

Towards energy efficiency in Dutch social housing

Insights from Energy Performance at the housing stock level

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IEBB
THEMA 2 
DATAGEDREVEN OPTIMALISATIE
VAN RENOVATIECONCEPTEN

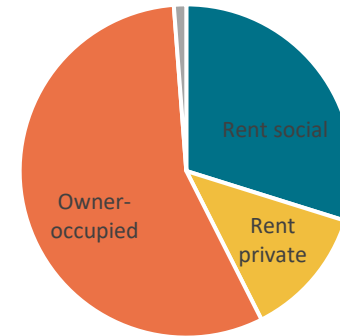
Content

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- Sustainability policies towards 2020
- Current renovation strategies
- Discrepancy theoretical and actual energy savings
- Modelling actual energy savings
- Sustainability policies beyond 2020

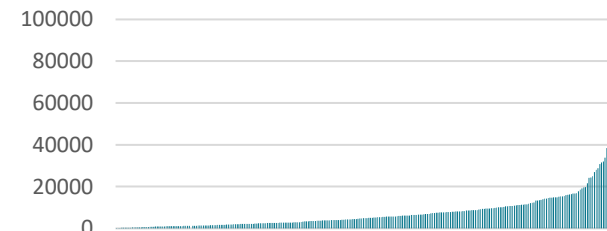
Dutch social housing associations

- Own 30% of the Dutch housing stock
- Highest percentage in Europe
- Organized in 296 housing associations
- Small (<100 dwellings) to large (>77.000 dwellings)
- Have own decision power
- But governed by strong central law
- Both in maximum rent and tenant allocation
- Play an important role in Dutch strategy to enhance a sustainable build environment
- Umbrella organization: Aedes → sponsor project

