

**HOUSEHOLDS ENERGY CONSUMPTION AND
EVERYDAY PRACTICES: MATERIAL
STRUCTURES AND SOCIAL VARIATIONS**

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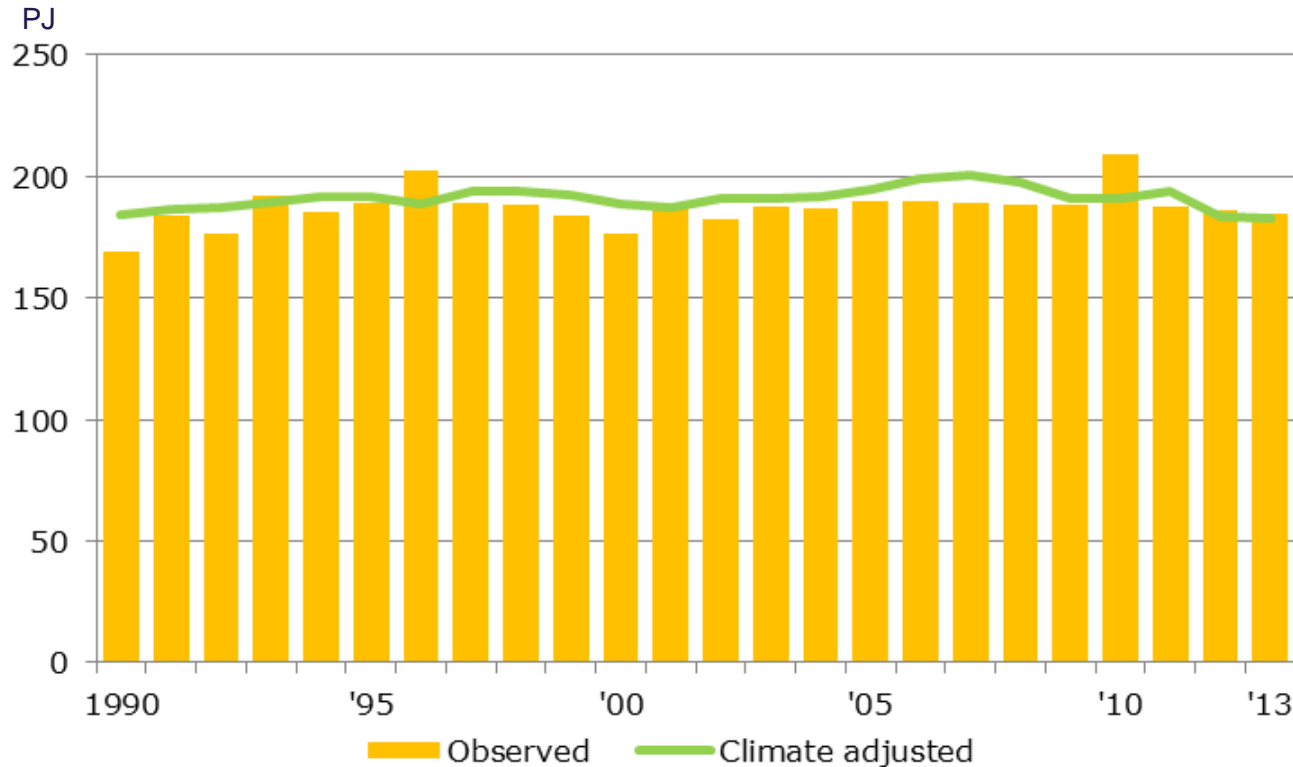
DANISH BUILDING RESEARCH INSTITUTE
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What is my agenda....

- Energy efficient buildings and technologies influence practices – the wrong direction
- There is a theoretical difference between individual behaviour and collective practices
- Discuss smart home approaches in light of this
- What can we learn for future energy research and policy?

