MINNESOTA SB 2030 ENERGY STANDARD®

Sustainable Building 2030 Energy Standard

Small Building Method

2020 through 2024

v1.0

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Prepared by

Center for Sustainable Building Research, University of Minnesota

Center for Energy and Environment

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The method outlined in this document may be used for SB 2030 projects considered *Small Buildings* beginning the SD phase (or equivalent) on or after January 1, 2020, and before January 1, 2025. Note that this method may be updated, project teams should verify that they are using the most current version of this method.

Small Buildings are those projects with less than 20,000 gross square feet in conditioned area, please see complete definition below for what areas to include.

Introduction, Applicability, and SB 2030 Process Overview

Small buildings face different constraints than larger projects. Although smaller projects often use a more limited number of assemblies and simpler mechanical systems, the benefit of performing in-depth energy modeling and cost-evaluation is smaller for these projects as compared to large buildings with generally greater energy consumption. This standard has been created as an option for small buildings—in lieu of the use of full building simulation and cost-evaluation—to demonstrate that a building is aggressively incorporating cost-effective energy efficiency upgrades and on-site renewable energy consistent with the intent of the SB 2030 program. This Small Buildings Method may be used by project teams as an approach that ensures cost-effectiveness both in terms of the energy design options and the overall project design and development costs.

All projects required to meet the SB 2030 Standard for 2020-2024 (80% energy reduction) are permitted to use a variety of strategies to meet their energy and carbon targets. Before looking at off-site strategies such as renewable energy, projects must demonstrate that they have exhausted cost-effective measures available on-site—including both energy efficiency and on-site renewable energy generation. Small projects following the method outlined here are allowed to follow a set of prescriptive standards that establish the minimum level of energy efficiency needed and separately evaluate the renewable energy potential. This approach aligns with the SB 2030 program's hierarchical approach to energy and permits smaller project teams to forgo the energy modeling and cost evaluation that is required of larger projects to determine the minimum cost-effective efficiency and renewable energy measures.

The method outlined here is applicable for projects considered Small Buildings under the SB 2030 program starting schematic design or equivalent on or after January 1, 2020, and prior to January 1, 2025, and which meet the size requirements outlined below. This method may be superseded by subsequent versions, though projects are permitted to continue to use this version (1.0) if schematic design had started prior to the release of a subsequent version.

Definition of a Small Building under the SB 2030 program:

Projects that include less than 20,000 gross square feet (gsf) of conditioned space are considered "Small Buildings" under the SB 2030 program. The B3 Guidelines Small Building Method is similar but distinct, so it is important to note the differences in what area contributes to the definition of a "Small Building" under each program.

The table below outlines which spaces may contribute to each program's area determination. Note that there are spaces that may contribute towards a project's area under the B3 Guidelines definition but not towards the area under SB 2030 (e.g., a space in which the HVAC systems will not be modified but which will undergo other renovations), and vice-versa (e.g., a space that is indirectly conditioned and not regularly occupied).

Which spaces need to be included in the building area calculations to determine applicability of the B3 Guidelines Small Buildings Path and the SB 2030 Small Buildings Method?			
	Regularly occupied	**Not regularly occupied**	**Not regularly occupied, and primarily inactive storage/industrial process**
Conditioned space	Include for both B3, SB 2030	Include for both B3, SB 2030	Include for SB 2030, potentially excluded from B3
Indirectly conditioned	Include for both B3, SB 2030	Include for SB 2030, potentially excluded from B3	Include for SB 2030, potentially excluded from B3
Semiheated space	Include for both B3, SB 2030	Include for SB 2030, potentially excluded from B3	Include for SB 2030, potentially excluded from B3
Unconditioned space	Do not include for B3, SB 2030	Do not include for B3, SB 2030	Do not include for B3, SB 2030

Table 1: Spaces included in Small Building definitions—differences between SB 2030 and B3 Guidelines programs[1]

Project teams electing to use the Small Building Method must meet all requirements in Parts 1 through 5 outlined in this document. Please notify the SB 2030 Coordinator (at sb2030@b3mn.org) if your qualifying project intends to use the Small Building Method, as changes are necessary in the Tracking Tool to allow phase submission without design simulation documentation. The project team must also indicate which of the available options in Part 2 they will be using.

SB 2030 Process Overview

The following is a description of the SB 2030 Process used by larger projects; footnotes are used to indicate where these requirements differ for Small Buildings.