Distribution
Dutch housing stock



Distribution size of
housing associations



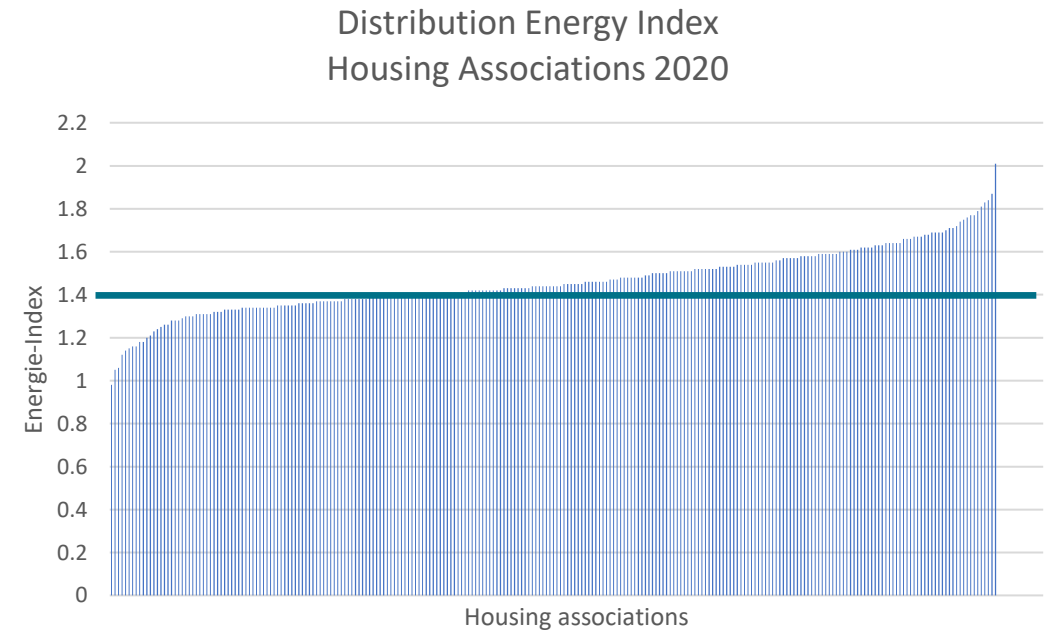
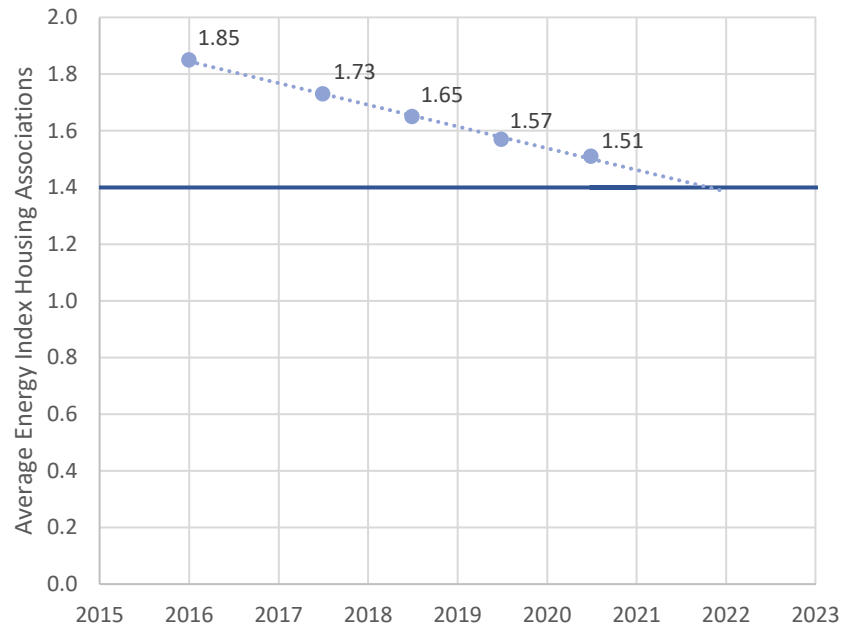
Country	Share social housing
Netherlands	30 %
Denmark	21 %
Norway	20 %
Sweden	19 %
France	17 %
...
Poland	8 %
Italy	4 %
Spain	3 %
Croatia	2 %
Greece	0 %

