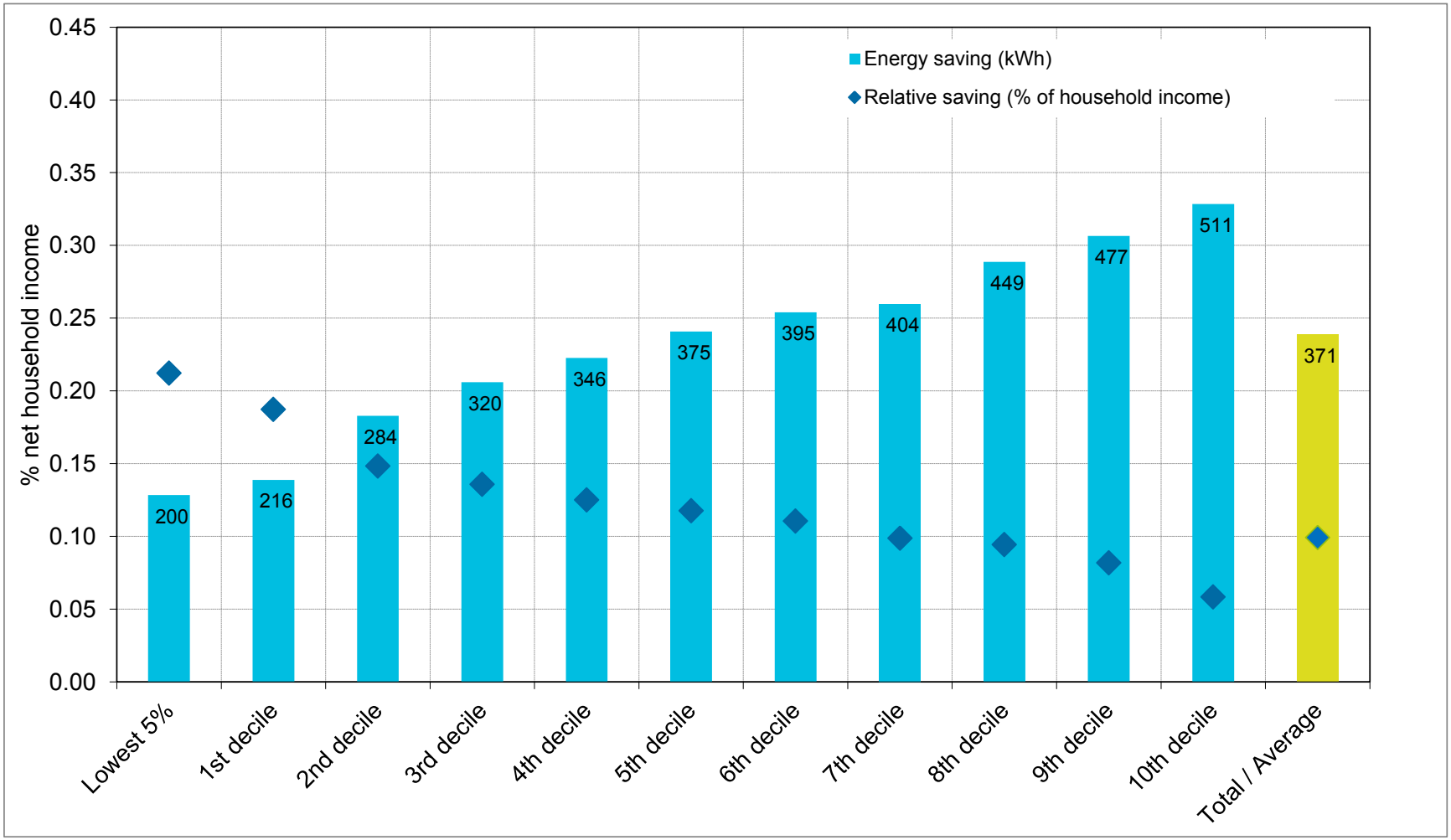
Reduction of room temperature by 1 K



Target group: low income households

- Monetary savings are most visible, play a major role in every day decision making
- Are more receptive to policies that provide information on monetary savings related to certain activities
- Policy example within the Germany National Climate Initiative: *Specific advice and consultancy service to low income households*
  - Home energy check, training programme for long-term unemployed to work as energy assistants in low-income households
  - Evaluation: very successful, provides simultaneously for new employment and energy savings. Results in changes in user-routines and low-budget investment. Reduction of electricity consumption by 16% plus learning effects.
  - Project is currently expanded to include heating and provide financial incentives for investment in appliances

