MINNESOTA

SB 2030
ENERGY STANDARD

SB 2030 Updates: Using the Energy Standard Tool's New Features

Patrick Smith, Senior Research Fellow, Center for Sustainable Building Research, University of Minnesota

October 21, 2020

Overview

- Logistics: Webinar and Education Credits
- SB 2030 2020 Update (Pat Smith)
    - Overview of project's path through the program
    - Hierarchy of renewables
- SB 2030 Tool Walkthrough (Ryan Schwartz)
    - Energy Model Used
    - Navigating the Tool
    - Using the Analysis Manager
    - Building a SB 2030 Model
    - Space Asset Areas
    - Using Detailed Inputs
    - Modifying Geometry
    - Characterizing Systems
    - Modifying Geometry
    - Rating User Interface
- Q&A Responses and Discussion

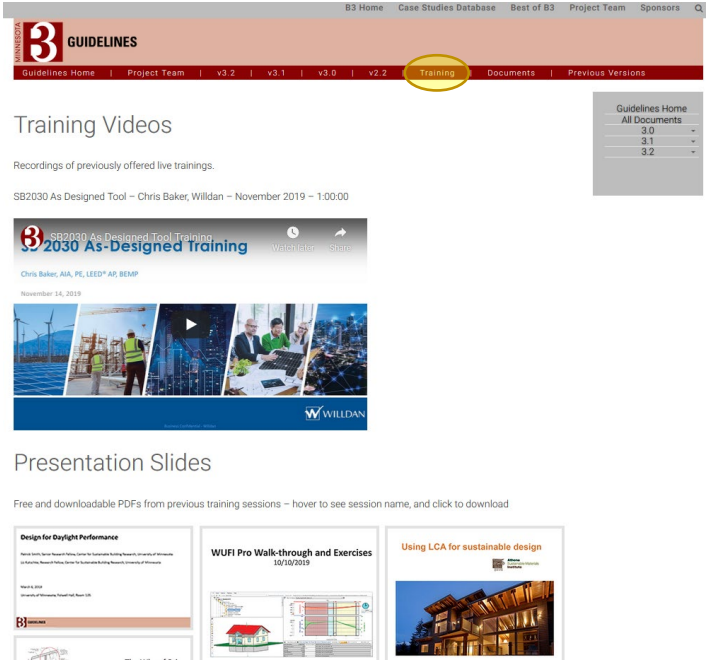
Logistics

- Trainings are recorded, will be posted on our training site at b3mn.org
- Those needing AIA credit – please send your AIA # in the chat, or via email to patsmith@umn.edu
- Due to the number of attendees we'll be keeping non-presenters on mute
- Please note questions in the Q&A chat as they come up; we'll leave time at the end to address them.

B3 News

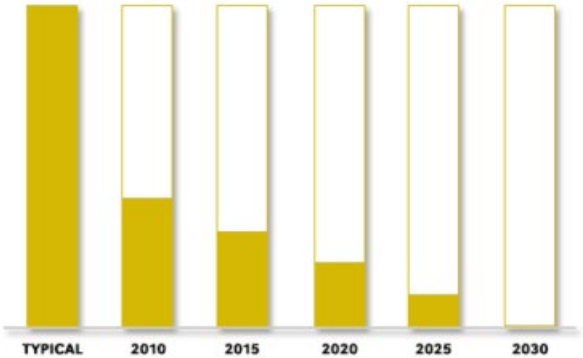
B3 Training Website

- Recordings of previous live training sessions
- Slide decks from previous live training sessions

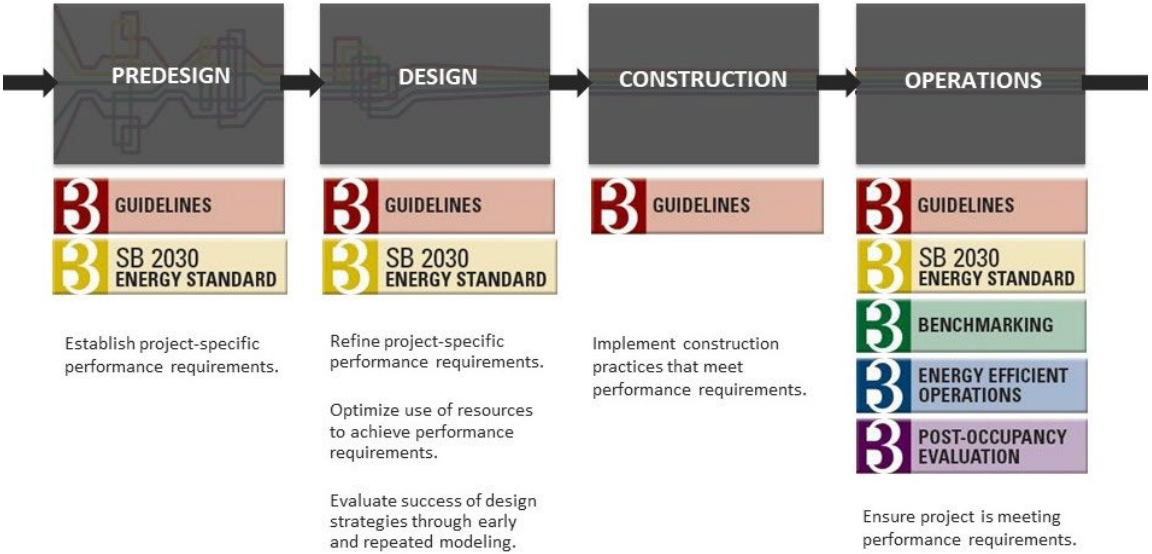


Introduction

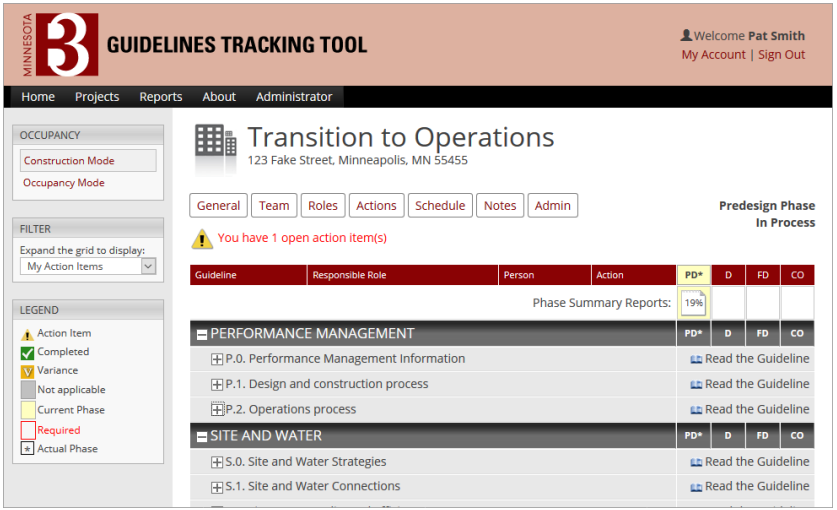
SB 2030 is a progressive energy and carbon reduction program, modeled on the Architecture 2030 program; customized to better fit Minnesota's buildings, climate, and policies, and expanded to allow the inclusion of more building types.

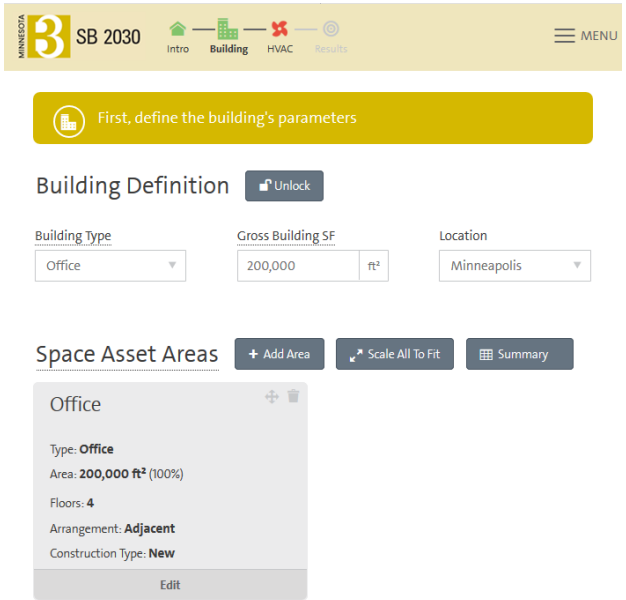


SB 2030 and B3 Programs



Tools – Tracking Tool and SB 2030 Energy Standard Tool



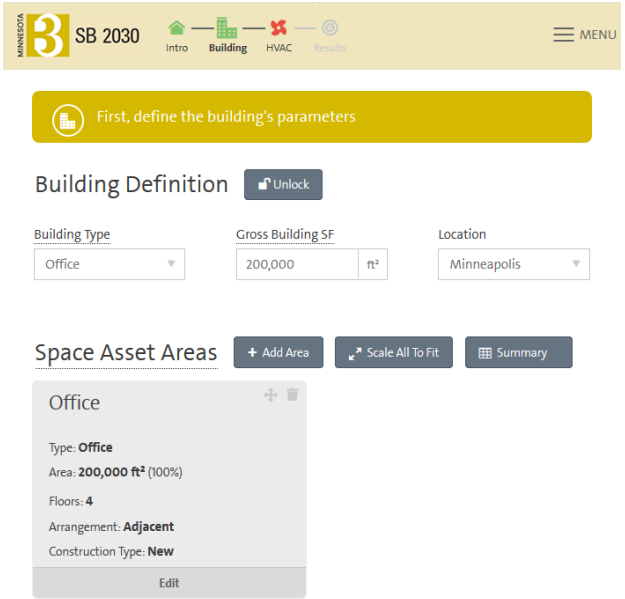


Energy Standard Tool

This tool produces an energy model that simulates the energy use of a 2003 average building of the same function and operation as the SB 2030 project.

This modeled baseline is aligned with the CBECS 2003 Dataset, permitting a wider array of variables to be considered.

The reduction (60%, 70%, 80%, or 90% depending on the year) is then taken from that baseline to determine the SB 2030 Standard.



Overview of a project's path in the program

Projects participating in the SB 2030 program follow these steps, tracked at several phases through the B3 Guidelines Tracking Tool.

- During Predesign an initial Energy and Carbon Standard is set for the project. Preset defaults for typical building type are included in the tool as often in early design these more detailed values may not be known.
- Through Schematic and Design Development the project performs initial design energy modeling.
- At the construction documents phase (called Final Design in the tracking tool) project teams submit a final energy model for the project and upload construction documents and related documentation, project reviewed by the SB 2030 Review Team.
- During operation – annual submission and as needed updates to the Energy Standard Tool (e.g. updating schedules if changed).

If needed—projects implement efficiency and renewable energy based on hierarchy

Projects not cost-effectively able to achieve the SB 2030 Energy and Carbon Standards with only energy efficiency measures are then required to provide sufficient carbon-neutral renewable energy (RE) to achieve the standards.

This is aligned with the NREL classification system (though with some considerations based on the type of buildings and ownership organizations that participate in the SB 2030 Program).

Hierarchy of renewables

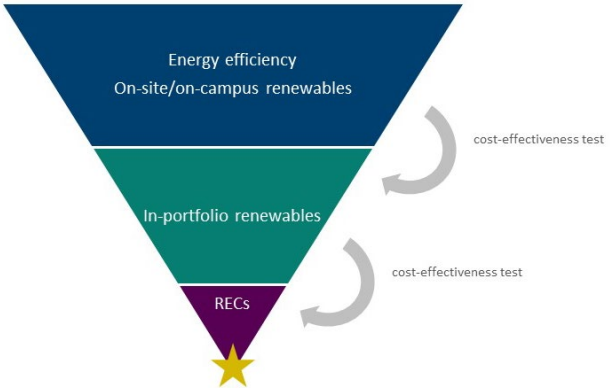
SB 2030 Program Energy Efficiency and Renewable Energy Supply Options Hierarchy

Option Number	NZEB Supply-Side Options	Examples
0	Reduce site energy use through energy efficiency and demand-side renewable building technologies.	Daylighting; insulation; passive solar heating; high-efficiency heating, ventilation, and air-conditioning equipment; natural ventilation, evaporative cooling; ground-source heat pumps; ocean water cooling
On-Site Supply Options		
1	Use RE sources available within the building footprint and connected to its electricity or hot/chilled water distribution system.	PV, solar hot water, and wind located on the building
2	Use RE sources available at the building site and connected to its electricity or hot/chilled water distribution system.	PV, solar hot water, low-impact hydro, and wind located on parking lots or adjacent open space, but not physically mounted on the building
Off-Site Supply Options		
3	Use RE sources available off site to generate energy on site and connected to the building's electricity or hot/chilled water distribution system.	Biomass, wood pellets, ethanol, or biodiesel that can be imported from off site, or collected from waste streams from on-site processes that can be used on site to generate electricity and heat
4	Purchase recently added off-site RE sources, as certified from Green-E (2009) or other equivalent REC programs. Continue to purchase the generation from this new resource to maintain NZEB status.	Utility-based wind, PV, emissions credits, or other "green" purchasing options. All off-site purchases must be certified as recently added RE. A building could also negotiate with its power provider to install dedicated wind turbines or PV panels at a site with good solar or wind resources off site. In this approach, the building might own the hardware and receive credits for the power. The power company or a contractor would maintain the hardware.

NZEB Supply Options 0, 1, and 2 must be considered first and implemented if cost-effective. On-campus development of Supply Option 2 is included in this evaluation and considered equivelant to on site Supply Option 2.

If the SB 2030 Standard cannot be met cost-effectively using supply options above, additional RE should be developed from within the project owner's portfolio (note that this in-portfolio RE development is not listed as a supply option number here). NZEB Supply Option 3 is also permitted, subject to evaluation by the SB 2030 Project Team.

The remainder of RE needed to meet the SB 2030 Standard shall be procured through Renewable Energy Credits (RECs).



Program Update 2020: Cost effective method reevaluation

From 2009:

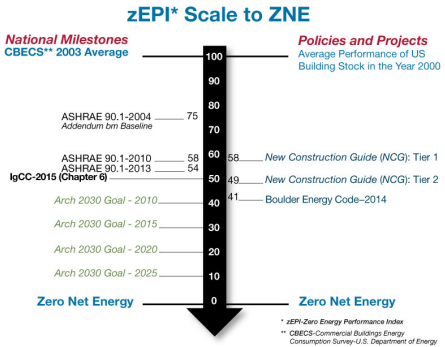
- Used a societal test, participant test, and utility test perspectives – determined that a simple payback threshold of longer than **15 years** would likely lead some individual building projects not being cost-effective.
- Initially was performed using a parametric analysis of 115 buildings to find this cost effective boundary.

From 2019:

- Updated analysis concludes that a payback period of **12 years** is now the cost-effective boundary for measures under the SB 2030 program.

Program Update: Hold Renovations to the Same Standard

- Major Renovations were previously held to a more relaxed standard than new construction, consisting of half of the required reduction for energy consumption from the 2003 baseline building.
- The cost-effectiveness hierarchy will be more fully integrated in the program software and tools, including the Energy Standard Tool, permitting projects to achieve an adjusted standard and compliance with the program.
- National programs such as the AIA 2030 Commitment currently use the same standard for major renovations as for new construction.
- Projects which had already begun predesign are allowed use the more relaxed standard (at 80%-better)
- Durability and historic considerations can be noted as rational to not pursue some potential strategies, in particular for legacy masonry structures.



SB 2030 Program – Alternative paths

- ***Small Buildings Method:*** Projects (currently under 20,000 sf) are permitted to use the Small Buildings Method, which uses prescriptive approach in lieu of a comprehensive building energy simulation.
- ***Partial Mechanical Upgrades****:* Major renovation projects that are not replacing the full mechanical systems have fewer opportunities to achieve improved performance and limited system design opportunities.
- ***Wastewater Treatment Facilities:*** Wastewater Treatment Facilities required to meet SB 2030 are asked to follow a process which evaluate and benchmark existing facility (if any), document energy conservation measures considered for the project and provide anticipated performance metrics.
- ***Cost-Effective Adjusted Standard (pre-2020):*** As SB 2030 is required to be achieved cost-effectively some projects may request to document the limit of this cost-effectiveness in order to adjust the SB 2030 Standard EUI. This process has been adapted into the process for setting the On-Site SB 2030 Target for projects needing to access off-site resources to hit their targets.

