Modelling real world energy savings in UK policy appraisal

Challenges and potential approaches

15 June, 2022

Department for Business, Energy & Industrial Strategy

Introduction

This presentation covers

- The difference between theoretical and real world energy demand/savings and how this might arise
- Our current approach to estimating real world energy savings and issues with it
- Options for improving our current approach to estimating real world energy savings

If time…

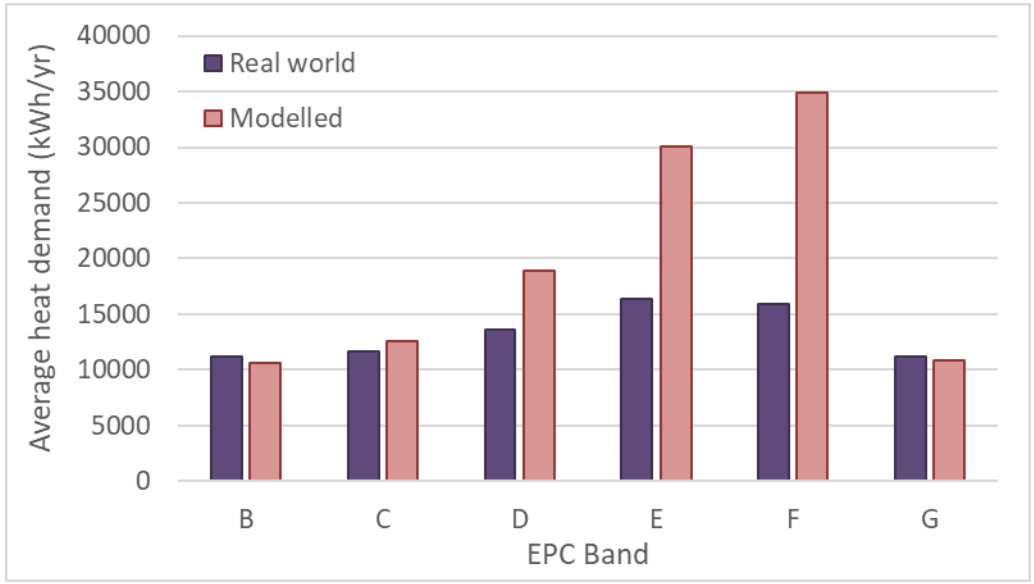
- Further details on how one of the options might work in practice

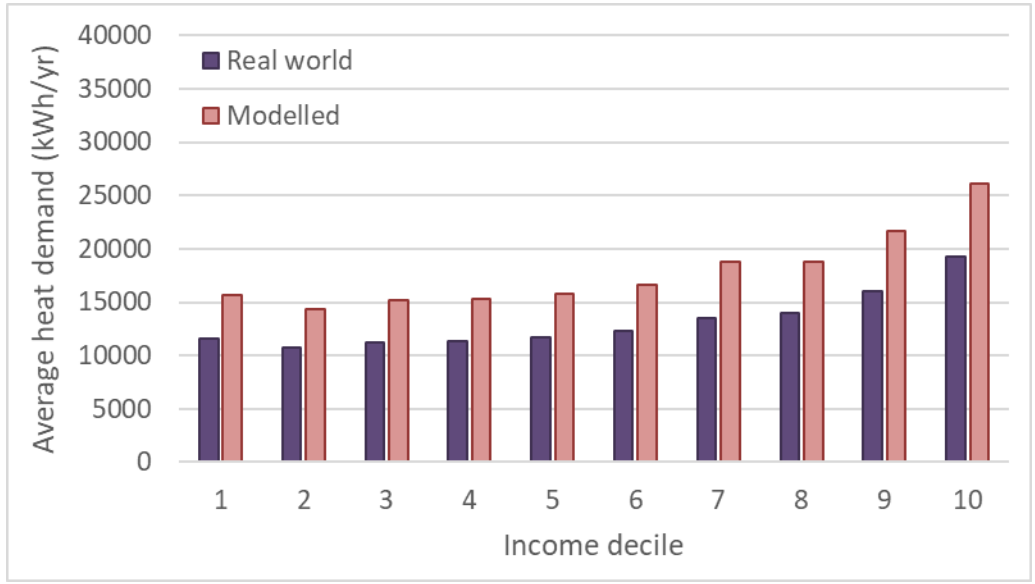
Theoretical vs real world energy demand/savings

My definitions

- Theoretical demand – energy demand from an energy model with standard occupancy and heating pattern assumptions.
- Real world demand – either measured demand, or from a model that accounts for the actual behaviour of the occupant.