Target group: higher income households

- Highest physical savings potentials, but monetary savings in relation to disposable income are very small.
- Financial measures (e.g. taxes) would increase savings, make them more visible (but be regressive in nature and cause inequity).
- Higher income households least likely appreciate financial savings.
- Policies need to take this into account. Information and disclosure projects more promising:
  - smart meters and bills, alert gadgets
  - technical support programs (for heat or hot water devices),
  - pilot programs for new and advanced technologies (to bring about a pioneer spirit),
  - campaigns to raise or reiterate awareness

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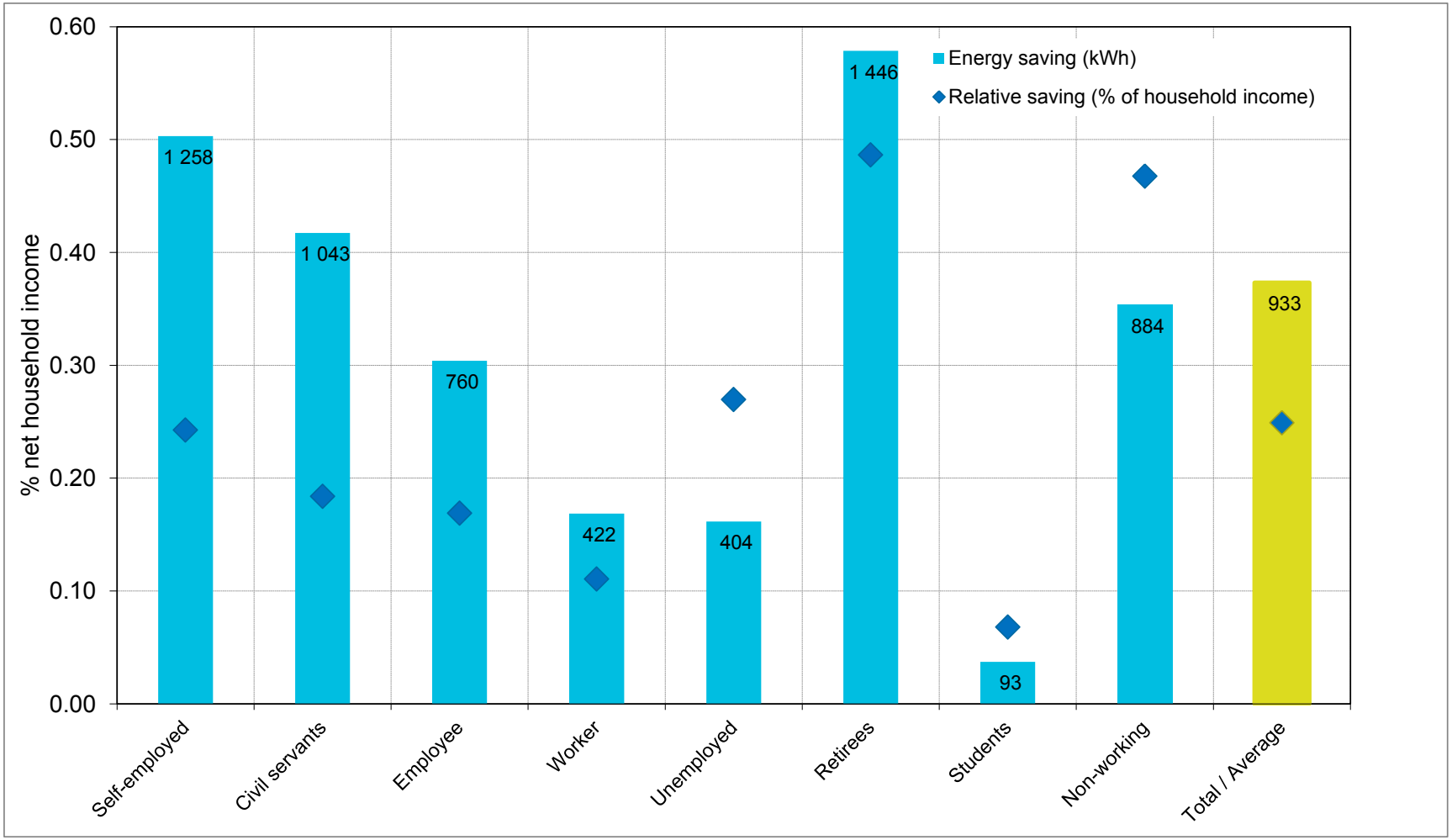
Reduction of living space to 40 m^2 per capita – by social status