*The state of housing 2019, Housing Europe

Sustainable development Dutch social housing associations towards 2020

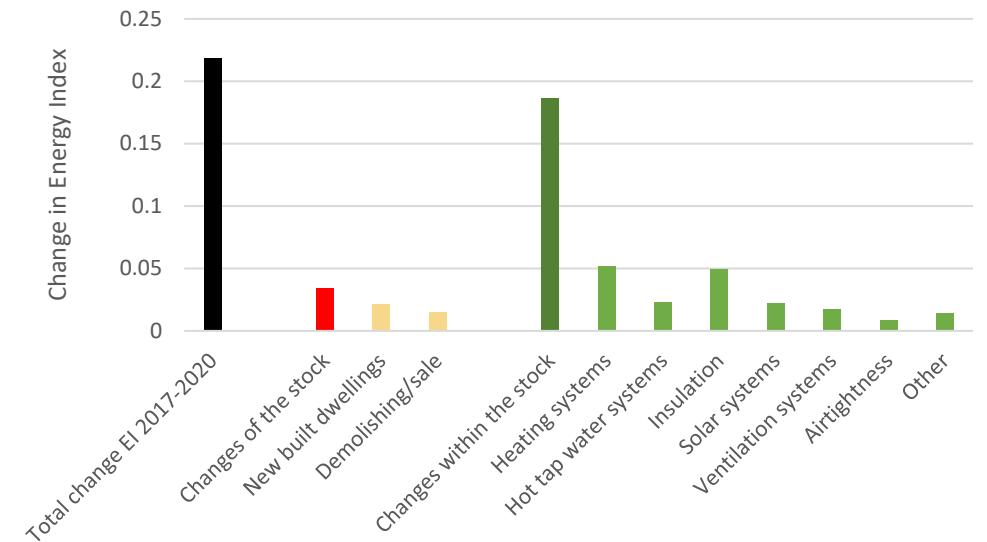
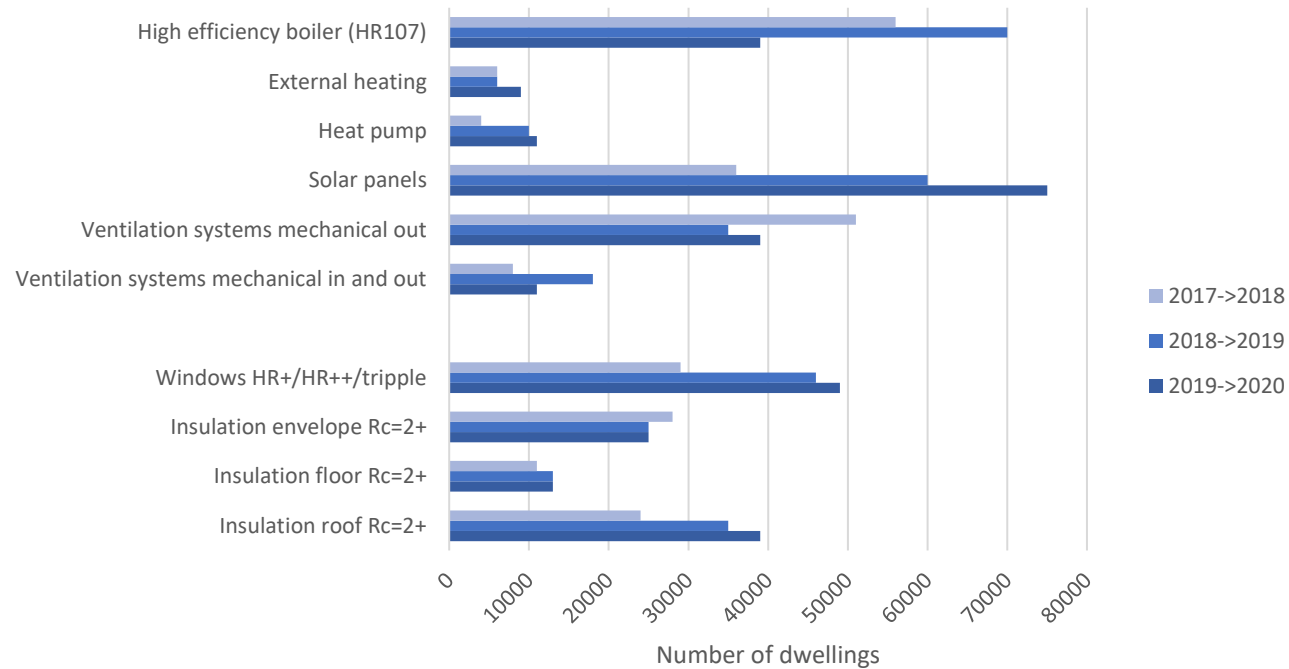
- **Main driver: Improvement of energy labels**
- **Energy Performance of Building Directive**
 - Dutch legislation 2010-2015: NEN 5128
 - Dutch legislation 2015-2020: NEN 7120
 - Dutch legislation 2021+ : NTA 8800
- **Energy label = Energy Index (EI) = Calculation of a theoretical energy consumption of a dwelling given its building characteristics, divided by a building specific budget.**
- **Range Energy label from A++ to G**
- **Climate agreement 2013 → Housing associations have an average energy label B (EI 1.40) in 2020**
- **Monitoring system AEDES/TU DELFT**
 - SHAERE → annual EI + building characteristics of 2.0+ million dwellings
 - Research period 2017-2020