SB 2030 As-Designed Training

Ryan Schwartz, LEED® Green Associate

October 21, 2020

WILLDAN

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Learning Objectives

01 Use the SB 2030 tool to set an energy standard for a building.

02 Calculate expected Energy Use Intensity (EUI) and carbon emissions for a building.

03 Describe when the ‘As-Designed’ tool is appropriate for modeling a project.

04 Explain the difference between Space Types and Space Asset Types.

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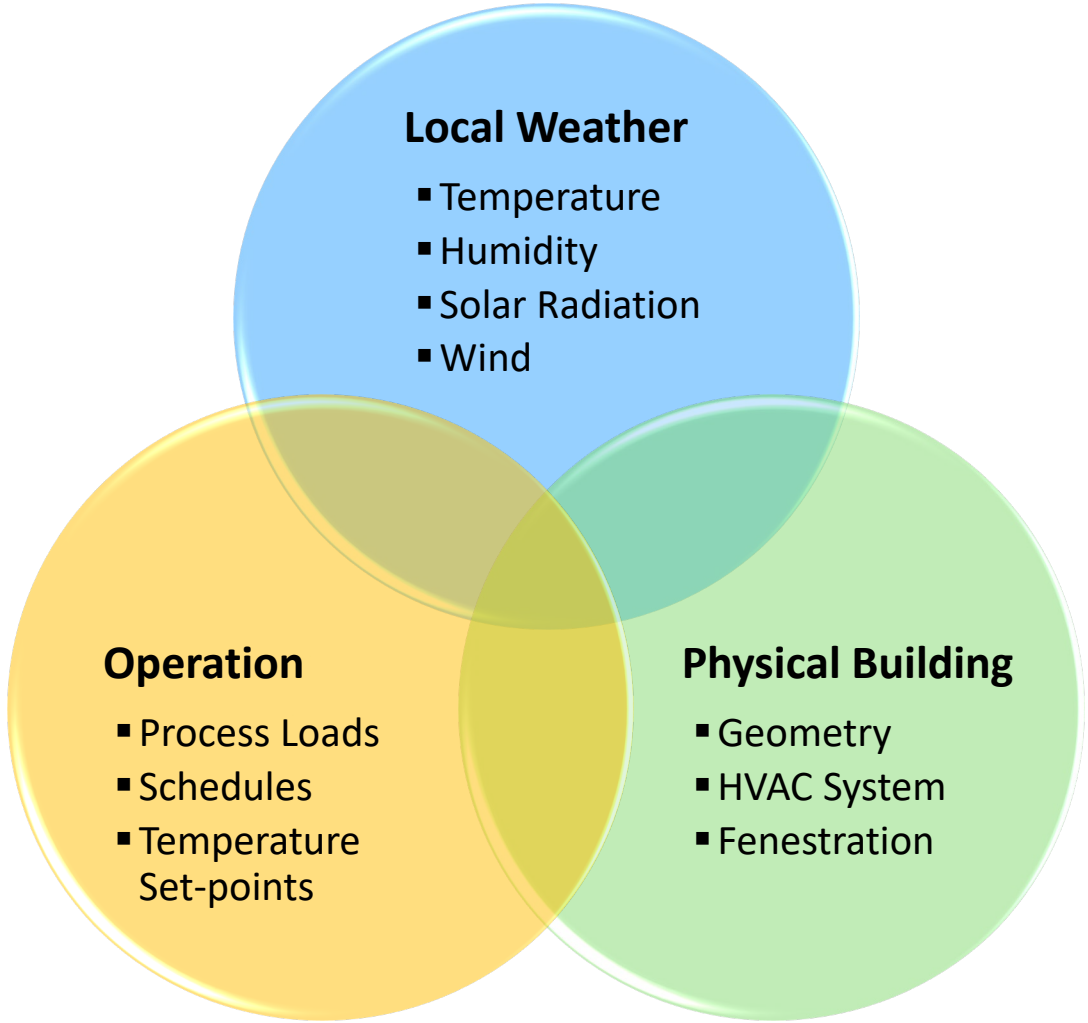
SB 2030 Tool

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



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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

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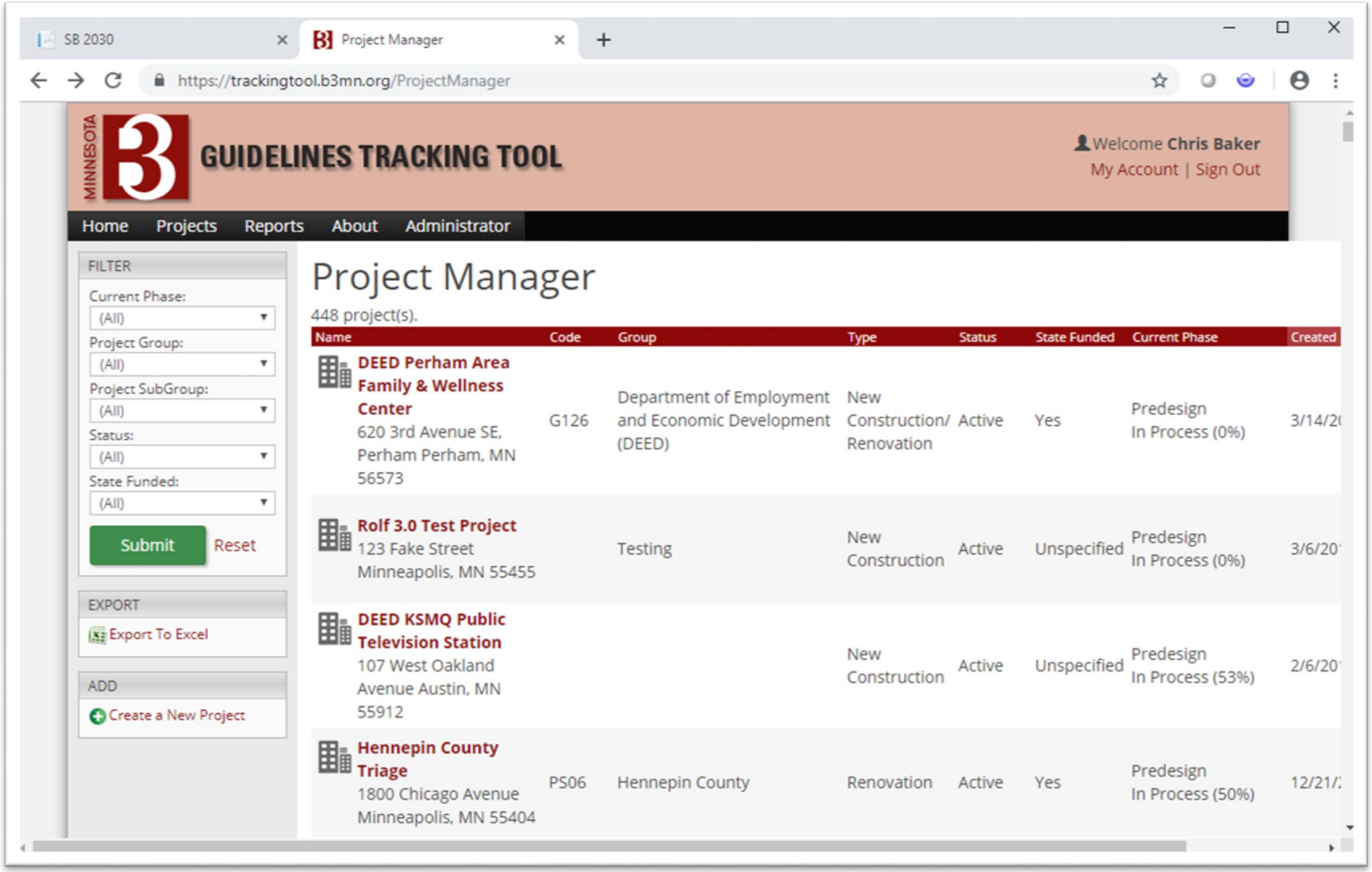
Navigating SB 2030

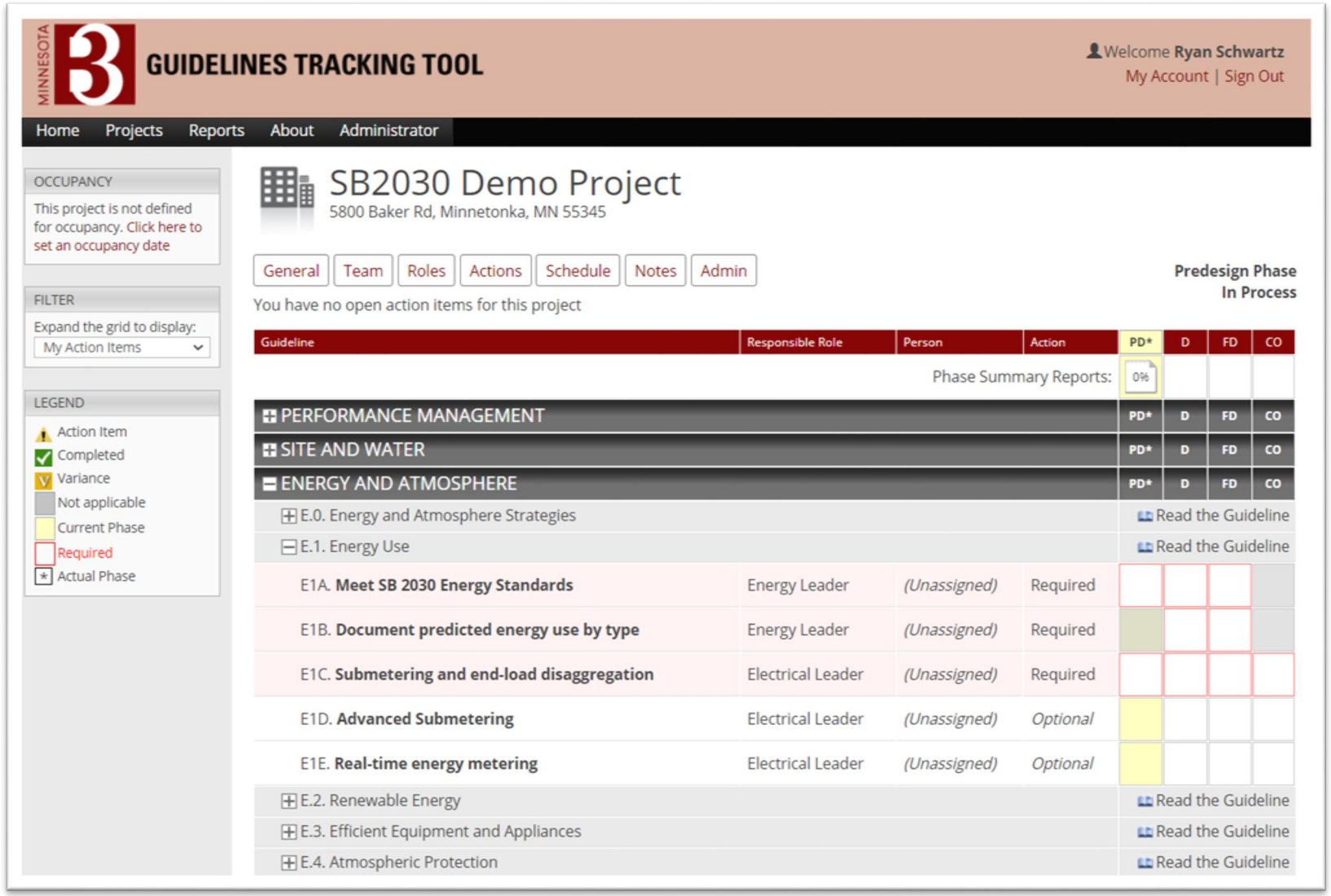
Navigating to SB 2030 Tool

- Access full version of tool from B3 Guidelines Tracking Tool
- Goal Setting version (v3.0 EST) available at https://www.b3mn.org/2030energystandard/



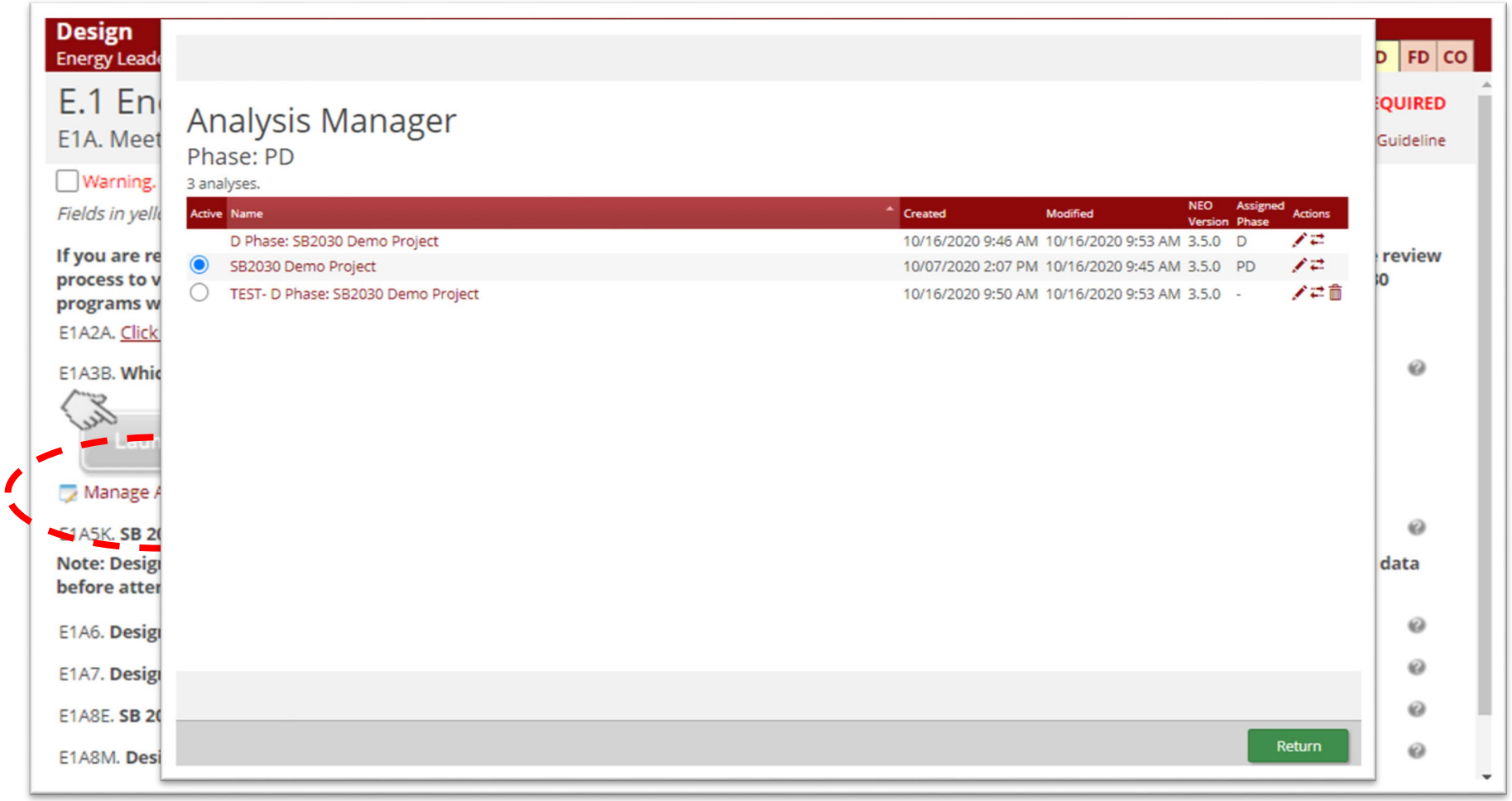
Navigating to SB 2030 Tool

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



Analysis Manager

- Manage analyses across a project's phases
- Set active analysis for each phase, Rename, Clone, and Delete analyses

