



MOBISTYLE

ENERGY HEALTH
INDOOR ENVIRONMENT

Provision of personalized information on energy, IEQ and health
leading to energy efficient behaviour and habits

Sustainable Places Conference 2017

Middlesbrough, 28 June 2017



Structure of the today's presentation



1. Current EU approach:
 - Energy efficiency at the heart of EU
2. MOBISTYLE approach:
 - Understanding user behaviour
3. First findings based on social science aspects:
 - What is the main driver for users to change their behaviour towards more cautious building energy use?
4. Ongoing work and recommendations for future engagement with users



DIRECTIVE 2010/31/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 19 May 2010

on the energy performance of buildings

(recast)



(3) Buildings account for 40 % of total energy consumption in the Union. The sector is expanding, which is bound to increase its energy consumption. Therefore, reducing energy consumption and the use of renewable sources in the buildings are important measures needed to reduce energy dependency and greenhouse

Buildings - European Commission
<https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings>
Buildings are responsible for 40% of energy consumption and 36% of CO2 emissions in the EU
While new buildings generally need fewer than three to five ...

PDF With buildings accounting for nearly 40 percent of global energy
ccap.org/assets/Success-Stories-in-Building-Energy-Efficiency_CCAP.pdf
With buildings accounting for nearly 40 percent of global energy consumption, the building sector should play a key role in effective climate policy. Efficiency ...

United Nations Environment Programme (UNEP) - SBCI
staging.unep.org/sbci/AboutSBCI/Background.asp
Buildings use about 40% of global energy. 25% of global water, 40% of global ... Residential commercial buildings consume approximately 60% of the ...



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Policy implementation



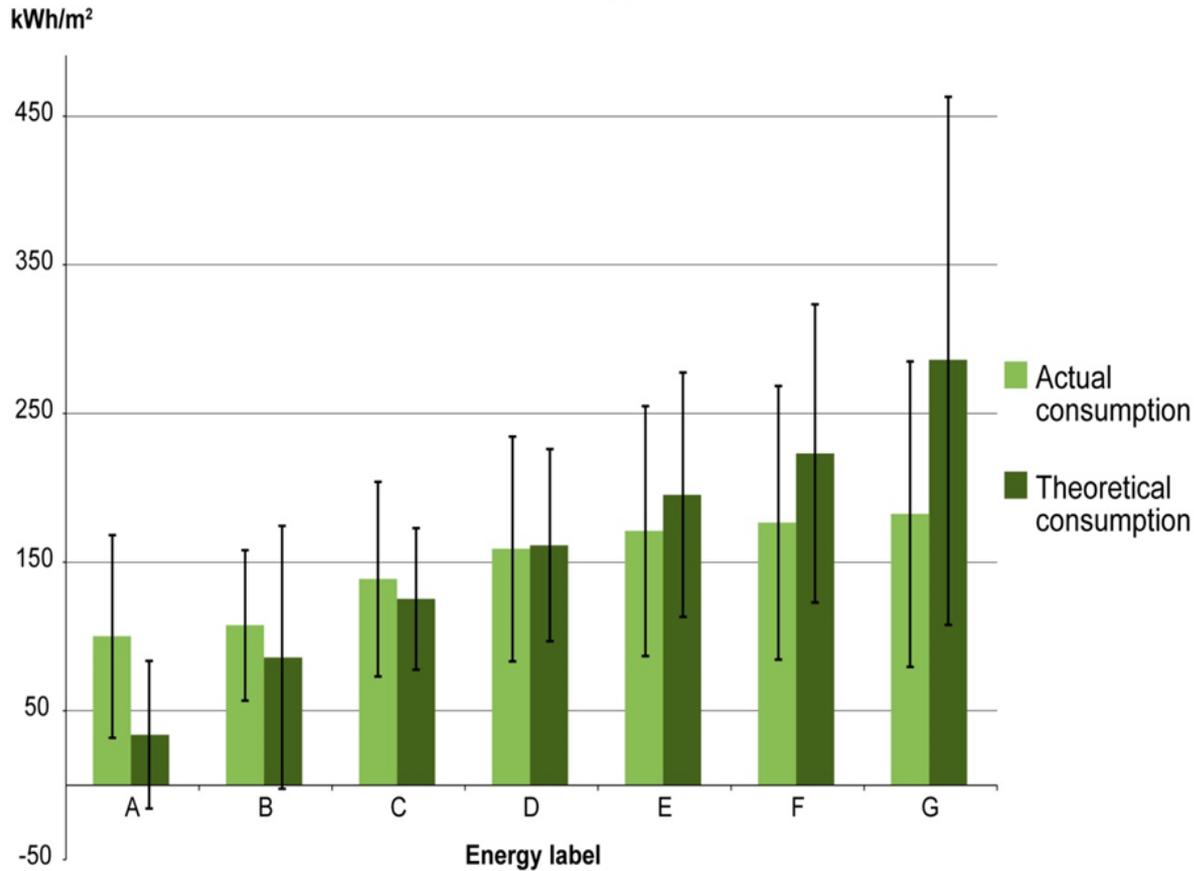
- Energy labelling
- Smart metering
- Numerous sensing services
- Different types of building data



Who understands this information?

