

### 2018 Building Performing Analysis Conference and SimBuild

Building Type: Museum  
(including retail space and full service restaurant)

Total Floor Area: 60,000 m<sup>2</sup>

Location: Denver, Colorado

#### Total Energy Usage

**227** MWh

#### Site EUI

**0.041** kWh/m<sup>2</sup>

#### Annual Water Usage

**0.000** m<sup>3</sup>

#### Annual Electricity Cost

**0.868** \$/m<sup>2</sup>

#### Annual Water Costs

**0.000** \$/m<sup>3</sup>

#### Total Annual Costs

**4840** \$/yr

#### CPSF

**0.081** \$/sf

#### Total Energy Generation

**244** MWh

#### Net Zero Energy

**-17** MWh

#### Carbon Equivalent

**-0.731** Tons, CO<sub>2</sub>

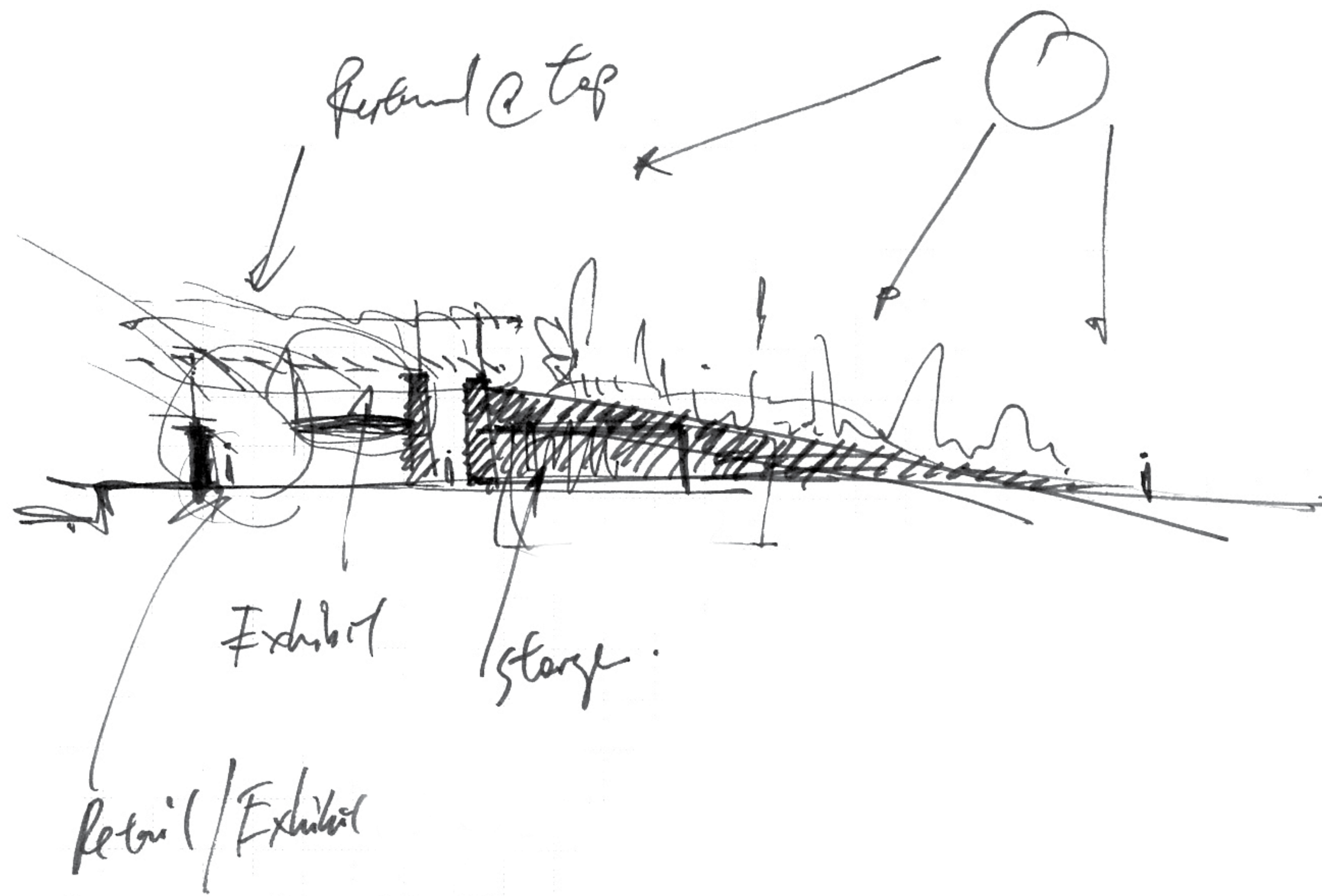
#### Team

Team Captain/EMS  
Cory Rosa EMS  
Josh Gibbins

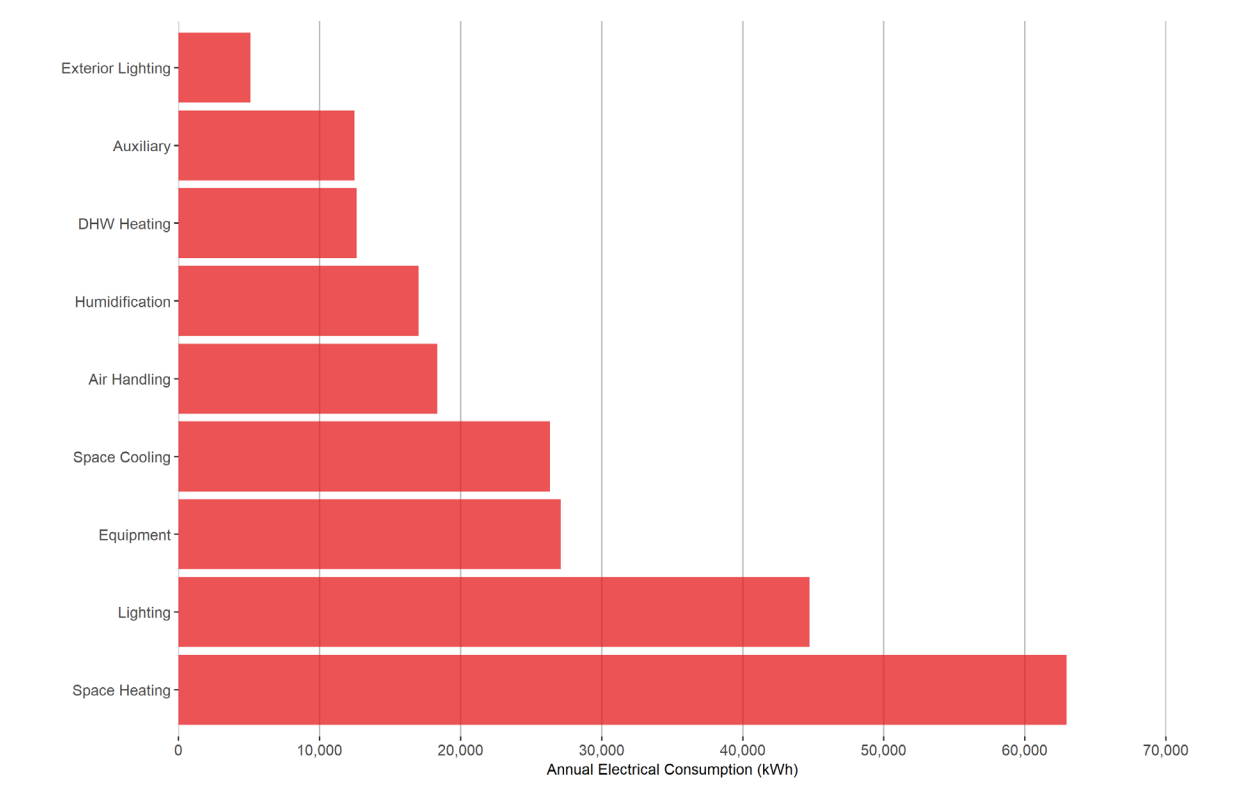
Architecture  
Elena Wiersma Architecture  
Benjamin Gregory

