SB 2030 As-Designed Training

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WILLDAN

Agenda

01 About SB 2030

02 Navigating SB 2030

03 Creating SB 2030 Models

- Building
- HVAC
- Design
- Results

MINNESOTA B3

BUILDINGS, BENCHMARKS & BEYOND

Tools and Programs for Sustainable Buildings in Minnesota

Administered by:

COMMERCE DEPARTMENT

DEPARTMENT OF ADMINISTRATION

B3 Tools and Programs

For new buildings or renovations to meet sustainability goals for site, water, energy, indoor environment, materials and waste

Meet energy use and carbon emissions goals

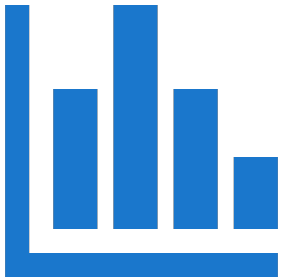
Track and compare energy use on existing buildings

Minimize energy use during building operations
This program can be applied to any existing building

Determine occupants' perceptions of the building indoor environmental quality
The POE survey is required for B3 buildings

Three Types of Code Compliance

Prescriptive



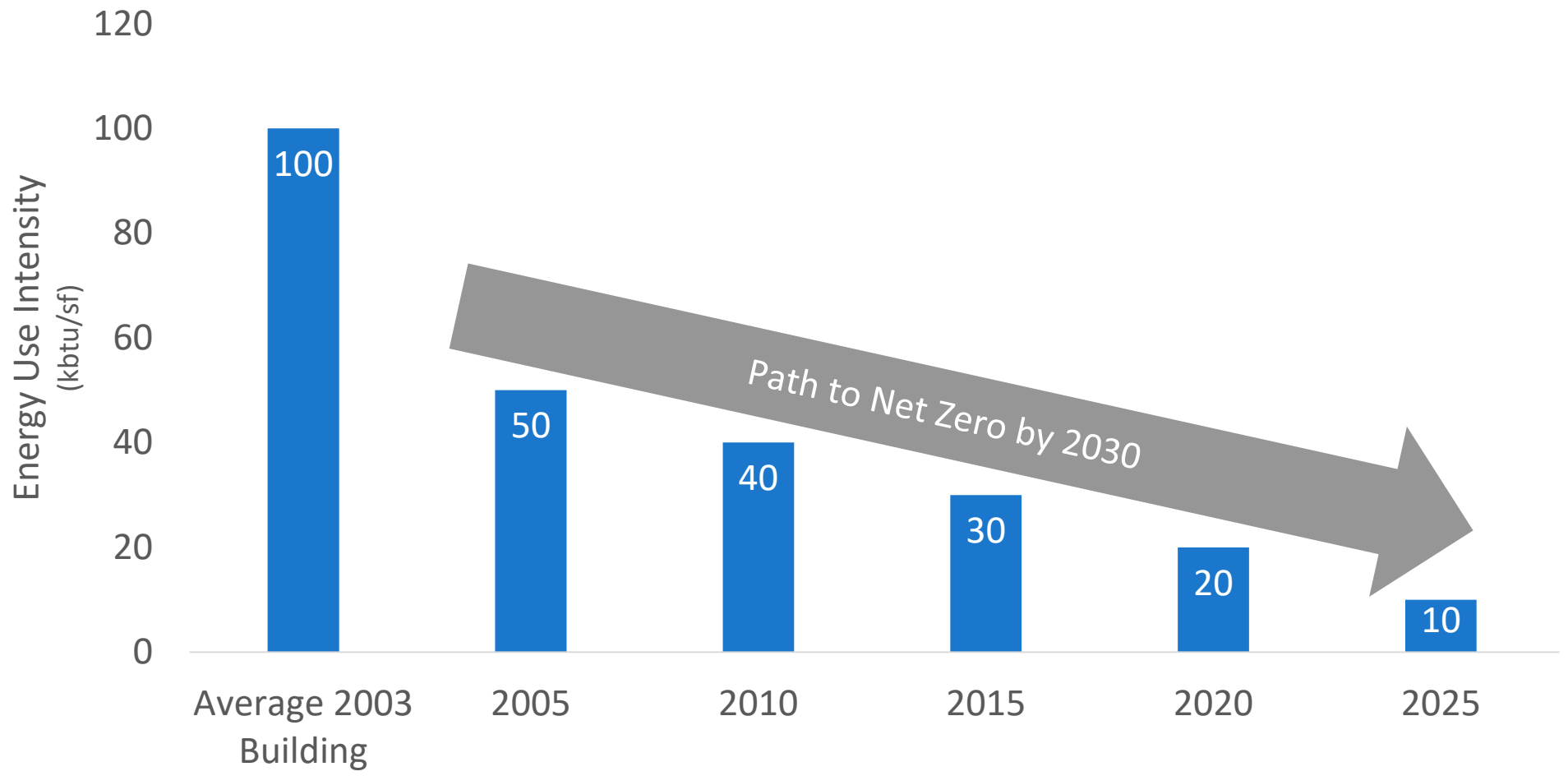
Performance

Outcome

Minnesota's SB 2030

- Outcome-based energy goal for State-bonded buildings
- Sets energy use and carbon emissions as a % reduction from typical building of that type
- Requires 10 years of metered performance
- 15-year payback maximum

Energy Use Goal Tapering to Zero in 2030



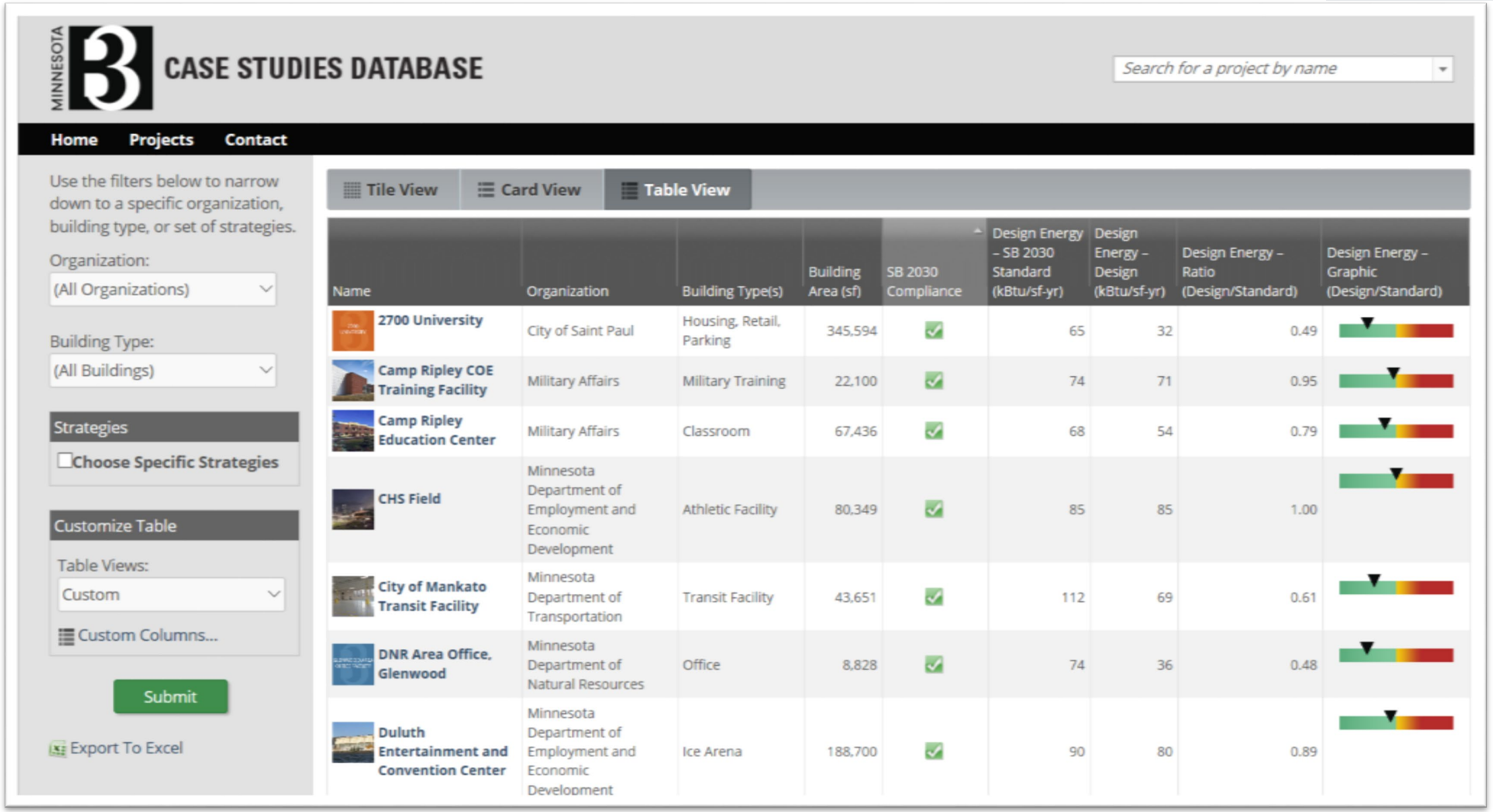
Moving to 80% Better in 2020

For projects stating schematic design or later on or after January 1, 2020

- Proposed Approach
  - Evaluation of compliance based both on carbon and on site energy consumption
  - Modify the requirements around on-site renewable energy evaluation
  - Allow a campus-based approach to renewable energy development
  - Eliminate the relaxed standard for renovation projects
  - Exclude EV charging and process loads
  - Characterize biomass derived using carbon-neutral methods

- Future Considerations
  - Time-of-day CO_2 emissions factors

Update EUI During Operations



MINNESOTA B3 CASE STUDIES DATABASE

Search for a project by name

Home | Projects | Contact

Use the filters below to narrow down to a specific organization, building type, or set of strategies.

Organization: (All Organizations)

Building Type: (All Buildings)

Strategies

Choose Specific Strategies

Customize Table

Table Views: Custom

Custom Columns...

Submit

Export To Excel

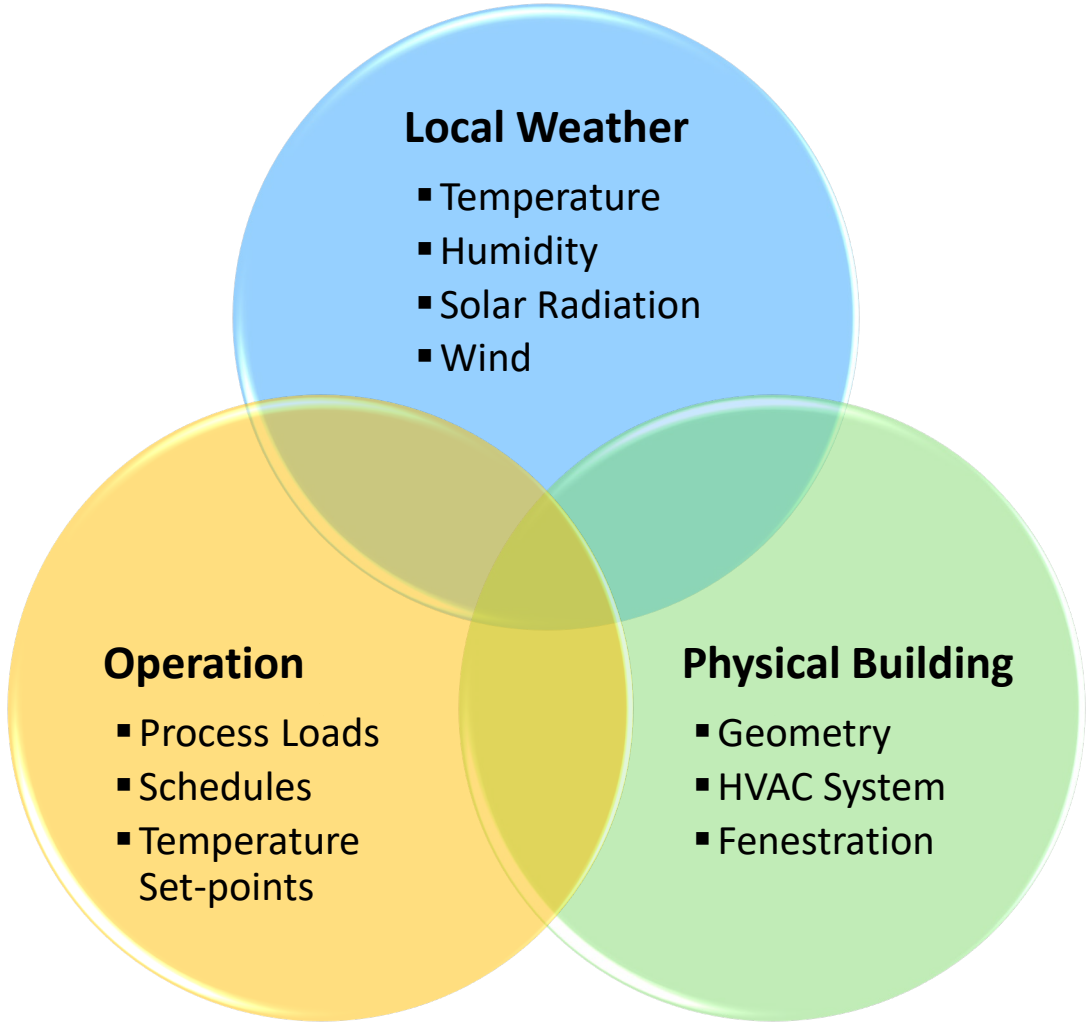
Tile View | Card View | Table View

Name	Organization	Building Type(s)	Building Area (sf)	SB 2030 Compliance	Design Energy – SB 2030 Standard (kBtu/sf-yr)	Design Energy – Design (kBtu/sf-yr)	Design Energy – Ratio (Design/Standard)	Design Energy – Graphic (Design/Standard)
2700 University	City of Saint Paul	Housing, Retail, Parking	345,594	✓	65	32	0.49	
Camp Ripley COE Training Facility	Military Affairs	Military Training	22,100	✓	74	71	0.95	
Camp Ripley Education Center	Military Affairs	Classroom	67,436	✓	68	54	0.79	
CHS Field	Minnesota Department of Employment and Economic Development	Athletic Facility	80,349	✓	85	85	1.00	
City of Mankato Transit Facility	Minnesota Department of Transportation	Transit Facility	43,651	✓	112	69	0.61	
DNR Area Office, Glenwood	Minnesota Department of Natural Resources	Office	8,828	✓	74	36	0.48	
Duluth Entertainment and Convention Center	Minnesota Department of Employment and Economic Development	Ice Arena	188,700	✓	90	80	0.89	

SB 2030 Tool

Energy Models and Simulations

- SB 2030 Tool uses DOE-2, a simulation engine developed by the Department of Energy
- DOE-2 performs an hour-by-hour analysis of the building accounting for
  - Physical building
  - Operation
  - Local weather



Energy Models and Simulations

- Each hour of the year, DOE-2 accounts for the following things:
  - Outdoor weather conditions
  - Sun position
  - Number of people in the building
  - Amount of lighting turned on
  - Infiltration
  - Ventilation requirements
  - Wall/roof insulation levels
  - Window properties
  - HVAC efficiencies and controls
  - And more!

