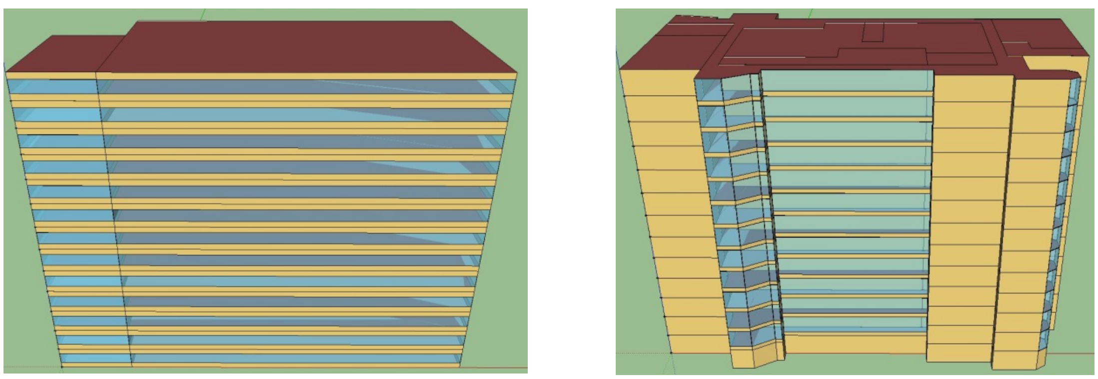
By Penn State (Retrofit Manager)

Case Study 3: Life Sciences Building

This subtask modeled the third case study, a life sciences building, located in Philadelphia. This building is a thirteen-story with 275,000 ft^2 (26,000 m^2) area, and it is part of a university hospital complex. The main function in the building is biomedical research laboratories occupying about 55% of the total floor area while the remaining areas are supporting offices, restrooms, equipment rooms, and circulation spaces. Figure 2.3.1 shows two models for this building to demonstrate RMT capabilities. This building has a complex geometry compared to Building 101 and One Montgomery Plaza buildings. Therefore, there is a need to make simplifications for the building geometry. Figure 2.3.1-a shows the simplified version of the building that is a combination of two rectangle shapes with a fixed window-to-wall ratio while Figure 2.3.1-b illustrates the detailed model. Using the detailed model for the RMT requires using additional features that are not possible with the existing web version of RMT.



(a) (b)

Figure 2.3.1 Screenshots of the energy model for the third case study: (a) simple model and (b) detailed model

During this final project quarter, we have also further examined the previous two case studies of office buildings, Building 101 and One Montgomery Plaza. We have found that re-ordering installation sequence of energy efficiency measures has little effect on net present value and long-term energy-savings, so long as load reduction measures precede equipment replacement, especially for de-centralized, cooling systems. The results suggest that simple-payback ranking of measures may miss substantial energy savings. Other findings are that ventilation and temperature setbacks have significant energy savings, and that cooling load reductions are preferred to heating load reductions in office buildings with setbacks, because heating equipment has less size-dependent replacement cost variation, internal gains are during occupied hours, peak heating load is offset by setbacks, and benefits from heat load reduction, primarily wall insulation, are offset by cooling load increase in shoulder seasons. This suggests that RMT should include load reduction potential for cooling systems, but not install-year variation of measures. RMT should use life-cycle cost instead of simple payback, and prioritize HVAC capacity, replacement dates, replacement cost, and peak load contributions as areas for accuracy refinement. Daylighting and operable window measures are priorities for development, as they offer substantial load reduction opportunities for cooling, and mitigate the counter-productive consequences of added insulation. Larger savings targets will require internal load reduction, major revisions of building enclosure for passive benefits of daylighting ventilation, and controlled solar gain, and changing the HVAC system type.