

Designing smart systems to understand and shape energy use in buildings

Martin Pullinger

School of Informatics

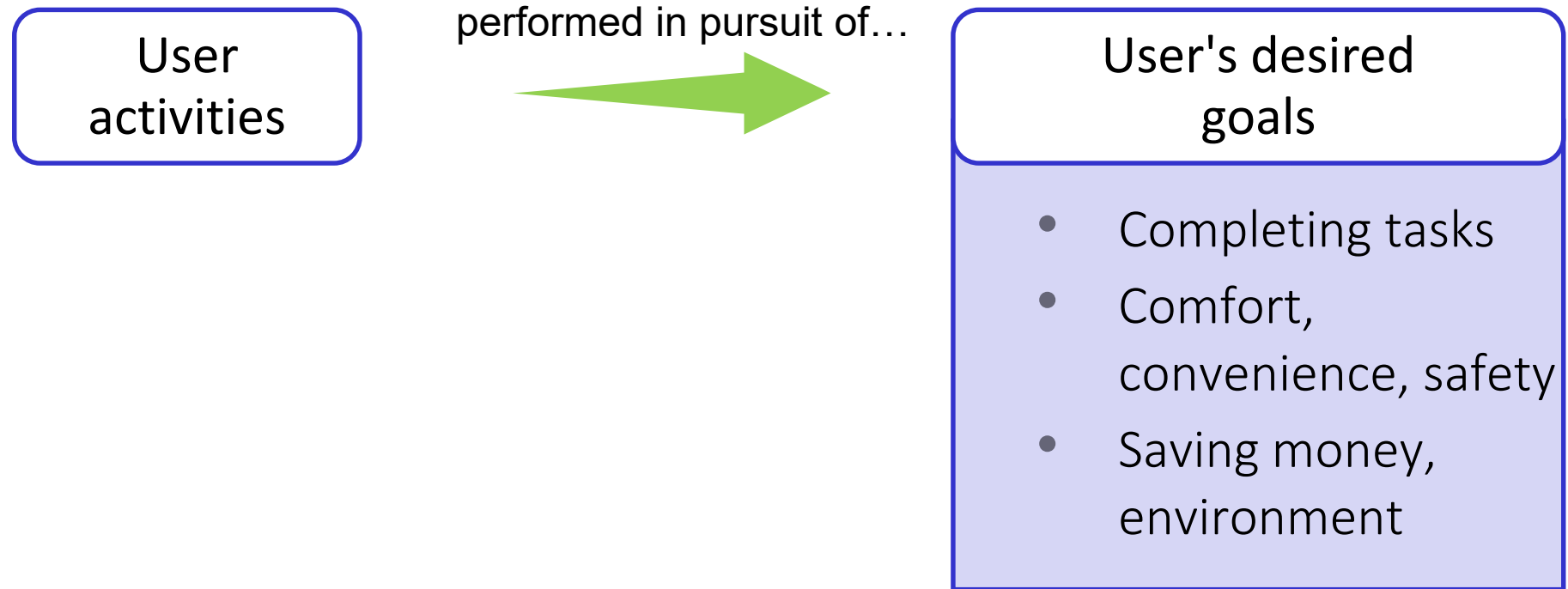
martin.pullinger@ed.ac.uk



THE UNIVERSITY
of EDINBURGH

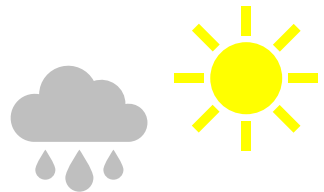
How users affect building energy consumption

Building users 'drive' building energy use



Social science perspective on user influence on energy use

Environment



People

Motivations



Capabilities

Activities



Outcomes



Energy use

User goals

Built environment (potentially) *enables*,
but doesn't *require*,
energy efficient activities

Our work: Understanding user influence

Measuring and understanding user influence on energy demand

BIGSMALL project

- ML: Improved 'Non-Intrusive Load Monitoring': identifying appliance use from smart meter + room temperatures and humidity
- Quantitative methods: smart meter data, ML + survey data to understand user influence

Facilitating secure access to smart meter data

Smart Meter Research Portal

- Physical infrastructure and ethical processes for access to UK smart meter data
- Stakeholder (industry, policy, third sector) engagement to understand use cases

Living labs methods

ENHANCE

- Engaging building users to reflect on their energy using activities, end goals and solutions to reduce energy use

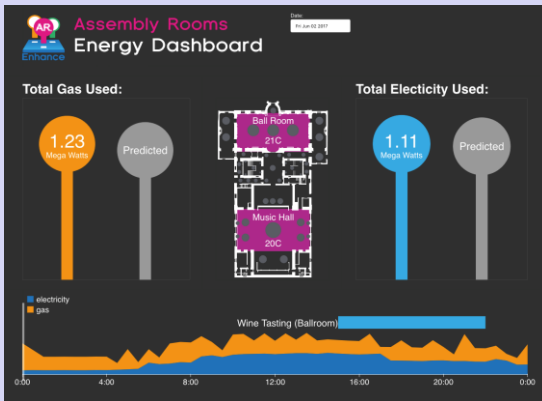


Our work: Feedback and control systems

Non-domestic building data to occupants

ENHANCE project

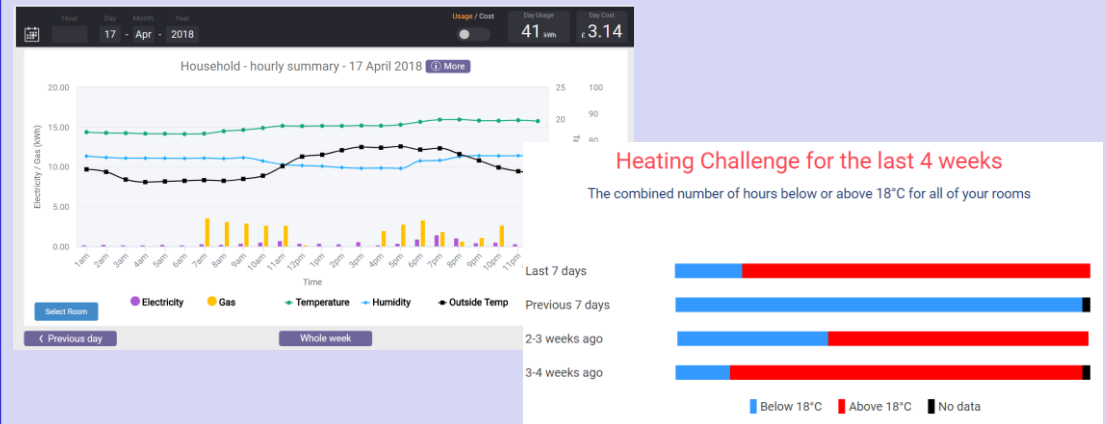
- Events venue



Domestic building data to occupants

IDEAL project

- 240 homes across Edinburgh region
- Home information and energy saving advice



Lab equipment booking system

Little Interface for Lab Equipment Efficiency (LILEE)



Improving intervention outcomes

- Co-design methods
- Real world, long term evaluation – RCTs, in-depth interviews and focus groups

Our future work

Activity inference Efficiency interventions

- Modelling user activities
- Digital telecare
- Improved building environment control for indoor production
- Domestic heating automation
- Integrating energy storage

Brazilian context

- Inferring energy using activities
- Facilitating building data access
- Design methods
- Energy efficiency interventions