SB 2030 Overview

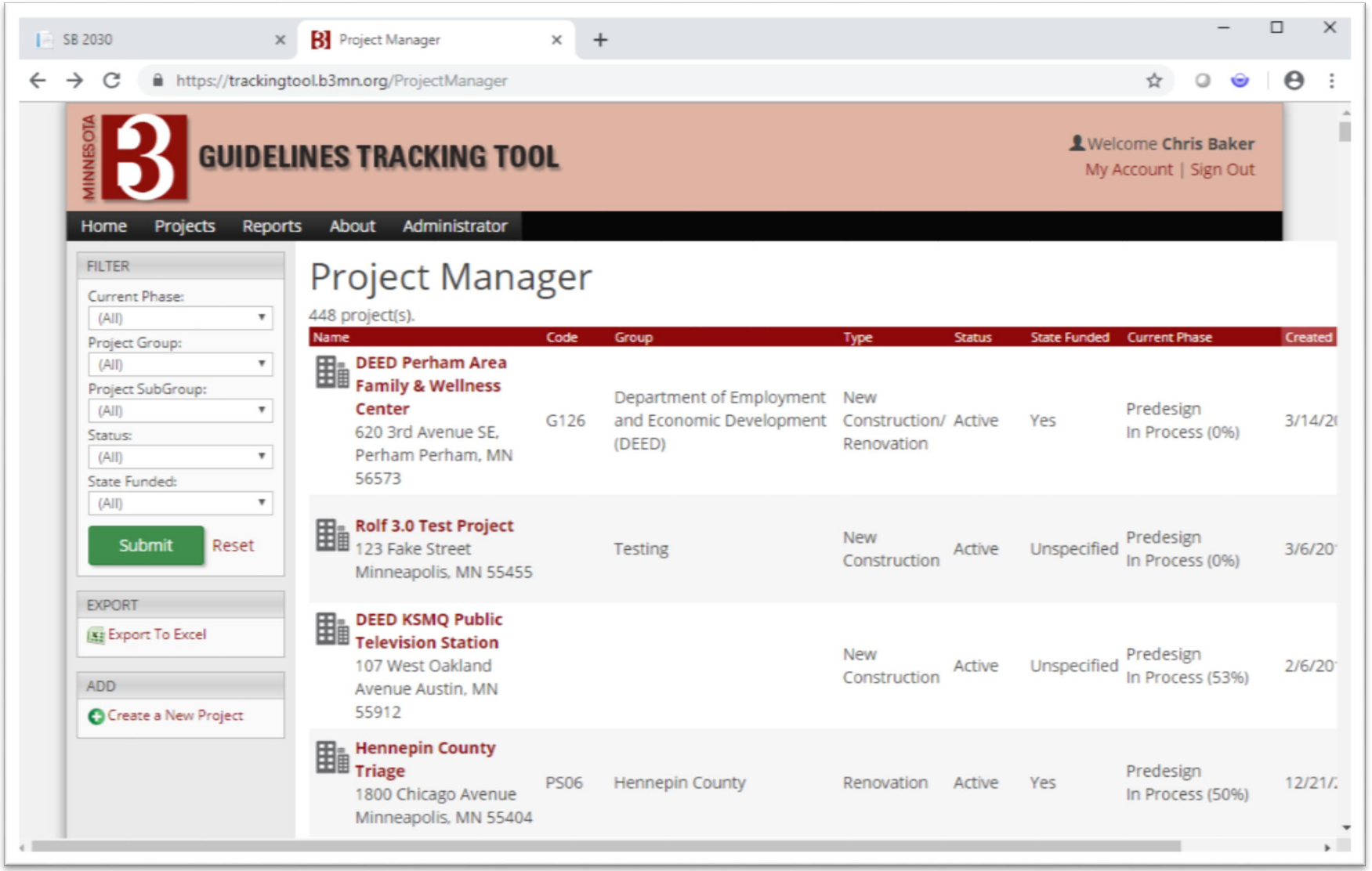
- **Default Building Characteristics**
  - Industry data to set defaults for building and space characteristics
  - Standards such as ASHRAE 90.1, COMNET, ASHRAE Fundamentals, AIA Healthcare Guide, ASHRAE 62.1, and more…
  - Where industry standards lack data, SB 2030 pulls data from nearly 2,500 real buildings

- **Web Based Simulation Tool**
  - HTML5 and AngularJS technologies
    - Compatible with most browsers and devices. IE11, Edge, Chrome, FireFox, Safari
    - No need for iOS or Android apps!
  - Responsive web design automatically responds to window size and screen size
  - Touch-friendly design can be used on laptops or tablets down to 7.8” x 5.3” in size

Navigating SB 2030

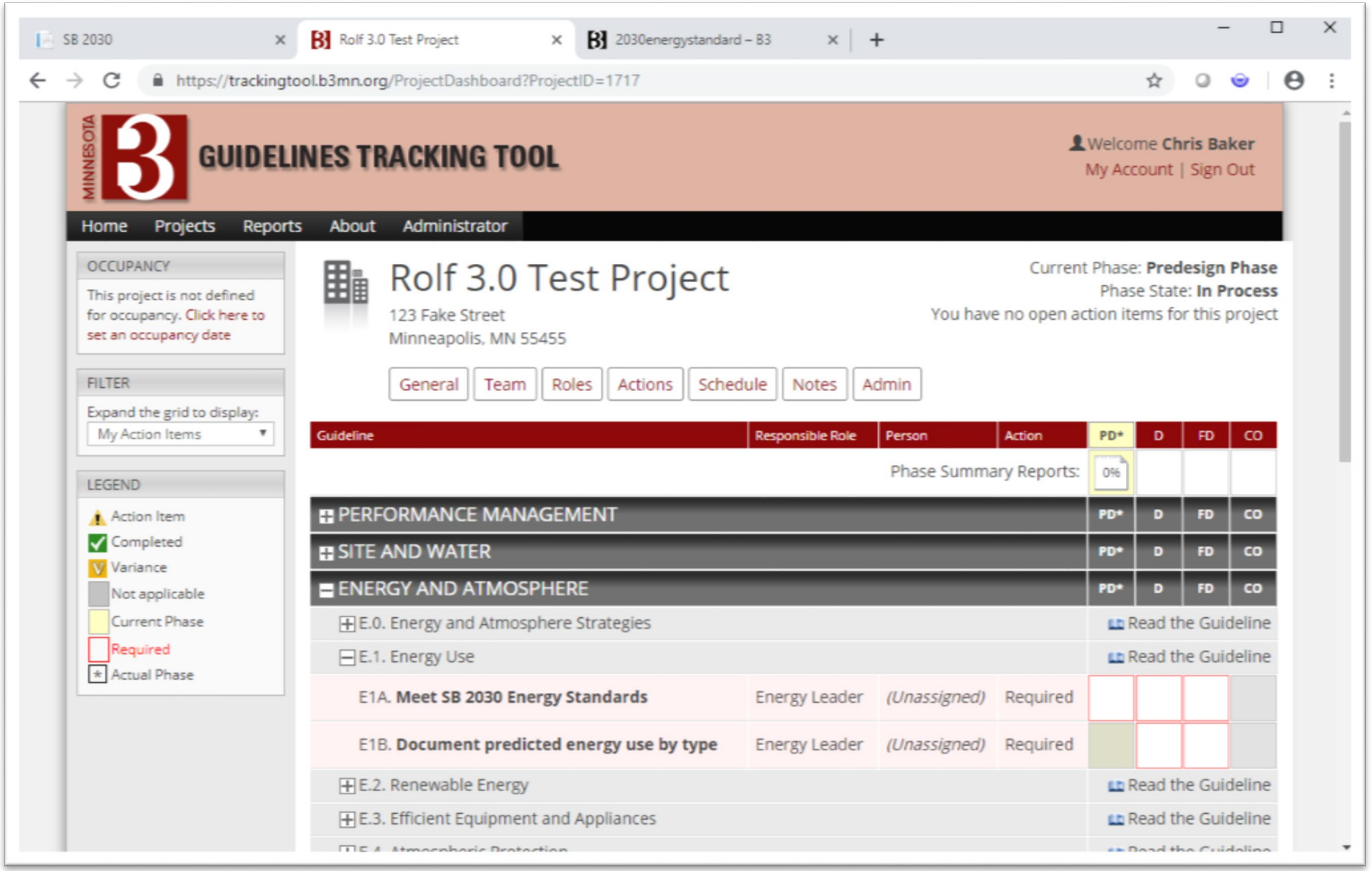
Navigating to SB 2030 Tool

- Access full version of tool from B3 Guidelines Tracking Tool
- Goal Setting version available at https://www.b3mn.org/2030energystandard/