Sustainable development Dutch social housing

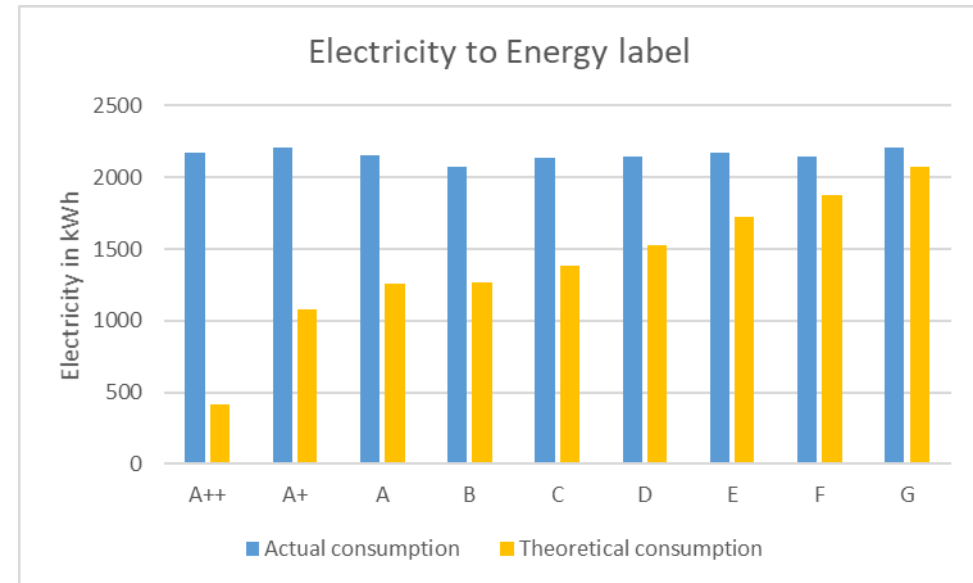
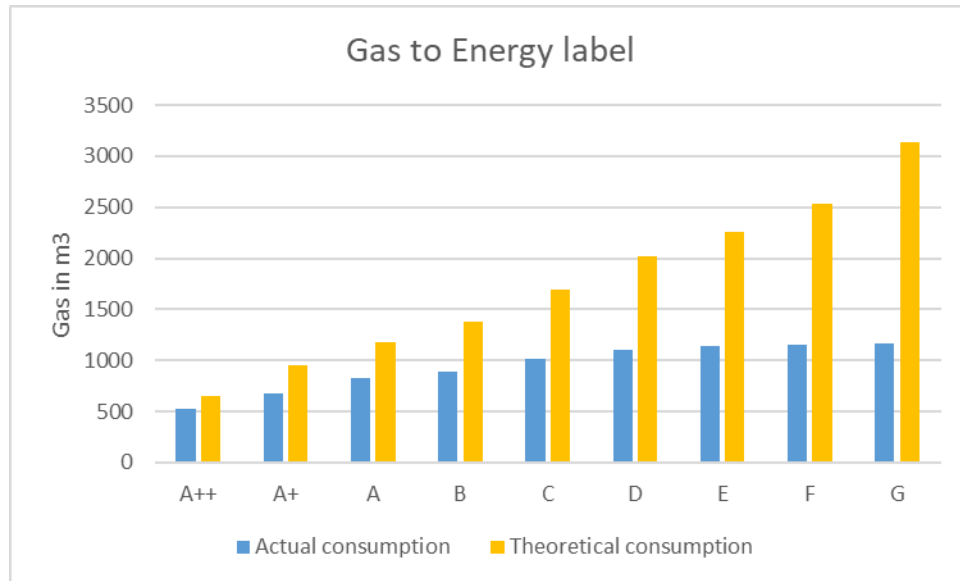