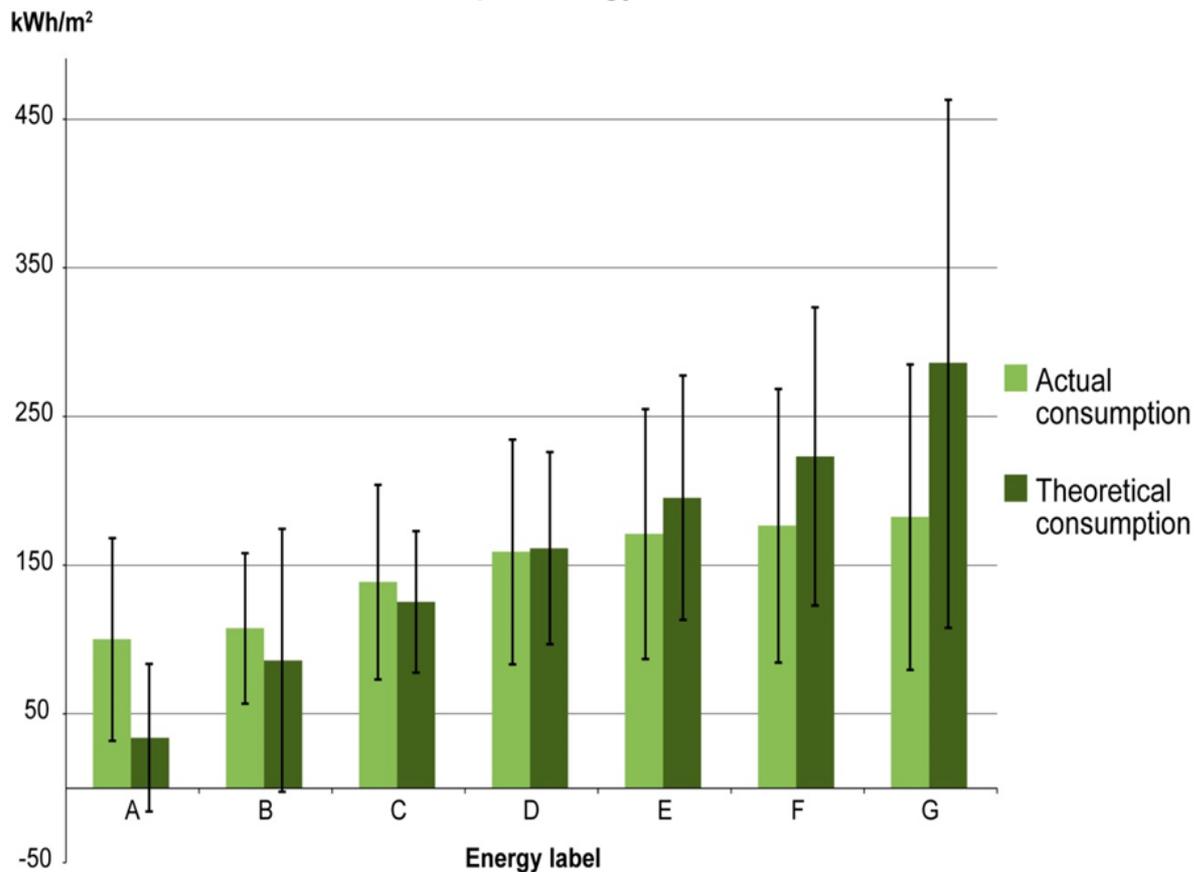


Actual and theoretical energy consumption per m² of detached housing per energy label



REFERENCE: UserTEC – User Practices, Technologies and Residential Energy Consumption. P. Heiselberg, AAU, Denmark [LINK](#).