Navigating to SB 2030 Tool

- Tool is under E1A
- Separate instances of tool for each phase

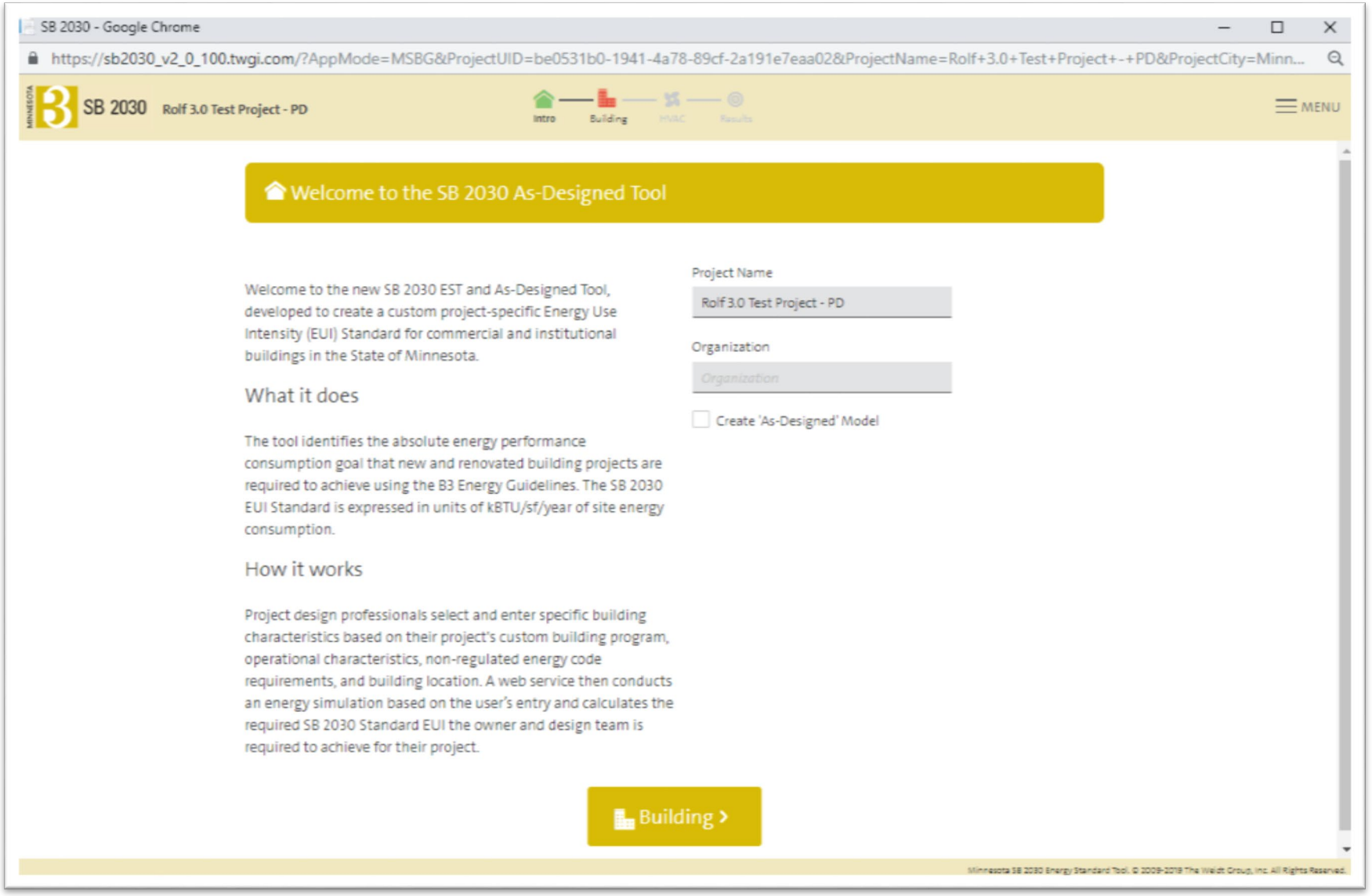


Creating SB 2030 Models

USER INTERFACE OVERVIEW

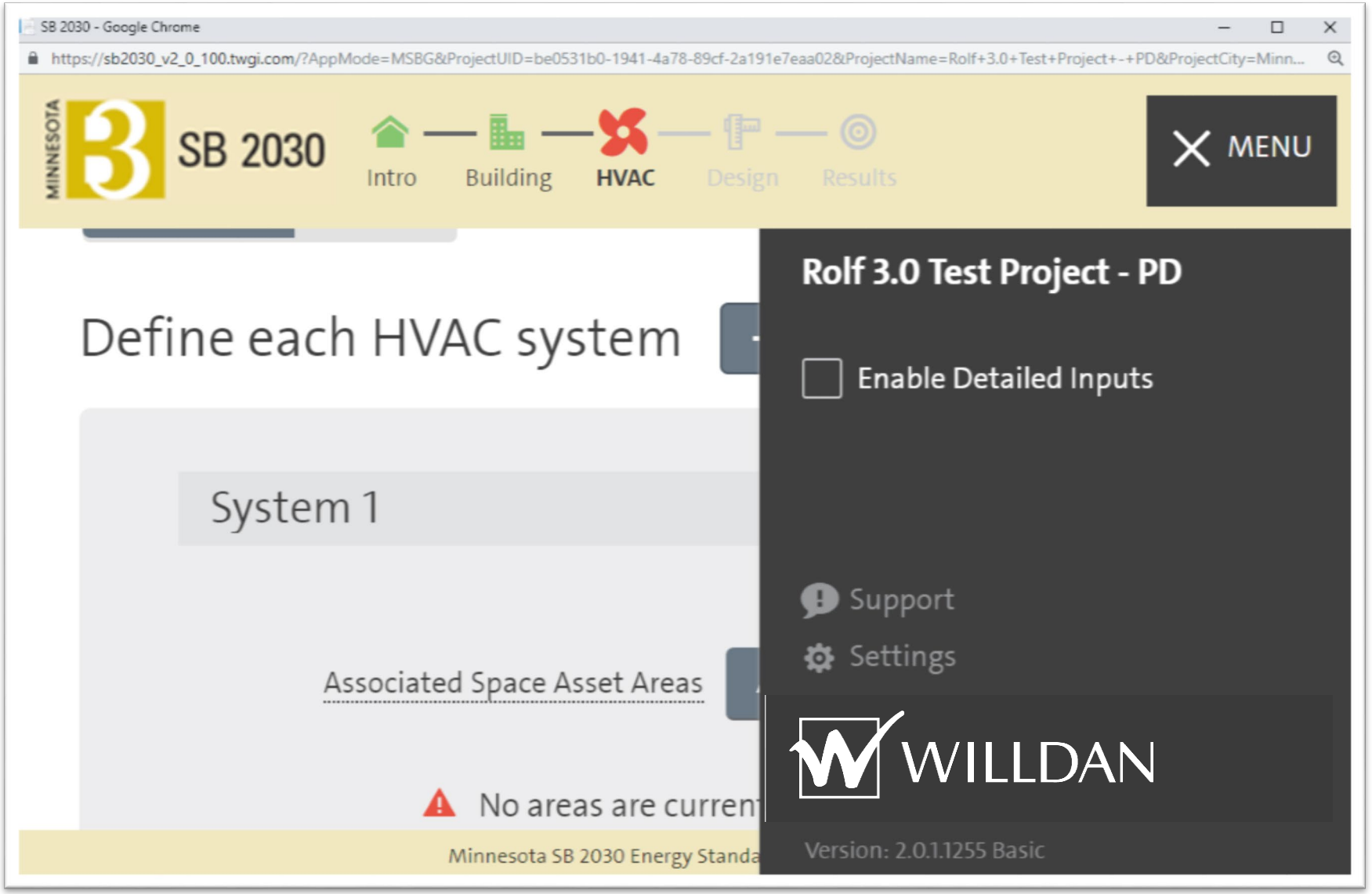
SB 2030 Models

- Two modes
  - Standard Tool
  - As-Designed Mode



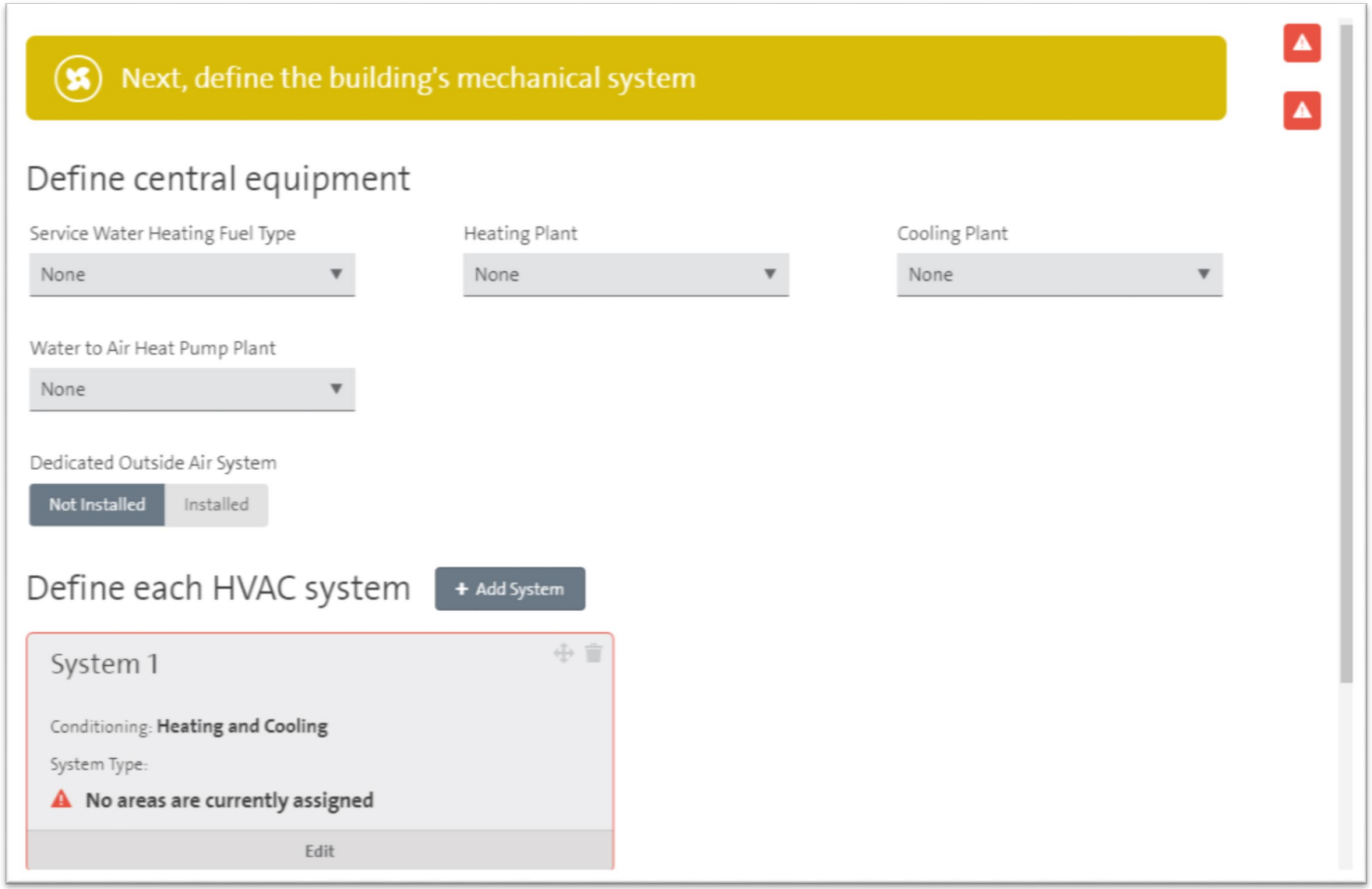
SB 2030 Navigation Overview

- Top menu shows steps
  - Building
  - HVAC
  - Design
  - Results
- Color indicates status
  - Red – error Light gray – not complete
  - Green – complete
  - Bold – indicates location
- Enable Detailed Inputs for
  - Schedules
  - Geometry
  - Constructions
  - Plug/process loads



User Interface Overview

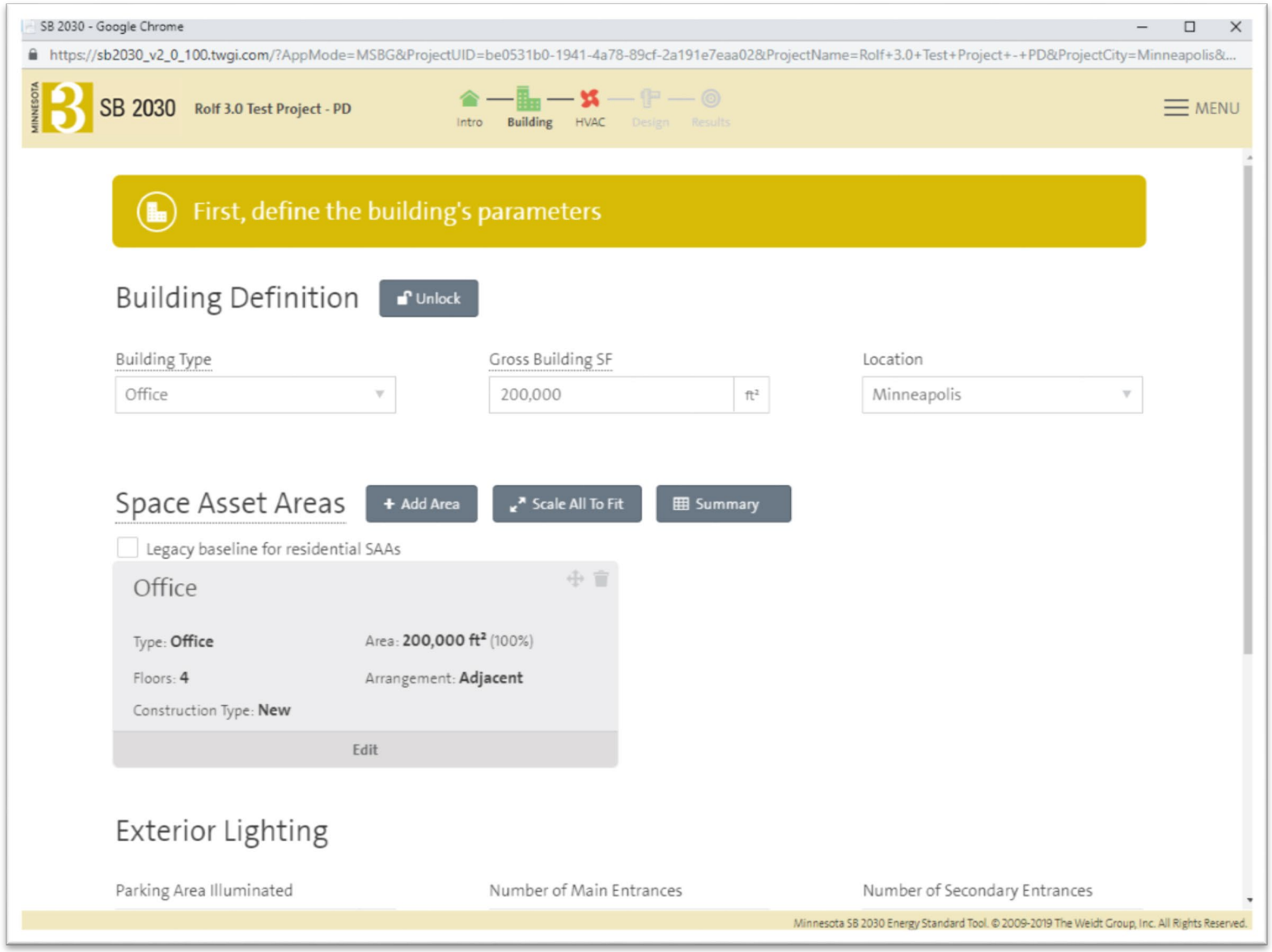
Error Messaging



- Watch out for red error messaging…
- Hovering over the warning will expand it
- Red outlines or underlines will guide you to the issue

User Interface Overview

Help and Definitions



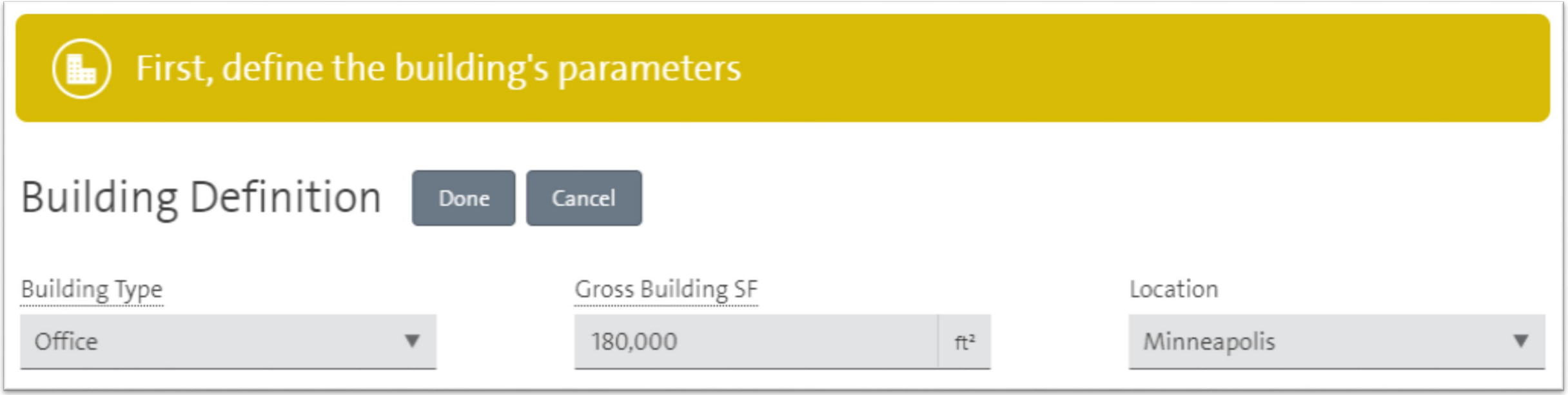
- Help is indicated by lines under headings and are located throughout the tool – use them!

BUILDING A SB 2030 ENERGY MODEL

Starting a SB 2030 Model

Building Type

- Users start by reviewing the building
- This creates defaults as starting points for the model
- User is able to modify as many defaults as known to further refine the model
- The building types comes from the B3 Guidelines Tool, but you can change it here



Available Building Types

- Automotive Facility
- Bank
- Broadcast Facility
- Computer Center
- Convention Center
- Core and Shell
- Corrections Facility
- Courthouse
- Data Center
- Dining – Bar Lounge/Leisure
- Dining – Cafeteria/ Fast Food
- Dining - Family
- Dormitory
- Education – College/ University
- Education – Elementary
- Education – High School
- Education – Middle School
- Fire Station
- Gymnasium
- Healthcare Clinic
- Hospital
- Hotel
- Laundry
- Library
- Mall
- Manufacturing Facility
- Multifamily
- Museum
- Nursing home
- Office
- Other
- Parking – Enclosed Garage
- Police Facility
- Post Office
- Religious Facility
- Retail – Big Box
- Retail – Convenience Store
- Retail – Strip Mall
- Retail – Supermarket
- Senior Housing
- Student Union
- Theater/Auditorium
- Town Hall
- Transportation
- Warehouse – Active
- Workshop

CREATING THE UNIQUE BUILDING

Space Asset Areas

Creating the unique building

- Building blocks to create the unique building
- Represent different programmatic functions within a building
- Users can build custom buildings from the collection of available types
- Definitions are based on ASHRAE, COMNET and past experience
  - Some details are editable by the user
- Additional Space Asset Areas can be used to represent different building conditions
  - Original Apartment Units with PTACs
  - 2010 addition with air source heat pump
  - Building would have two Apartment Space Asset Areas

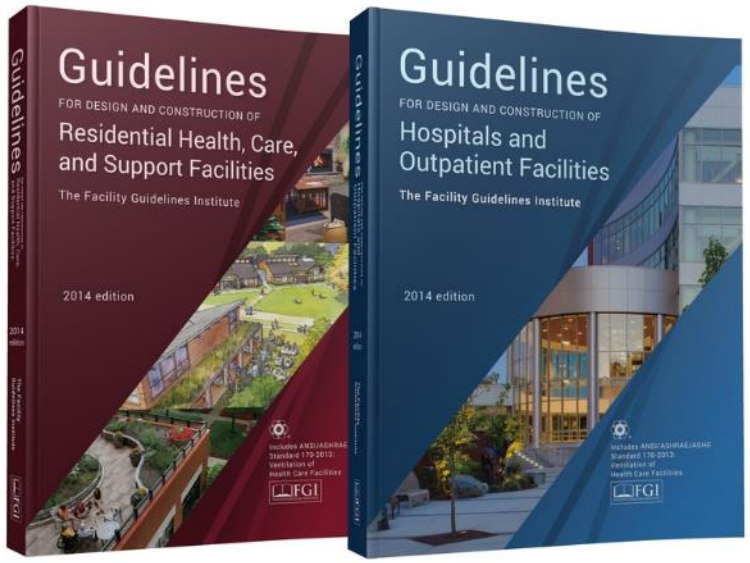
Space Asset Areas vs. Space Type

- SAAs were developed primarily by assigning Building-Type level characteristics
- Most SAAs are applied broadly across areas of the building
- Some Space Asset Area (SAA) characteristics are more representative of a specific space type
- Practice called for some SAAs to be more specific
  - AIA Healthcare ventilation requirements
  - Space-type lighting power densities

Space Asset Areas vs. Space Type

Space Asset Areas that can fall in this SAA/Space Type gray area

- Healthcare Ventilation
  - Emergency Departments
  - Laboratory
  - Operatory
  - Patient Room
  - Treatment