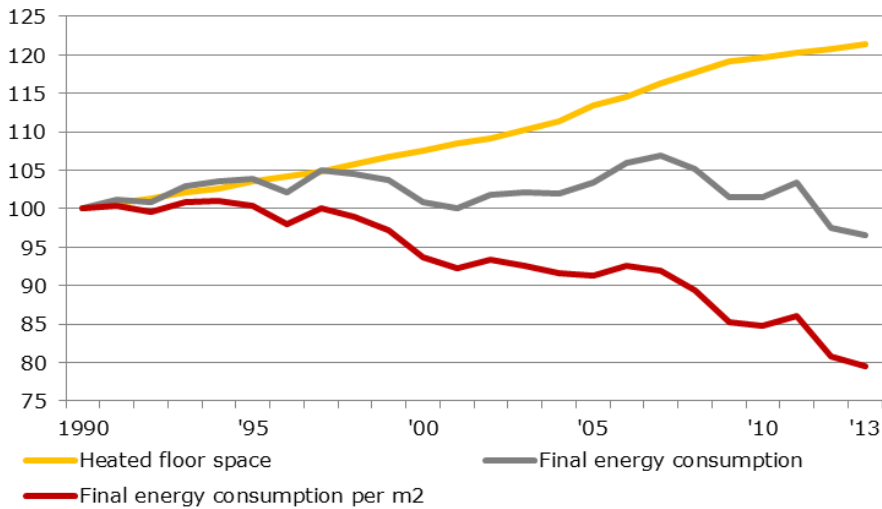


Energy consumption in households in Denmark ...not much is happening and we need reductions!



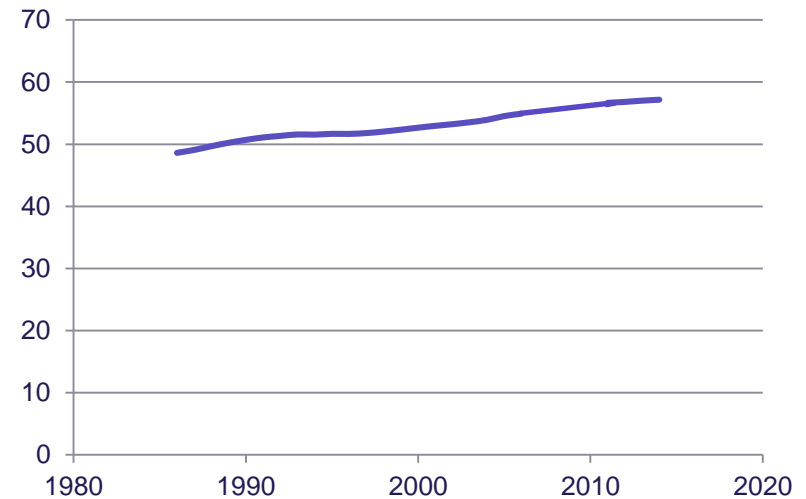
Energy efficiency and number of heated square meters

Index 1990=100



Energy statistics, Danish Energy Agency, 2013

Squaremeter per person



Statistics Denmark, 2013



User practice VS Efficient technology



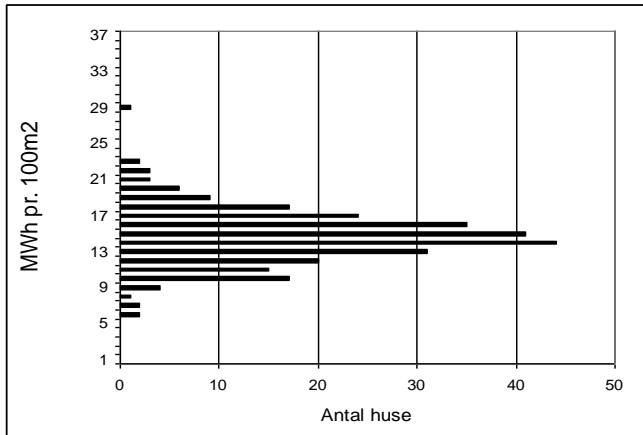
Identical houses – different consumption:

