



Building level intelligence (WP6)

Challenges

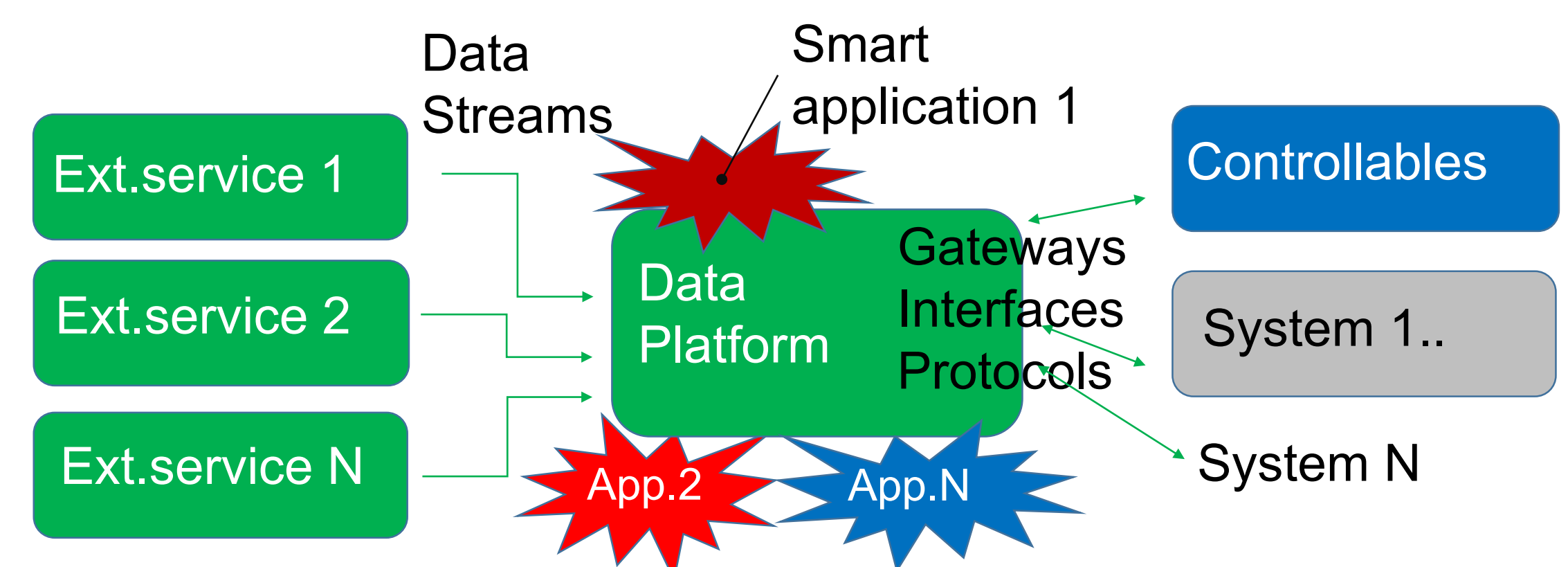
When electrification displaces the usage of fossil fuels and the share of wind, solar and nuclear power increases, CO₂ emissions from power generation and consumption are expected to decrease - however - the need for and value of flexible consumption is expected to increase. Various heat pumps, HVAC-systems, e-vehicles and other controllable loads and local distributed resources such as photovoltaic systems and energy storages, together with local energy networks (E+H+C) and interacting ICT-solutions, compose a complex system, which is capable to improve energy efficiency and flexibility of a building. However, the complexities presented by lack of data, various automation systems and critical services must be overcome.