In the UK there are very big differences between theoretical and real world energy demand



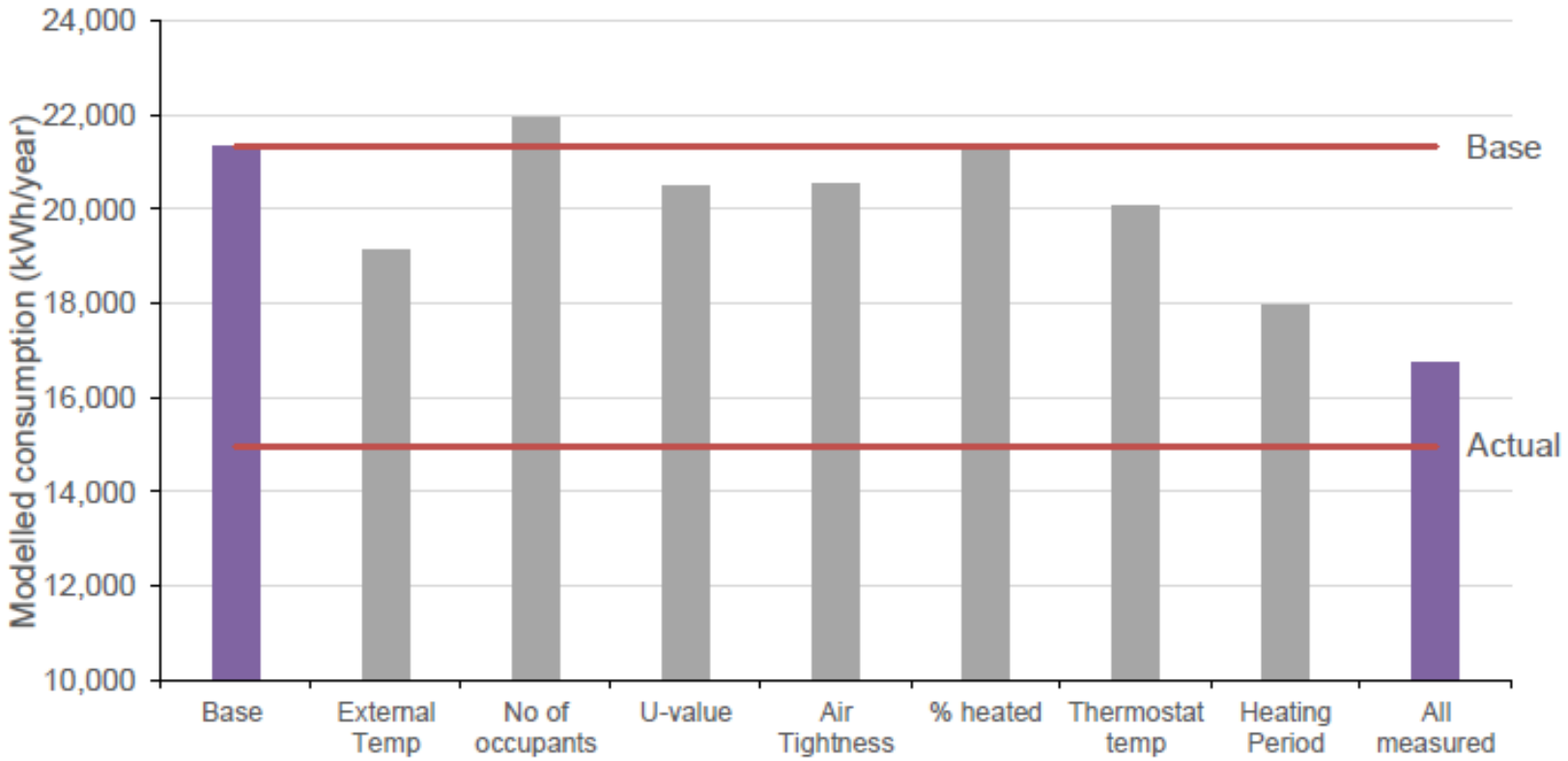


Both theoretical and real world estimates of energy demand and savings have their uses

- Theoretical demand/savings: comparing the performance of different technologies or houses.
- Real world: assessing the likely impact of a policy.