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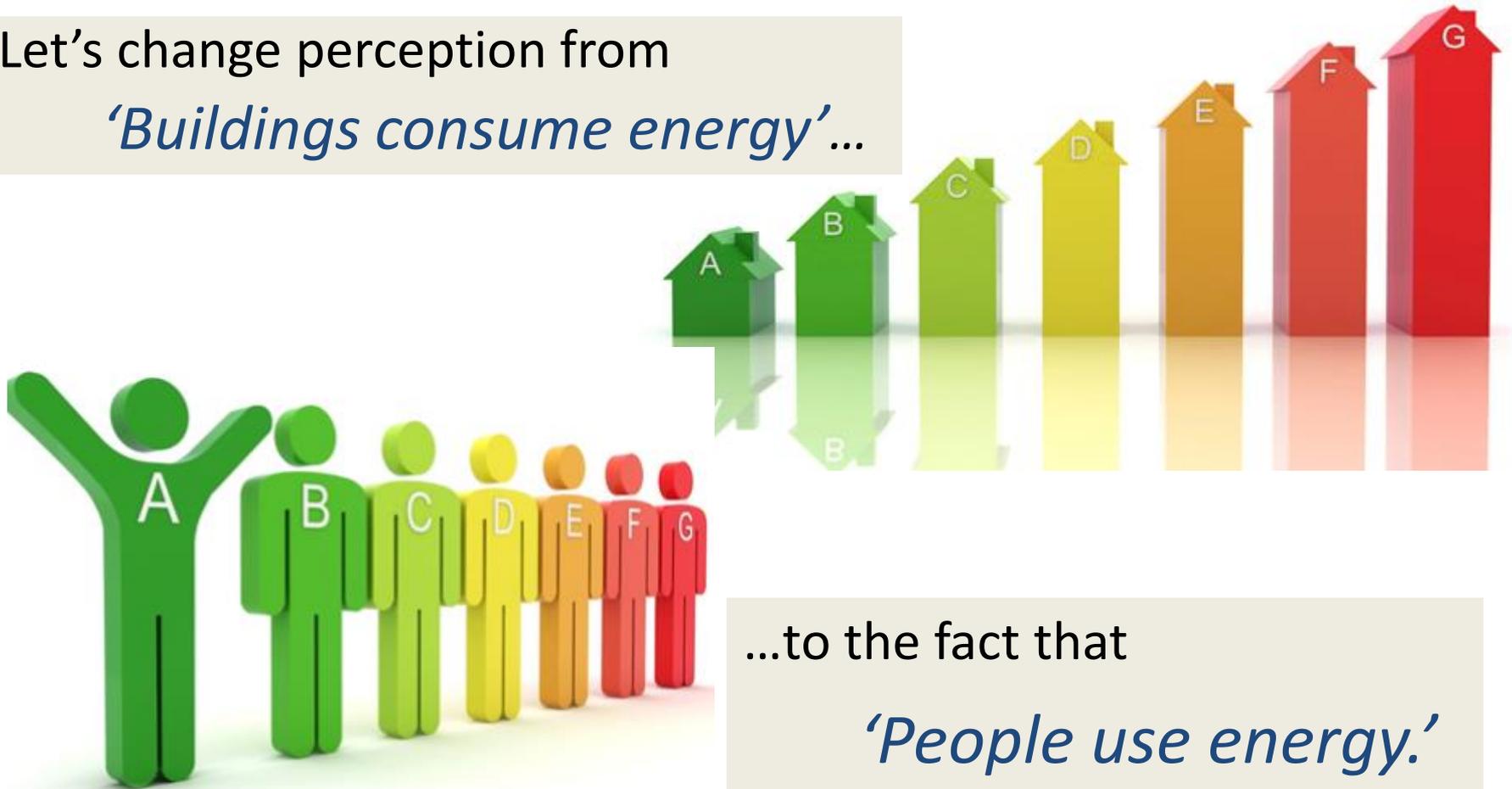


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Let's change perception from
'Buildings consume energy'...



...to the fact that
'People use energy.'



MOBISTYLE project



‘Motivating end-users behavioral change by combined ICT based modular information on energy use, indoor environment, health and lifestyle.’