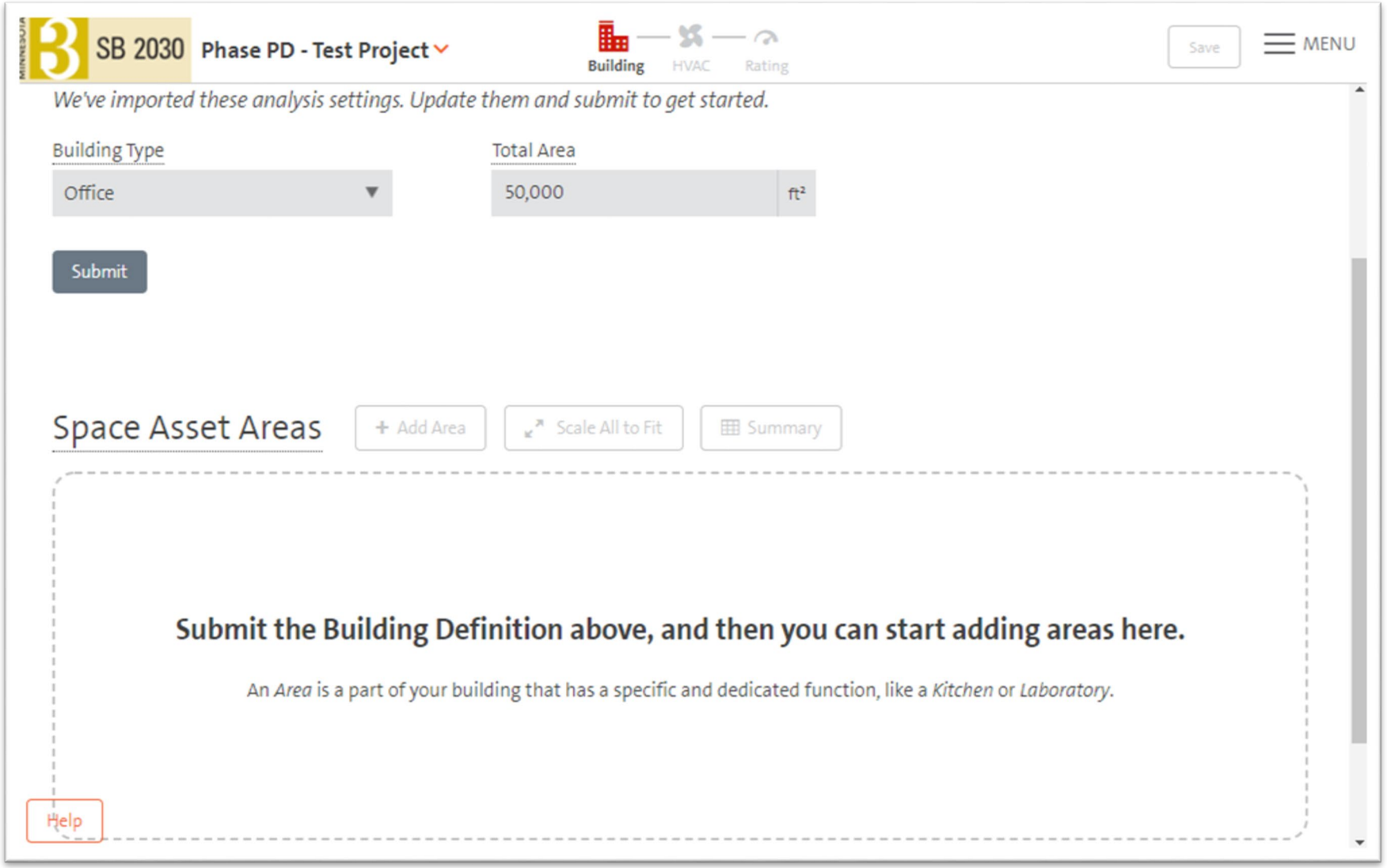


Creating SB 2030 Models

USER INTERFACE OVERVIEW

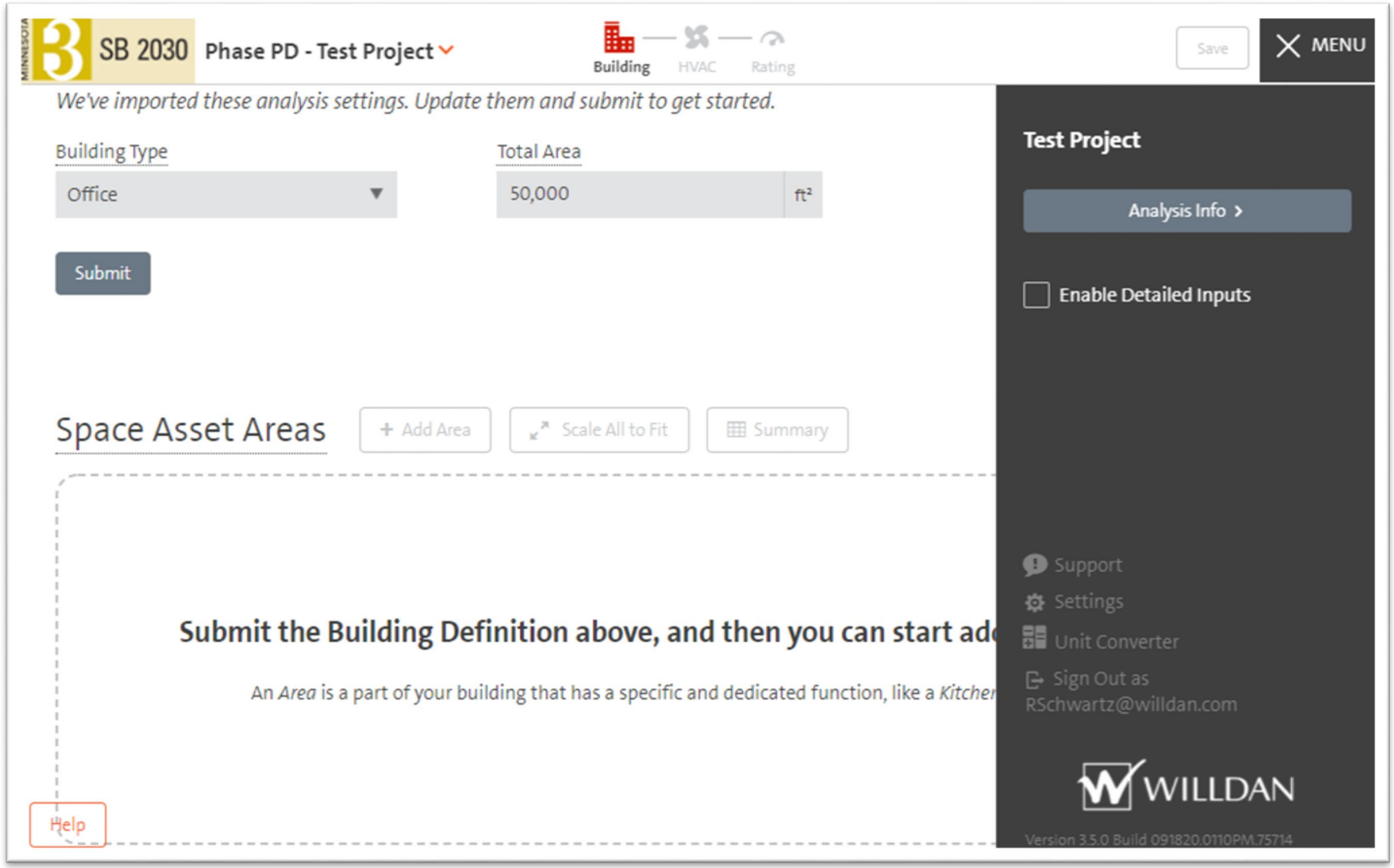
SB 2030 Models

- New User Interface
  - Single path for Target and Design results



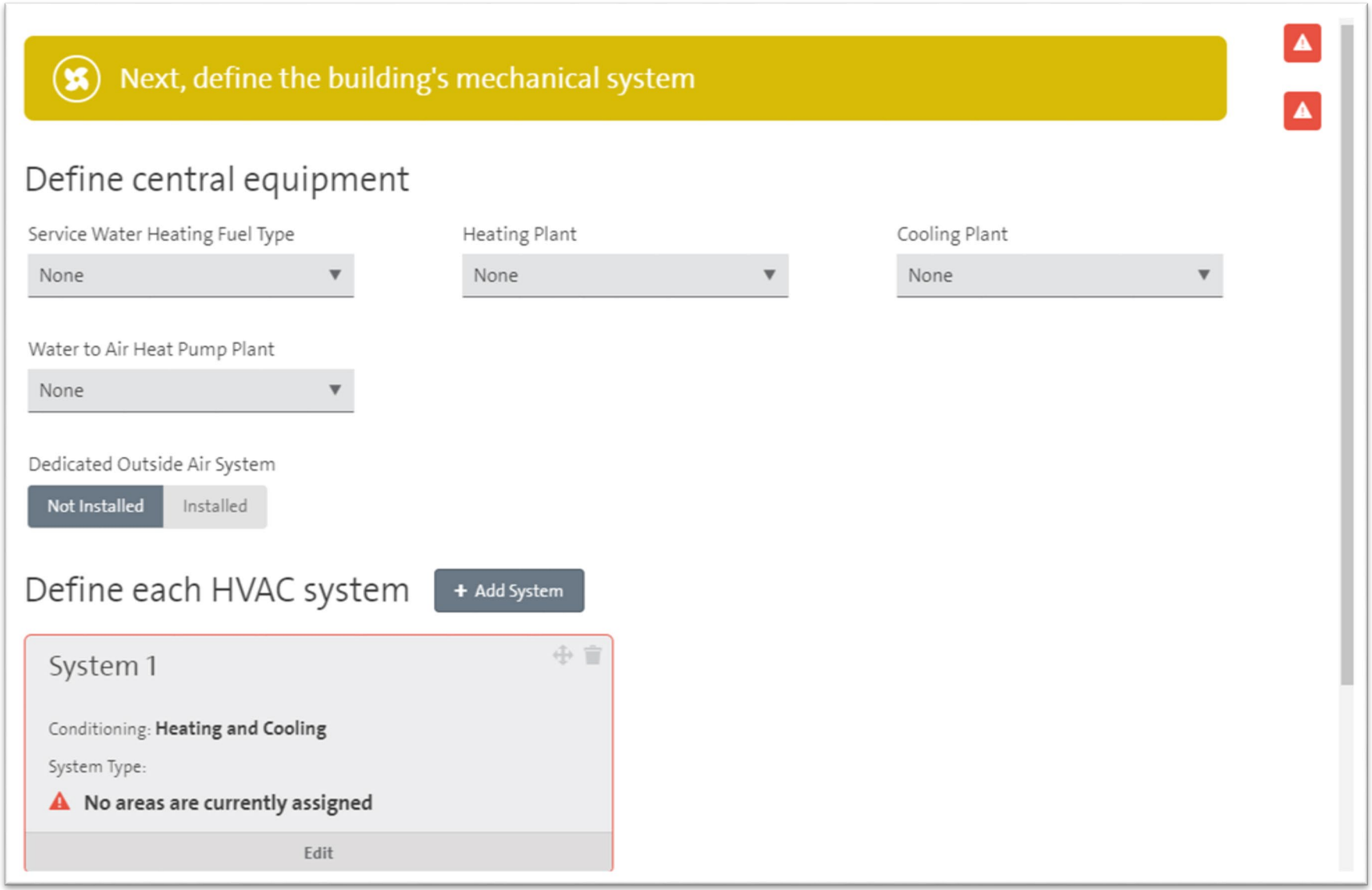
SB 2030 Navigation Overview

- Top menu shows steps
  - Building
  - HVAC
  - Rating – “NEW”
- Color indicates status
  - Red – error
  - Light gray – not complete
  - Dark gray – complete
  - Bold – indicates location
- Enable Detailed Inputs for
  - Schedules
  - Setpoints and ventilation
  - Geometry
  - Constructions
  - Plug/process loads



User Interface Overview

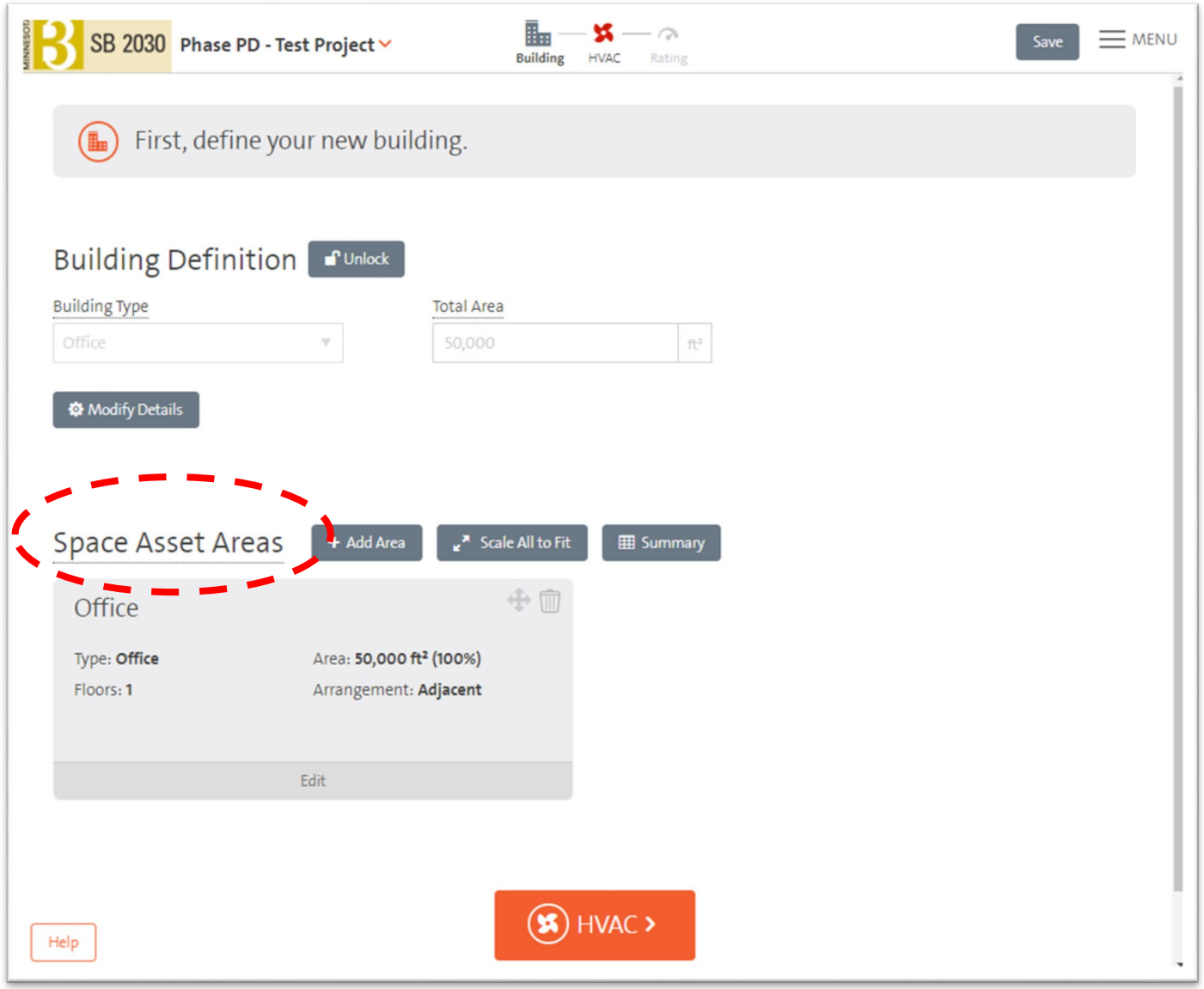
Error Messaging



- 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



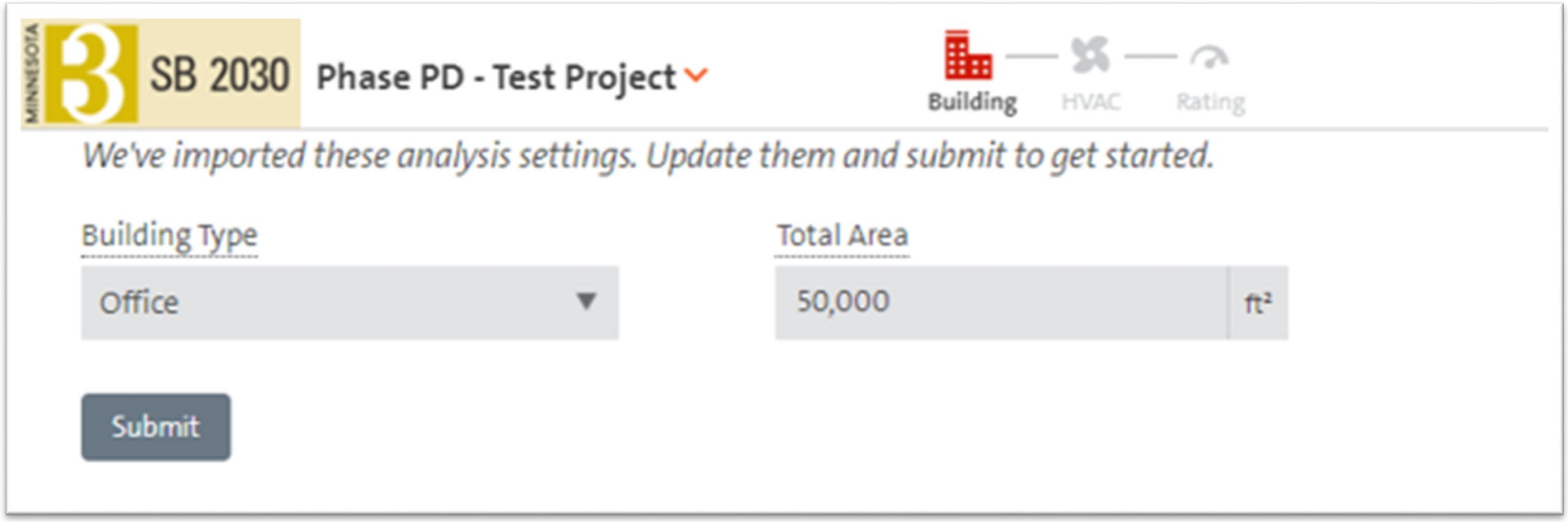
- Help is indicated by lines under headings and are located throughout the tool – use them!

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



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 Building
- Retail – Big Box
- Retail – Convenience Store
- Retail – Supermarket
- Senior Housing
- Strip Mall
- 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