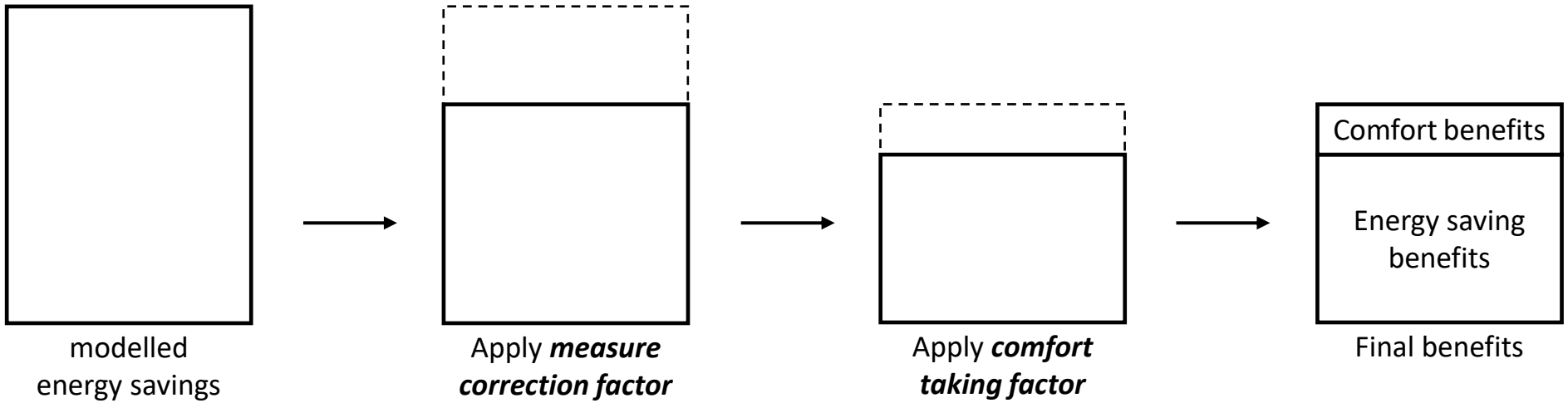
Why a difference between theoretical and real world energy demand?

Changes to a few key model assumptions can close much of the gap between theoretical and real world energy demand.



Our current approach to estimating real world energy savings

We apply 2 correction factors to modelled energy savings to convert them into real world savings



Measure correction factor: accounts for lower real world demand and worse real world measure performance
Comfort taking factor: accounts for increase in demand when energy efficiency is improved

This methodology was adequate when it was developed, however:

- There is only one measure correction factor for each measure and only one comfort taking factor for all measures/houses. This does not take into account differences between theoretical and real world savings for different measures in different houses with different households living in them.
- No correction to demand, making it difficult to estimate % savings or the impact of switching heating fuels.

The data and models we are working with

Standard Assessment Procedure (SAP)

- An energy model used to calculate energy consumption in houses.
- Used in Energy Performance Certificates (EPCs).

English Housing Survey (EHS), and Energy Follow up Survey (EFUS)

- The EHS is an annual survey of thousands of households, covering information about the house and the household.
- Allows us to run SAP on a representative sample of the housing stock.
- Every ~10 years, EFUS gathers additional data on a few hundred EHS households, including detailed temperature logging data.

National Buildings Model (NBM)

- A housing stock energy model that runs SAP on the EHS and allows us to vary parameters of each house to simulate the installation of different measures
- Used to model the impact of different policies

National Energy Efficiency Data Framework (NEED)

- Annual electricity and gas meter data for millions of UK houses.
- Linked to other data sources such as EPC data.
- Also includes measure installation data where an efficiency measure has been installed as part of a government scheme.

The combination of detailed survey data and measured consumption data is important. The former is required for using energy models, and the latter is required for calibrating them to real world demand.

Different approaches to improving real world energy estimates

Option 1: Update the current correction factor approach

Create more granular correction factors for different types of house or household.

Pros: Relatively easy to implement.

Cons: Does not help with starting demand.
Correction factors still won't be as granular as our data.

Option 2: Update input temperatures and heating patterns in model

Create a model that predicts internal temperature and use this within SAP to improve accuracy of modelled energy demand.
Measure installation parameters can be fine tuned to better reflect the real world performance of measures.