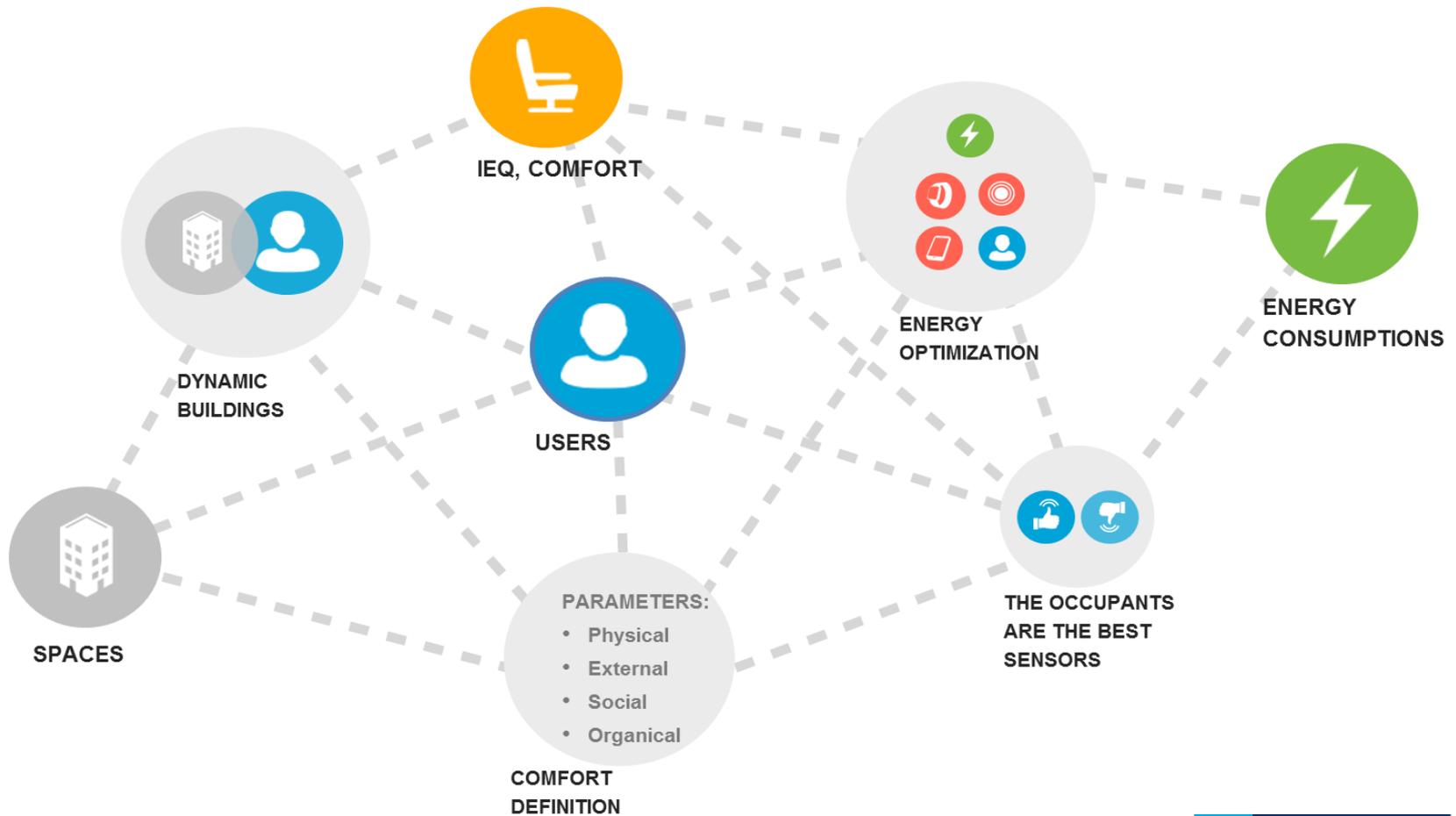
‘People use energy.’



The building ecosystem.....



.....is efficient if all the components are mutually conscious.....





Understanding occupant behaviour



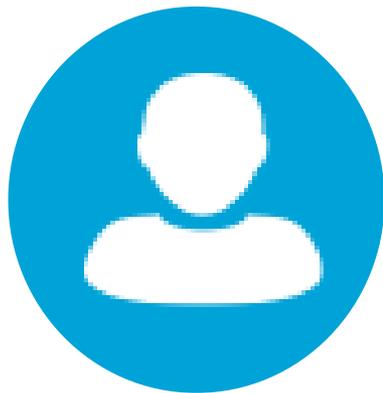
One of the major factors influencing building energy consumption.

Contributing to uncertainty between energy use prediction and reality.

→ **We should *understand* the users and their needs → anthropology experts**

Main MOBISTYLE research questions:

- What is the lasting motivating factor for users to change their behavior?
- How do they use existing ICT based solutions? What is needed to make these solutions user-friendlier?



MOBISTYLE demonstration cases with different user groups:

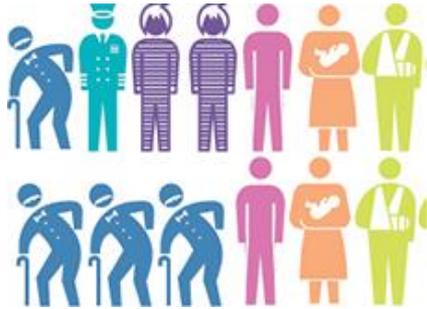
- 2 residential building areas (PL, DK)
- University buildings (SI)
- Apartments in a hotel (IT)
- 1 health-care centre (NL)



MOBISTYLE approach



Integrating social science aspects into occupant behavior research



STEP 1: IDENTIFICATION

WHO ARE WE SOLVING FOR?
- Collecting thick data

STEP 2: RESEARCH

WHAT DO PEOPLE WANT?
- Listen to the users
- Provide an added value (new motivation factor)

STEP 3: INTERPRETATION

WHAT AND HOW TO SERVE THEIR NEEDS?
- Requirements for ICT solutions
- Tailored solutions to different user groups
- Varied communication and feedback strategies

STEP 4: TESTING

WHY DOES IT MATTER TO THE PEOPLE?
- Put them in control
- Educate the users
- Engaged learning