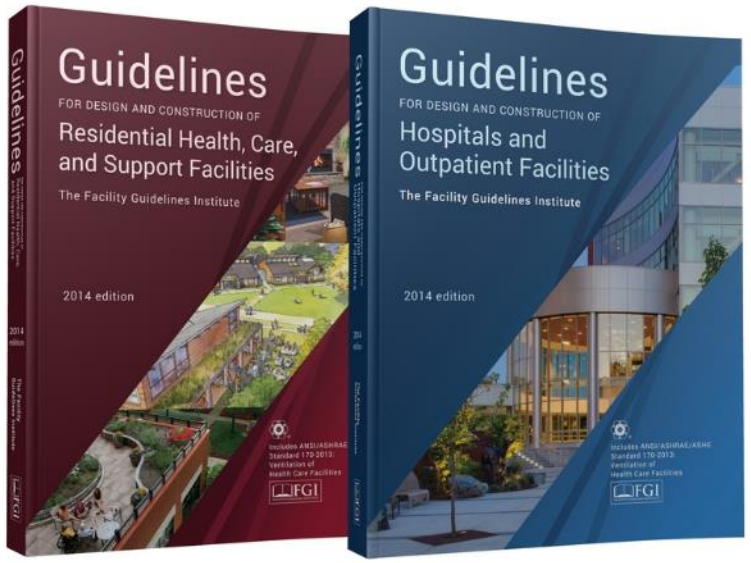
Space Asset Areas vs. Space Type

- 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

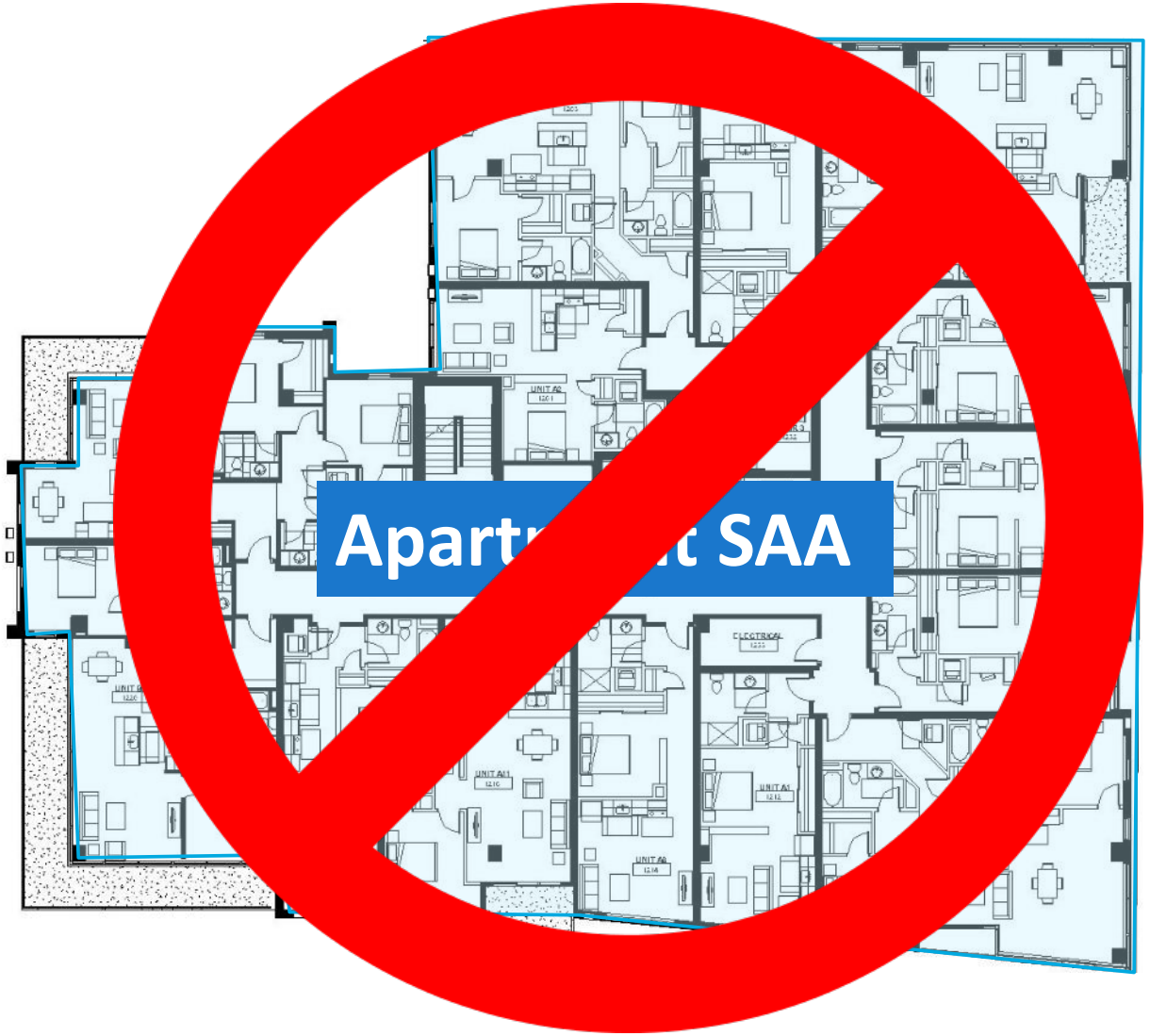


Space Asset Areas vs. Space Type

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

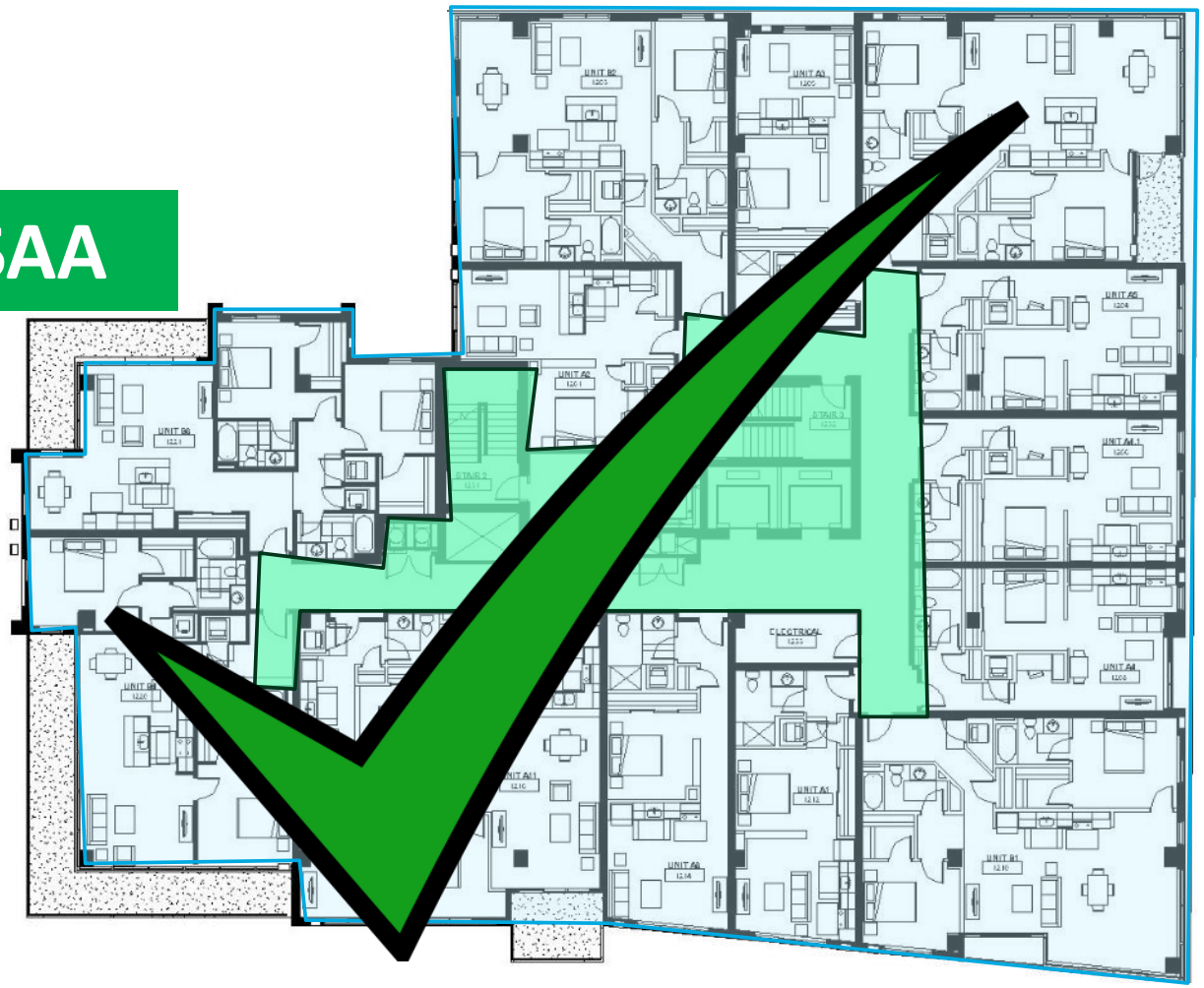
Example Area Take-offs: Apartments



Example Area Take-offs: Apartments

Apartment SAA

Common Areas SAA



Example Area Take-offs: Hospital

Example Area Take-offs: Hospital

Patient Room SAA

Common Areas SAA

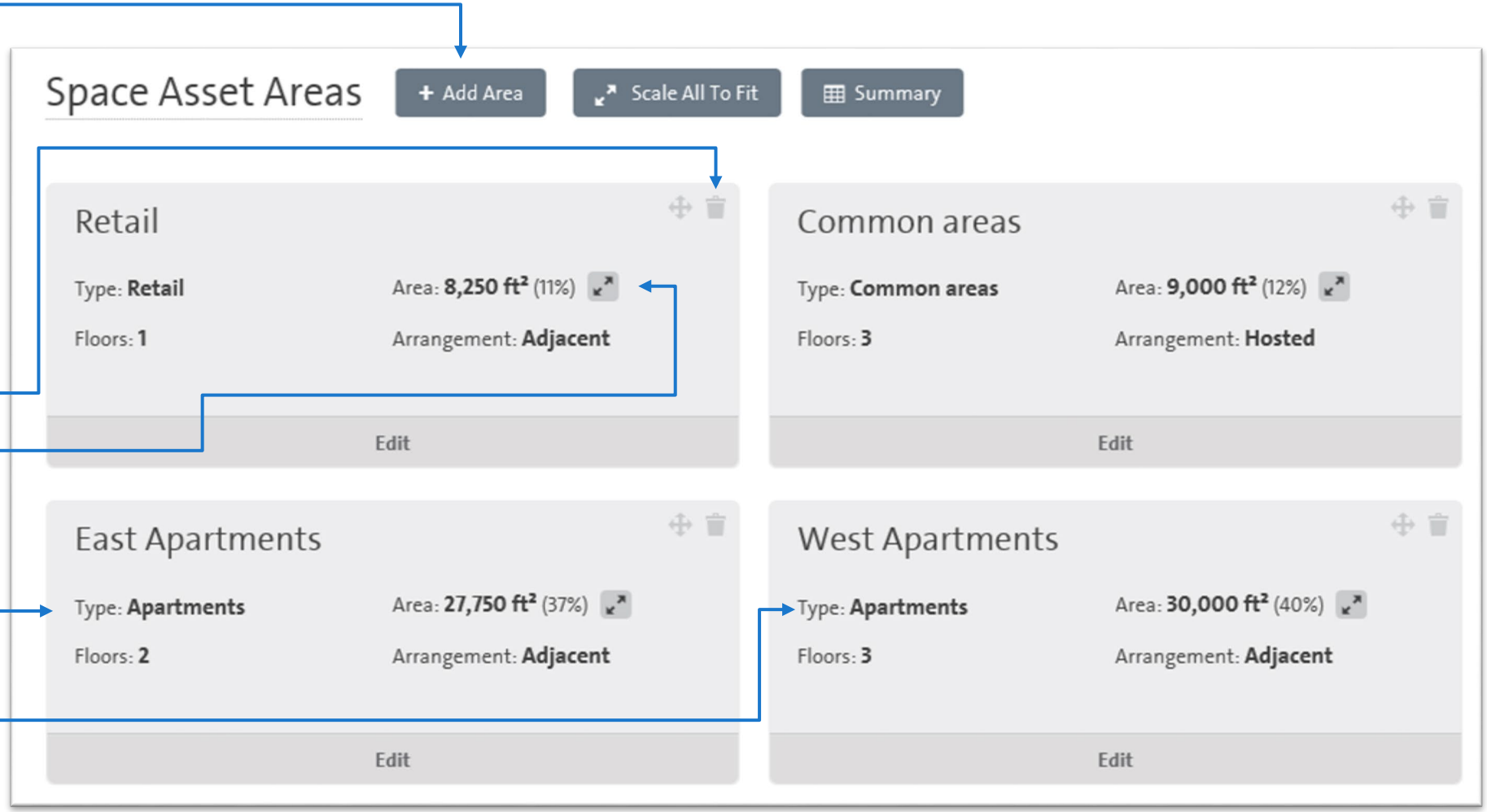
Current Available Space Asset Types

- Apartment – Low Rise
- Apartment – Mid/High Rise
- Auto Repair
- Classrooms
- Common Areas – Multifamily
- Computer Center
- Conference/Meeting Area
- Convention Center
- Courtrooms
- 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
- Warehouse – Active
- Workshop
- Worship Area

Starting a SB 2030 Model

Building Definition

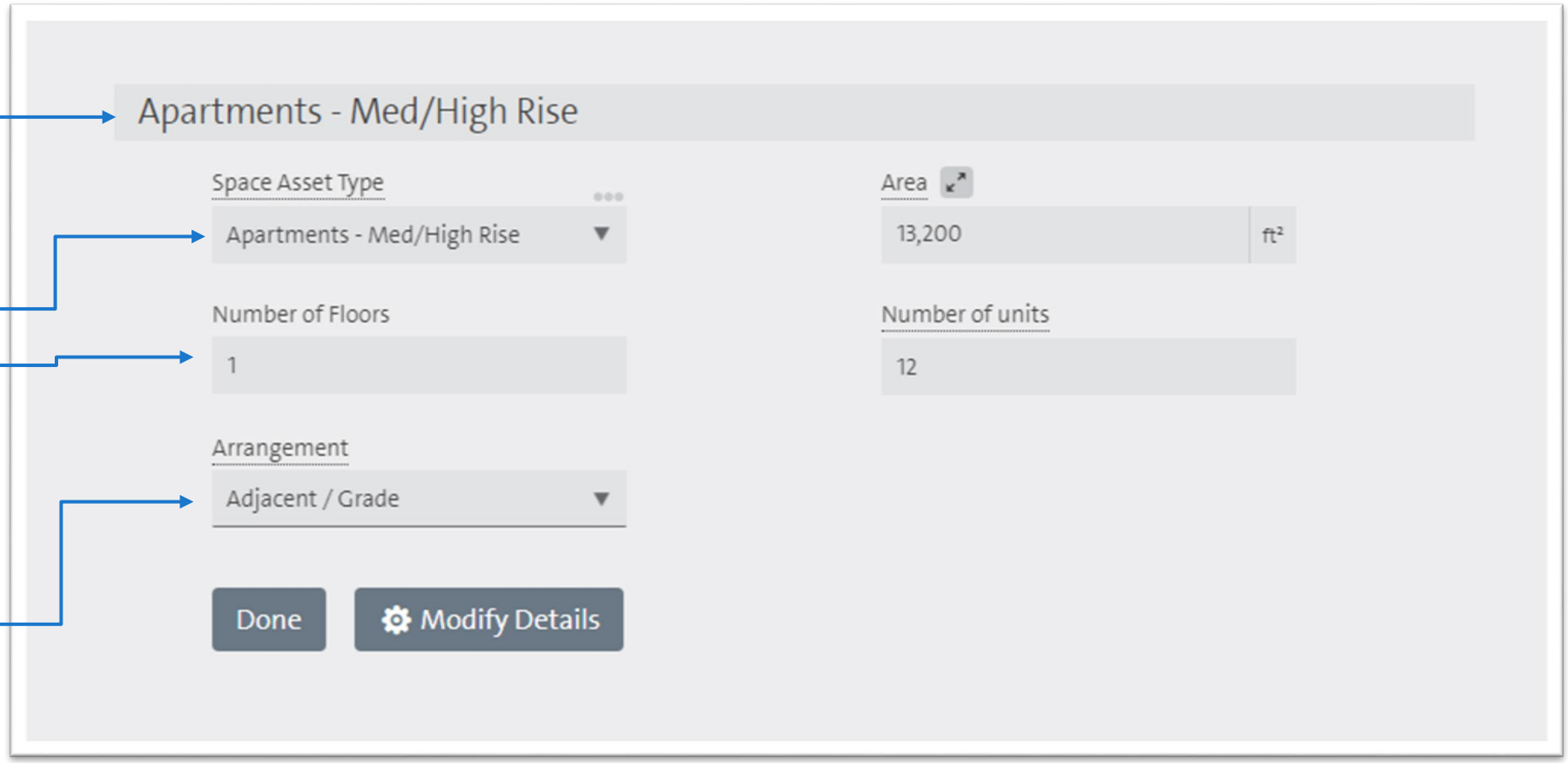
- Define the Space Asset Areas
  - Default based on building type
  - Add with ‘add area’ button
  - Delete with ‘trash can’
  - Scale area to fit
  - More than one of the same SAT can be used within the building



Starting a SB 2030 Model

Refining Space Asset Areas

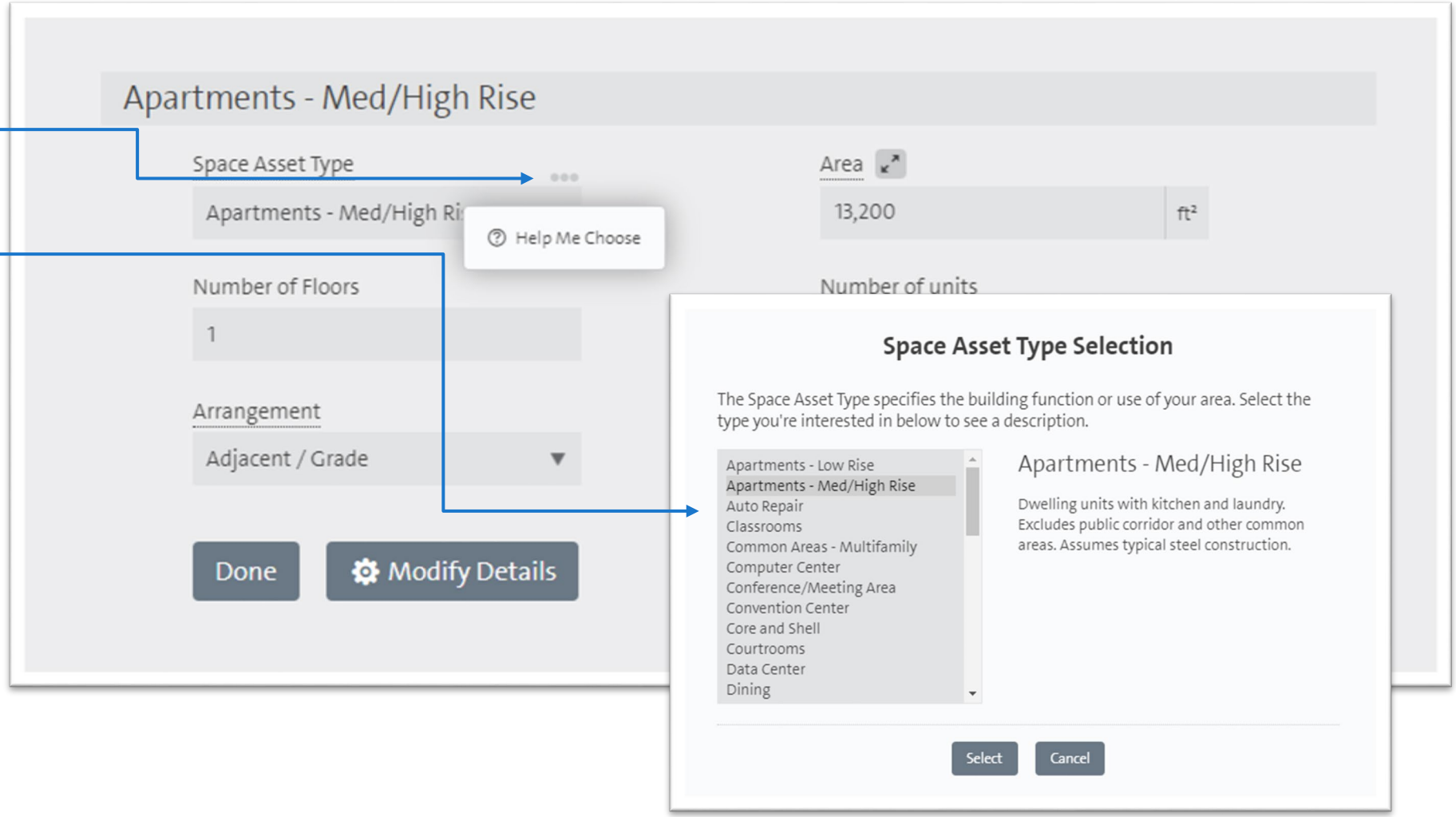
- Edit Space Asset Areas
  - Use the Edit Button under the SAT
  - Give a custom name
  - Adjust type
  - Select # of floors
  - Adjust the size
  - Adjust the geometry Adjacent – SAT is next to another
    - Stacked - SAT is on top of another
    - Hosted – SAT if fully contained in another