2017-2020 dominant renovation strategies

Measures 2017 -> 2018 -> 2019->2020



Discrepancies theoretical vs actual savings



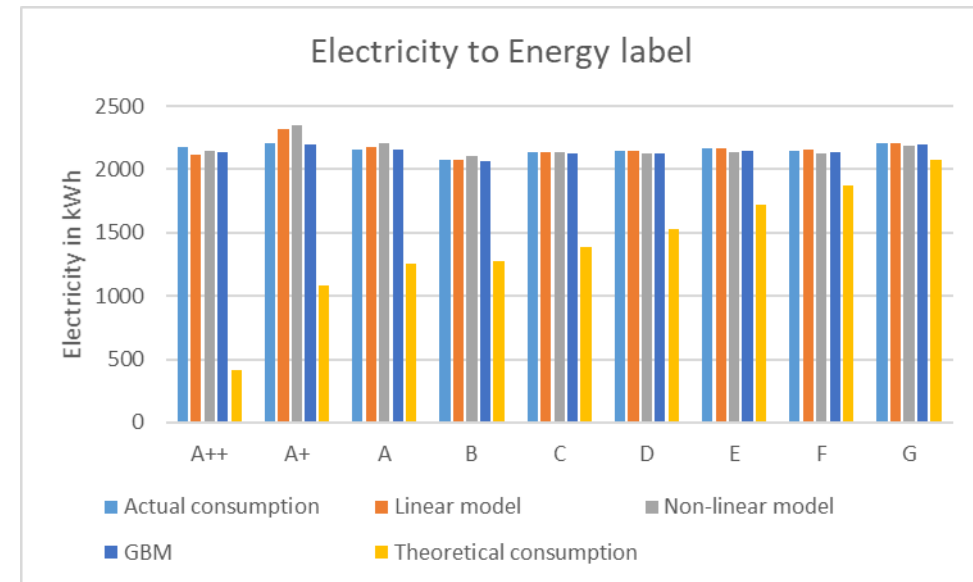
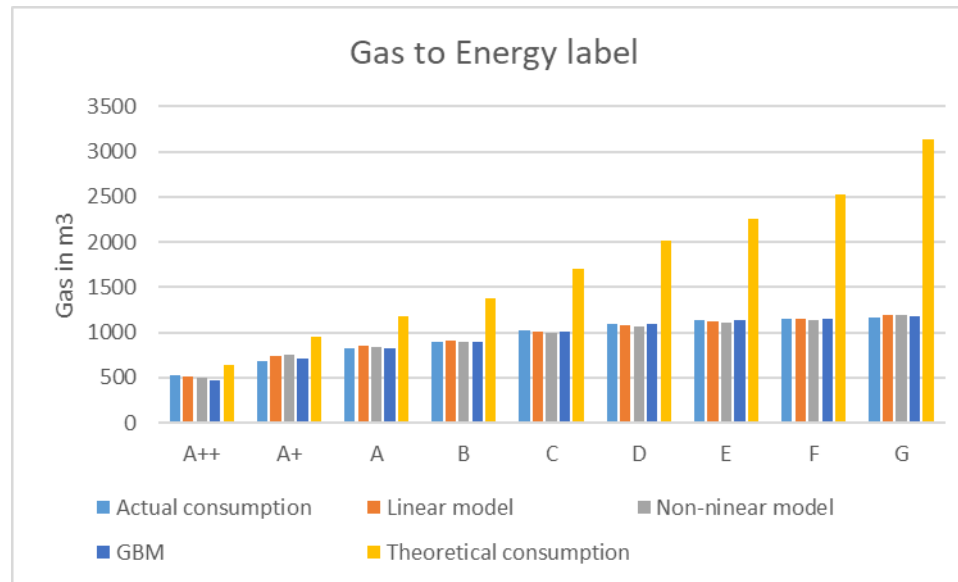
- Prebound effect and rebound effect