Preliminary results

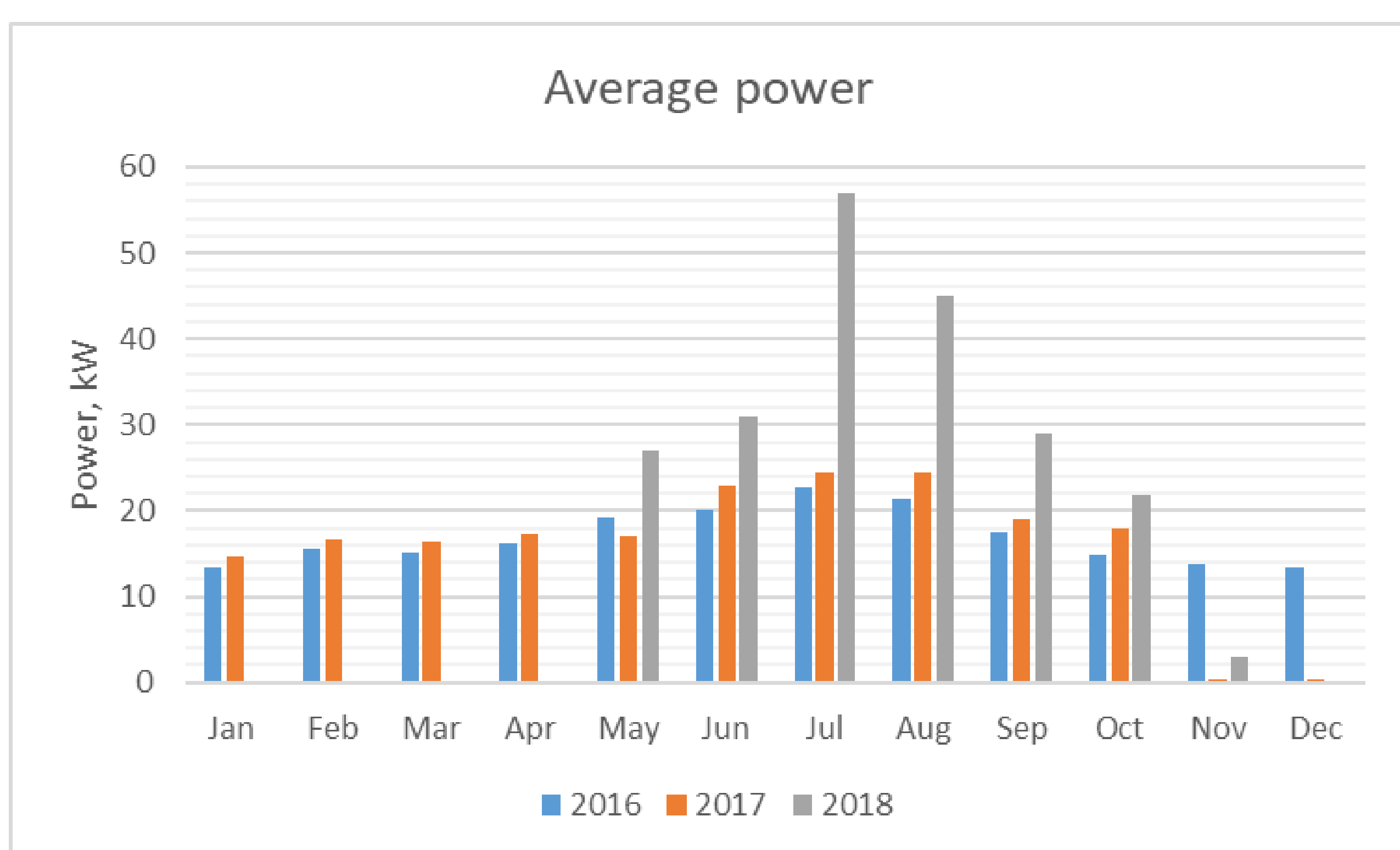
Energy efficiency and flexibility mappings have been implemented and documented regarding two buildings. First subsystems (PV-units, Fingrid's open data -service) have been integrated into the oBIX research platform (ongoing work: BAS, chiller unit, PV-hybrid, EV-charger, power monitoring system). Electricity measurements of subsystems do not typically support flexibility assessments: There is a clear need to add online/real-time measurements. Frequency Containment Reserves FCR-N threshold 0,1 MW seem to be too high (pooling is needed, big controllable loads (in practice) are very rare in this kind of buildings).

Goals – we strive to:

- Carry out energy audits and link experts, data streams and systems in order to find ways to improve energy efficiency and flexibility at the building level in the Otaniemi area.
- Locate subsystems in target buildings which could be monitored and controlled intelligently taking mutual interactions and external information into account.
- Support piloting of new energy efficiency and flexibility measures and technologies at suitable locations and assess feasibility and impacts (and create investment proposals).
- Facilitate access to the market also for small flexible loads as part of a larger entities (pooling).
- Understand the needs and border conditions of energy users by means of surveys, sensors and feedback-systems.



Together with other WPs, we are building a system where different subsystems (connected to the research platform, large chillers, EV-charging, PV-hybrids, HPs, elevators, sensors etc. will be 1) monitored and 2) controlled taking local e-balance, boundary conditions, internal and external conditions & prognoses and the prices of the various energy products into account.