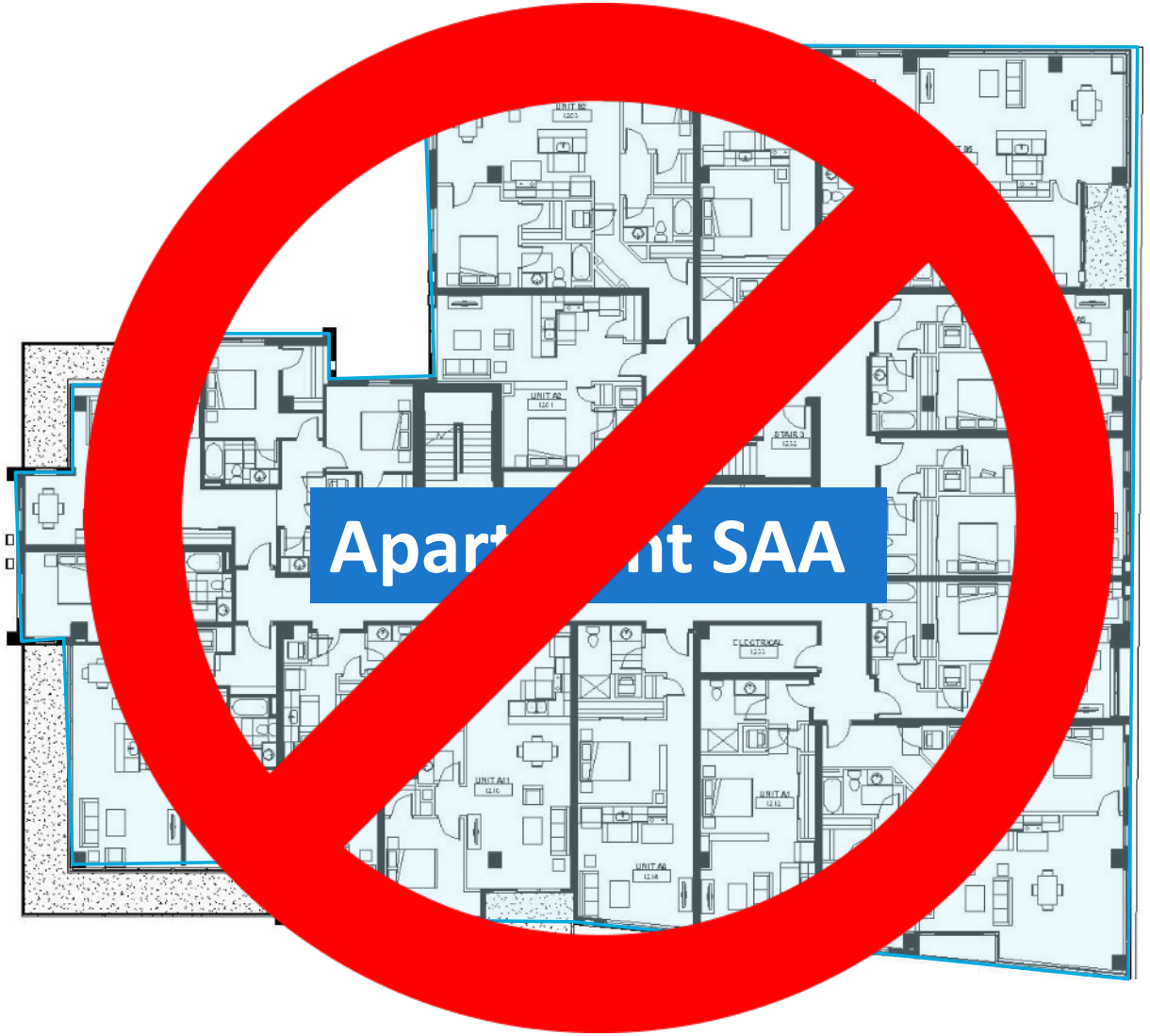


Space Asset Areas vs. Space Type

Space Asset Areas that can fall in this SAA/Space Type gray area

- Space-Type loads
  - Apartments
  - Laboratory
  - Computer Center
  - Kitchen
  - Laundry
  - Locker Rooms
  - Convention Center
  - Conference/Meeting area
- Not an exact science
  - Do not overthink
  - If using drawings, take in large chunks
    - Model is an abstraction based on a typical building; as such, SAA areas should be developed similarly

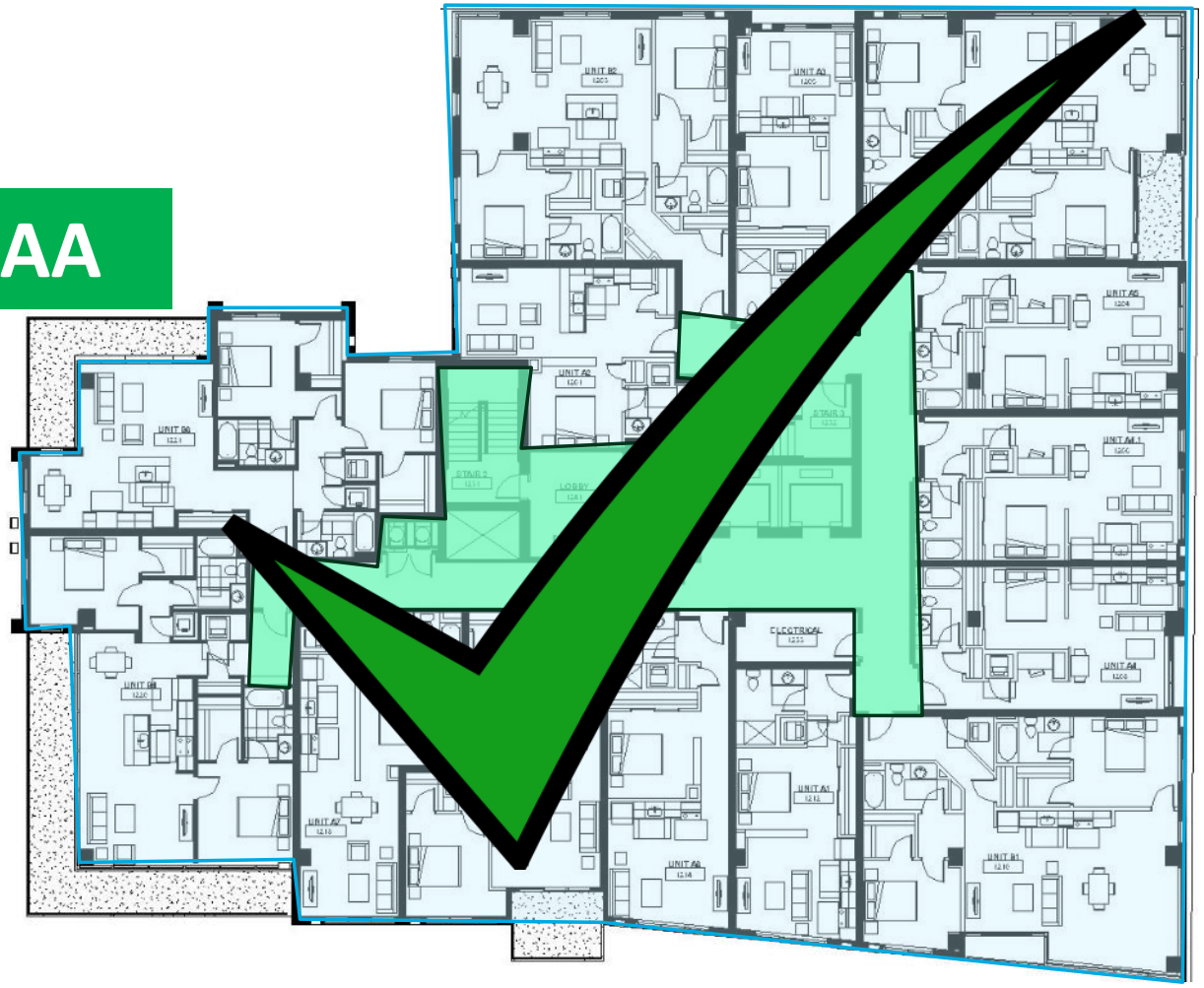
Example Area Take-offs: Apartments



Example Area Take-offs: Apartments

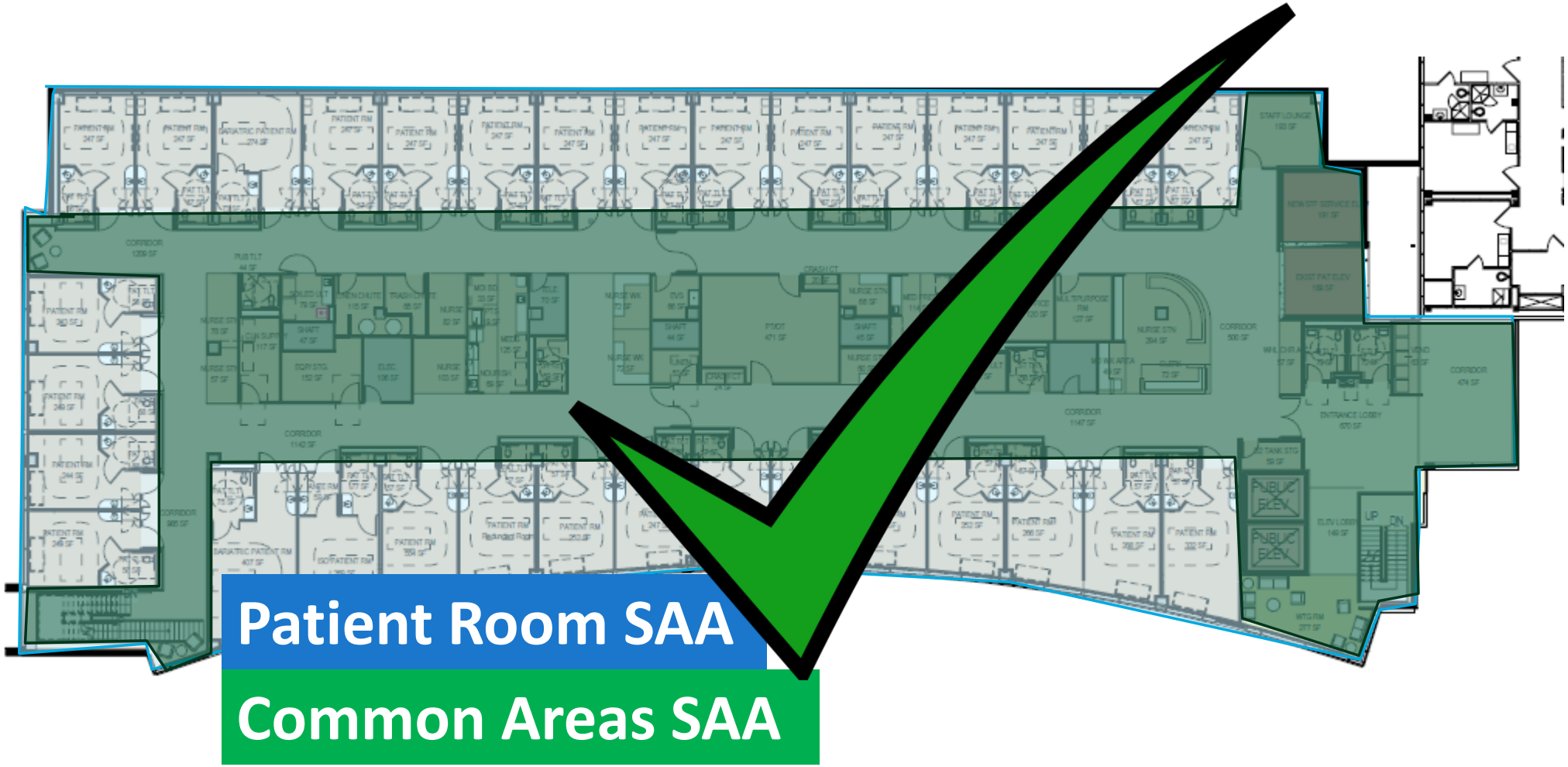
Apartment SAA

Common Areas SAA



Example Area Take-offs: Hospital

Example Area Take-offs: Hospital



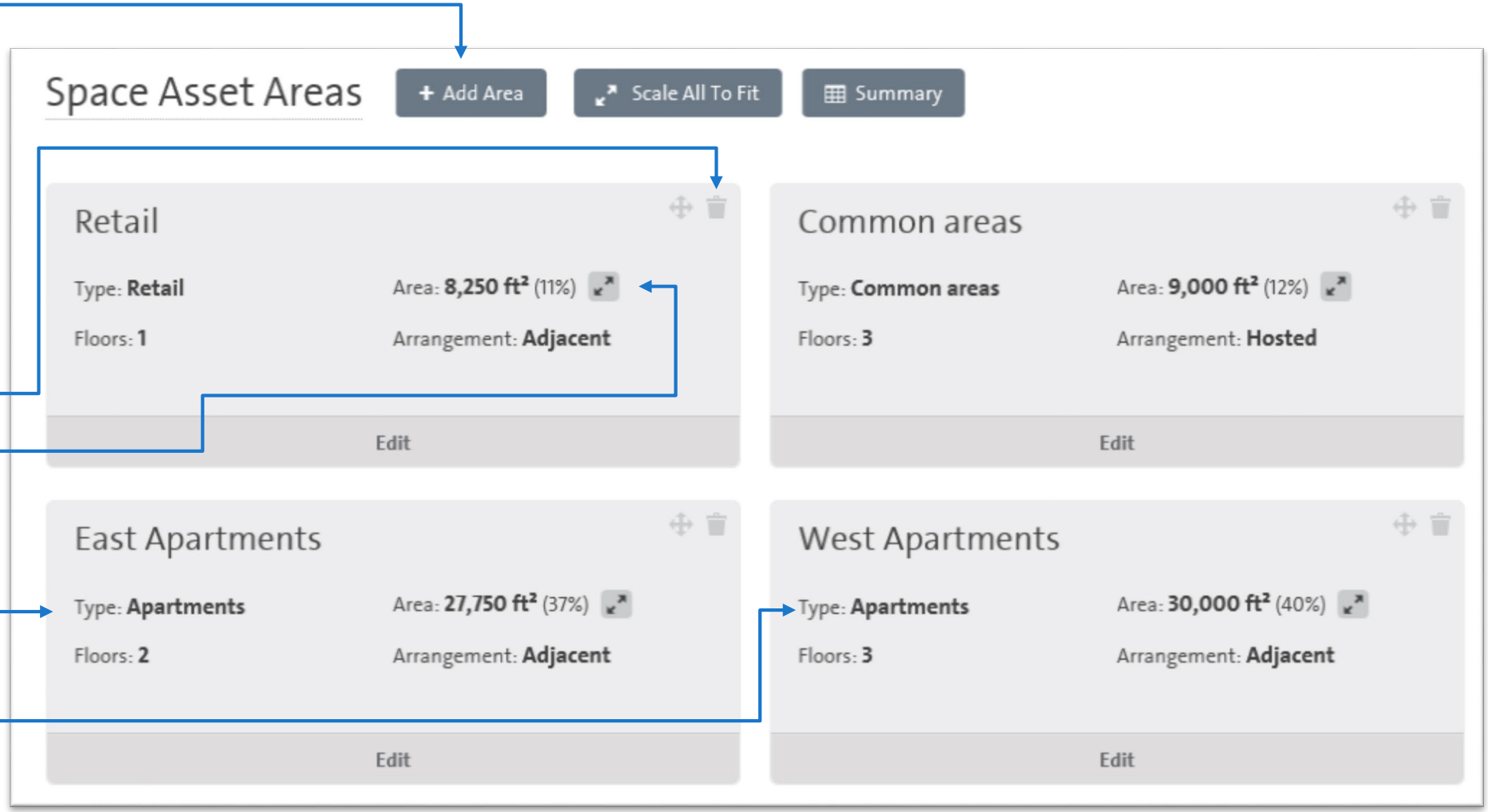
Current Available Space Asset Types

- Apartment
- Auto Repair
- Classrooms
- Common Areas – Multifamily
- Computer Center
- Conference/Meeting Area
- Convention Center
- Core and shell
- Data Center
- Dining
- Dorm Rooms
- Exhibit Space and Archives
- Fitness
- Garage – Emergency Vehicle
- Garage – Enclosed
- Guest rooms
- Gymnasium
- Jail Holding Area
- Kitchen
- Laboratory – Educational
- Laboratory – Research
- Laundry
- Locker rooms
- Maintenance/Repair
- Manufacturing
- Office
- Operatory
- Patient Room
- Retail
- Retail – Refrigerated
- Stacks and Reading
- Tenant Shell
- Theater/Auditorium
- Treatment
- Vivarium
- Warehouse – Active
- Warehouse – Inactive
- Workshop
- Worship Area