Modelling actual consumption

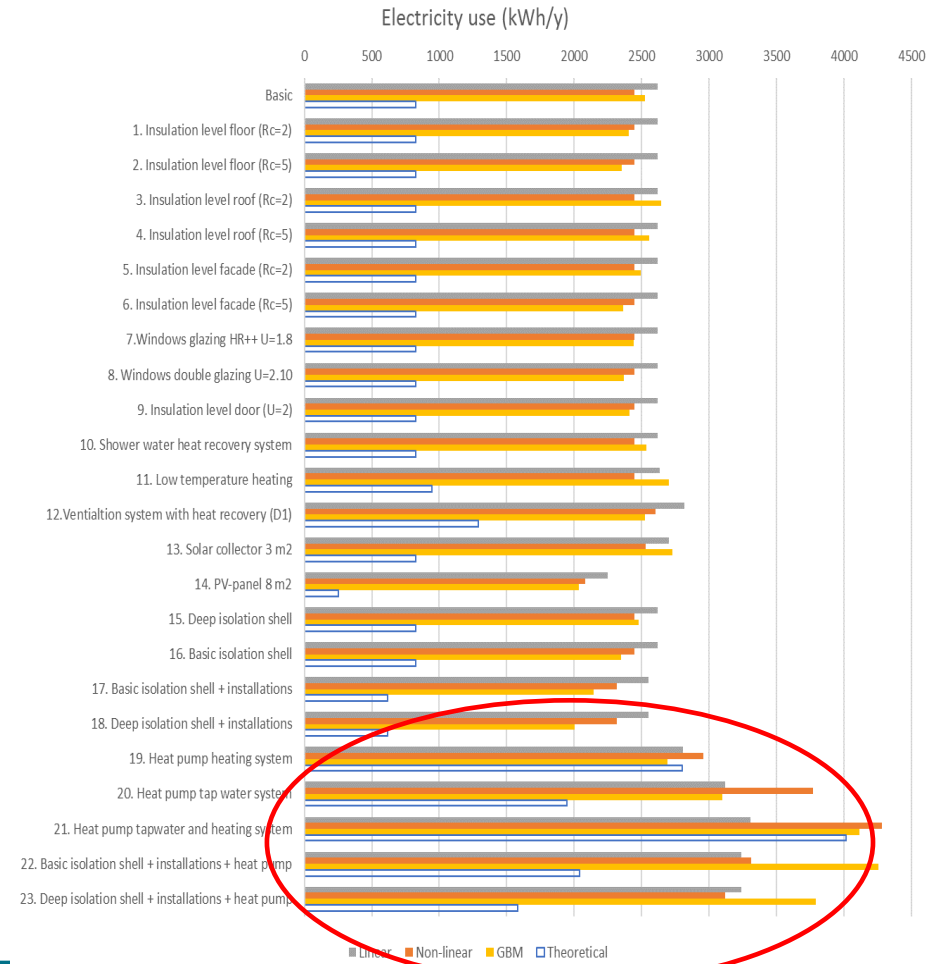
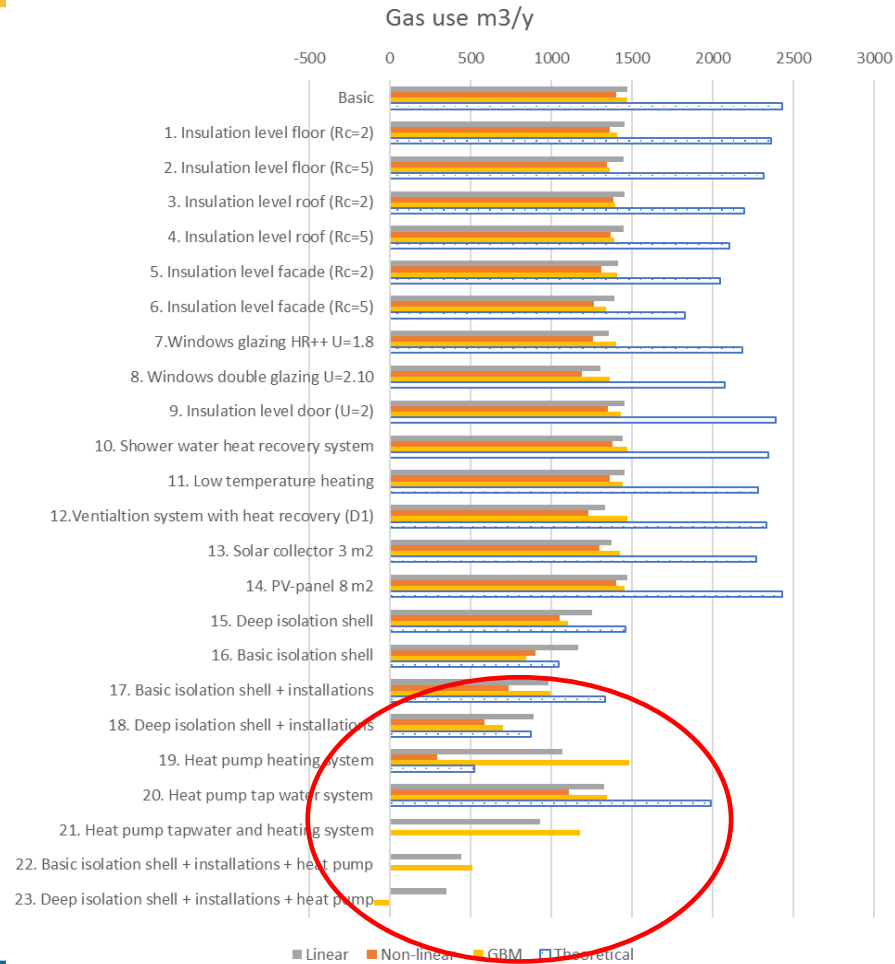
- **SHAERE database 2.0+ million dwellings + building characteristics**
- **Actual energy consumption from Central Bureau of Statistics (anonymized at address level)**
- **Three different modelling techniques: linear regression, non-linear regression, machine learning (GBM).**
- **GOAL: model average actual energy consumption by building characteristics. A change in building characteristic is a renovation.**