- Factor 2-3 in difference in heat consumption dependent on user practices

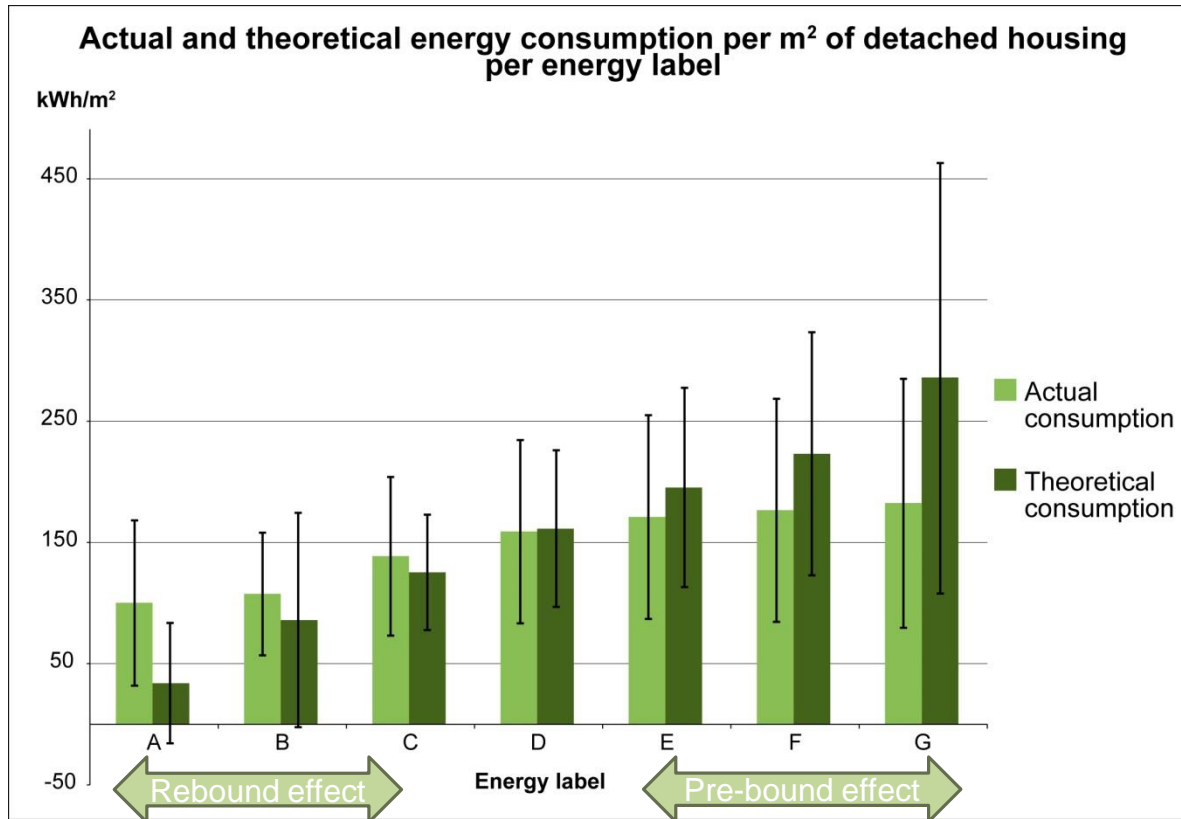
New low-energy housing:

- Factor 2 lower consumption compared to average homes

User practice means at least as much as the energy efficiency of the building



Efficient homes versus efficient practices....