Starting a SB 2030 Model

Building Definition

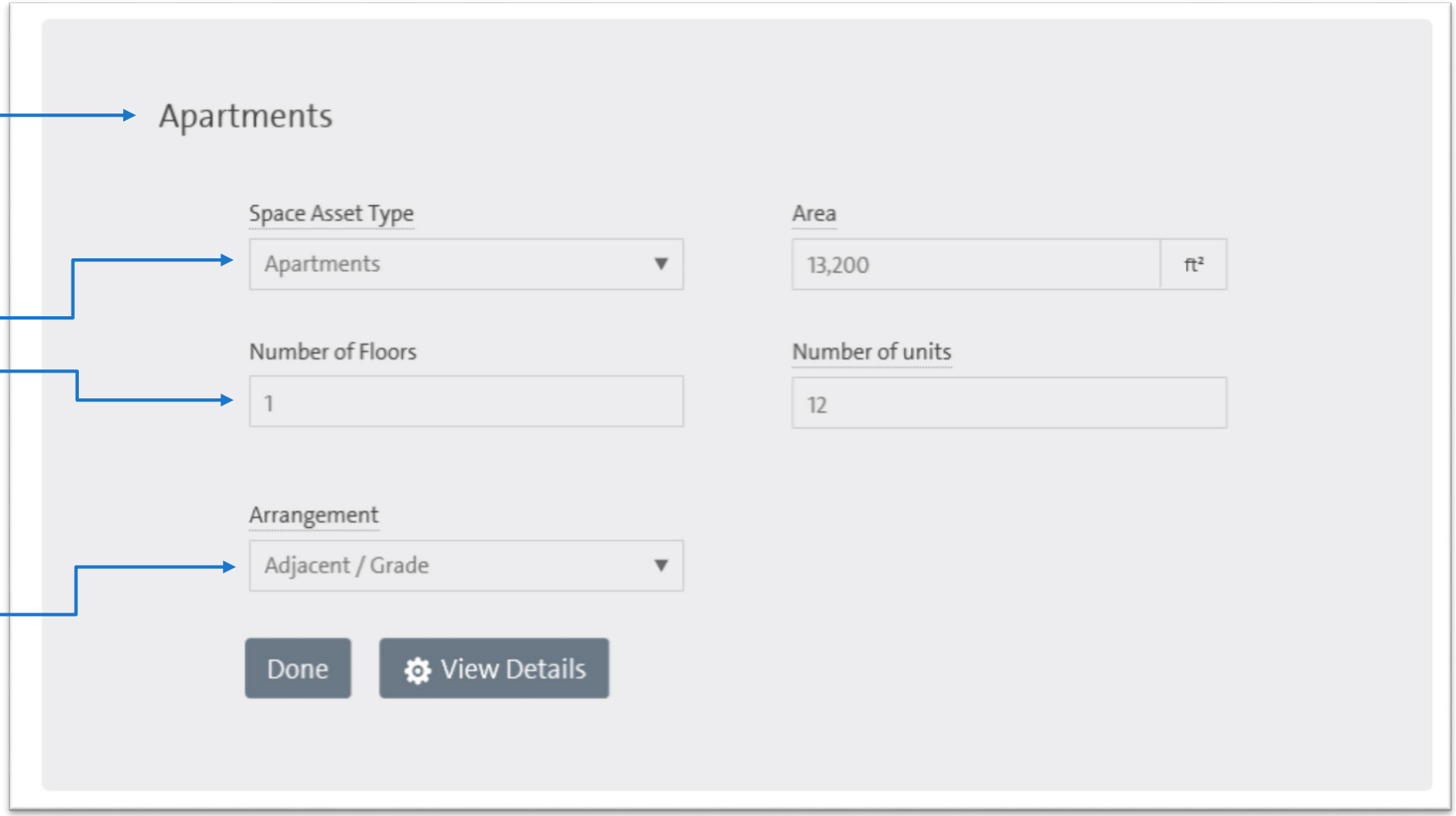
- Define the Space Asset Areas
  - Default based on building type
  - Add with ‘add area’ button
  - Delete with ‘trash can’
  - Scale area to fit
  - More than one of the same SAT can be used within the building



Starting a SB 2030 Model

Refining Space Asset Types

- Edit Space Asset Areas
  - Use the Edit Button under the SAT
  - Give a custom name
  - Adjust type
  - Select # of floors
  - Adjust the size
  - Adjust the geometry Adjacent – SAT is next to another
    - Stacked - SAT is on top of another
    - Hosted – SAT if fully contained in another

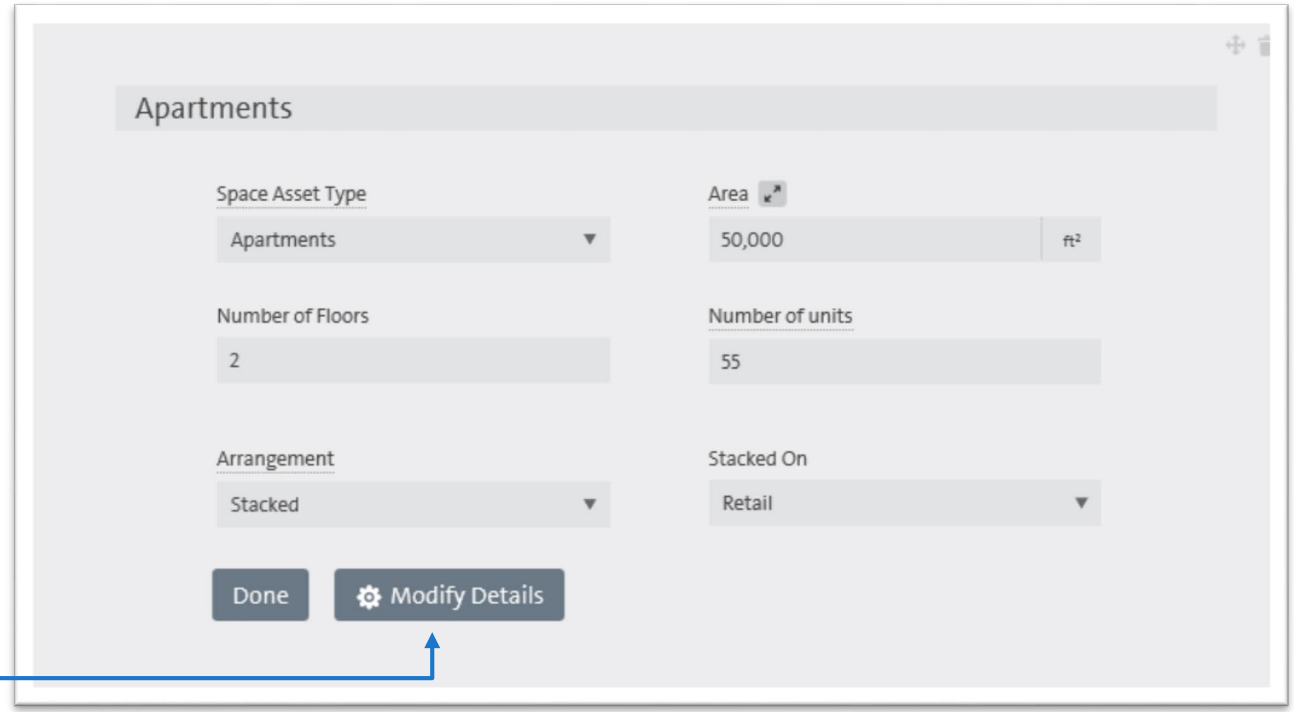


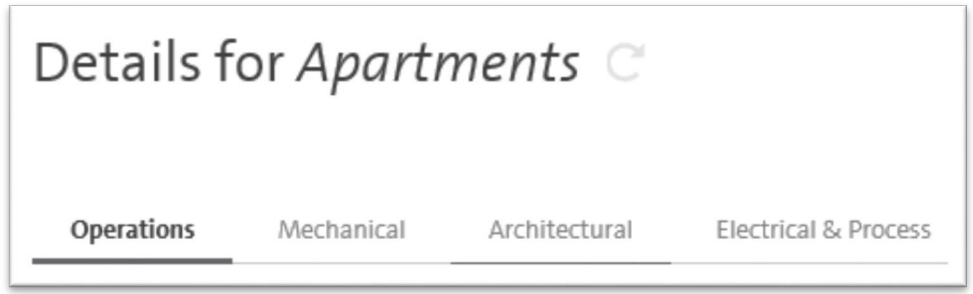
MODIFYING SPACE ASSET AREA DETAILS

Starting a SB 2030 Model

Refining Space Asset Types

- Edit space asset area, select
- Sets additional parameters when known
- Not required to complete a model
- Default is selected energy code
- Details include
  - Schedules
  - Ventilation rates
  - Geometry
  - Floor to floor heights
  - Space temperatures
  - Plug and process loads
- Each Space Asset Area can be different





Starting a SB 2030 Model

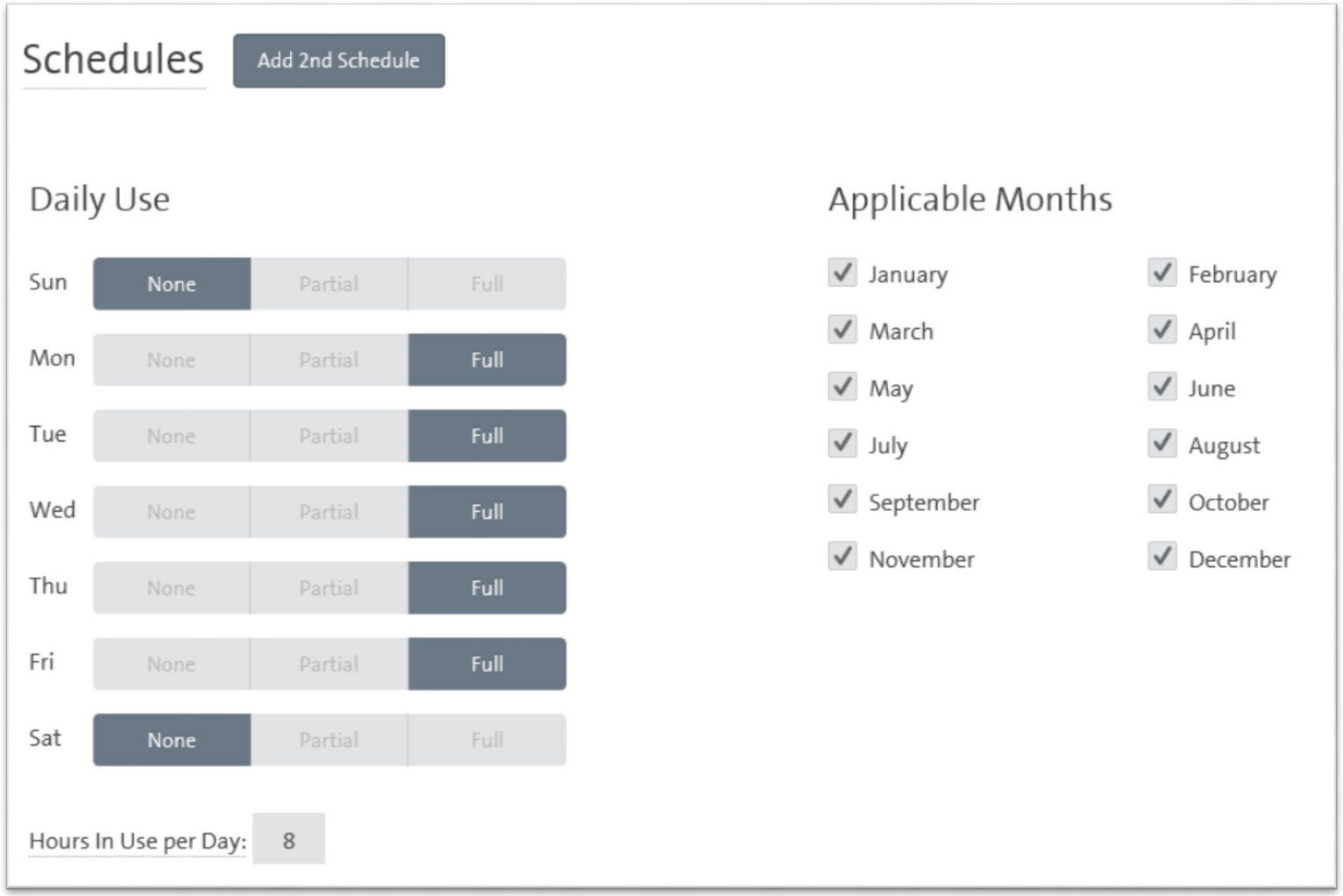
Operational details

- Make a SAA unoccupied
- Adjust the # of people in a SAA
- Typically, defaults are fine here

Starting a SB 2030 Model

Operational details

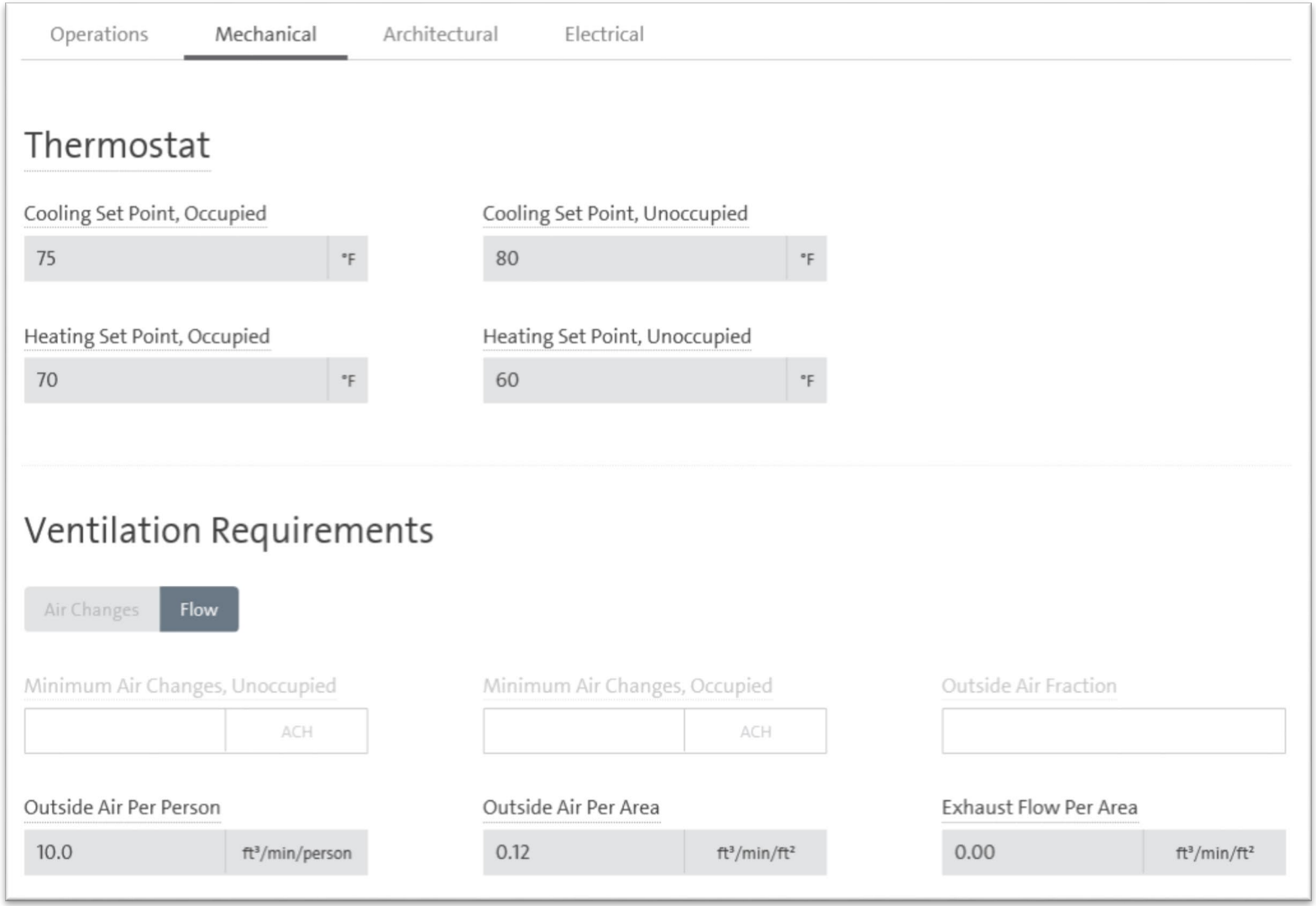
- Select use by day
  - None, partial, full
- Select hours in use per day
  - This is full-time use
- Choose the months for which this schedule applies
- Add a 2nd schedule if needed
- Schedules impact lights, plugs, people and fans
- Default schedules are from ASHRAE