Pros: Elegant solution with everything incorporated into the energy model.
House/household specific estimate of energy demand and savings.

Cons: Very difficult to predict internal temperature.

Option 3: Apply proportional energy savings from energy model to a more accurate estimate of starting demand

Create a statistical model of starting demand and combine this with proportional theoretical modelled savings to estimate absolute real world savings. Measure installation parameters can be fine tuned to better reflect the real world performance of measures.

Pros: Achievable with the data we have available.
House/household specific estimate of energy demand and savings.

Cons: A bit clunky to implement – requires combining 3 different models.

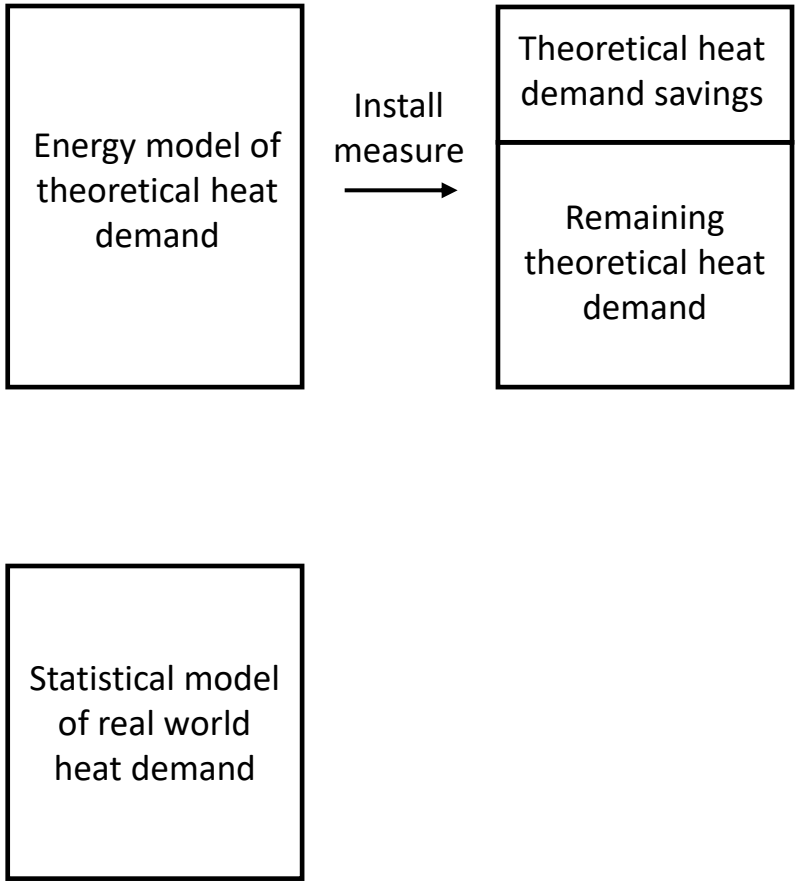
How option 3 might work in practice

Ideally there are 3 elements that need to be corrected when moving from theoretical to real world savings:

