Optimising heat consumption at micro-level using user centric data driven model

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Research focus

- 1. Novel approach to estimate the heat demand.
- 2. Calculating the U-value.
- 3. Novel approach to optimise heat usage at home.
- 4. User profile based on the customer behaviour.





Overview



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Data

• Frequency is set to the datasets are set to 5 min.

Project	Feature
	Hour
	Minute
	Day
	Weekday
	Month
	Outdoor Temperature
	Temperature
REMOURBAN	Motion
	Heat Demand
	Pressure
	Humidity
	Wind Speed
	Sunset time
	Sunrise time
	Weather Type

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Data



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Date Time

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$$Q_{Total} = Q_{Losses} + \sum_{k=1}^{n} Q_{Home}$$

$$Q_{Home} = UA(T_{indoor} - T_{outdoor})$$

$$Q_{Home} = Q_{Livingroom} + Q_{Bedroom}$$

$$Q_{Home} = UA(T_{Predict} - T_{Weather(predict)})$$

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Floor Plan and U-value



Wall Types	U-value (W/m ² K)
Solid wall in very old buildings	2.30
Solid wall in old buildings	1.70
Unfilled cavity wall	1.50
Solid wall with 100 mm thick external insulation	0.32
Filled cavity wall with 100 mm thick external insulation	0.25

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Time Series





2. Calculating U-value

$$U = \frac{Q_{HeatMeter}}{A(T_{Sensor} - T_{Weather})}$$

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- Heat meter, Sensor and weather are already collected in the data store.
- Area exposed to external environment is constant.
- Calculating U-value can allow to improve the insulation of home.
- Forecasting of U value can help with the heat estimation.

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3. Optimise heat consumption

- Experiment is setup in the lab with two radiators, representing living room and bedroom.
- The control strategy is developed based using scheduler of previous work.





Optimise heat consumption



Time Series





Control Strategy



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Cost Comparison



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4. User profile

- Each user is unique, and their consumption as well.
- The same data can be transferred and used by the companies and customer in case of home switch.
- The models would be built for individual customer.
- This would allow model to adapt to customer behaviour change.





User Profiles



Time Series

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User Profiles





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Comparison of temperature

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Conclusions

- Predicting desired temperature based on the individual customer shows high accuracy.
- Heat prediction would improve due to micro-level prediction approach.
- The novel approach of calculating U-value.
- Control strategy tested in lab environment, could be used to optimise the heat consumption at customer level.
- The customer profiles can be built to improve the heat prediction and adhere to the customers behaviour.
- Overall, Human centric approach is quiet novel.





Thank you for Listening