Based on 230.200 detached Danish houses with an energy label. (Gram-Hansen and Hansen, 2016)



Technology and user practices
are integrated and have to be
understood and regulated as
such



Example: Floor heating guides another type of comfort including new comfort norms and practices

- New buildings have efficient low-temperature floor heating
- Imply changing practice of heating
 - Difficult/slow to regulate
 - Regulating less
 - Equal heating in all rooms
 - Heats more rooms
 - Nice warm feet, but low-energy homes do not need all this heat
 - Temperatures are felt differently depending of the floor materials

Technology guides user to have higher temperatures in new vs old houses

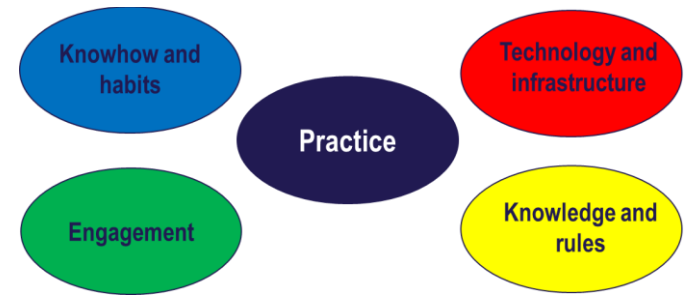
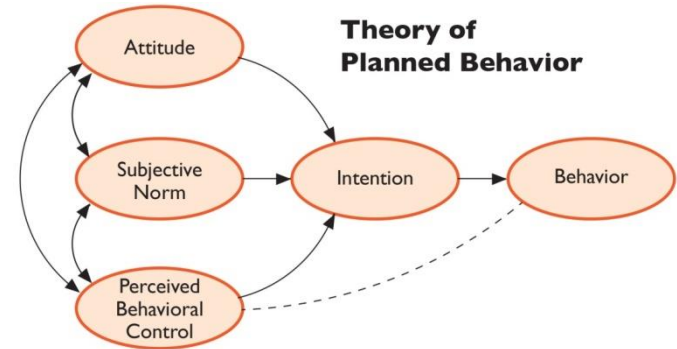
Based on survey questionnaire and qualitative interviews.



(Madsen, 2017)
(Hansen et al; 2018)

Users are important how to conceptualise them: Behavioural VS practice theoretical approaches

- Individual VS collective
- Rational based on subjective attitudes and norm VS habitual formed by social and material structures
- Focus on the practices VS on the humans
- Technology and infrastructure not included VS included



Practice theory is strong in understanding technology-practices relations in a longer (historical) timespan

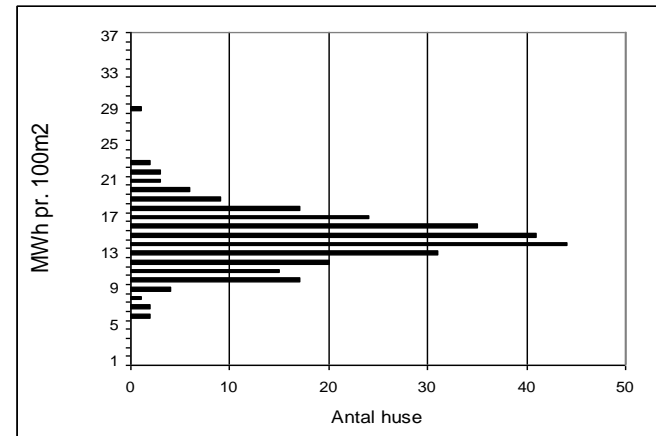
- New infrastructures of water, sewage, energy and communication made way for new appliances and changing practices in the home
- New norms of communication, comfort and cleanliness developed collectively
- Norms and needs are socio-technically constructed



Practice theory can also elucidate variations in consumer practices (in other ways than individual behaviours)

Even with identical buildings and technologies we see huge variation

- We carry tacit knowledge from previous social and material settings in our habits
- Social class, and thus social relations and meanings are part of the explanations of variations



Smart-home and feedback to solve the “user problem”?

Energy management imply that households are conscious and economic rational

Our studies show that

- Regulating heat and indoor climate are more routinized than conscious rational
- Technological structures influence collective understandings of comfort and convenience
- Thus smart technologies will also influence understandings of home and comfort – and maybe in more consuming directions.