Architecture  
Maria Melo Architecture  
Qinyu Lu

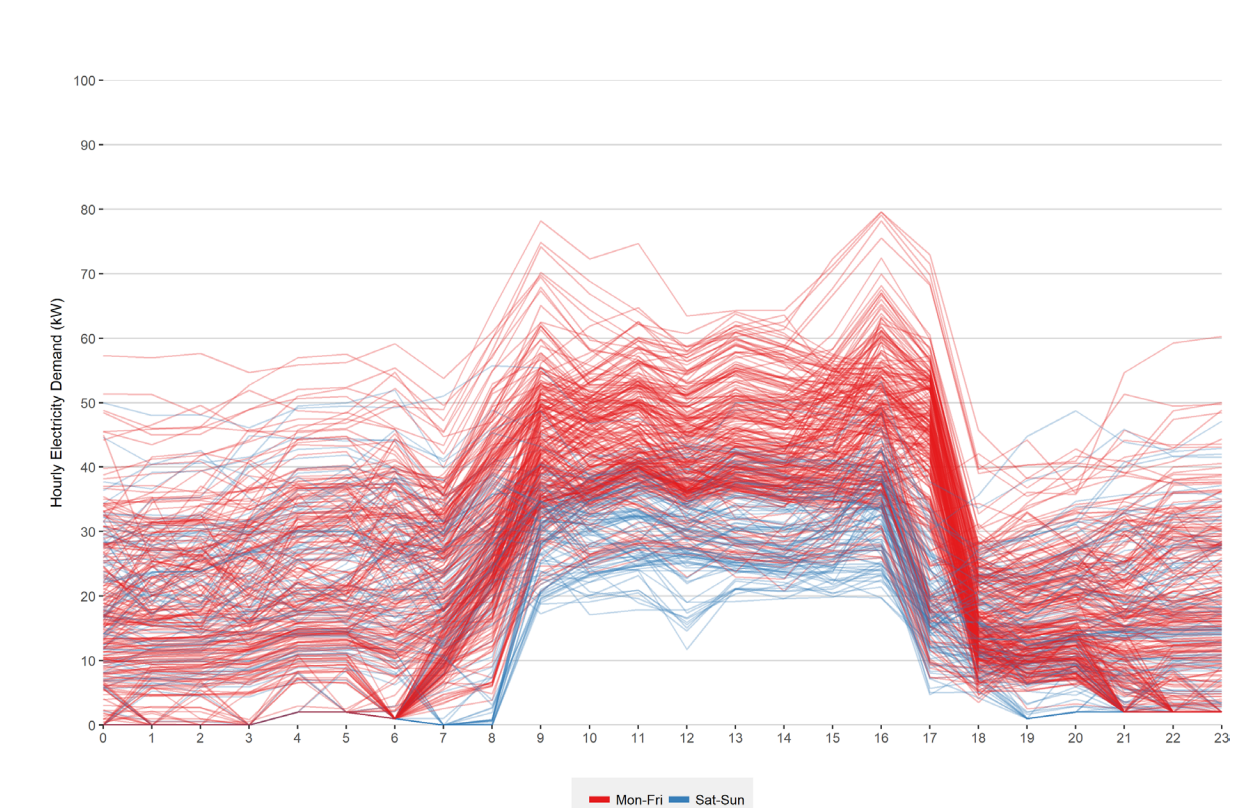
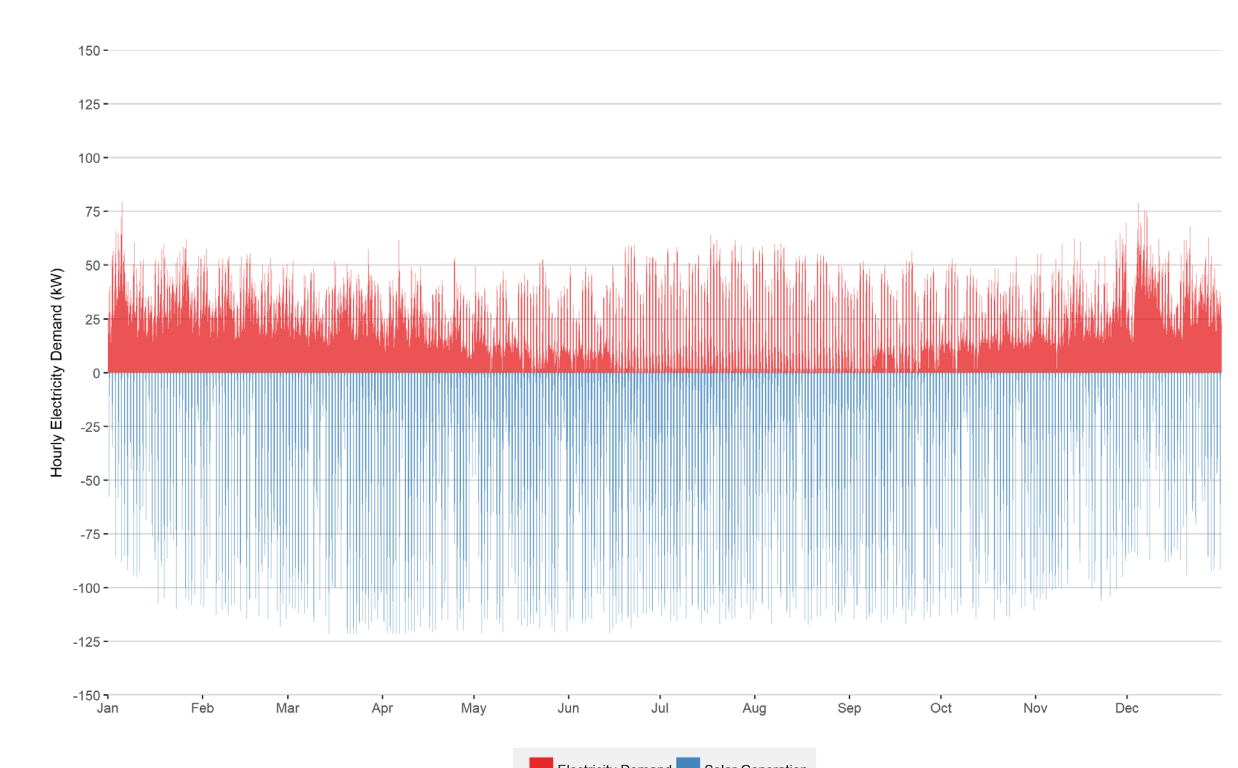
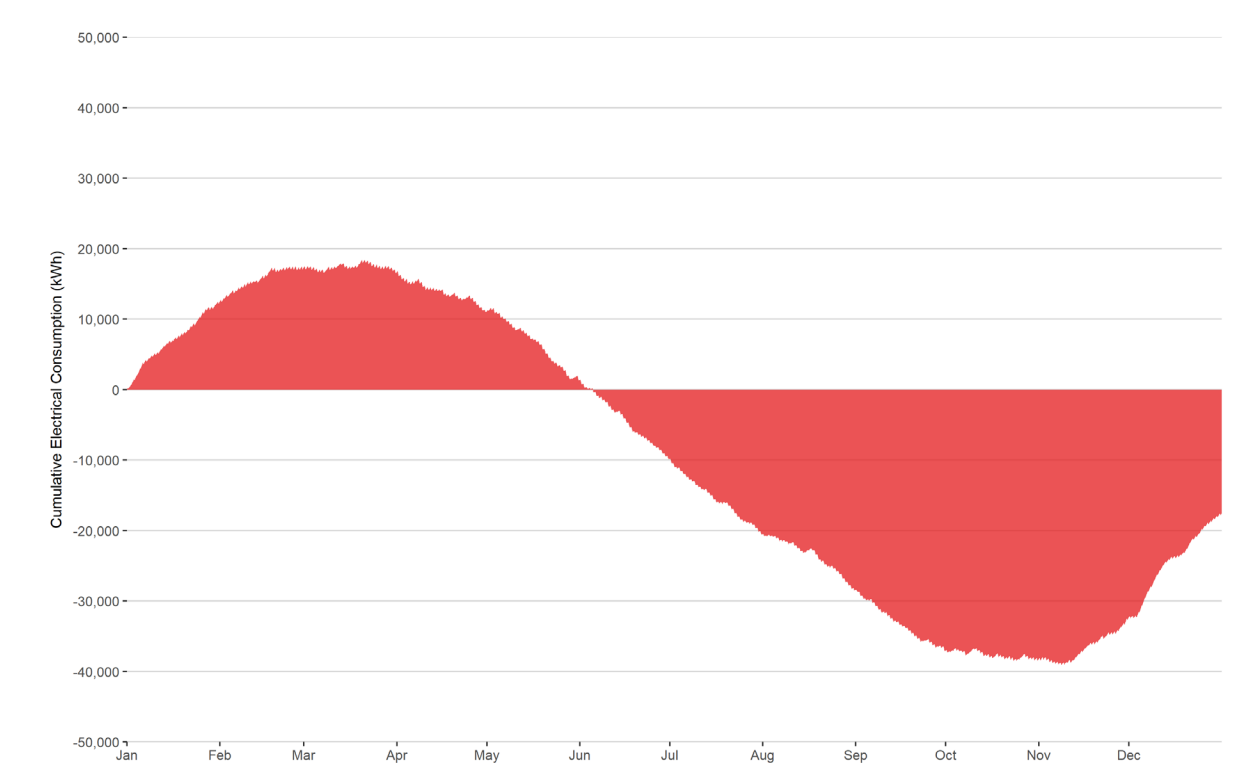
Coach  
Patrick Darby



Key Plan



Section sketch



#### Model Description

- Green field: a naturalised landscape produces oxygen, insulates the building, and supports a flock of sheep.
- Solar park: the parking lot solar energy system powers the building; the shade reduces heat island effect.
- Light done right: diffuse sunlight permeates the building, mimicking circadian lighting rhythms.
- Precision comfort: the state-of-the art HVAC system is precise and efficient, keeping indoor air fresh and comfortable year-round.

#### Energy Savings Strategies

- Site: chosen for its proximity to Sloan Lake; the surrounding water table can reliably be tapped for use in the geothermal system.
- Embedding in earth: the building is partially embedded in the earth to reduce thermal loads.
- Thermal envelope: air tight and insulated with wool, which requires minimal processing and is renewable.
- Daylighting: offsets lighting electricity consumption and is optimized considering its thermal impact.
- Ventilation: favouring natural ventilation reduces fan electricity; demand controlled ventilation reduces fan energy and outside air conditioning requirements.
- Heating and cooling: a variable refrigerant flow (VRF) system provides all heating and cooling; this reduces thermal transport and air handling electricity consumption.
- Geoexchange: the VRF system's thermal source is the ground; the avoids the need to generate heat; instead, heat is transported from one location to another.



Vignette looking west