EXTERNAL RESEARCH STAY AT MIT, USA
CREATING AN URBAN BUILDING ENERGY MODEL FOR A DANISH CITY

During my external stay at MIT (Massachusetts Institute of Technology) from January till June 2017, I am going to create an urban building energy model for one Danish case study that the CITIES project, which I am part of, investigates. Centre for IT–Intelligent Energy System in Cities (CITIES) was launched in January 2014 as a 6-year research centre, which has been financially supported from a range of industrial and academic partners, and the Danish Council for Strategic Research. I am specifically involved in Work Package 3, which investigates Intelligent Energy System Integration. During my external stay, I will work in close collaboration with the groups of Prof. Christoph Reinhart who is an expert in urban modelling and Prof. David Hsu who is an expert in urban design and planning.

The model that I will create should encompass all the information regarding the geometry of the buildings, building fabric and energy systems. The examined building stock will be treated with archetypes based on different features of the buildings (use, construction age etc.) which will be further investigated. These data will be combined with GIS data sets of the city to acquire the building footprints and heights and to visualize the area. The output of this model will be the estimation of citywide hourly energy demand loads down to the individual building level. These loads will be subsequently compared and validated with real data of energy consumption of this city/case-study, which have been previously acquired by smart meters installed in the whole area.

In parallel, the statistical analysis of these data will enable the clustering of the load profiles based on patterns, which will determine the classification of the buildings into archetypes in the urban energy model. The objective of this study is to create a methodology for city modelling that can combine the building energy modelling at urban scale and the statistical analysis of smart meter data that will facilitate the integration of renewables to the building sector. This can subsequently provide solutions to smart grid operators and energy planners about the optimized urban energy modelling and the optimum integration of energy systems in cities. It will also propose a new classification scheme for buildings that will accurately represent the energy load profiles and can replace the old existing classification in the national building databases.