1. Starting demand

Statistical model of real world heat demand

How option 3 might work in practice



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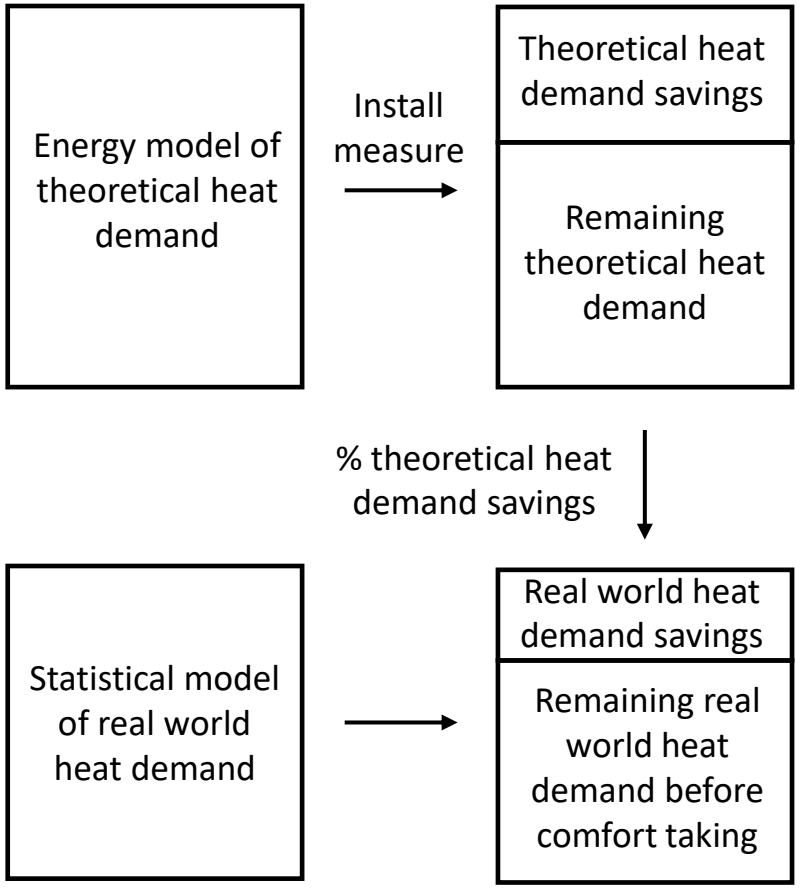
1. Starting demand
2. Measure performance

How option 3 might work in practice



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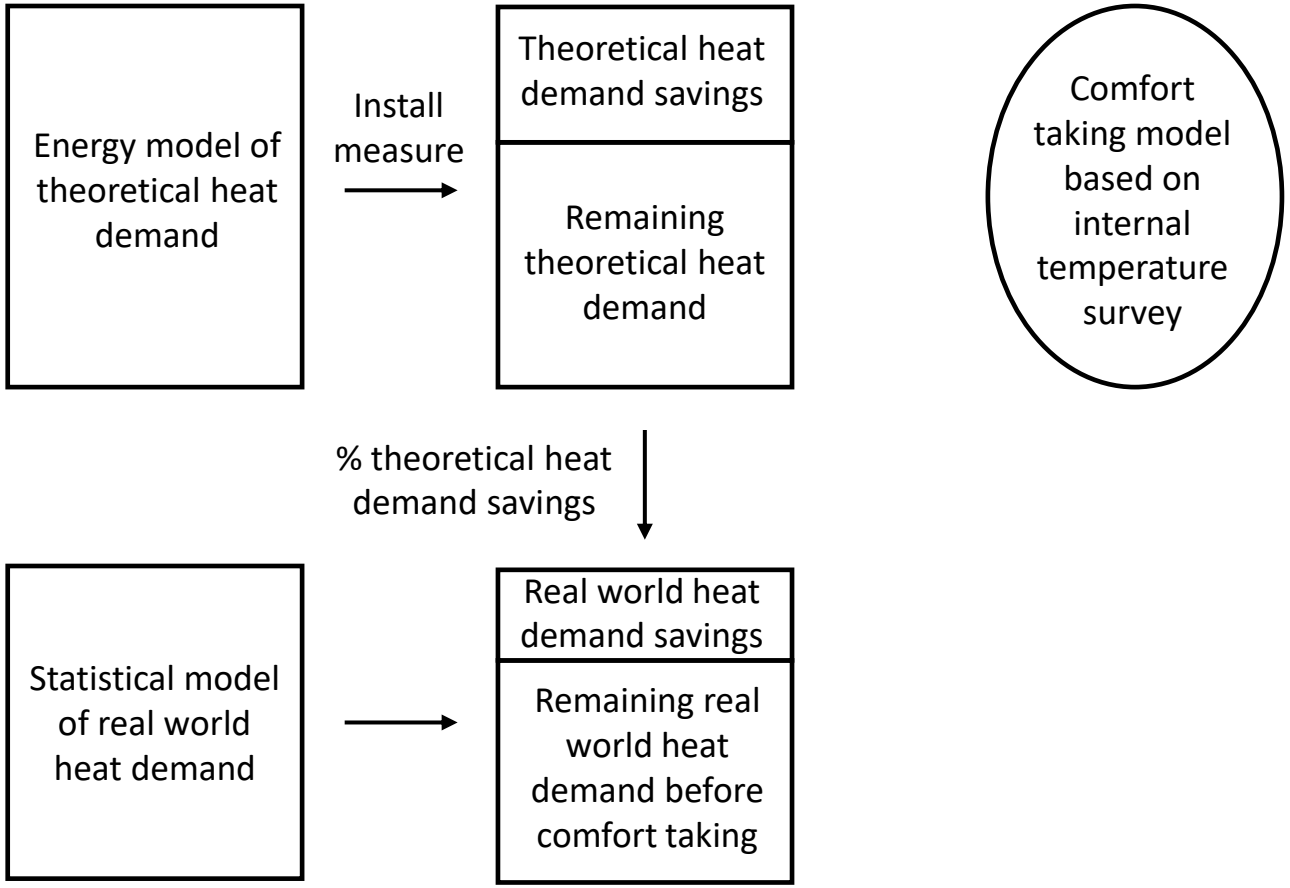

