Why too much focusing on the "average" may hamper the heat transition for private homeowners

The impacts of behavior variables on the heat demand

Department: Sustainable Development
Research group: Energy &Resources
Supervisor: Dr. Wen Liu
Email address: w.liu@uu.nl

Project description

It is known that ceteris paribus, houses with more floor area and not yet retrofitted older houses (with a poor energy label) consume more heat. Still, these variables can only partly explain the wide range in domestic heat (gas) consumption (Burgers, Koning et al. 2021). The unexplained part of the range in gas consumption is likely related to behavioral variables (household size, preferred indoor temperature, presence of people, full-house heating/partial heating, (un)conscious heating behavior). These variables impact the range in gas consumption and affect the effectiveness of policy instruments aiming at heat demand reduction.

Scientific research into the impact of the behavioral variables on the heat demand of similar houses is scarce. Examples are (Guerra-Santin, Silvester 2017, Bedir 2017, Carpino, Mora et al. 2017). None of these earlier studies focused on how the range in heat demand affects the payback period (PBP) of insulation measures. This research aims to create a Monte-Carlo-based probability distribution function of PBP (or other investment decision indicator such as net present value), showing the likelihood of an attractive investment on the heat demand reduction for private homeowners. The hourly heat demand of existing buildings are simulated with a simulation tool TRNSYS (Trnsys 2021). The student needs is carrying out a combined TRNSYS simulation and a Monte-Carlo analysis with a probability distribution function of the annual heat demand as a result.

The research can be carried in the campus buildings or from home. Specific situation such as Covid-19 will have limited impact as no lab experiment is needed. The supervisor and selected student will make an agreement on the meeting frequency (meeting in the office and via the Teams will be balanced).

Job requirements

Background knowledge on energy science is required; Programming skills such as Python is preferred

Reference:

BEDIR, M., 2017. Occupant behavior and energy consumption in dwellings. *A+BE | Architecture and the Built Environment,* **16**, pp. 1-266.

BURGERS, M., KONING, V. and KRAMER, G.J., 2021. Variability in electricity and gas consumption by Dutch households (paper submitted to the journal Applied Energy).

CARPINO, C., MORA, D., ARCURI, N. and DE SIMONE, M., 2017. Behavioral variables and occupancy patterns in the design and modeling of Nearly Zero Energy Buildings. *Building Simulation,* **10**(6), pp. 875-888.

GUERRA-SANTIN, O. and SILVESTER, S., 2017. Development of Dutch occupancy and heating profiles for building simulation. **45**(4), pp. 396-413.

TRNSYS, 2021-last update, TRNSYS Transient System Simulation Tool. Available: http://www.trnsys.com/.