Starting a SB 2030 Model

Refining Space Asset Areas

- Help Me Choose
  - Space Asset Type descriptions available to assist in selection
  - Select Space Asset Type Selection pop-up window



MODIFYING SPACE ASSET AREA DETAILS

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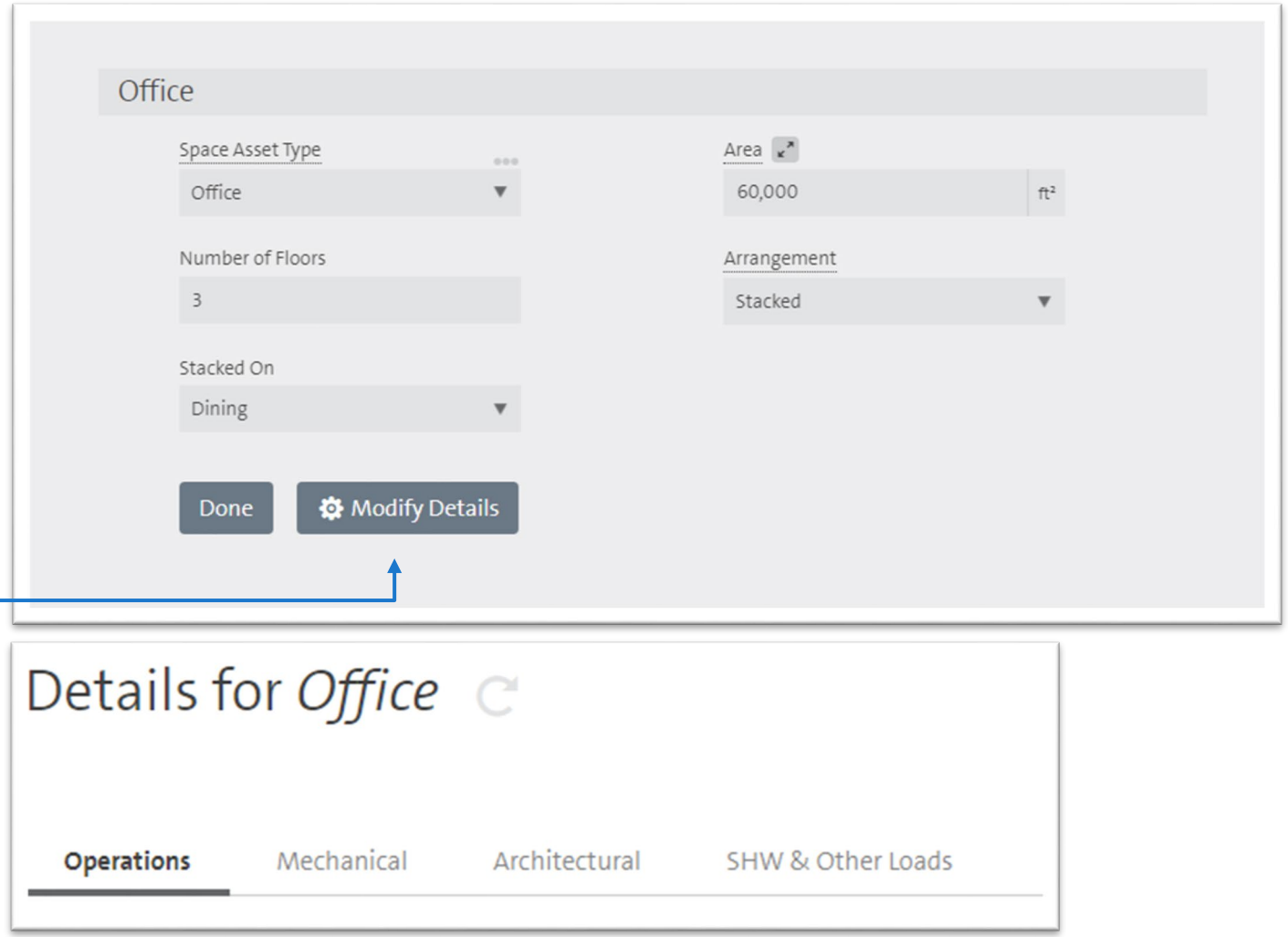
Starting a SB 2030 Model

Refining Space Asset Areas

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



Starting a SB 2030 Model

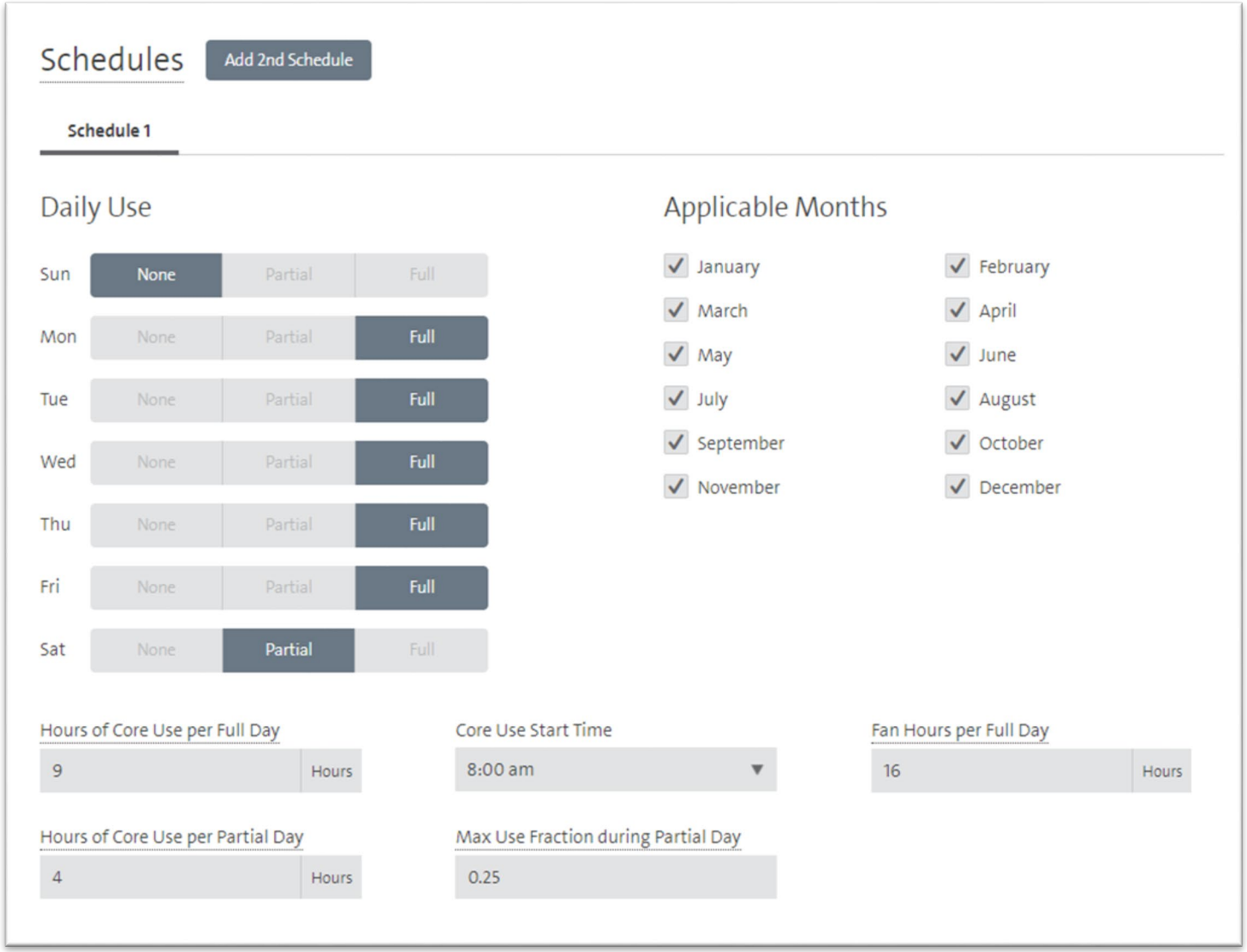
Operational details

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

Starting a SB 2030 Model

Operational details

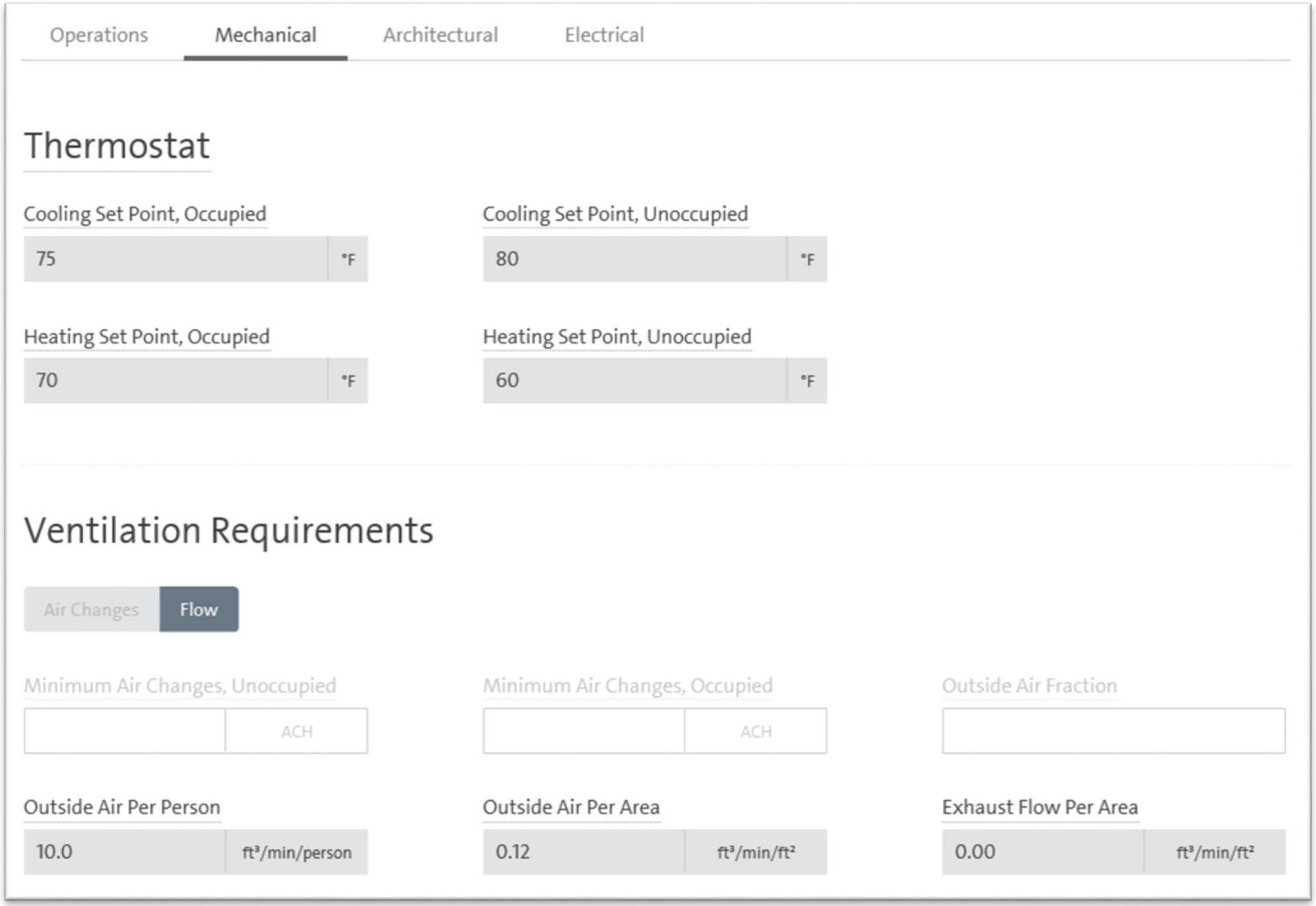
- Select use by day
  - None, partial, full
- Define Full and Partial Days
  - Hours of Core Use per Full Day
  - Core Use Start Time
  - Fan Hours per Full Day
  - Hours of Core User per Partial Day
  - Max Use Fraction during Partial Day
- Choose the months for which this schedule applies
- Add a 2nd schedule if needed
- Schedules impact lights, plugs, people and fans
- Default schedules are from ASHRAE



Starting a SB 2030 Model

Mechanical details

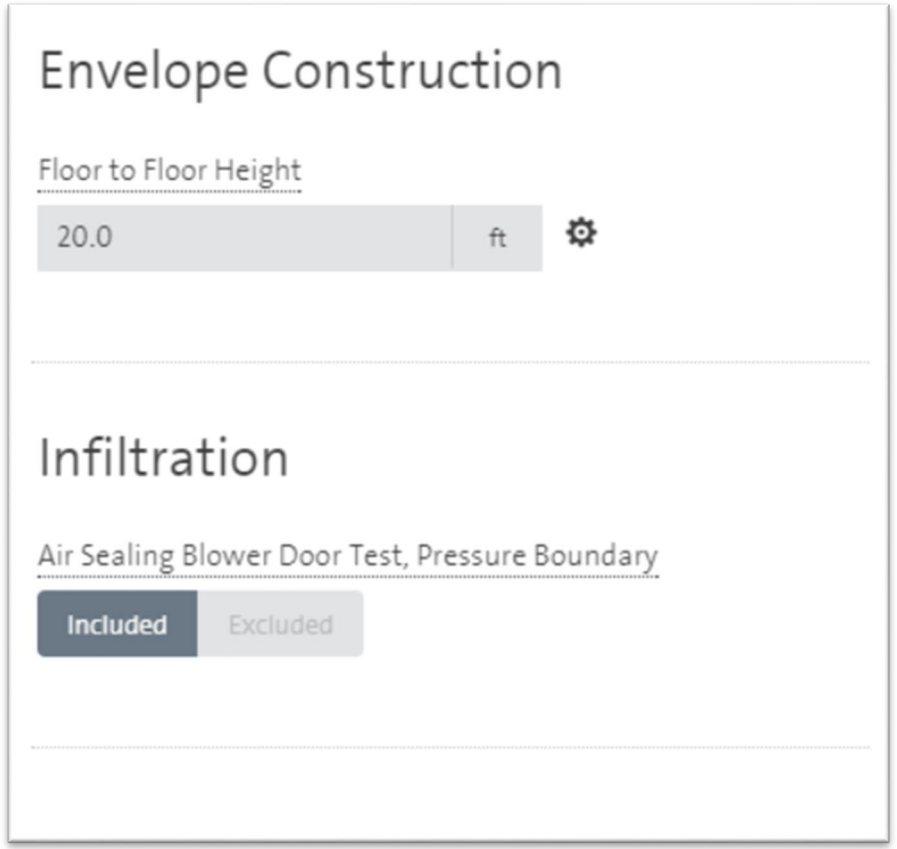
- Adjust thermostat setting
  - Separate heating and cooling
  - Separate occupied and unoccupied
  - Settings carry forward, no operation strategies at this time to adjust for savings
- Ventilation
  - Ability to set on air change or flow rate basis
  - Defaults to ASHRAE 62.1



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
- Infiltration
  - Include or excluded

