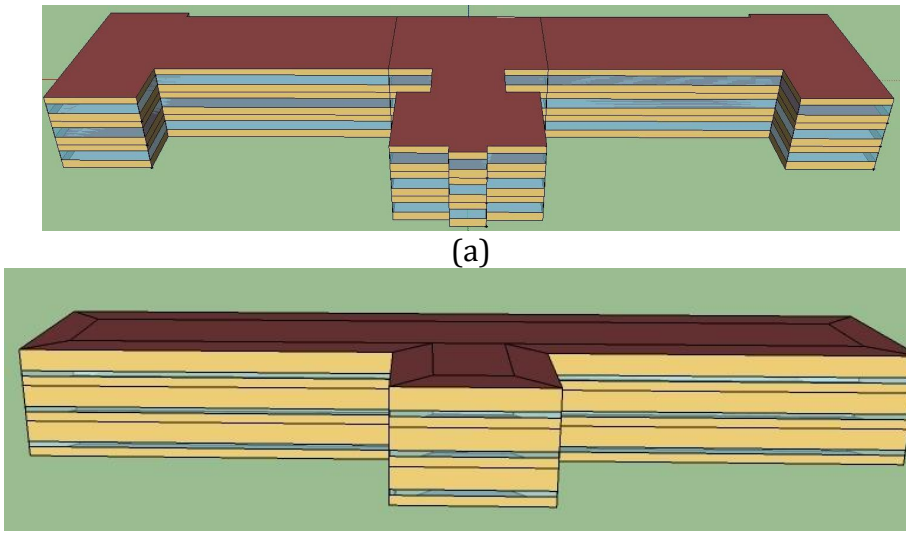
By Penn State (Retrofit Manager)

Case Study 1: Building 101, Philadelphia Navy Yard

In order to validate RMT models, Building 101 is used as one of the case studies. The RMT team used measured data from the installed sensors for Building 101 to determine operational inputs to the energy simulation models. Figure shows two different versions of a Building 101 model that were created directly by the RMT ruby scripts via OpenStudio API. Figure 1 (a) shows a detailed geometry model that takes more than 5 minutes to simulate Building 101 on recent personal computers. A more simplified model was created by using the T-shape method developed in the RMT (Figure 1 (b)). Simplification of building geometry decreases computational time. This simulation takes approximately 2.5 minutes to run on personal computers.

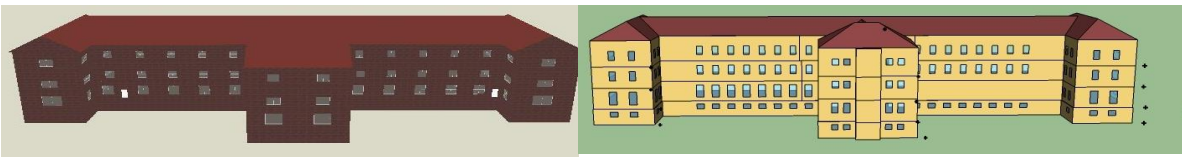


(a)

(b)

Figure 1 Energy simulation models created by the RMT for Building 101; (a) Energy model with detailed geometry and (b) Energy model with simplified geometry

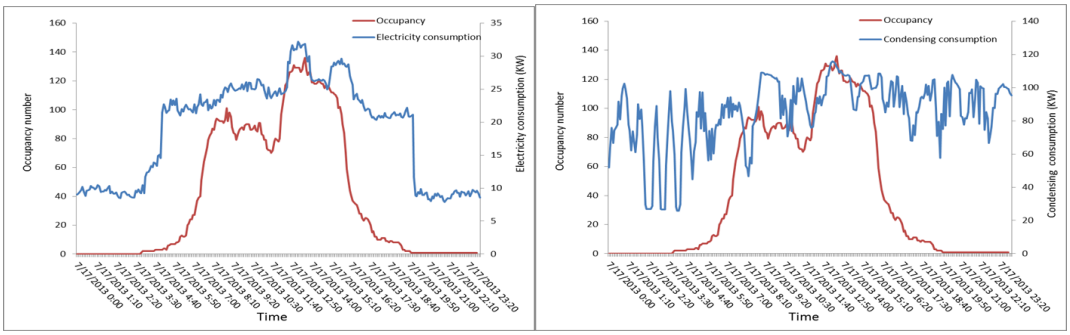
The RMT team created two detailed energy simulation models for Building 101 to demonstrate the required modeling efforts to achieve 15% accuracy for the selected case study. Figure 2 (a) shows the first detailed model created via DesignBuilder, and Figure 2 (b) illustrates the second detailed model developed via OpenStudio/SketchUP.



(a) (b)

Figure 2 Detailed energy simulation models created by (a) Design Builder and (b) OpenStudio/SketchUP

In order to determine the influence of occupant presence on the accuracy of energy simulations, this subtask is examining the correlation of building occupancy with the metered energy consumption data. Figure 1 shows an analysis of one-day data for Building 101. Primary consideration was given to understanding the drivers of energy consumption. The occupancy data showed a significant correlation with the overall amount of electricity used; the occupancy accounted for 78% of variation in electricity consumption for Building 101. Condensing energy use was used as a cooling energy. The result of the regression test shows that there is only a 16% correlation with occupancy. Further analyses are necessary to validate the results.



(a) (b)

Figure 1 Occupancy number versus hours for a day of measurement; (a) correlation between number of occupants and electricity consumption and (b) correlation between number of occupants and condensing unit electricity consumption