Starting a SB 2030 Model

Mechanical details

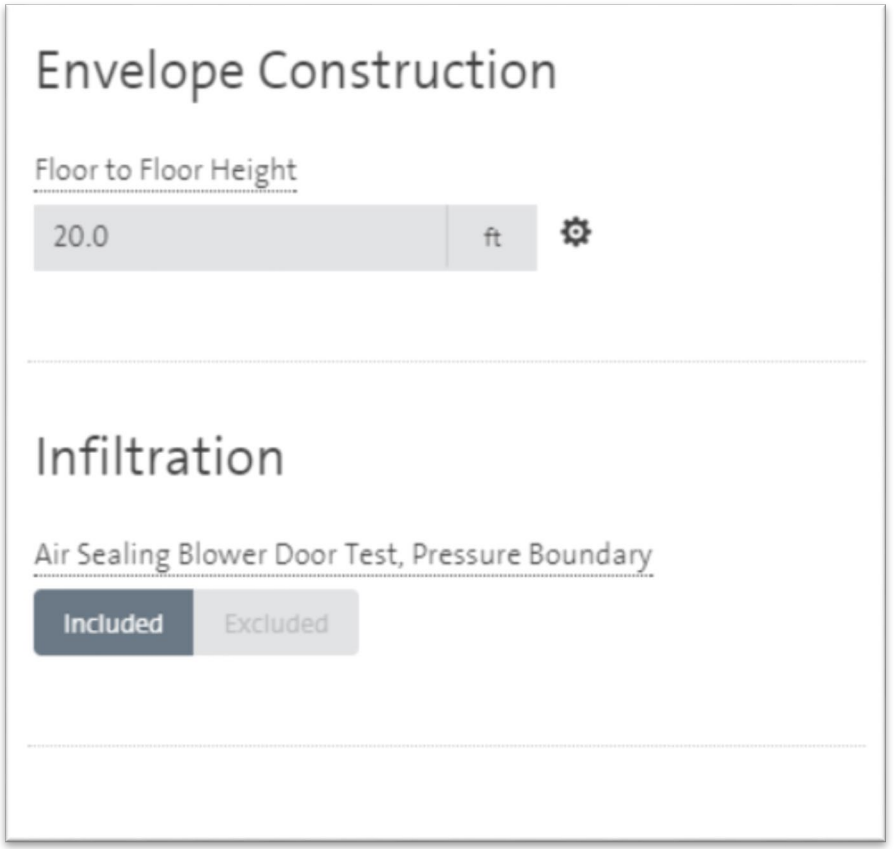
- Adjust thermostat setting
  - Separate heating and cooling
  - Separate occupied and unoccupied
  - Settings carry forward, no operation strategies at this time to adjust for savings
- Ventilation
  - Ability to set on air change or flow rate basis
  - Defaults to ASHRAE 62.1



Starting a SB 2030 Model

Architectural details

- Geometry
  - Covered later
- Envelope Construction
  - Hover over underlined name to gain additional information or see defaults
  - Floor to Floor Height –
    - Enter specific value

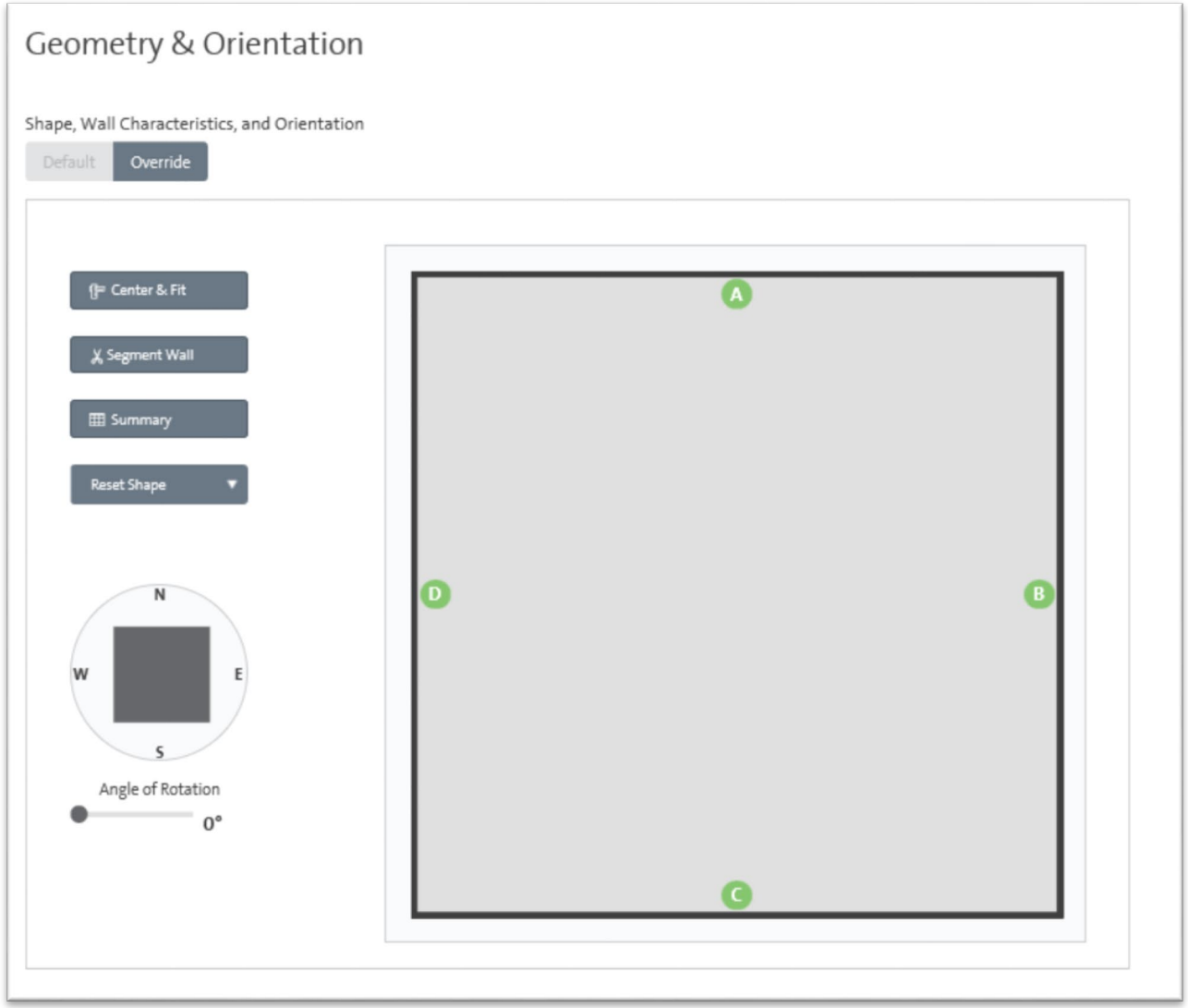


MODIFYING DETAILED GEOMETRY

Starting a SB 2030 Model

Architectural details

- Adjust geometry beyond SAT arrangement
  - Do only if unique
  - Done on a SAT-by-SAT basis
  - Can segment or note shared walls
  - Can set window to wall ratio by orientation
- May impact heat pump or VRF systems more than central systems
- Intended to be high level geometry; **DO NOT** include every cut out and corner!



Starting a SB 2030 Model

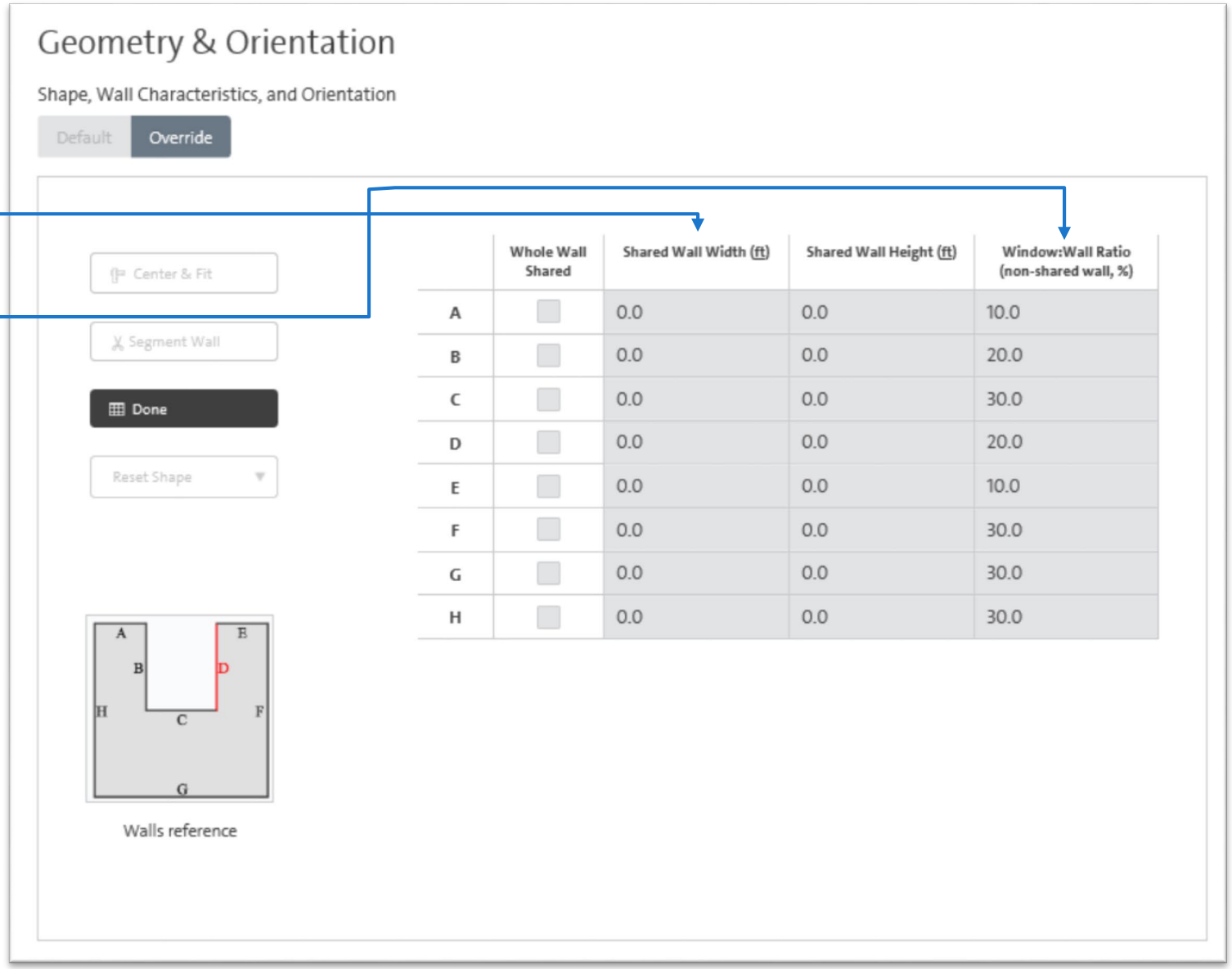
Architectural details

- Custom Geometry
  - Choose from standard shapes
  - Rotate building
    - Note rotation only shown here
  - Segment wall to further change shape

Starting a SB 2030 Model

Architectural details

- Custom Geometry
  - Summary
    - Note shared walls with another SAA
    - Adjust window to wall ratio

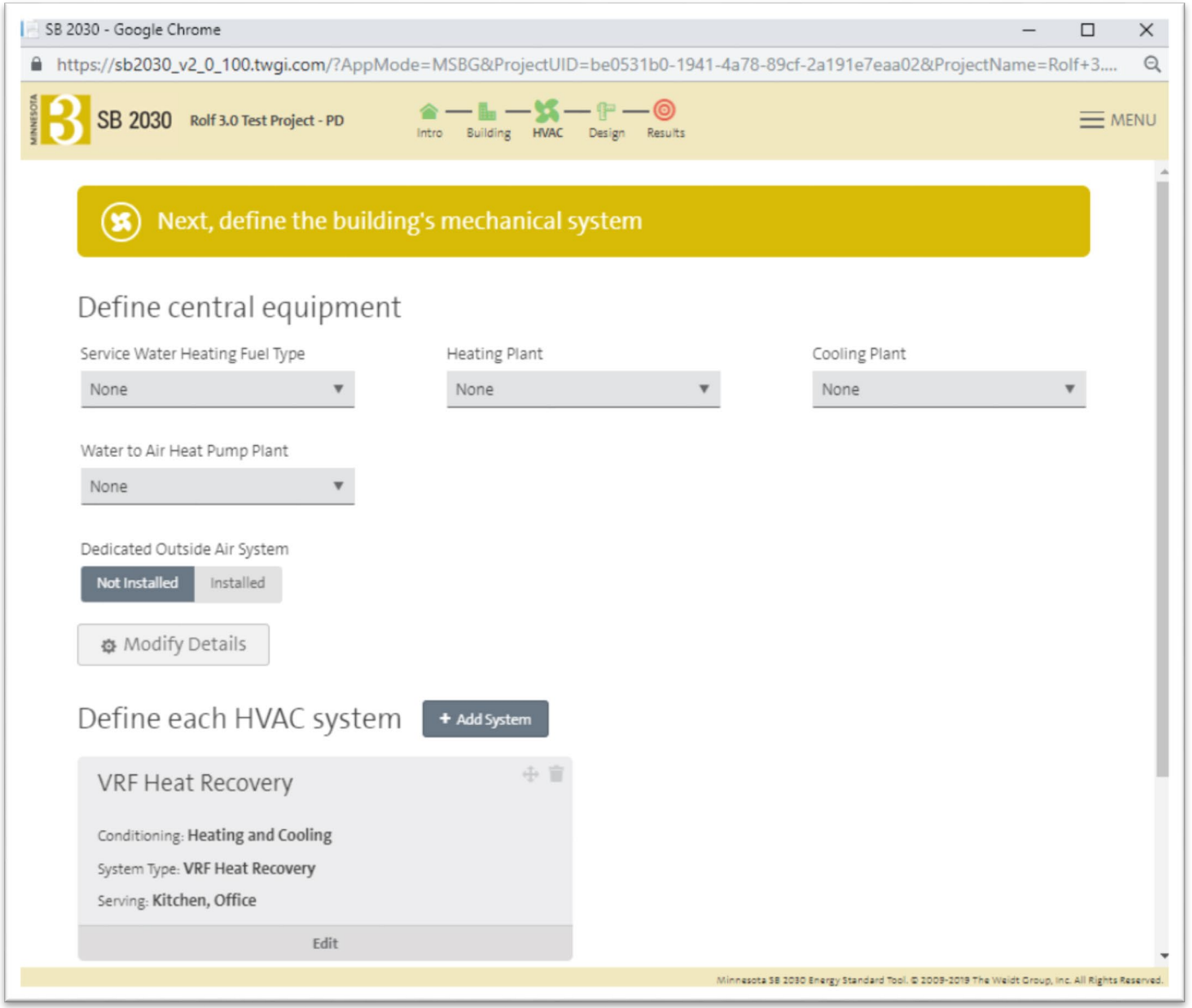


HVAC SYSTEMS

Starting a SB 2030 Model

HVAC details

- Define any central plant
- Then define system and zone level HVAC components
- HVAC systems are defined and one or more SAAs can be added to a system
- Red triangles let you know a system is not fully defined