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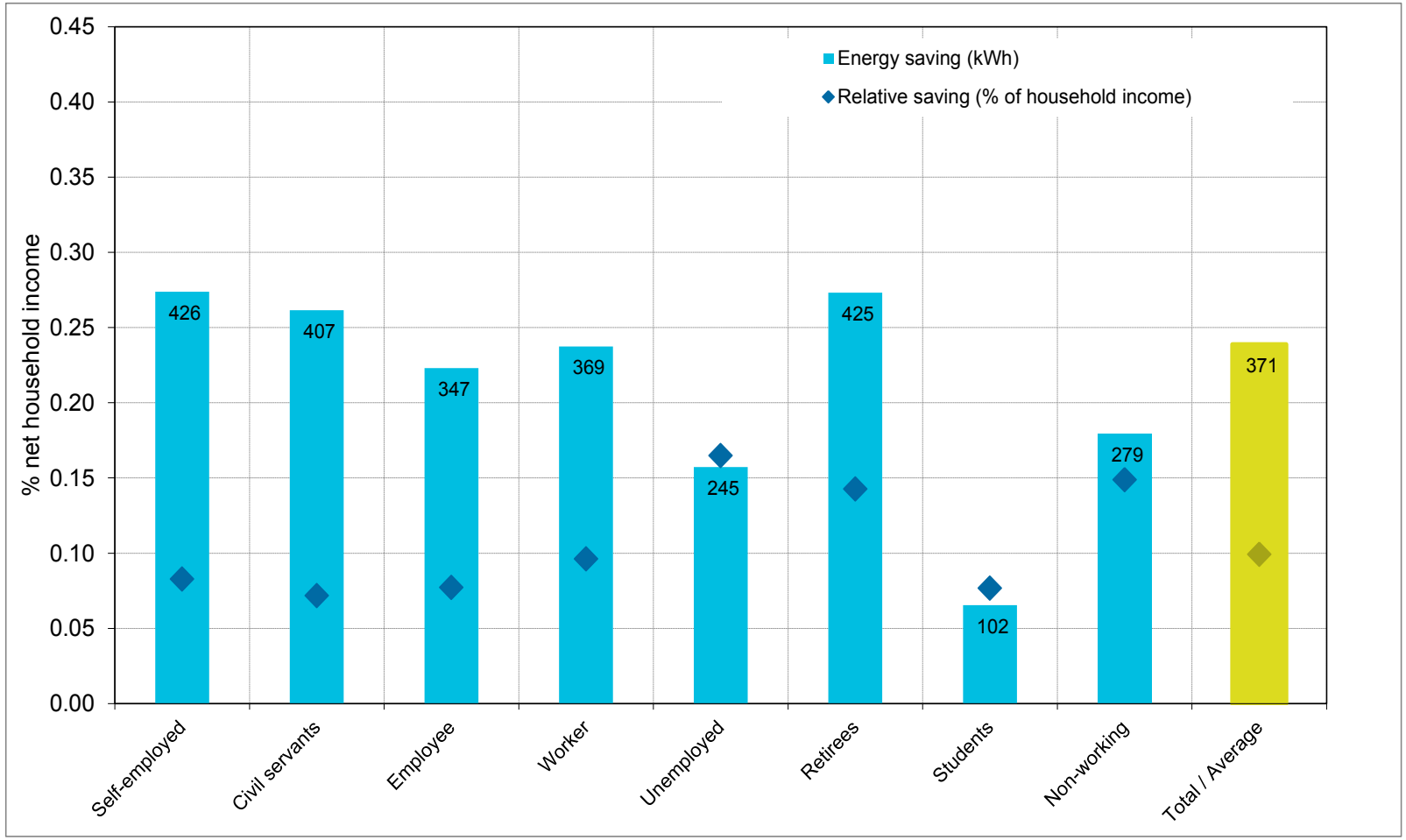
Reduction room temperature – by social status



Target group retirees

- Retirees have mixed income levels and distinct use patterns
- Highest potentials for reduction of living space and room temperature – they live in larger than average dwellings at higher than average room temperature
- Demographic development will reinforce this potential
- Policy example to overcome barriers: One-in-all-agency that serves as a single contact point for all matters related to relocating or remodelling of dwelling
  - financial and practical information,
  - broker between relevant agents (property owners, banks, public authorities etc.),
  - organizes the house or flat sale and the move into the new dwelling,
  - contact point for all questions and concerns