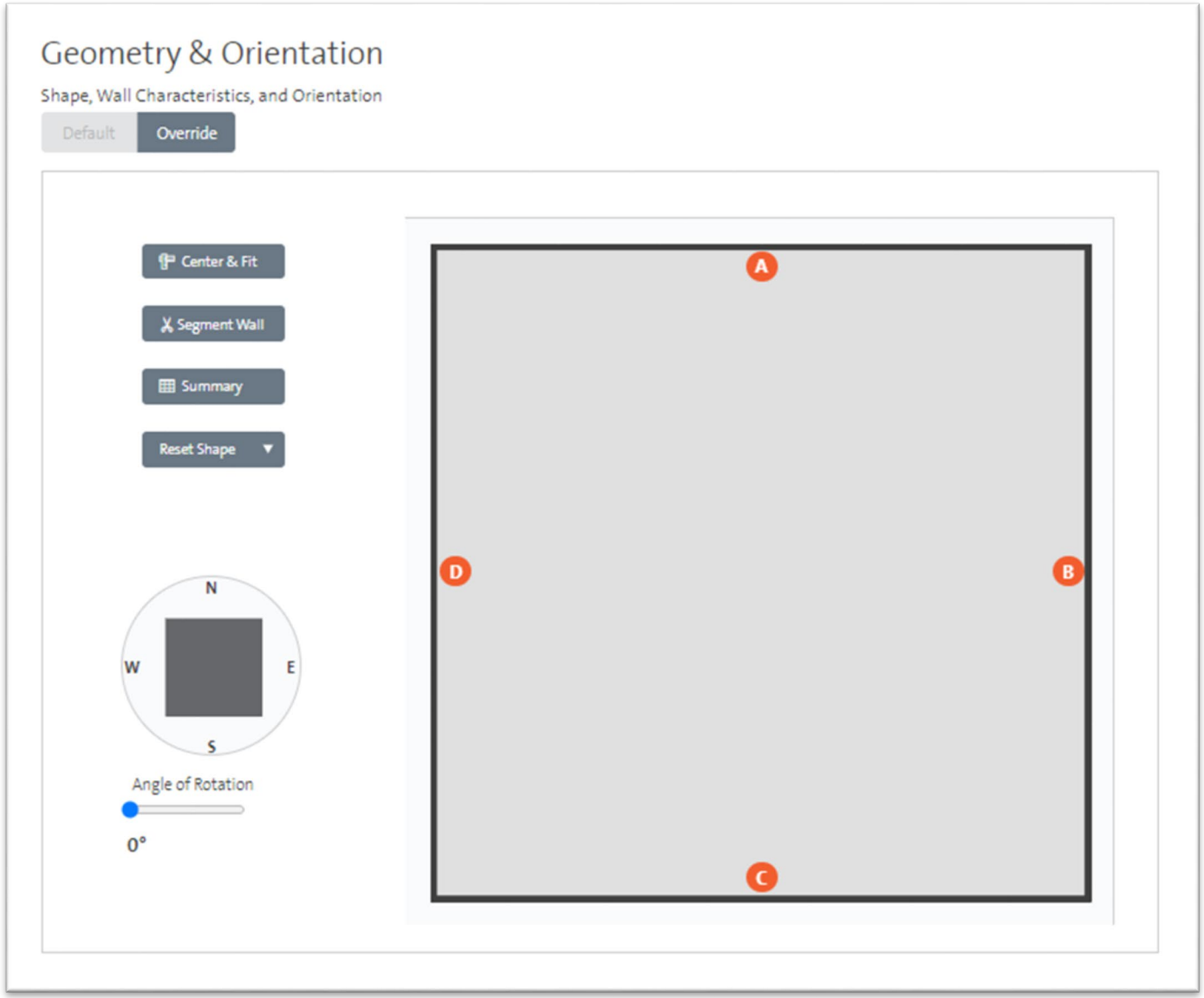


MODIFYING DETAILED GEOMETRY

Starting a SB 2030 Model

Architectural details

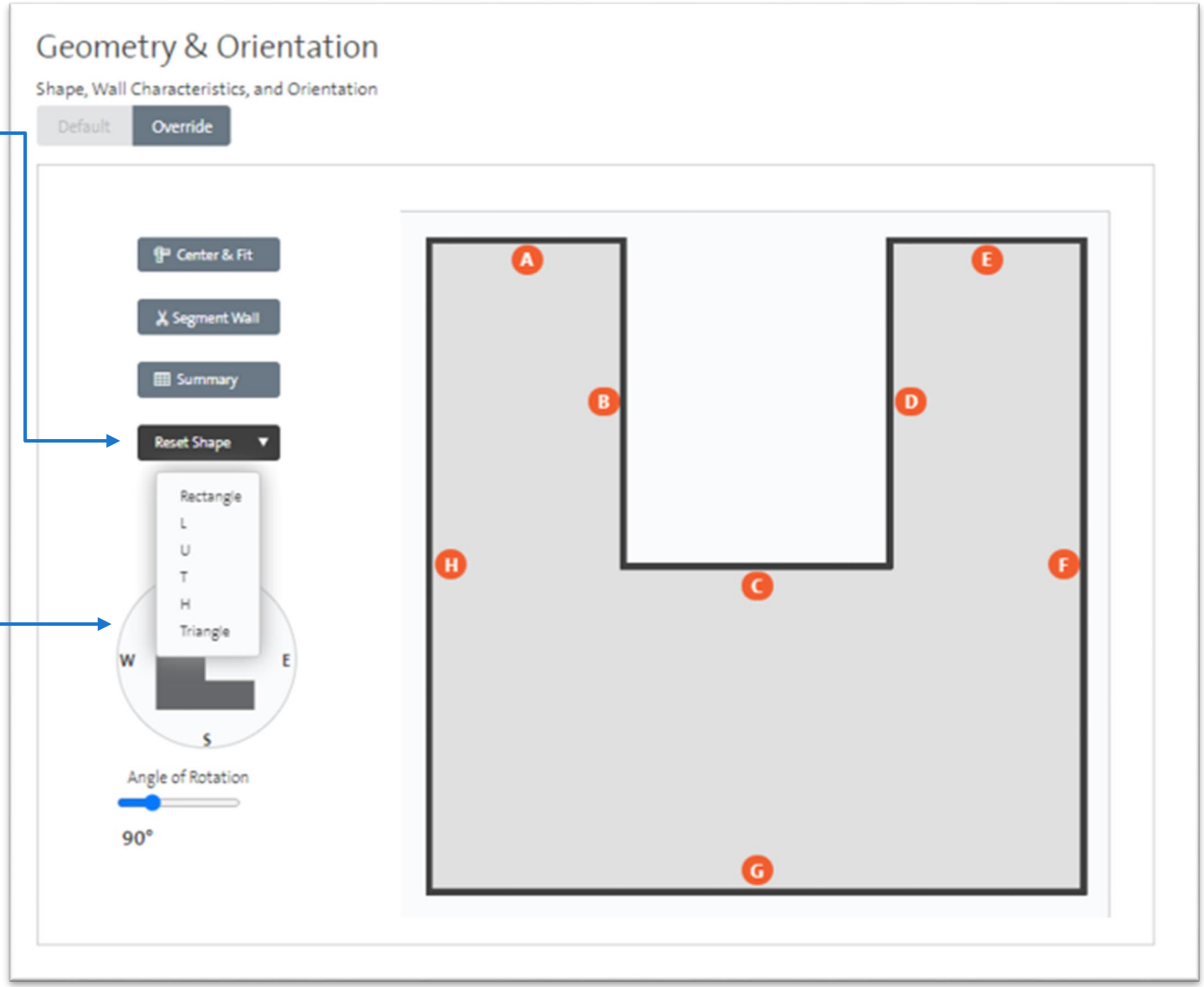
- Adjust geometry beyond default SAT arrangement
  - Do only if unique
  - Done on a SAA-by-SAA basis
  - Can segment or note shared walls
  - Can set window to wall ratio by orientation
- May impact heat pump or VRF systems more than central systems
- Intended to be high level geometry; **DO NOT** include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



Starting a SB 2030 Model

Architectural details

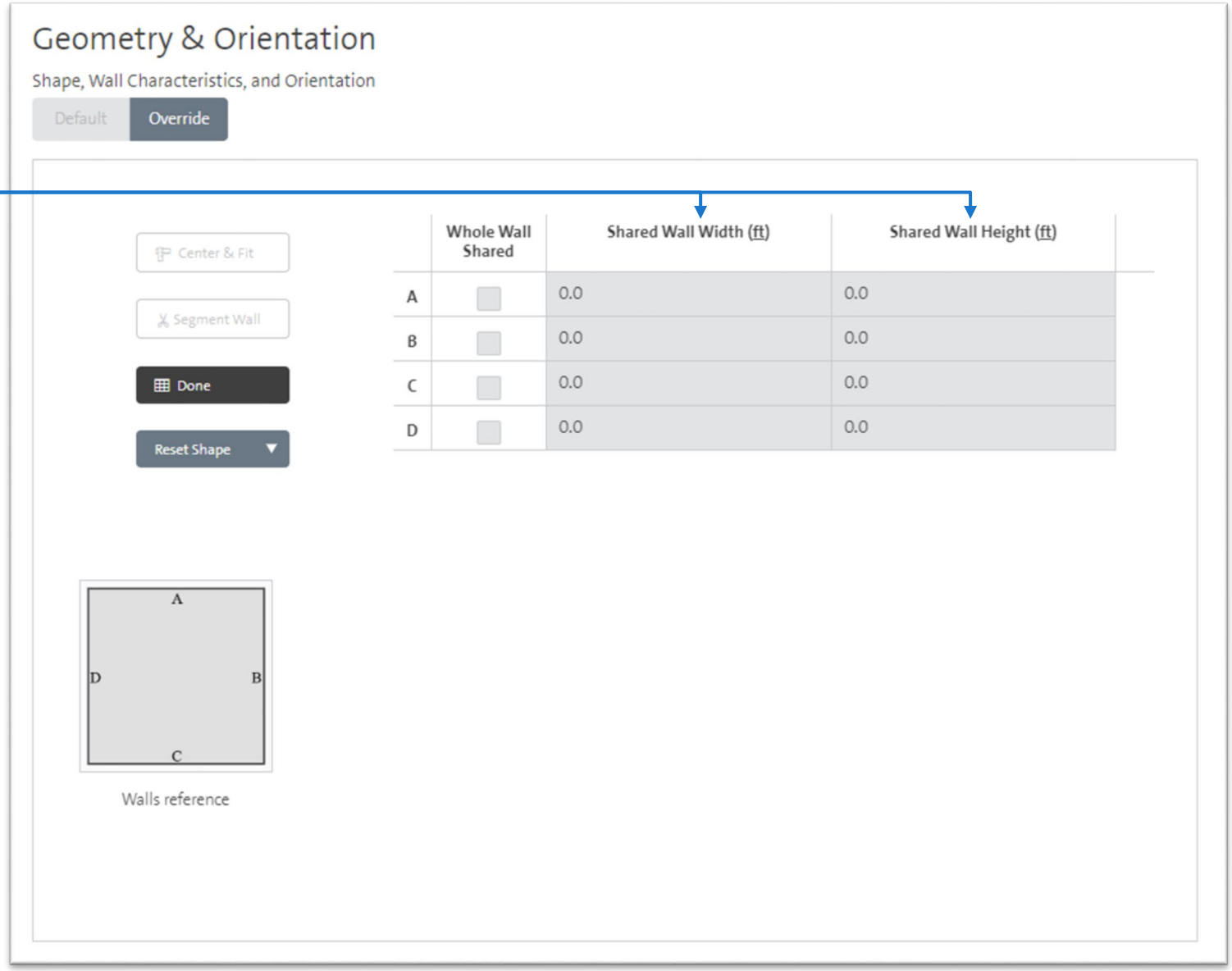
- Custom Geometry
  - Choose from standard shapes
  - Rotate building
    - Note rotation only shown here
  - Segment wall to further change shape



Starting a SB 2030 Model

Architectural details

- Custom Geometry
  - Summary
    - Note shared walls with another SAA based on width and height of shared portion
    - Exit Summary table by clicking “Done”

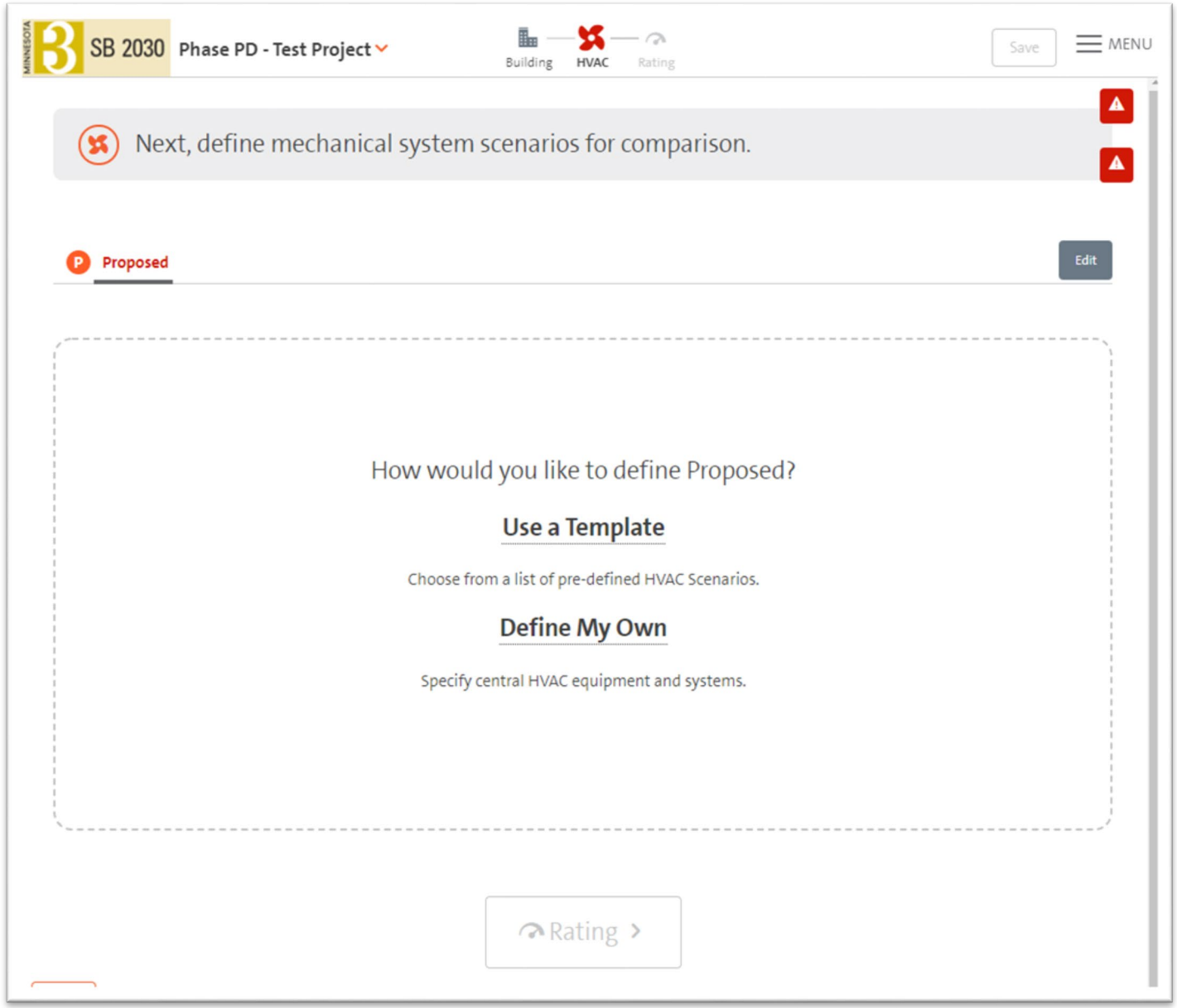


HVAC SYSTEMS

Starting a SB 2030 Model

HVAC details

- Define Proposed HVAC system
  - New “Use a Template” feature lists pre-defined HVAC scenarios
  - “Define My Own”
- 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