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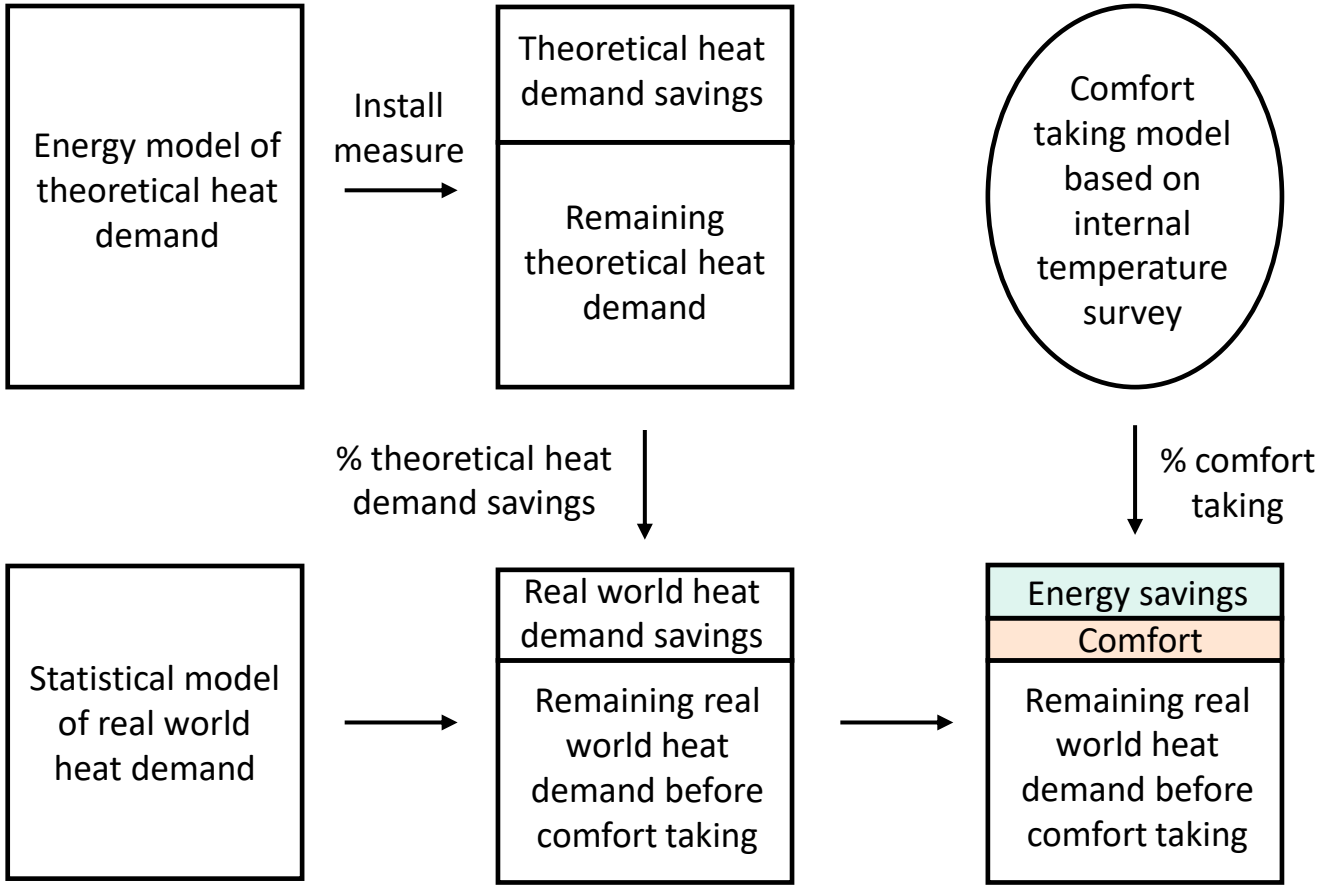