PEOPLE-CENTRED APPROACH
(surveys, questionnaires, interviews, focus groups, participant observation, experiments, etc.)



improvements

*Podjed, D., Anthropological approach in the MOBISTYLE project



First findings



based on MOBISTYLE focus groups organized for 5 demonstration cases

1. **Health and well-being** more important than energy saving and CO₂ emissions
2. No 'one-size-fits-all' solution
3. **Meaningful & relevant information** on local (person) as European (society) level
4. Offer **non-intrusive, calm technology**
5. **Coopetition** = cooperation + positive competition
6. Information coming from a **trusted source**
7. Ensure **user** and **data privacy**

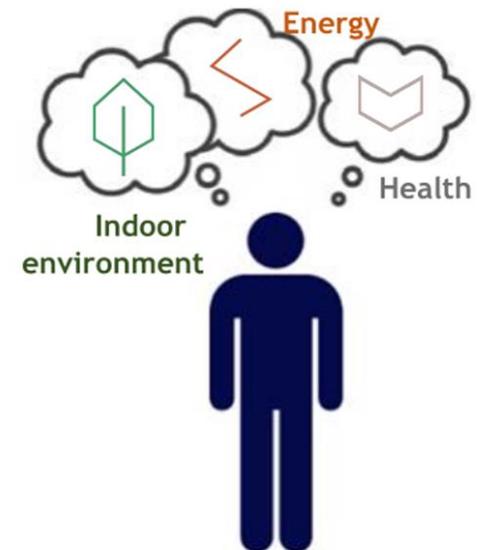


First findings



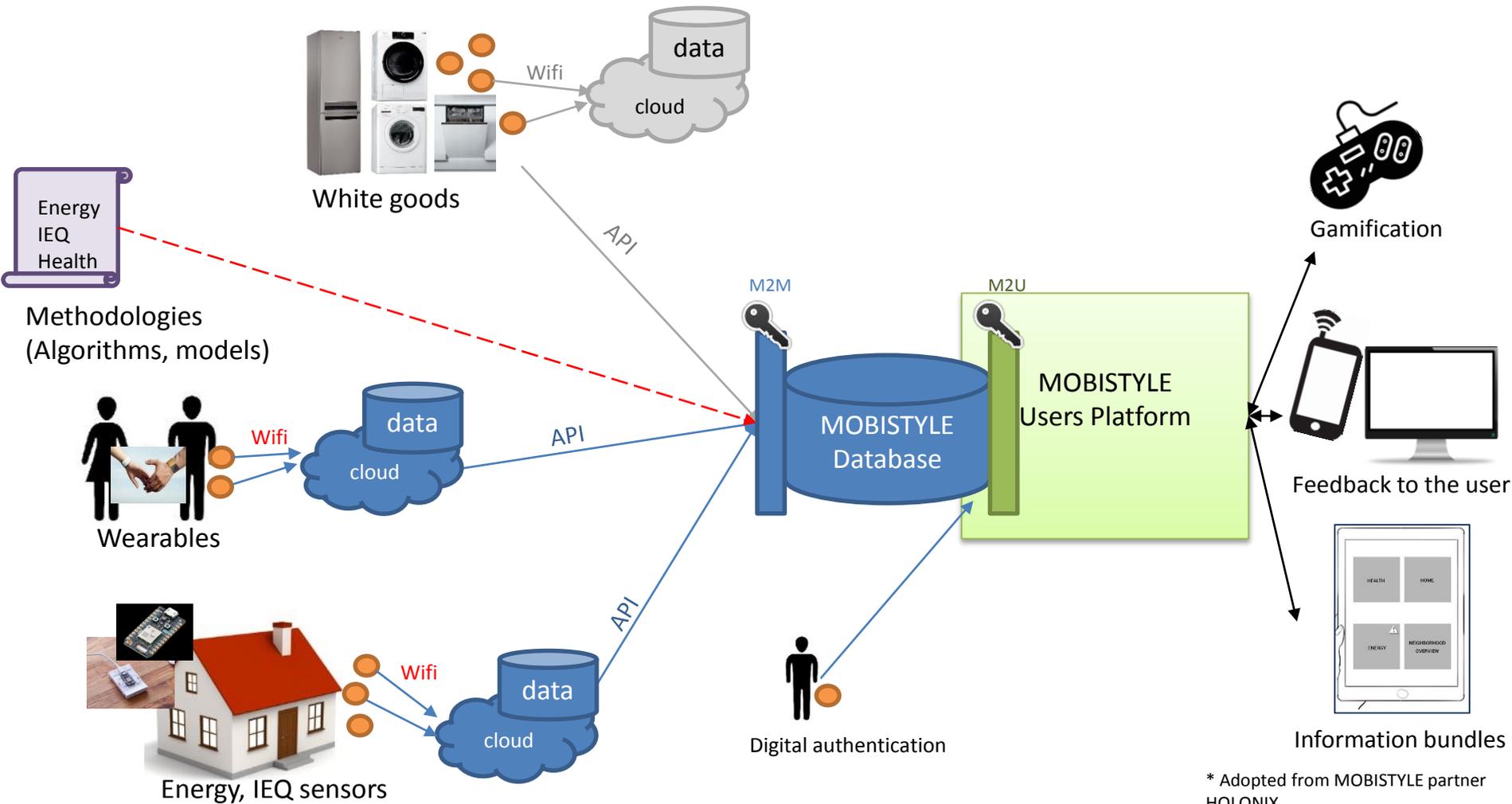
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MOBISTYLE ICT solutions