Smart technology is likely to become part of the future

- We may work with how it will be in ways which support less consuming practices rather than the opposite
- Smart technology must support notions of home – but it will also change these

(Gram-Hanssen and Darby,2018)



Concluding...

What do this mean for energy research and policy related to residential space heating?

- Technical innovation and regulation must include how practices are changed along with the introduction of the new technology
- Housing and family policy are as important as energy policy when regulating energy
- More interdisciplinary research are needed including the social, humanistic and technological approaches



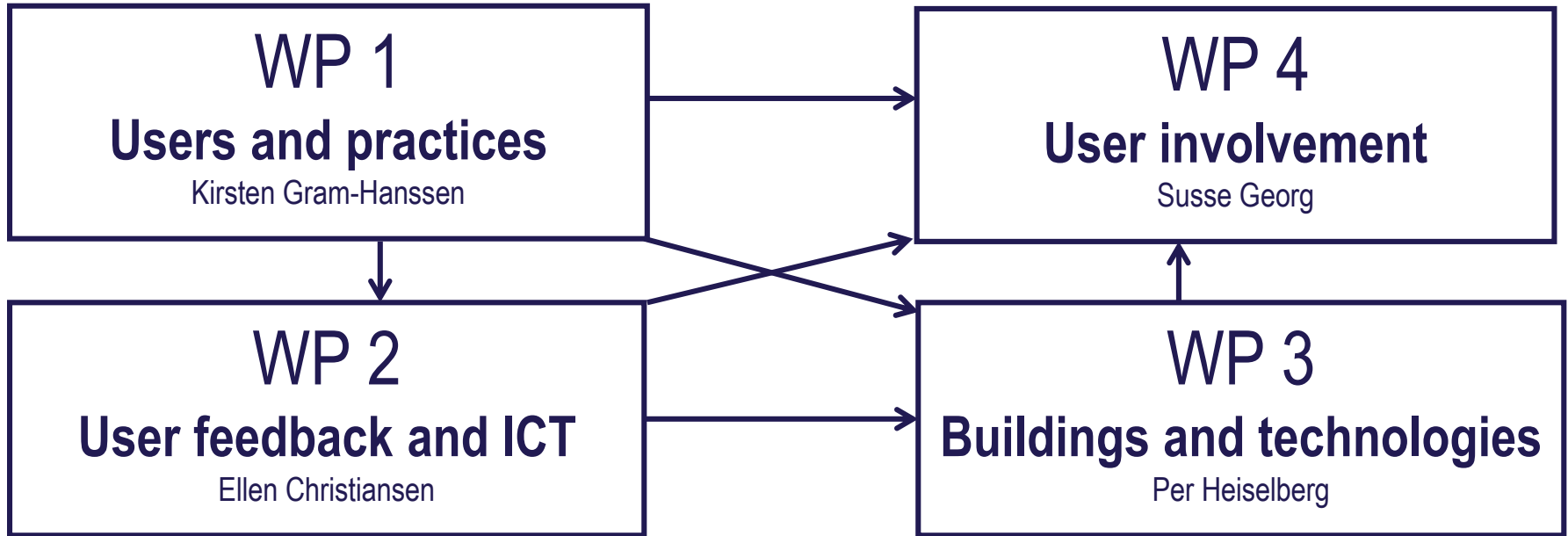
THANKS 😊



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UserTEC – User practices, technologies and residential energy consumption

2 DK and 4 international Universities + 12 Danish and International companies
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The building as a smart envelope and as a home?

Home is:

- Where we are in control and feel safe
- Where we are together
- Where we are active
- Where we show our identity

To become successful smart home technology have to support these notions of home and not be in contradiction to it



What innovation in building technologies do we get when not thinking of occupancy?

What innovations are promoted by building regulations and what happens in use:

- Low-temperature underfloor heating, but if heating to have warm feet?
- Sun shading - but if used during winter?
- Mechanical ventilation with heat recovery – but if still opening windows?