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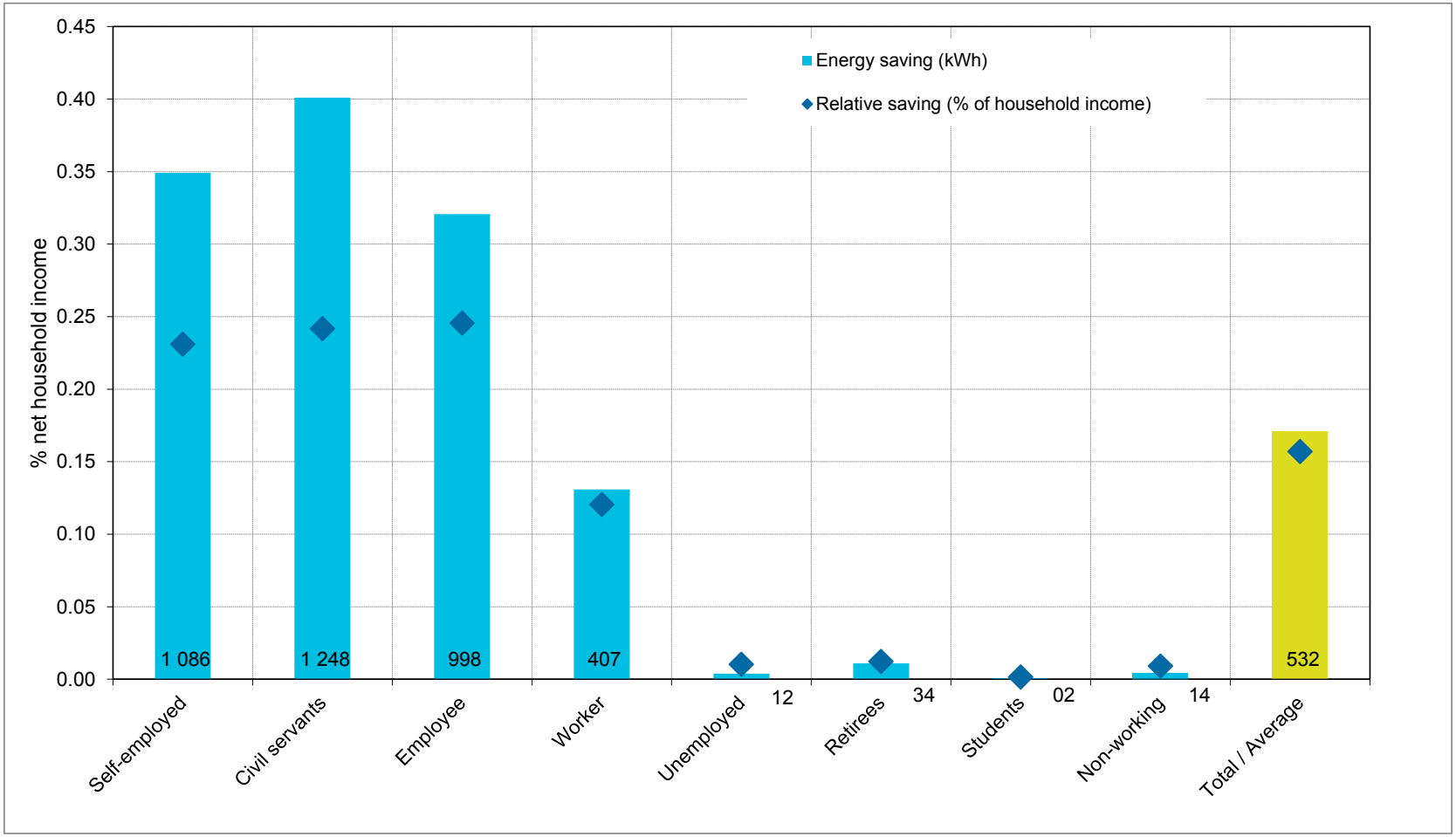
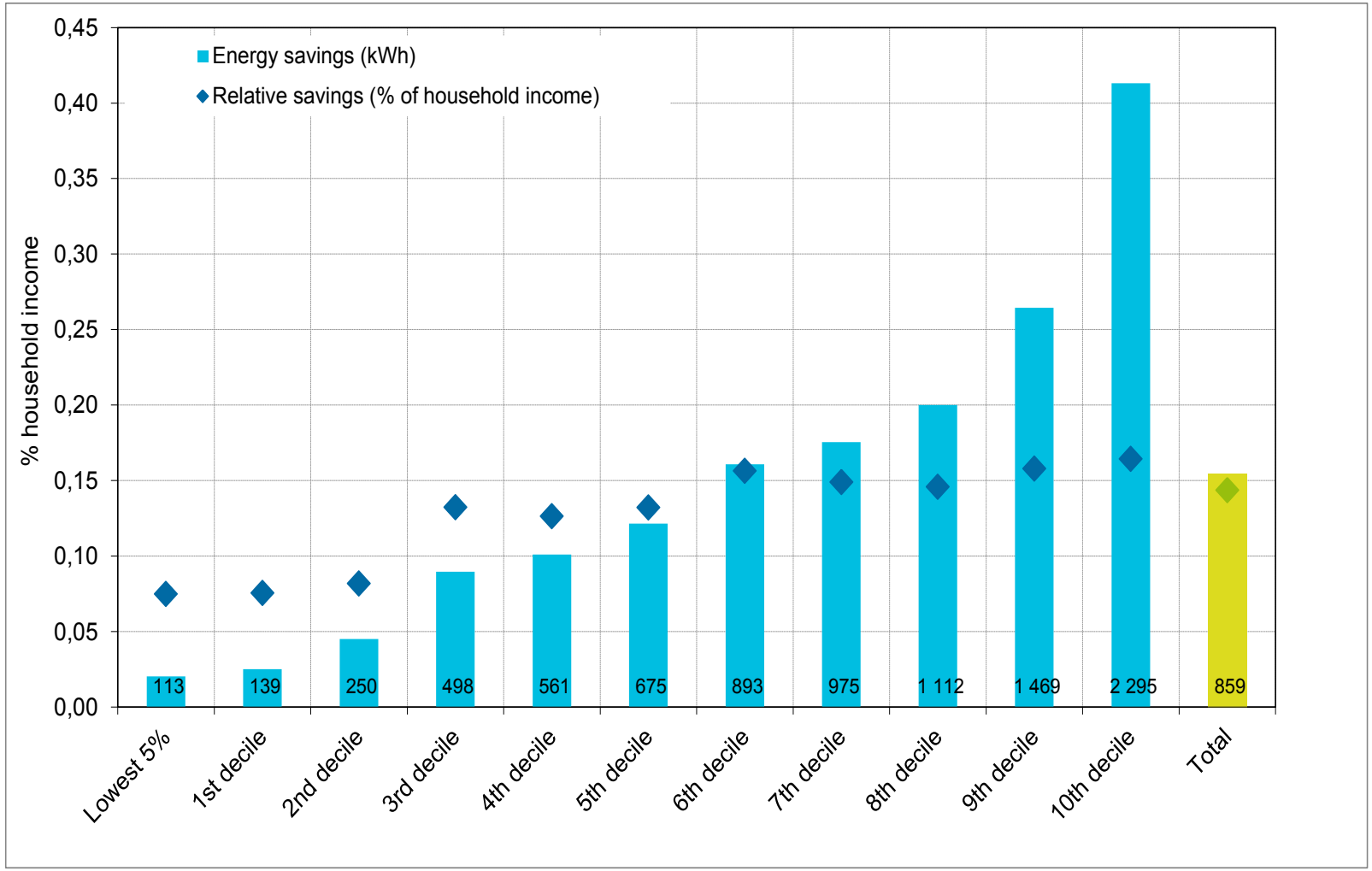