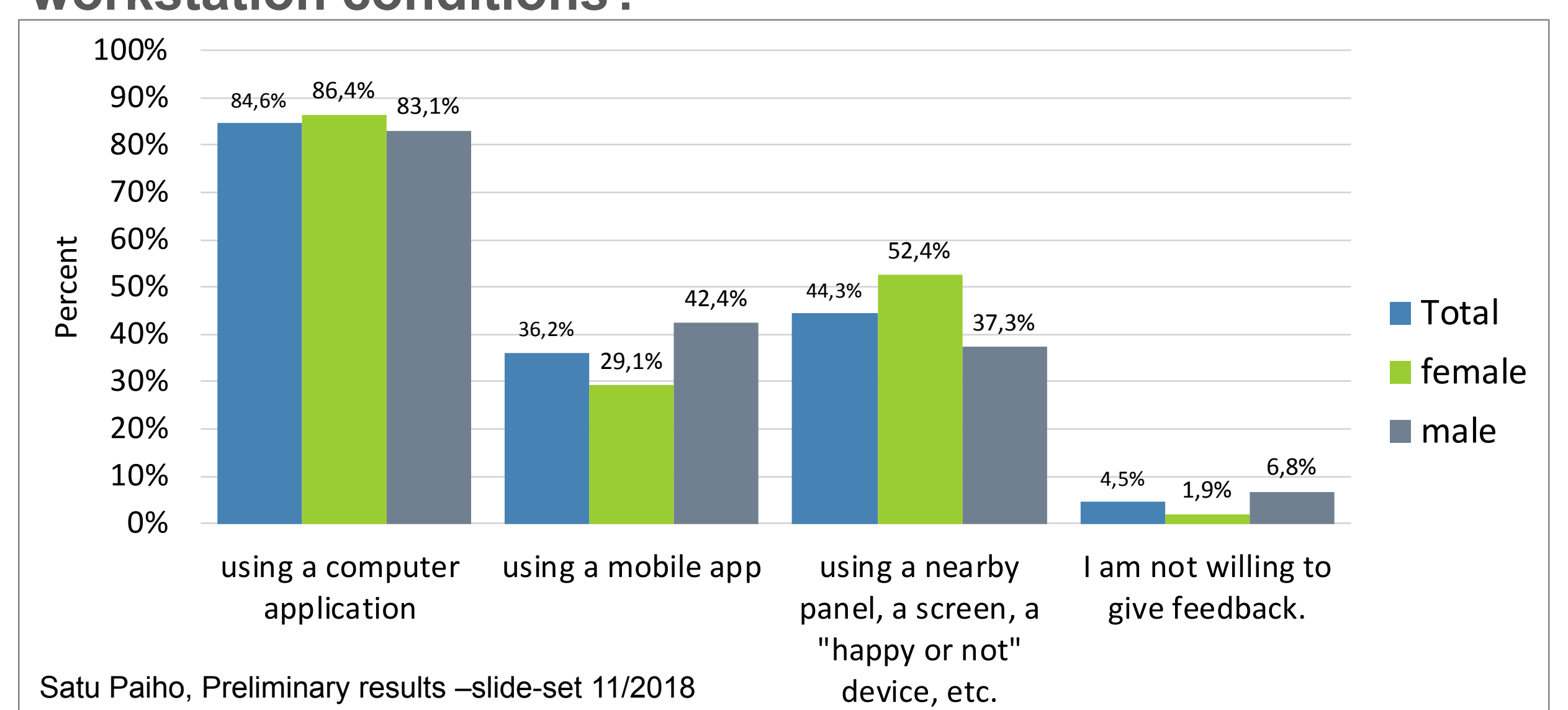


An example: Average monthly power of one potentially controllable chiller unit (Laitinen et al. draft 2019). In general electricity consumption of cooling systems (chillers) seem to be "peaking - issue" in VTT's building stock and efforts are ongoing to execute load control trials.

Pilot partners

VTT Technical Research Centre of Finland Ltd, Aalto University, Department of Electrical Engineering and Automation, Väre Energia Ltd., (Following partners: Aalto University Campus & Real Estate (ACRE), Eneron Ltd, Fourdeg Ltd, Green Energy Finland Ltd).

Would you be willing to provide feedback on your workstation conditions?



User and stakeholder feedback is an important part of the system:

- Over 60% are interested in the office-workers ability to influence on the energy consumption
- Over 40% would allow an automatic temporary temperature drop (to 18°C) or rise (to 26°C).
- In addition to user feedback apps also sensor systems will be utilized to optimize the operation of the HVAC-system

Clustering and measurement campaign by Aalto

- Clustering to identify buildings in terms of consumption profiles
- Energy consumption in Otaniemi and related emissions and costs.
- Drafting the measurement plans (->evaluation of flexibility necessitates submetering)

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