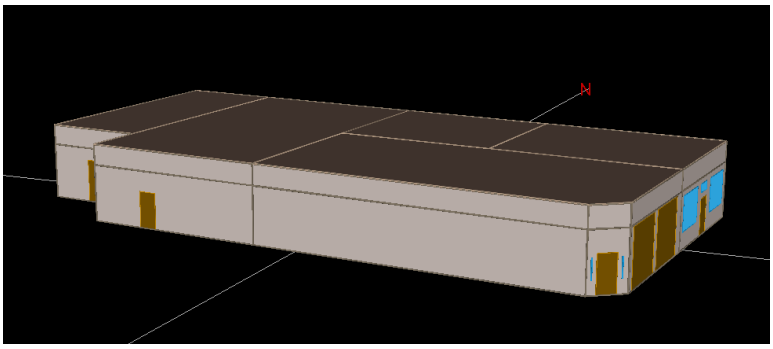
Building Models
EnergyPlus / eQuest

RW Offroad Specialties was looking for ways to supply a better working environment for their employees by the addition of building envelope improvements. The owners asked Sustainable Engineering LLC to perform the energy audit needed to prove technical merit to justify energy savings meeting the United States Department of Agriculture (USDA) Rural Energy for America Program (REAP) Energy Efficiency Grant requirements.

While the grant does not require a building model or simulation, it does require energy savings justification. RW had previously disconnected the natural gas supply and had no existing cooling or heating capability. Without energy load, proving energy bill savings was impossible. An energy model supplied a way to estimate heat transfer from the outside to inside.



The CMU building was constructed prior to 1965 and was a combination of two earlier businesses sharing a common wall. The existing roofing was mixed construction, some bare metal deck, some asphalt shingle, and some metal with elastomeric overcoat. Several new rollup doors were uninsulated, and although the owner had updated some lighting the rest of the building had dated fluorescent lighting. An energy model incorporates the building layer construction to decide heat flow through floor, walls, ceilings, windows, and doors.

Material Layers (ordered from outside to inside):

	Material Name	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft3)	Spec. Heat (Btu/lb-°F)	R-Value (h-ft2-°F/Btu)
1	Steel Siding (AS01)	0.005	26.0000	480.00	0.100	n/a
2	Blt-Up Roof 3/8in (BR01)	0.031	0.0939	70.00	0.350	n/a
3	Bldg Paper Felt (BP01)	n/a	n/a	n/a	n/a	0.060
4	Plywd 5/8in (PW04)	0.052	0.0667	34.00	0.290	n/a
5		n/a				

Lighting, plug loads, and water heating are added. HVAC systems can be incorporated and in this situation were added to the model to supply the client an estimate of HVAC sizing for future upgrades. By using regional weather data, the model supplies heating and cooling peak loads depending on the time of year. With a model of the building complete, the “what-if” opportunities became endless. What if you add wall insulation inside the existing CMU wall, or outside? Adding HVAC systems either before or after the EEI measures were applied showed how much smaller equipment was needed after insulating. We simulated numerous building

improvements and tabulated the energy savings. Cost estimates and impact on the operating business allowed us to recommend the most beneficial upgrades with minimal impact, and the model data was used to show the energy efficiency improvements for the grant application.

For RW offroad specialties, adding a ceiling radiant barrier and 2” rigid foam board reduced peak cooling loads by 43%. While we investigated adding insulation to the walls and floor, the energy reduction from those retrofits never provides a realistic payback. We also recommended window films for the east facing showroom that became overheated on summer mornings. Insulating the metal rollup doors reduced the radiant heating, especially on the southern doors. While these doors and window improvements were a much smaller contribution, the simple payback was fast. With these three improvements the summer cooling peak was reduced nearly 50% and winter heating reduced by 34%, all providing justification for a successful REAP Grant application.