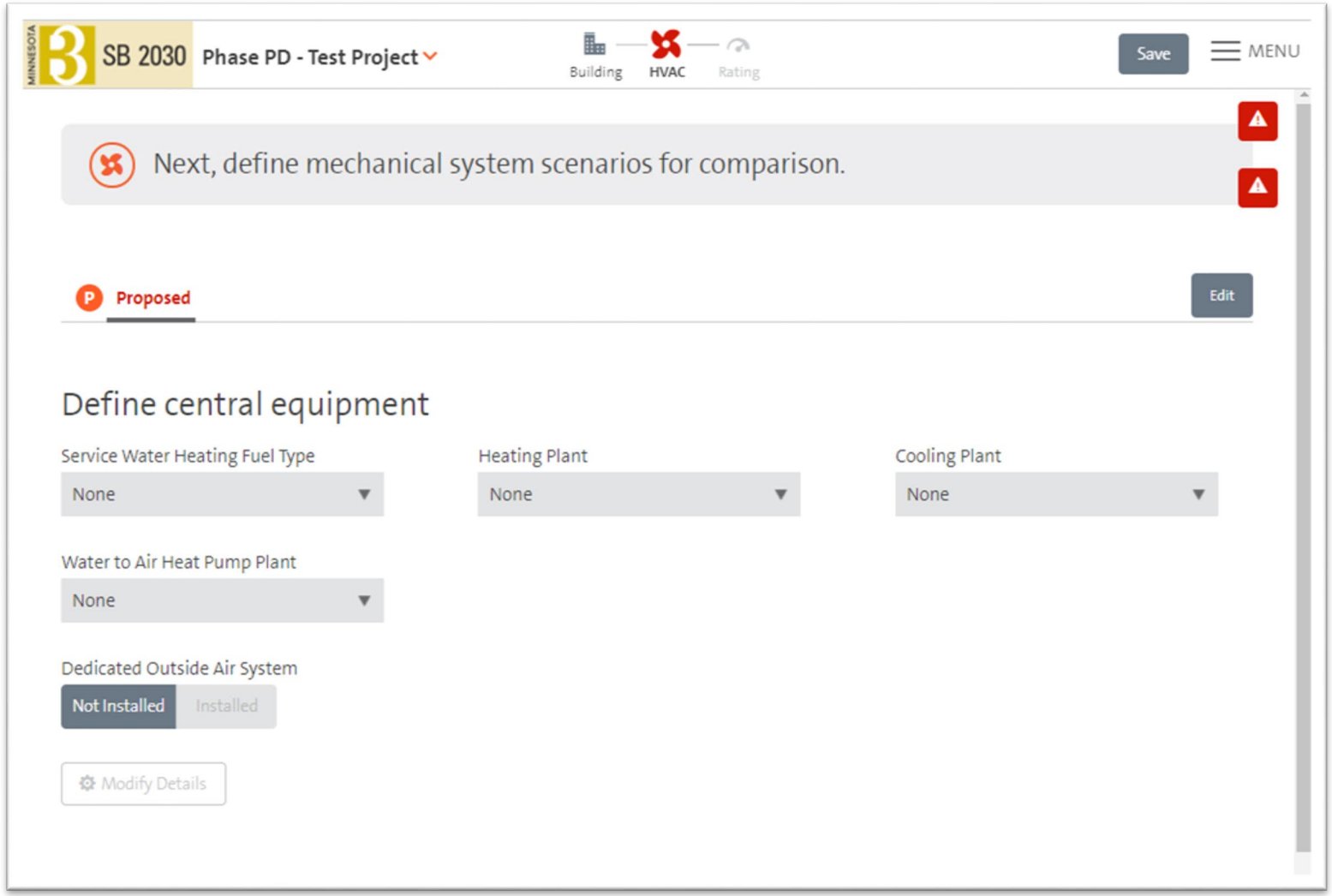


CENTRAL PLANT EQUIPMENT

Starting a SB 2030 Model

HVAC details – central plant

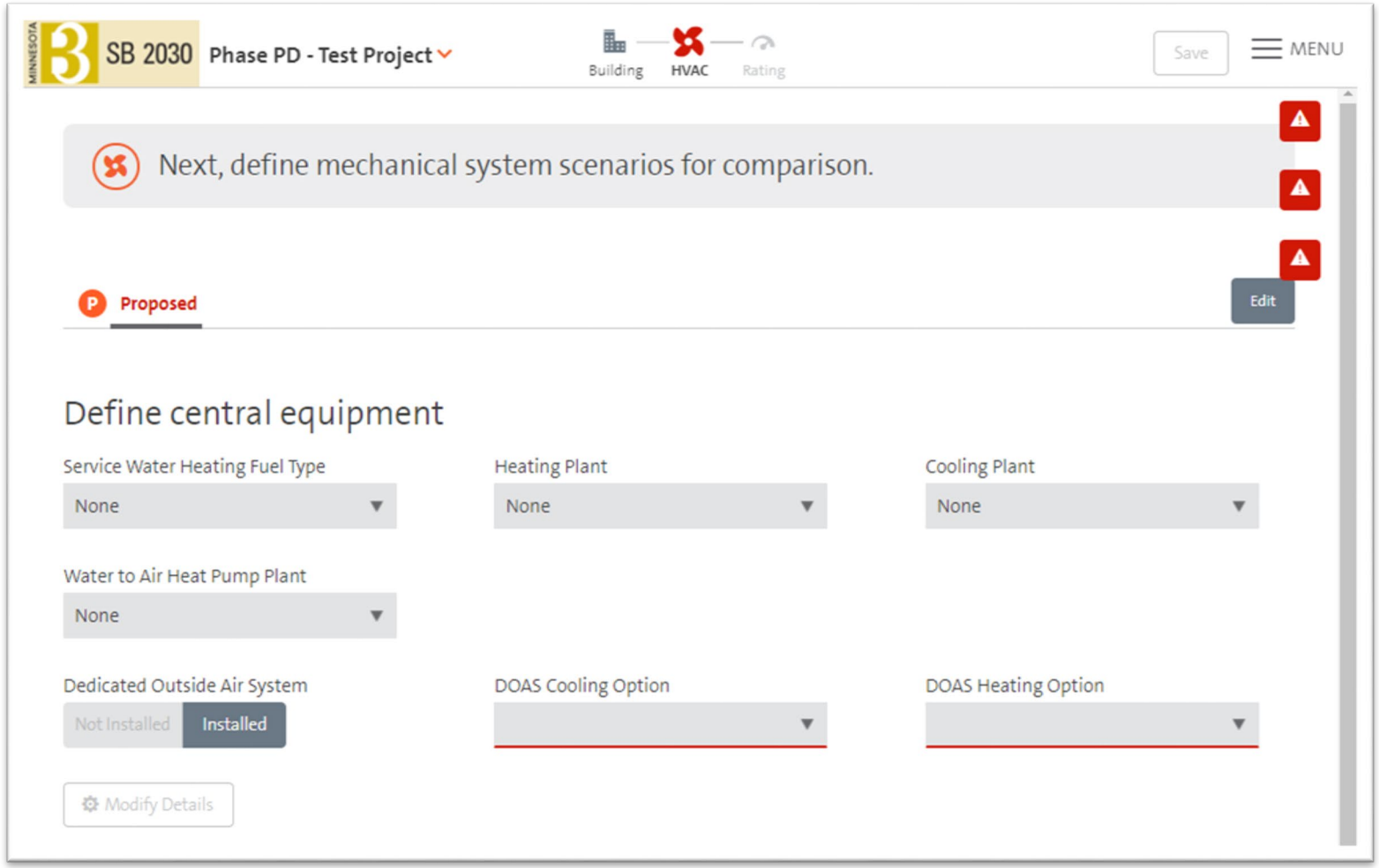
- Select service water heating system fuel type
  - Select none if SWH is not a factor in the project
- Select heating plant type
  - Boiler
  - District
  - None if no central equipment
- Select cooling plant type, if no chiller select none
  - District cooling
  - Air-cooled chiller
  - Water-cooled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

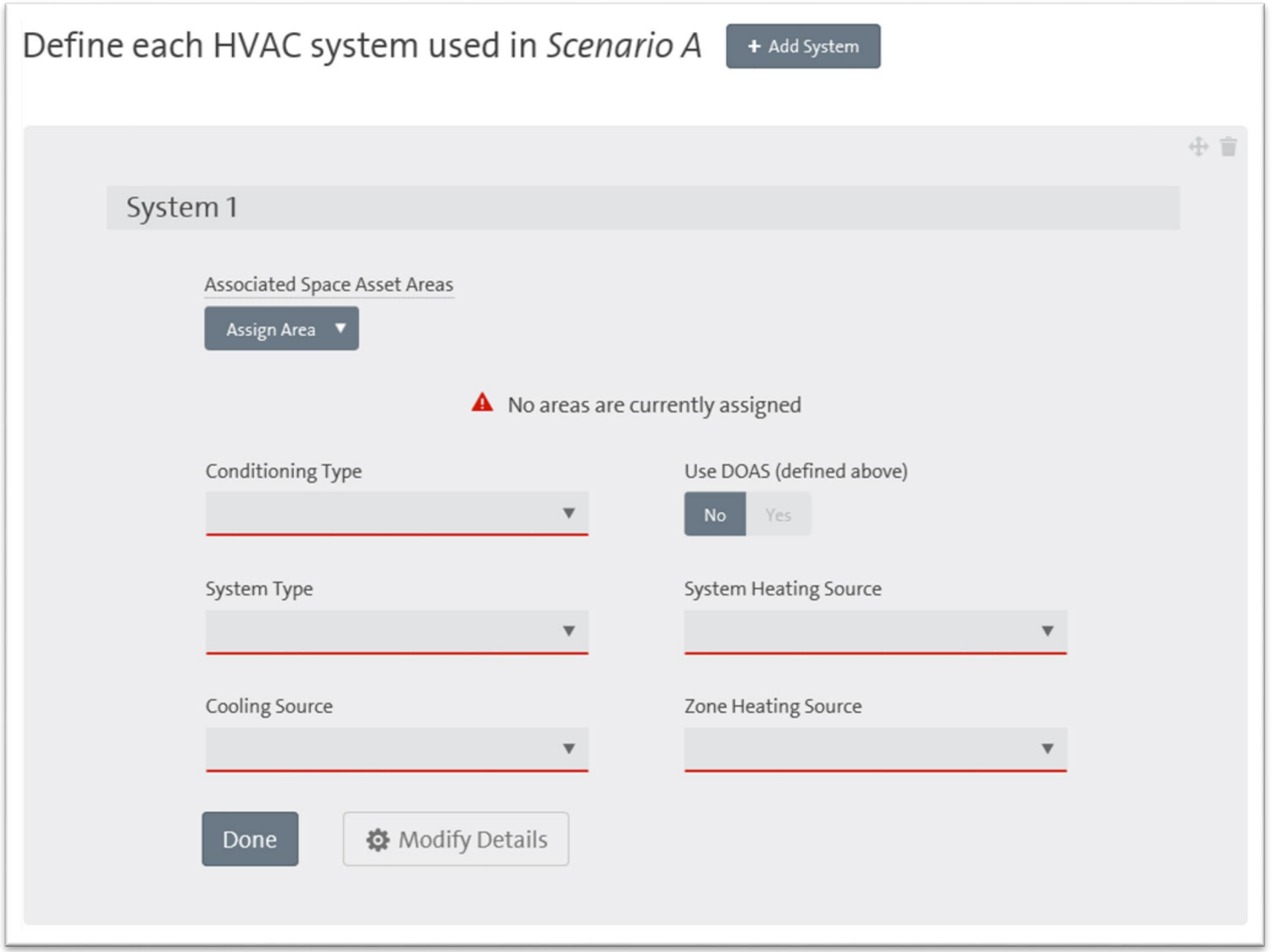


CREATING HVAC SYSTEMS

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



Rating User Interface

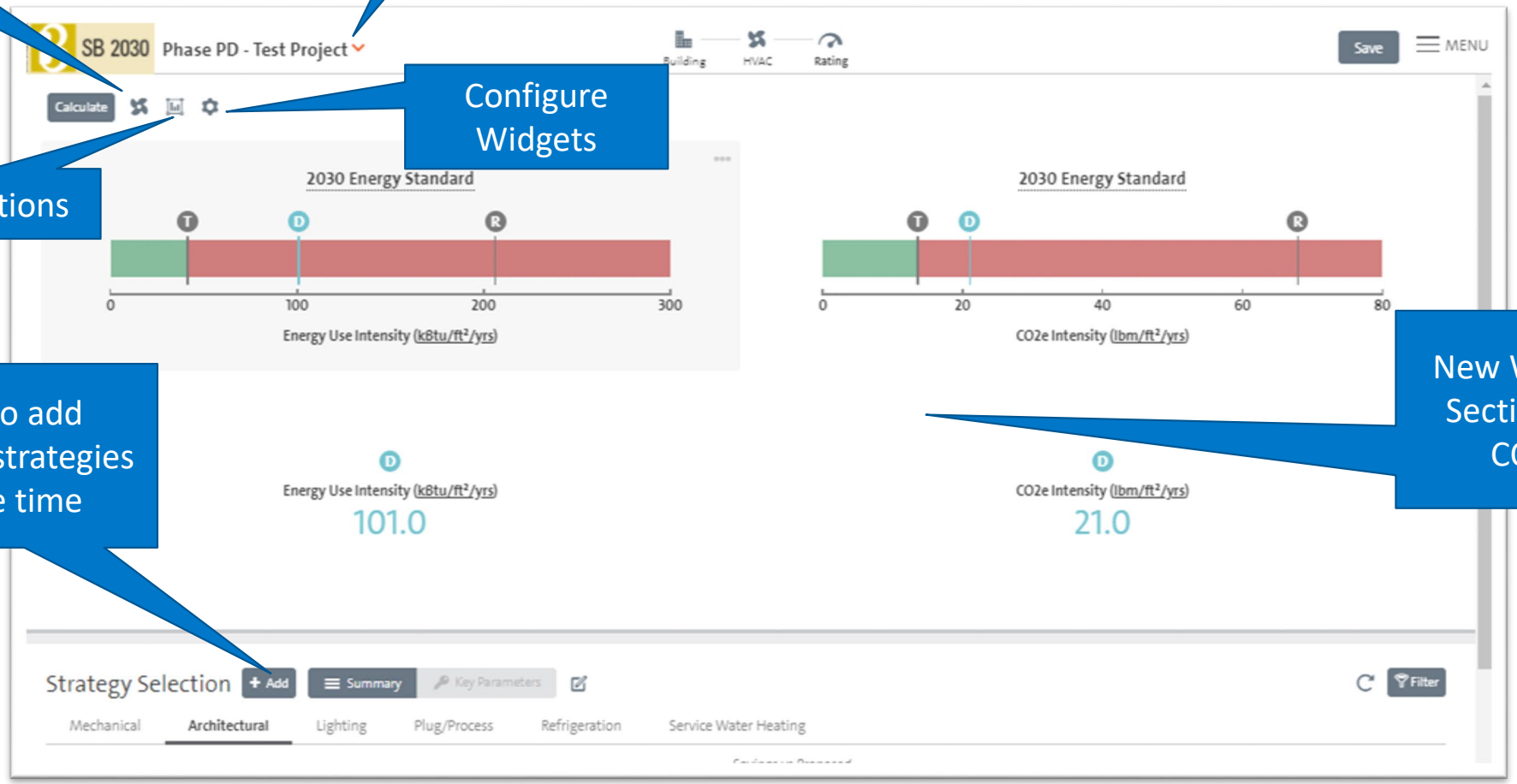
New User Interface

Mechanical Viewer

Click here for analysis info or to "Return" to Guidelines

Configure Widgets

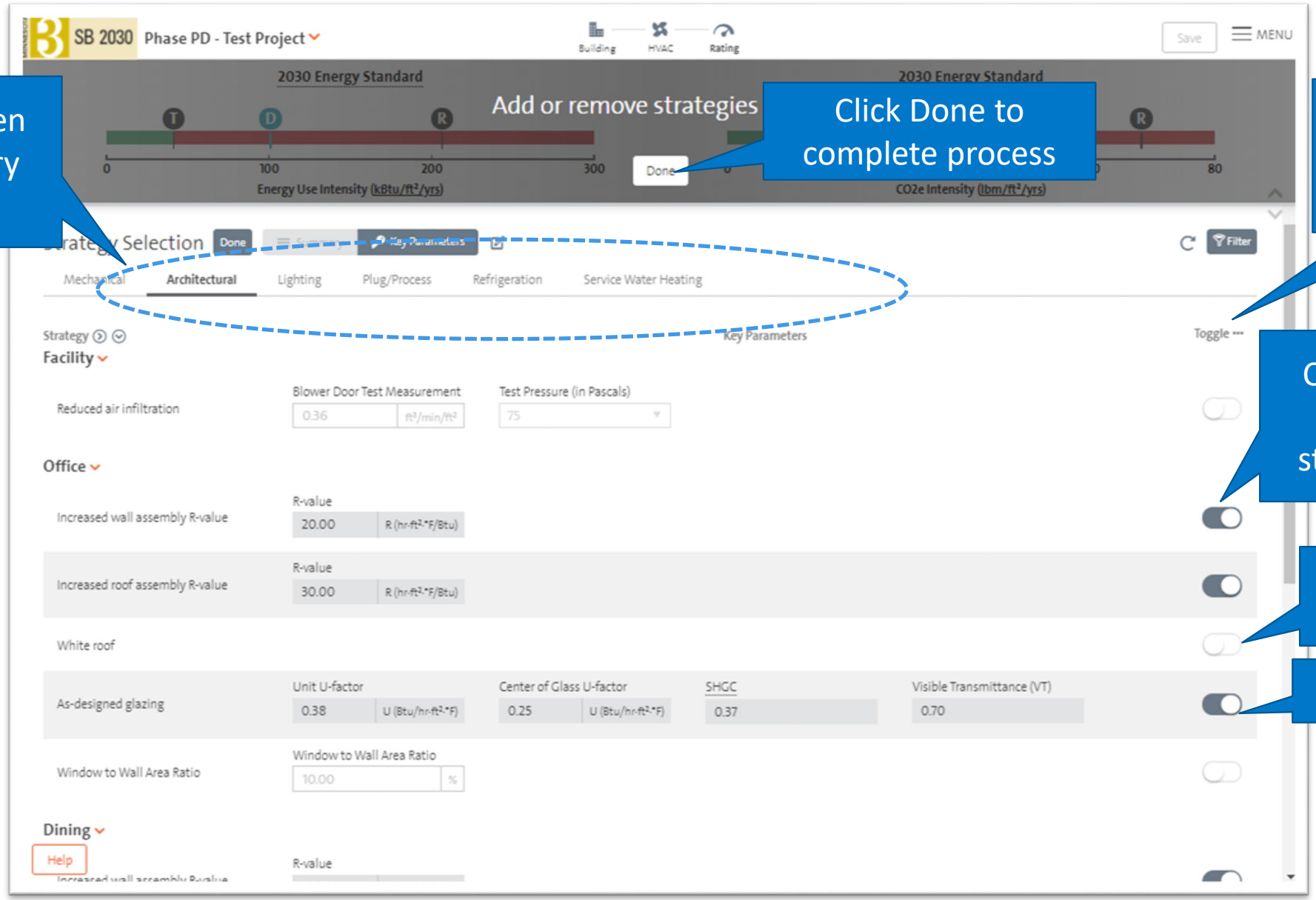
Visualizations



Click to add multiple strategies at one time

New Widget Summary Section with EUI and CO2e Intensity

Adding Measures



Navigate between strategy category tabs

Click Done to complete process

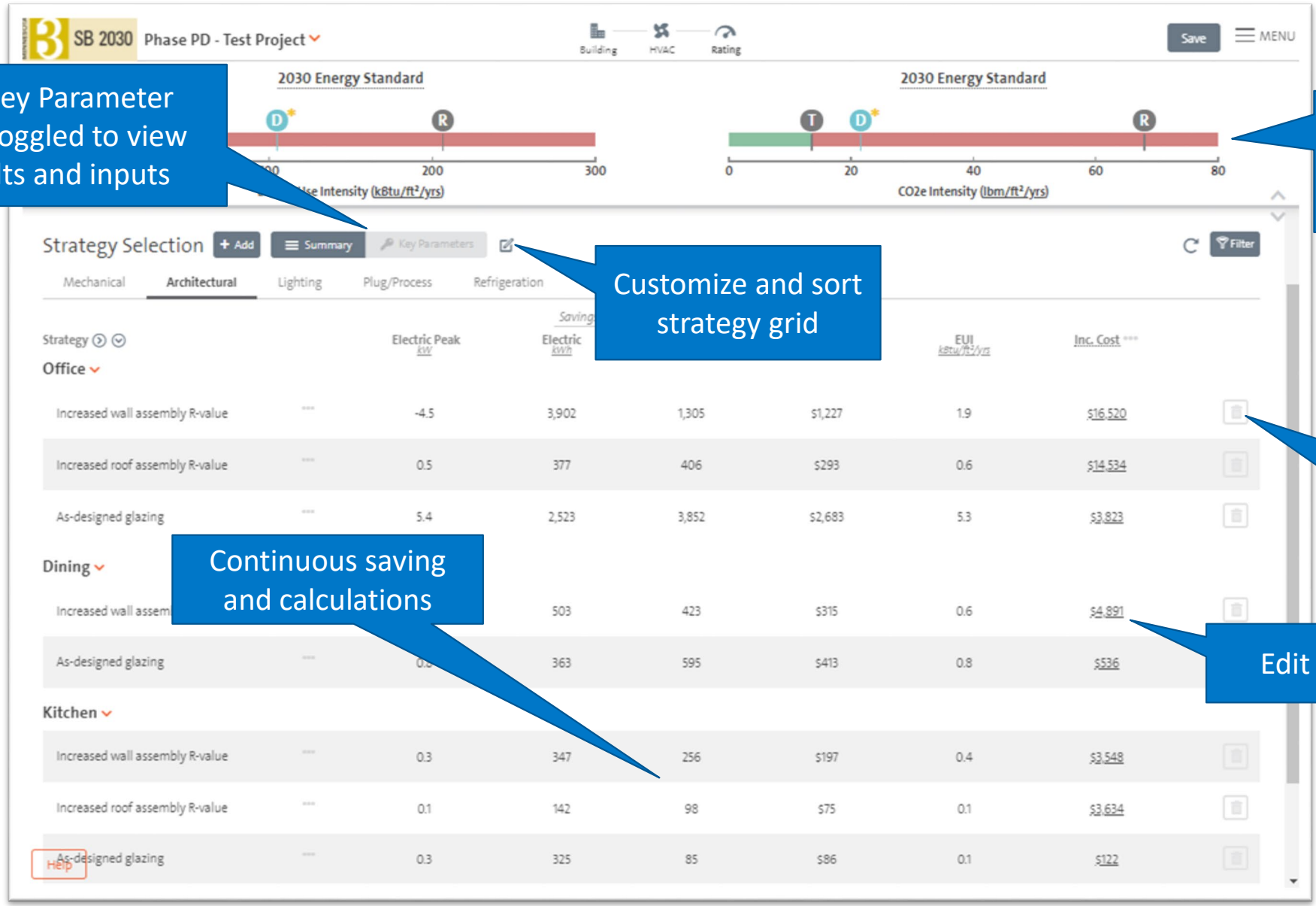
Click here to clear all default strategies