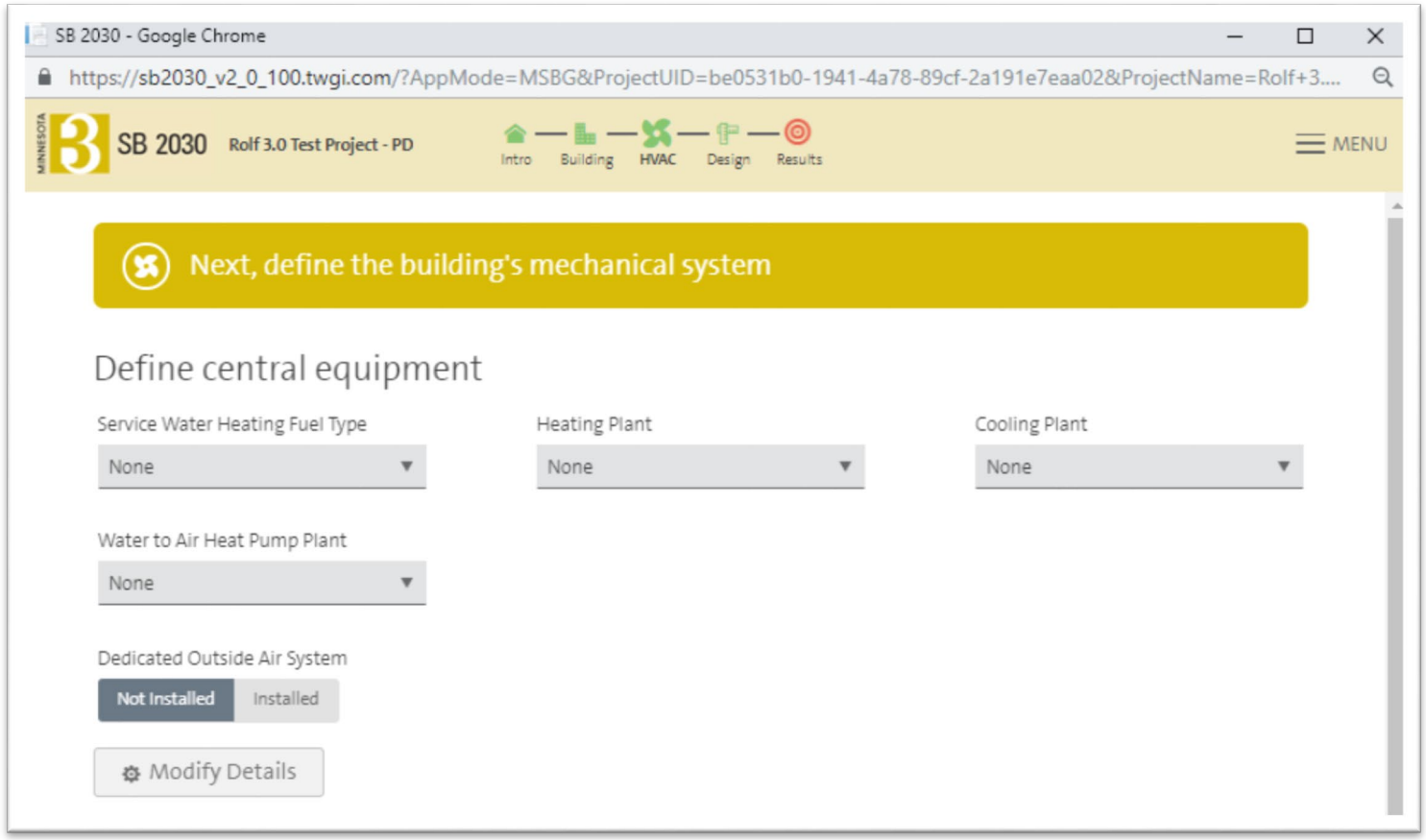


CENTRAL PLANT EQUIPMENT

Starting a SB 2030 Model

HVAC details – central plant

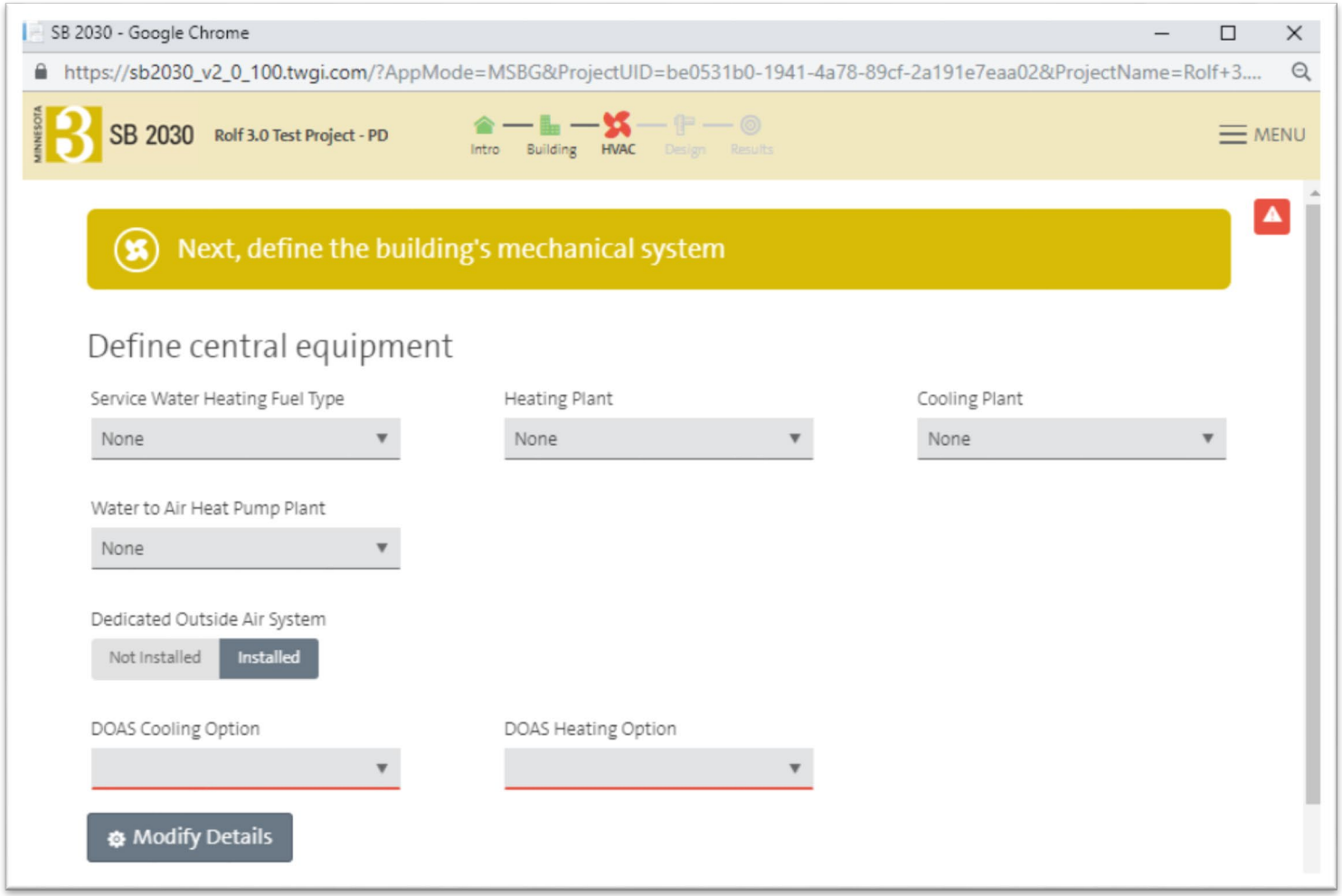
- Select service water heating system fuel type
  - Select none if SWH is not a factor in the project
- Select heating plant type
  - Boiler
  - District
  - None if no central equipment
- Select cooling plant type, if no chiller select none
  - District cooling
  - Air-cooled chiller
  - Water-cooled chiller
  - None if no central equipment



Starting a SB 2030 Model

HVAC details

- Dedicated outside air systems set at this level
  - If selected as Installed, specify additional details
- Select cooling option
  - DX
  - Heat pump
  - VRF
  - Central plant
- Select heating option
  - Furnace
  - Heat pump
  - VRF
  - Central plant
  - Electric resistance

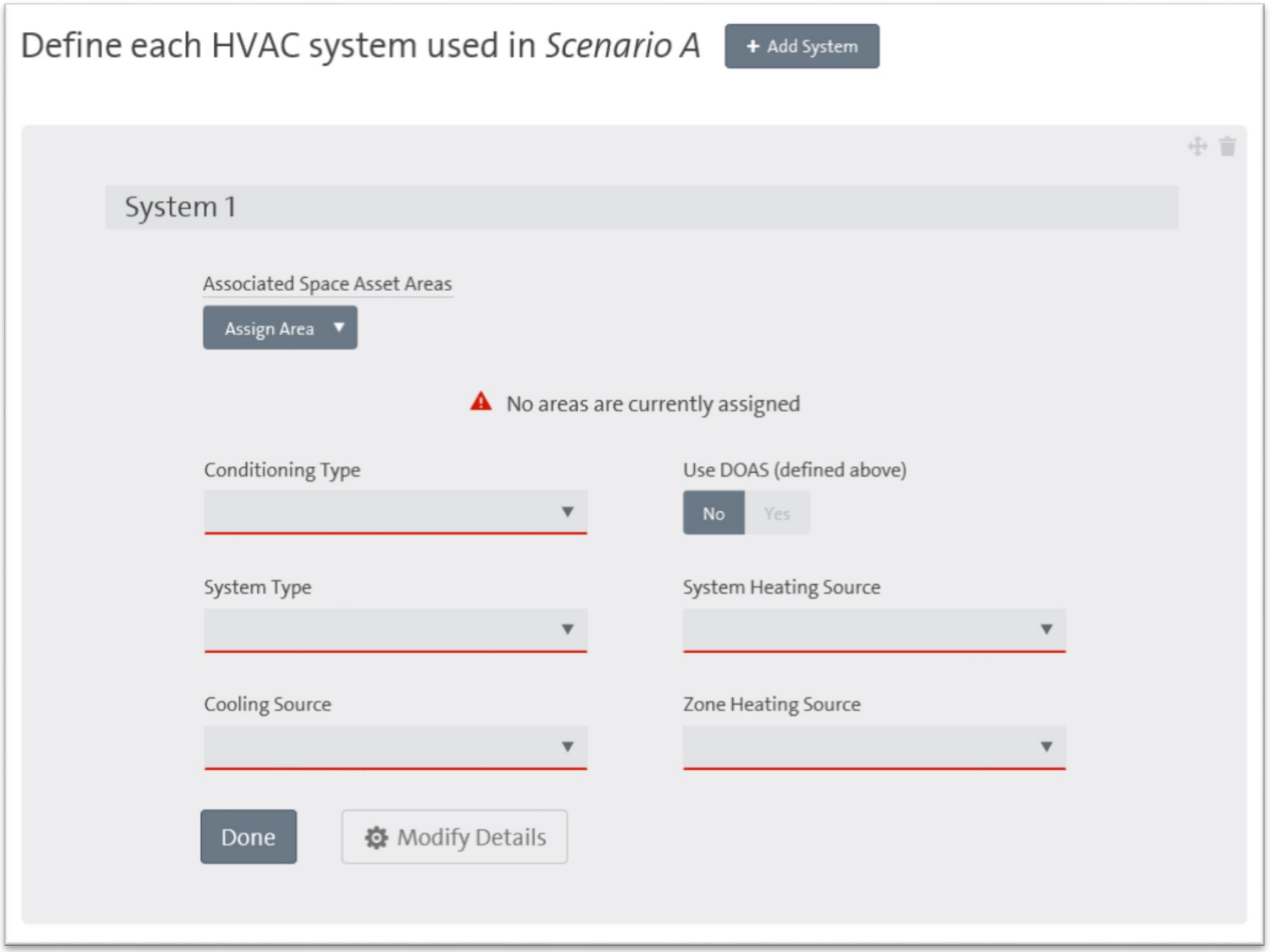


CREATING HVAC SYSTEMS

Starting a SB 2030 Model

HVAC details - systems

- Define each system
- Provide system name
  - Default is System 1
- Add space asset areas; can be 1 or many
- Complete drop-downs for other choices
  - Conditioning type
  - System type
  - Cooling source
  - Heating source
  - Zone heating source
- Use DOAS is only available if DOAS was selected in the plant section
- Repeat for additional systems