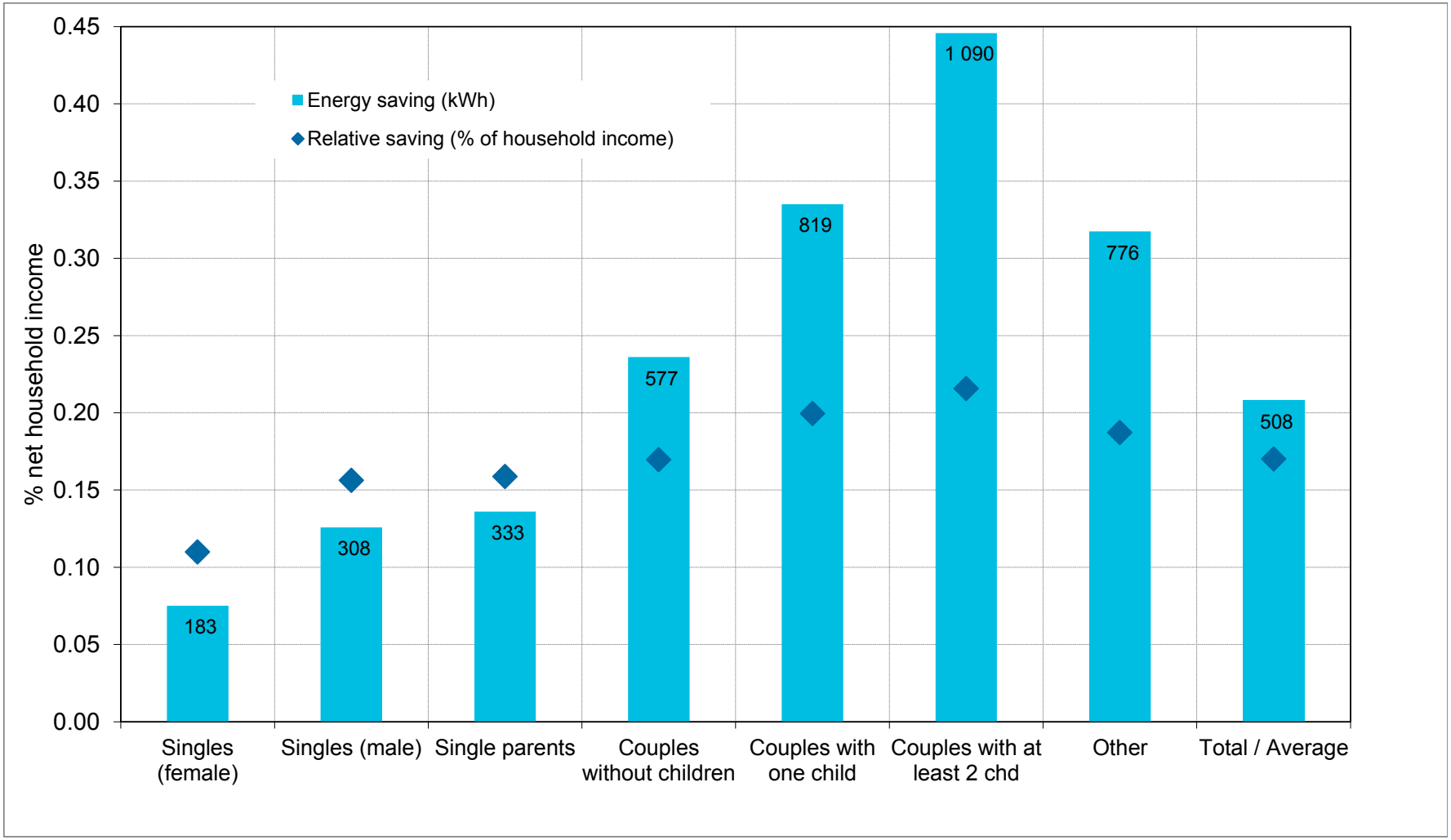
Mobility – Telemeetings (avoidance of 30% work related travel)