* Adopted from MOBISTYLE partner HOLONIX.



What is healthy?



Let's forget about the comfort requirements and look into what is healthy:

- World Health Organization limits instead EN 15251 comfort recommendations

Fluctuating temperatures and the Thermo-neutral zone (*):

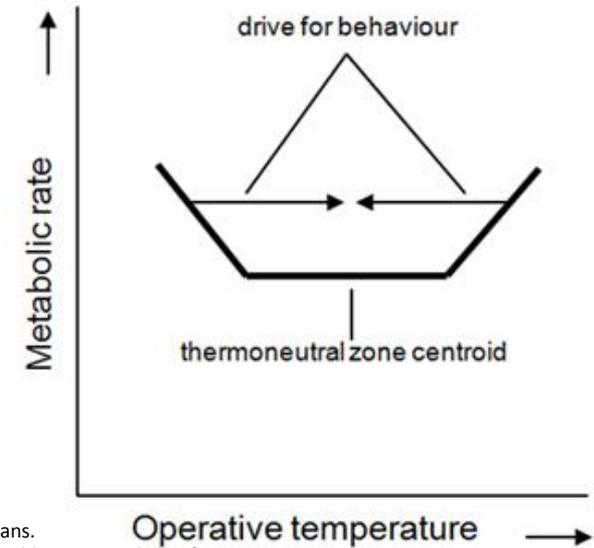
- Research from Maastricht University (MU) showing that dynamic indoor temperatures are better for our health than the 'comfort zone' of about 21 ° C (based on PMV)
- Our bodies need to work harder to maintain our core temperature of 37 ° C when indoor temperature is increased or decreased

↓

Increased metabolic rate (similar to exercising) →

Experimental studies at MU showed that exposure to dynamic thermal environment increases:

- Energy metabolism (*)
- Resilience to thermal discomfort due to acclimation (*, ***)
- Resilience to cardiovascular disease and insulin sensitivity (**)



REFERENCE:

*Van Marken Lichtenbelt, W.D.; Kingma, B.; Lans, A.; Schellen, L. (2014). Cold exposure – an approach to increasing energy expenditure in humans.

** van Marken Lichtenbelt, W. D.; Hanssen, M.; Pallubinsky, H.; Kingma, B.; Schellen, L. Healthy excursions outside the thermal comfort zone, Building Research & Information, 2017.

***van der Lans, A. A.; Hoeks, J.; Brans, B.; Vijgen, G. H.; Visser, M. G.; Vosselman, M. J.; Hansen, J.; Jorgensen, J.A.; Wu, J.; Mottaghy, F. M.; Schrauwen, P.; van Marken Lichtenbelt, W. D..

Cold acclimation recruits human brown fat and increases non-shivering thermogenesis, The Journal of clinical investigation, 2013, 123, 3395-3403.



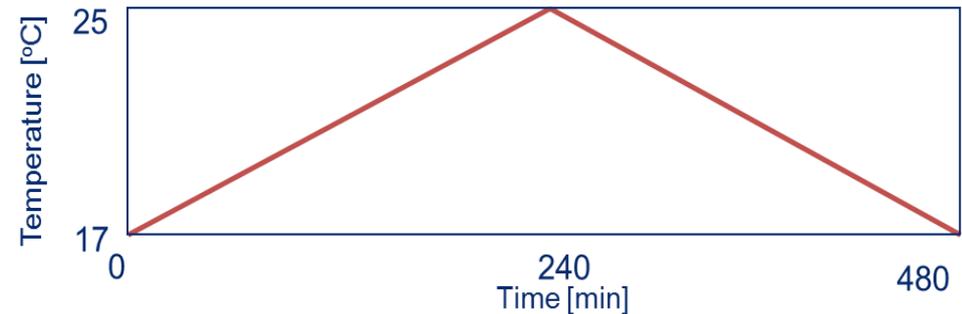
Energy – IEQ – Health



- TEMPERATURE TRAINING in MOBISTYLE

Effect of dynamic varying temperatures (personalized HVAC system) on building's energy saving, IEQ and health.

