# Title: Building stock – area of existing, demolished and new buildings

# Description:

# Future demand for heated residential area includes buildings existing in Base Year and buildings built after Base Year:

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# - Housing demand in year t. This is projected by DREAM group.

# - area in Base Year. This comes from DTU Energy Atlas based on BBR dataset.

# - area built between Base year and year t

# - area demolished between Base year and year t

# Future housing demand has been grouped by Region (DKE and DKW), position relative to existing district heating areas (Central, Decentral and Individual) and type of buildings (Single-family and Multi-family buildings).

Birgitte Gersfelt (bge@ens.dk) obtained projections of housing demand () from DREAM group (Danish Rational Economic Agents Model, DREAM, [www.dreammodel.dk](http://www.dreammodel.dk)). They are providing projections of housing demand from 2010 to 2050 in 5 year steps. Buildings are grouped by province, building type, construction period and household size (not used in TIMES), but not by position relative to existing DH areas. For each province and building type share of heated area in Central/Decentral/Individual is found for 2010 and assumed to be constant until 2050.

Division of buildings on Central, Decentral and Individual is based on the DTU Energy Atlas and Energy Producers Count by the Danish Energy Agency. Central and Decentral areas are composed of district heating areas (DH) and Next-to-DH areas. DH areas are supplied by DH, while Next-to-DH areas are sharing a border with them. Central DH areas are usually based in bigger cities, have larger installed capacities, more consumers, higher heat densities and higher efficiencies compared to Decentral DH areas. Individual areas are far away from DH areas and their connection to DH is not modelled.

Annual demolition rates relative to the area existing in 2010. Divided on East and West, Single-family and Multi-family, Central, Decentral and Individual and Before and After 1972. The annual demolition rate of 0.25 % is assumed from the Renovation Strategy, page 16 (<http://www.ens.dk/sites/ens.dk/files/byggeri/Strategi-for-energirenovering-af-bygninger/strategi-for-energirenovering-af-bygninger-web-050514.pdf>). SBi report "LEVETIDER AF BYGNINGSDELE VED VURDERING AF BÆREDYGTIGHED OG TOTALØKONOMI" (<http://www.sbi.dk/byggeteknik/kvalitet/levetider-af-bygningsdele-ved-vurdering-af-baeredygtighed-og-totalokonomi-1/levetider-af-bygningsdele-ved-vurdering-af-baeredygtighed-og-totalokonomi>)estimates demolition rate to be 0.3 %.

Area in the Base Year () is obtained from DTU Energy Atlas based on BBR dataset.

Area of new buildings is calculated as a difference between housing demand and the remaining buildings from Base Year.

# Assumptions:

* The share of buildings belonging to Central, Decentral and Individual areas is assumed to remain constant from 2010 to 2050
* Annual demolition rates are assumed for each time period, East/West, Central/Decentral/Individual, Construction period (Before and After 1972) and type of building (Single-family and Multi-family). Demolition rates are specified relative to areas in 2010. They are specified as variables so can be changed by the user.
* The assumption is that the housing demand is always met and that "non-occupied" area doesn't exist.
* Costs of demolition and construction are not included in the model.

# References:

* DREAM projections are made for the Danish Energy Agency. It is done by DREAM group (Danish Rational Economic Agents Model, DREAM, [www.dreammodel.dk](http://www.dreammodel.dk)). In the report "Modeling Household Formation and Housing Demand in Denmark - The Dynamic Microsimulation Model SMILE the analysis are done until 2040" (<http://www.dreammodel.dk/pdf/HousingDemand2013.pdf>)
* Strategy for energy renovation of buildings, available at <http://www.ens.dk/sites/ens.dk/files/byggeri/Strategi-for-energirenovering-af-bygninger/strategi-for-energirenovering-af-bygninger-web-050514.pdf>)
* SBi report "LEVETIDER AF BYGNINGSDELE VED VURDERING AF BÆREDYGTIGHED OG TOTALØKONOMI" can be used as reference for demolition rates. Available at <http://www.sbi.dk/byggeteknik/kvalitet/levetider-af-bygningsdele-ved-vurdering-af-baeredygtighed-og-totalokonomi-1/levetider-af-bygningsdele-ved-vurdering-af-baeredygtighed-og-totalokonomi>

# Method:

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# - Housing demand in year t. This is projected by DREAM group.

# - area in Base Year. This comes from DTU Energy Atlas based on BBR dataset.

# - area built between Base year and year t

# - area demolished between Base year and year t

# Data sources:

Areas of buildings in Base Year (2010) are divided by position relative to existing district heating areas (Central, Decentral and Individual), region (East and West Denmark), construction period (before and after 1972), province and type of building (Single-family and Multi-family). The source is DTU Energy Atlas based on the BBR dataset.