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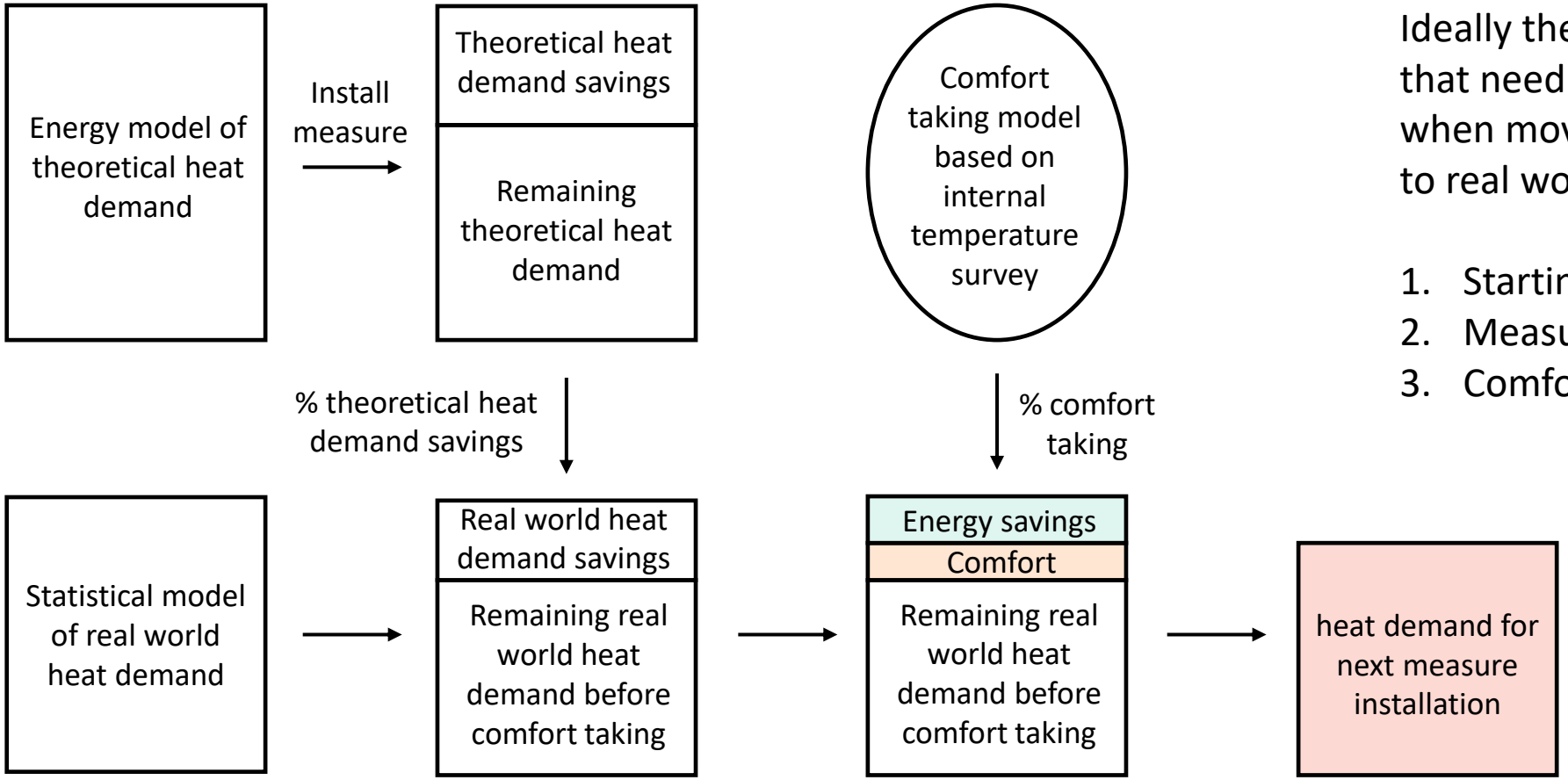

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