Click the strategy toggle to apply strategy to design

Not applied

Applied

Strategy Summary



Summary & Key Parameter Views can be toggled to view strategy results and inputs

Design summary results condense at the top

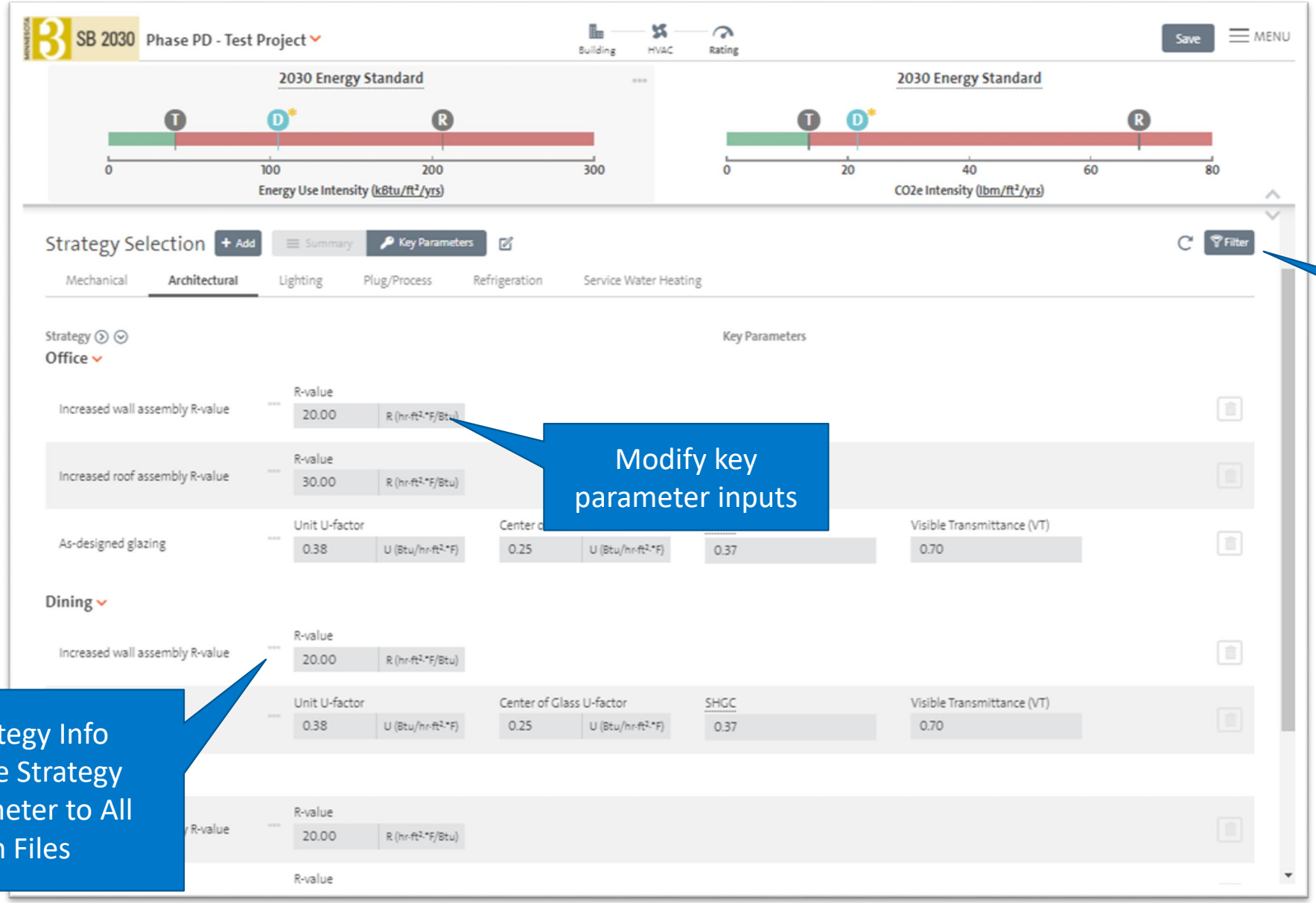
Customize and sort strategy grid

Click to remove strategy

Continuous saving and calculations

Edit costs

Strategy Key Parameters

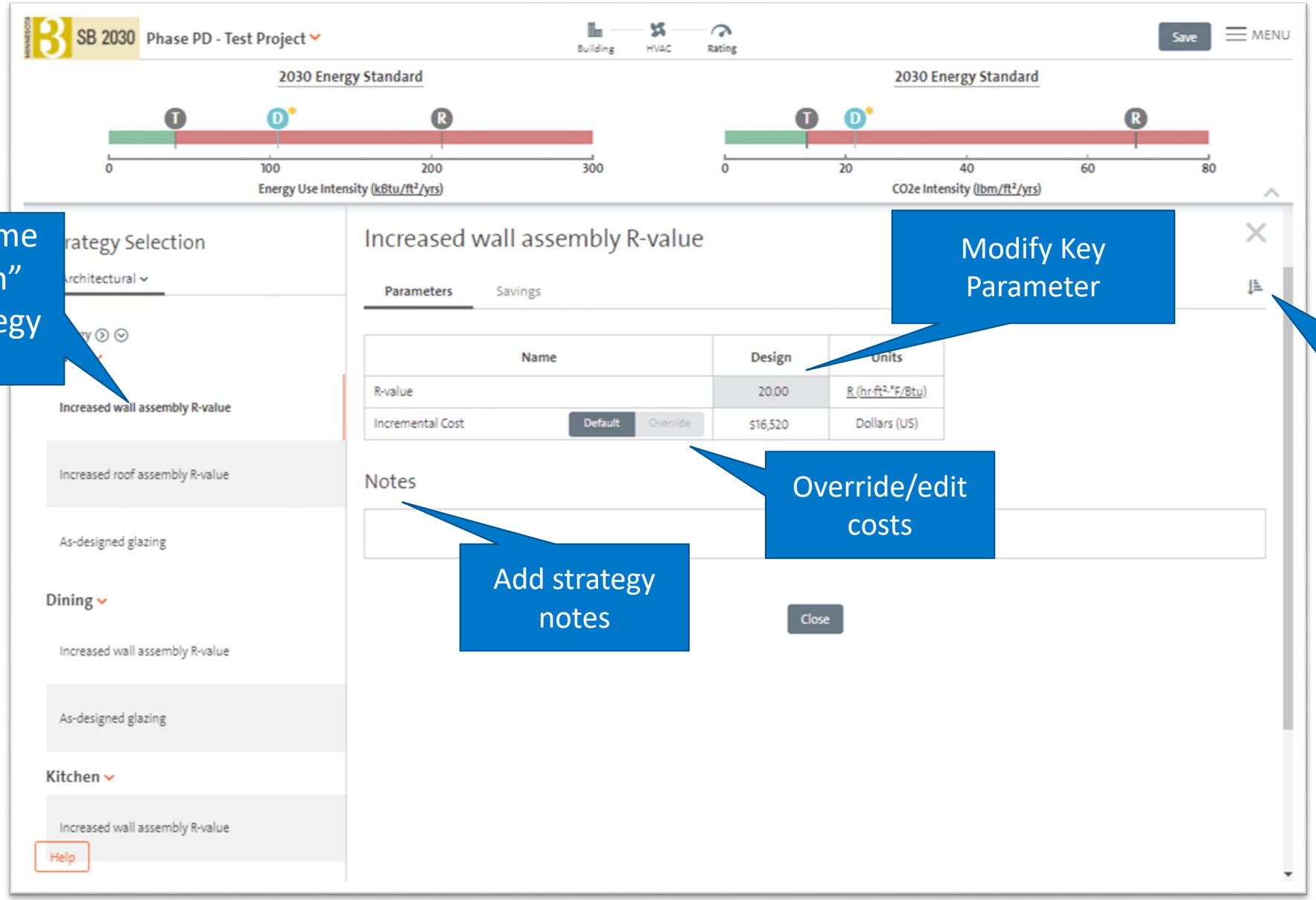


Modify key parameter inputs

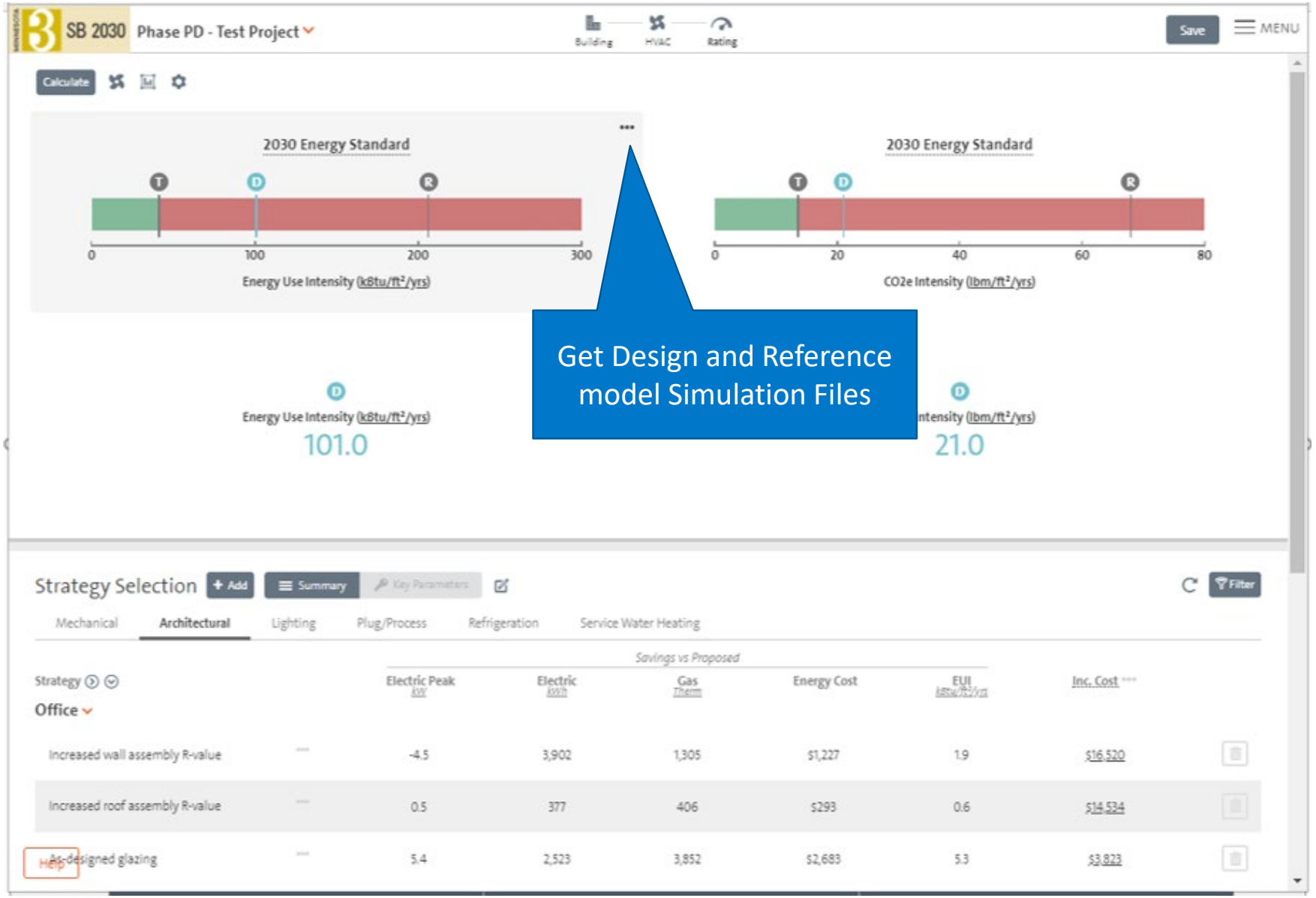
Filter strategies

Show Strategy Info
Re-calculate Strategy
Apply Parameter to All
Get Sim Files

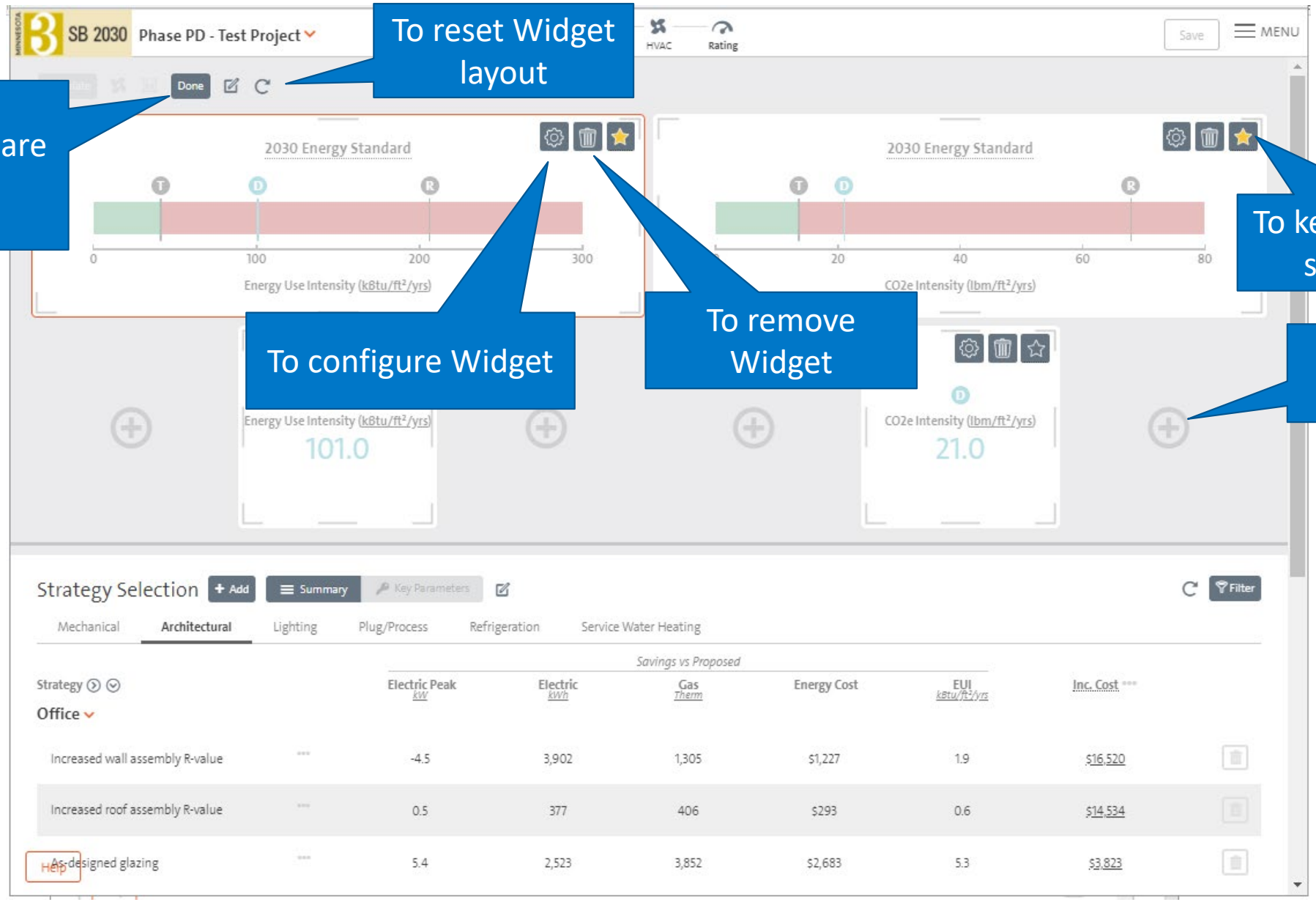
Slide-in Pane



Design and Reference Simulation Files



Widgets Feature



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

Business Confidential - Willdan

Available Measures

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

Business Confidential - Willdan

Available Measures

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

Business Confidential - Willdan

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

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

Business Confidential - Willdan

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

Business Confidential - Willdan

UPDATES FOR 2020

Updates To Come

- Updates to come
  - 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

- Partners

QUESTIONS?

Thank You

Ryan Schwartz

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