- **Challenges:**
 - **A large set of different building characteristics (60 parameters) = different renovation measures**
 - **We need to deal with occupant behavior = Natural spread in actual energy consumption → large set to average mean consumption**
 - **The different modelling techniques have pros and cons**
 - **We need to be aware of conceptual flaws in underlying data. Challenge to validate.**

Preliminary results sector



Preliminary results – case study 23 renovations



Conclusions modelling actual consumption

- All three examined empirical models give more realistic predictions on a sector level.
- However, detailed predictions for all different kinds of renovations give a higher range of uncertainty.
- Especially, for dwellings with future prove systems which are less dominant in the dataset.
- Secondly, some conceptual flaws need to be resolved.

- Preliminary conclusion, the linear model is too simplistic, the non-linear and GBM model are most promising.
- More research is needed.

Sustainability policies beyond 2020

- **Climate agreement 2019 and beyond – Housing associations**
 - **Less focus on energy label (but still present)**
 - Not a new goal formulated in energy label
 - Change in method, energy index becomes primary fossil energy consumption per m²
 - Still obliged to have an energy label per dwelling. Counts in the WWS.
 - **More focus on actual CO₂ reduction.**
 - 49% reduction of CO₂, by total Dutch build environment
 - **Introduction of neighborhood approach**
 - Choice of source of heat per neighborhood.
 - Municipality in the lead. Housing associations follow/adopt.
 - **Introduction of Insulation standard (“Standaard & Streefwaarden”)**
 - Trias energetica -> first lower demand
 - Improve the insulation of dwellings significantly towards 2050.
- **What we want to add: Support tool for housing associations to predict actual effects of renovations**
 - Predict effects on actual energy savings / decrease of CO₂ emissions / decrease of actual energy costs

Questions?