Mobility - Reduction of private air travel (by 50%)



Mobility – Modal shift car to bike



Mobility - target groups: high income households, families, employers

- Physical and relative financial savings increase with income
  - Distribution is skewed even within a single household group
- Financial savings could be increased and become more visible if energy use was made more expensive (but have to take equity concerns into account – regressive effect much lower than in case of electricity though)
- Potential instruments/policies:
  - Financial: revising tax schemes for motor vehicles and fuels (based, e.g., on CO2 efficiency), air traffic taxes related to GHG emissions, VAT on international flights, road and parking tolls, feebate systems, taxes on corporate cars (consider employers as a separate target group, also relevant for tele-meetings)
  - Non-financial measures: privileged parking zones for small cars, general speed limits in cities, bicycle pathways and infrastructure, compulsory bike parking, CO2 free city centers

Conclusions

- Highest absolute energy savings potentials are most difficult to reach, as they occur in households that are least like to appreciate financial savings.
- All in all monetary savings are rather small relative to disposable income.
- Policies and instruments need to address barriers or provide motivation
- Differentiating target groups and their distinct characteristics is indispensible

Þ Designing tailor-made, target group specific policies and realizing that financial incentives are limited helps triggering potentials specific to each group in a fair and promising way.

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Vielen Dank für Ihre Aufmerksamkeit!
Thank you for your attention!

Haben Sie noch Fragen?
Do you have any questions?