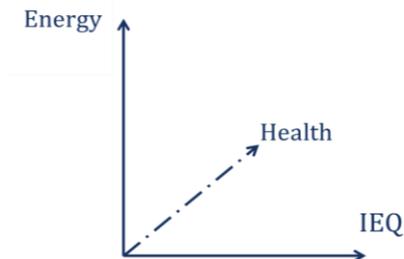
Schellen et al., Indoor Air 2010



Temperature deviations as part of overall healthy lifestyle and healthy aging strategy.

↓
Physiological response

↓
Psychological response



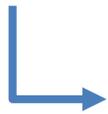
Gradually cooler environment in winter and warmer in summer can lead to energy saving, improved comfort and higher acceptance.



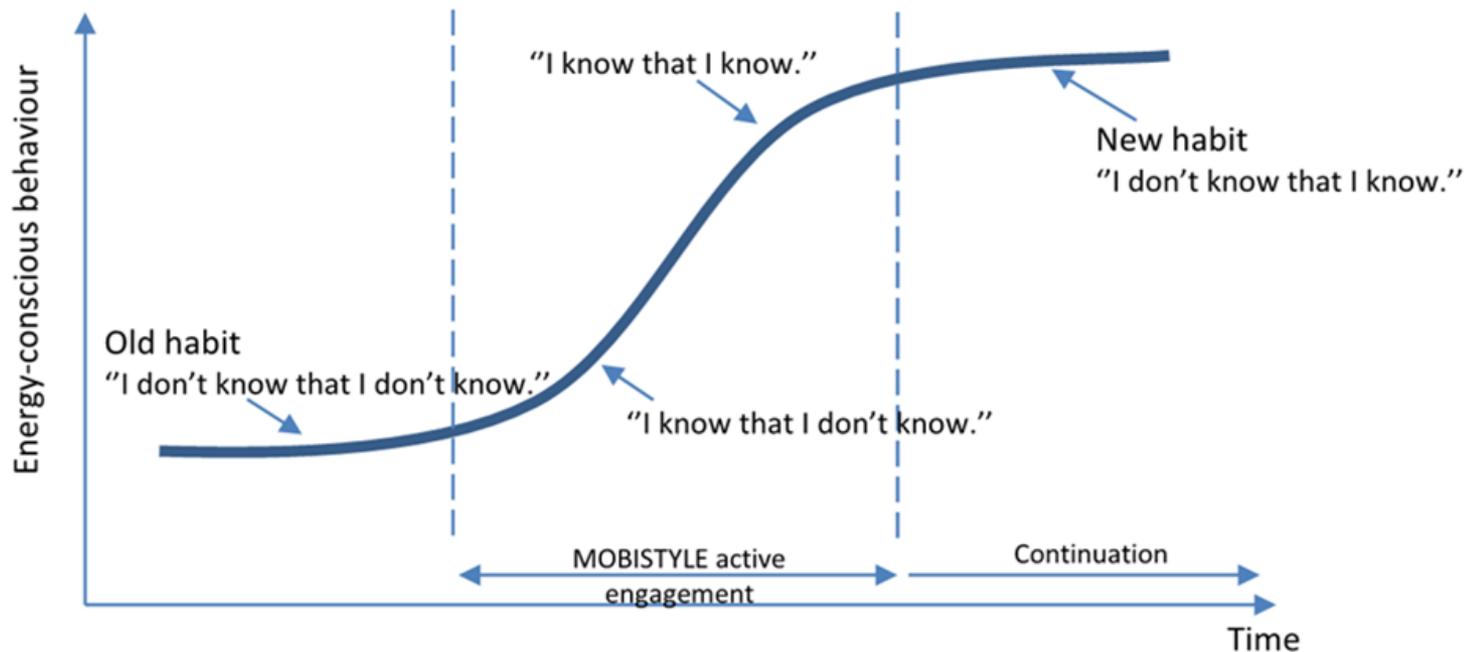
Change occurs gradually



MOBISTYLE quantitative objective: 16% of energy reduction prompted by combined monitoring and other consumption feedback strategies on energy, IEQ and health



The developed MOBISTYLE tailor-made ICT solutions and services are promoted and communicated with users through the *awareness campaigns*.