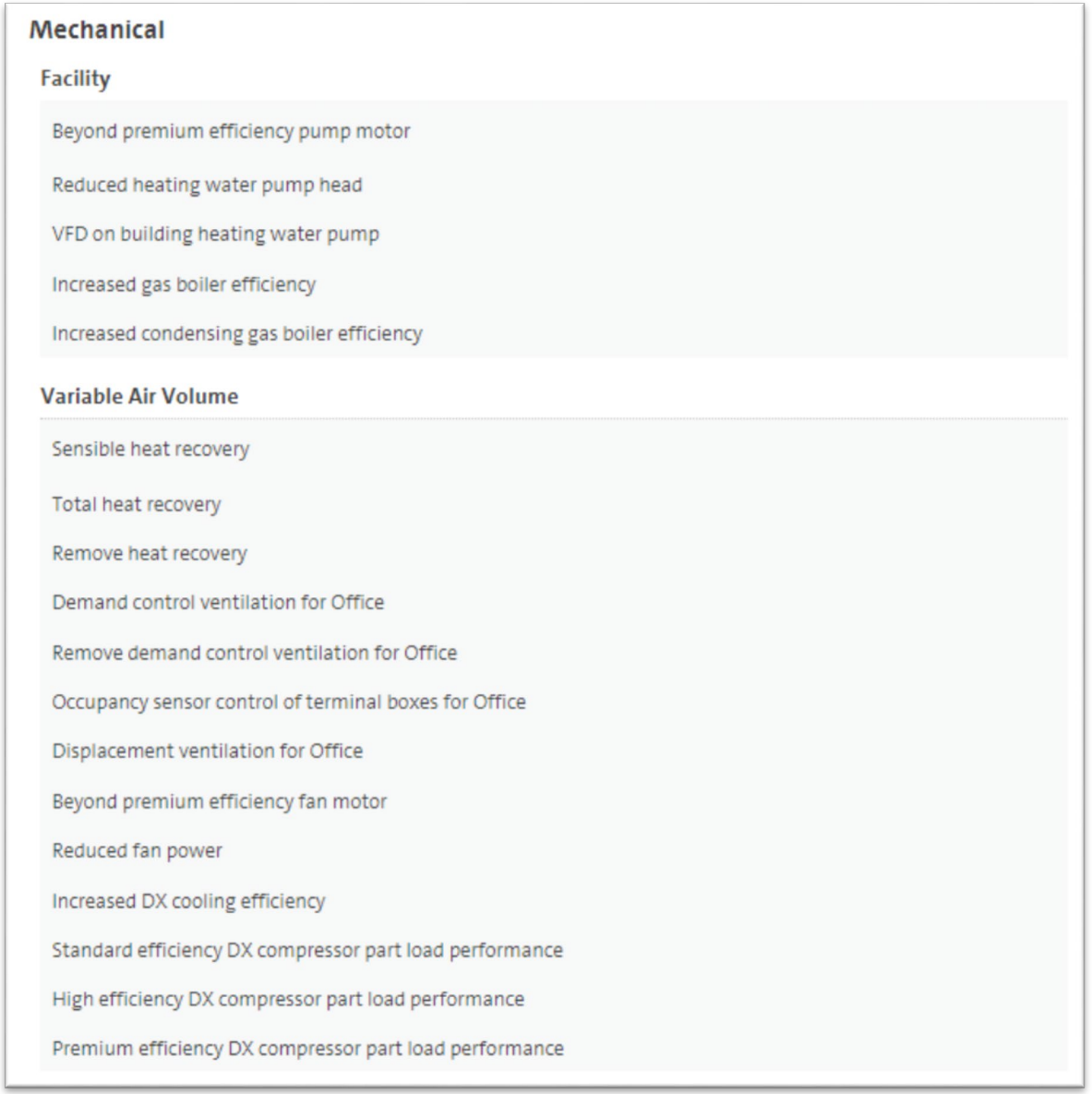
ADDING MEASURES

Available Measures

- Categories
  - Mechanical
  - Architectural
  - Lighting/Electrical
  - Plug/Process
  - Refrigeration
  - Service Water Heating
- Three levels of applicability
  - Facility
  - System
  - Space Asset Area

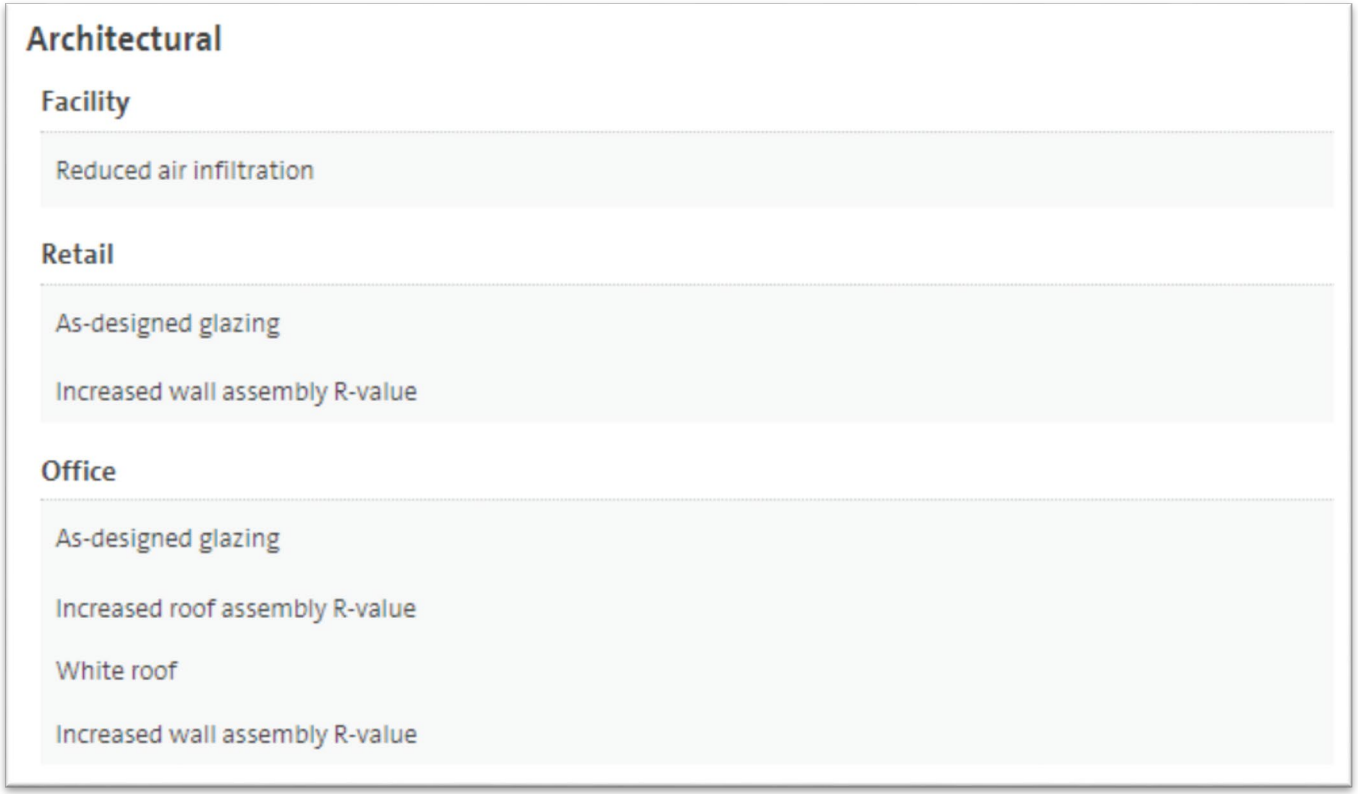
Available Measures

- Mechanical
  - Facility
    - Equipment efficiencies
    - Pump controls
    - Pump power reductions
    - DOAS related strategies
  - System
    - Equipment efficiencies
    - Motor efficiencies
    - Fan power reductions
    - Fan controls
    - Heat recovery
  - Space Asset Area
    - Ventilation controls
    - Thermostat setback controls



Available Measures

- Architectural
  - Facility
    - Infiltration
  - System
    - None
  - Space Asset Area
    - Wall insulation
    - Roof insulation
    - Roof reflectivity
    - Improved glazing characteristics



Available Measures

- Lighting
  - Facility
    - Exterior lighting power reduction
  - System
    - None
  - Space Asset Area
    - Interior lighting power reductions
    - Occupancy/ Vacancy controls
    - Daylighting controls

Lighting

Retail

Stepped daylighting control

Multi-stepped daylighting control

Dimming daylighting control

Occupancy sensor controls

Dual level occupancy sensor control

Vacancy sensor controls

Reduced lighting power density

Office

Stepped daylighting control

Multi-stepped daylighting control

Dimming daylighting control

Remove daylighting control

Occupancy sensor controls

Dual level occupancy sensor control

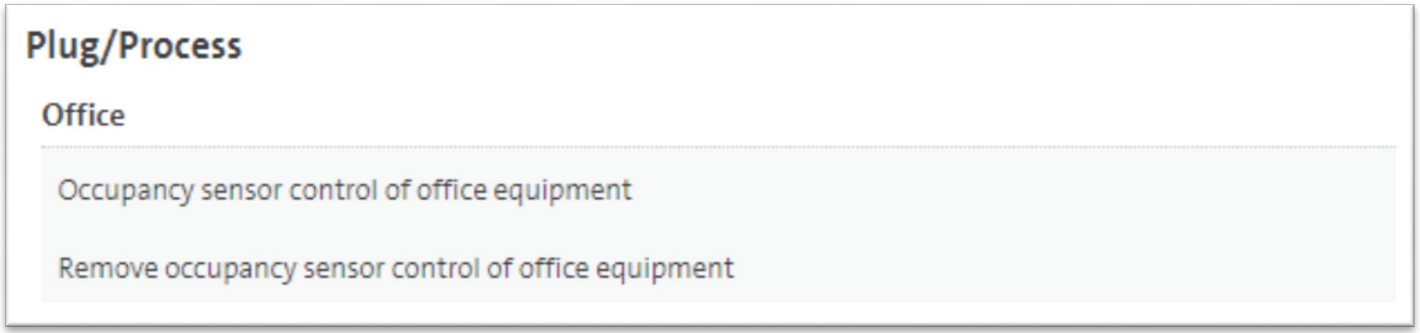
Vacancy sensor controls

Remove automated lighting controls

Reduced lighting power density

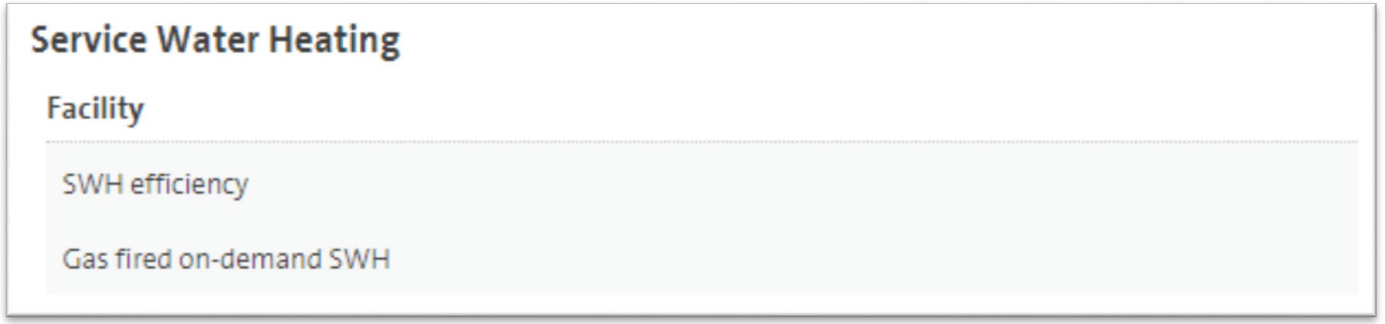
Available Measures

- Plug/Process
  - Facility
    - Snow melt system efficiency
    - Elevator efficiency
  - System
    - None
  - Space Asset Area
    - Office plug load controls
    - Residential ENERGY STAR® appliances
    - Commercial ENERGY STAR appliances



Available Measures

- Service Water Heating
  - Facility
    - System efficiency
    - On-demand water heater
    - Heat Pump water heater
  - System
    - None
  - Space Asset Area
    - Residential low-flow showerheads

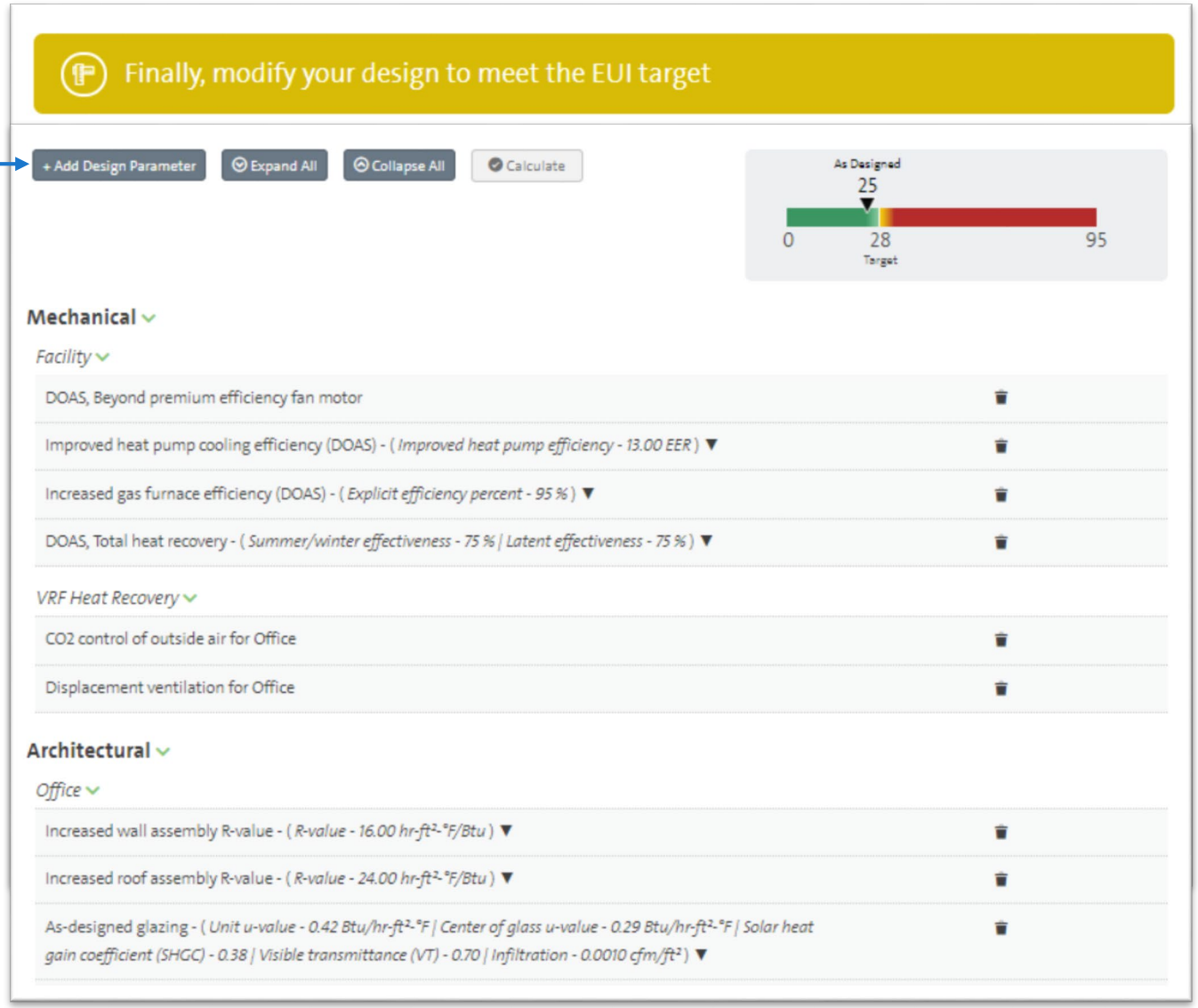


Available Measures

- Refrigeration
  - Facility
    - None
  - System
    - None
  - Space Asset Area
    - Casework lighting
    - Casework antisweat heat controls
    - Casework door improvements

Adding Measures

- First come, it will be blank
- Use Add Strategy button to choose from a list of available measures



UPDATES FOR 2020

Updates for 2020

- Updated tracking tool, Energy Standard Tool, and SB 2030 As-Designed Tool live January 1, 2020
  - Evaluation of compliance based both on carbon and on-site energy consumption
  - Modify the requirements around on-site renewable energy evaluation
  - Allow a campus-based approach to renewable energy development
  - Update cost-effectiveness evaluation
  - Eliminate the relaxed standards for renovation projects
  - Adding Solar PV to SB 2030 As-Designed Tool

SB 2030 SUPPORT

SB 2030 Support

- Resources
  - ‘How NEO® Works’ videos at: https://netenergyoptimizer.com/how-it-works
  - sb2030@b3mn.org
- Helpful information to provide when reporting an issue
  - Brief description of error or issue and when if occurred
  - Brief description of the building and model
  - Provide screenshots if available

Acknowledgements

- Clients

COMMERCE DEPARTMENT

DEPARTMENT OF ADMINISTRATION

- Partners

CSBR
Center for Sustainable Building Research

LHB
PERFORMANCE DRIVEN DESIGN.

cee
Center for Energy and Environment

QUESTIONS?

Thank You

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