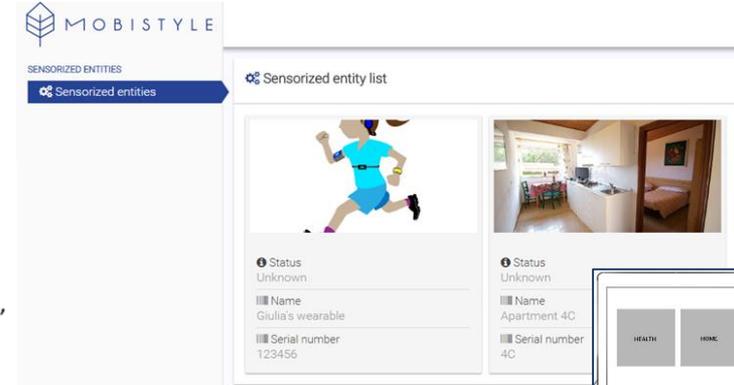
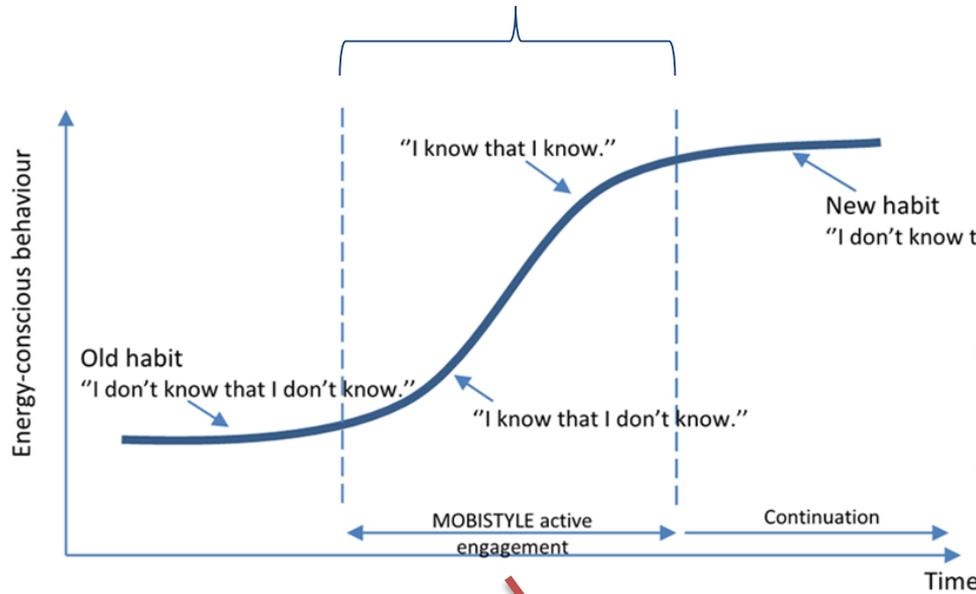




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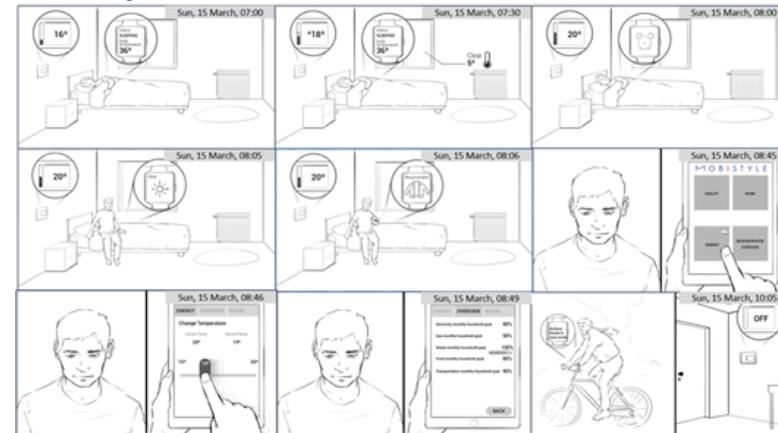


MOBISTYLE awareness campaigns



MOBISTYLE Open Users Platform (information bundles)

Storyboards



Feedback to the user





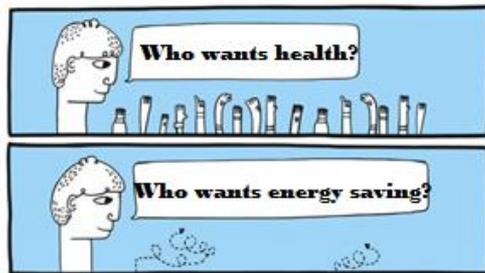
Lessons learned until now



Energy efficiency at the heart of EU transition towards sustainable future



Interdisciplinary work between engineers and social scientists can help understanding users



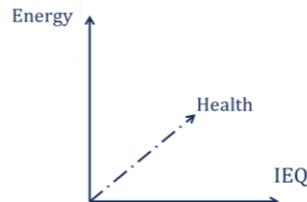
For users: **health is today's wealth!**



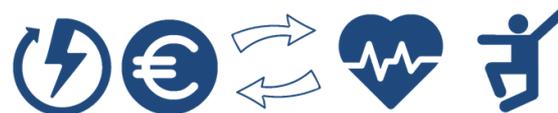
Health can be intentionally incorporated in decision-making process (added economic value)



Primary target = healthy building → Consequently = energy-efficient building



Promote solutions where goals on energy efficiency, good IEQ and health overlap





Thank you for your attention.



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COLOPHON

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