During the predesign phase (or equivalent) an initial energy standard—or energy budget—is set for the project. This standard helps communicate the required energy savings for the project and assists in setting parameters for budgeting and initial design efforts. The standard is set with the Energy Standard Tool, which calculates the standard by creating a model of a 2003 building and then applying a reduction based on the year in which schematic design began.

The inputs to the tool are program-driven elements—such as space use, schedule, air flow rates, occupancy, and others that impact the project's energy consumption. The tool also includes preset defaults for typical building types and occupancy patterns, which can be particularly useful at the early phases prior to when more detailed values are known. This modeled-baseline approach permits flexibility in accommodating various building types and operational parameters. The SB 2030 Energy Standard Tool can be accessed online through the B3 Guidelines Tracking Tool as an online project file accessible by the design team and reviewers.

[1] Conditioned Space and Semiheated space are defined per ASHRAE: https://www.energycodes.gov/resource-center/faqs/what-are-space-conditioning-types

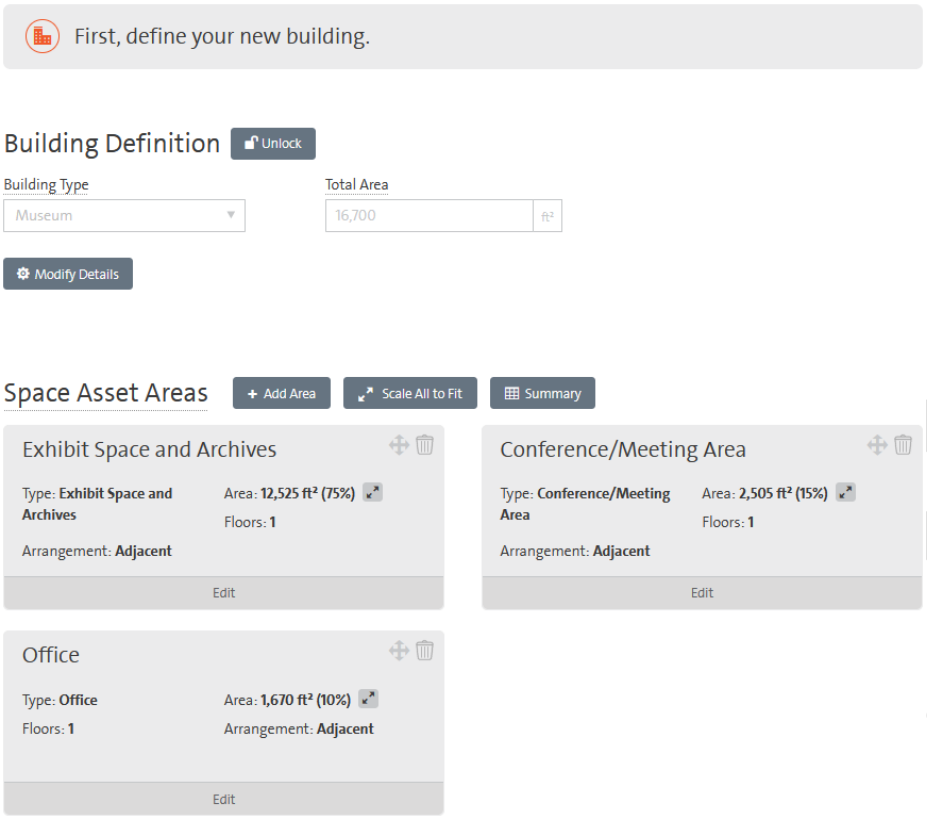

Figure 1: SB 2030 Energy Standard Tool interface

Through the Schematic and Design Development phases, the design team performs energy simulations[2] of their project and compares results to the Energy Standard—ensuring that the energy efficiency and renewable energy generation designed into the project meet program requirements. An initial assessment is submitted at the end of the "Design" phase in the B3 Guidelines Tracking tool to ensure that the energy conservations measures included in the project are likely to achieve compliance with the SB 2030 Standard. This early submission is reviewed by the SB 2030 Review team.

At the "Final Design" submission, the design teams submit a final energy simulation[3] for the project and uploads construction documents and related documentation, including a metering plan of how the project's energy use will be monitored. These are reviewed by the SB 2030 Review Team to ensure that the design energy model and the Energy Standard Tool both match the construction documents, and that the project is expected to meet the SB 2030 Energy Standard. Note that if a design team begins its participation in the SB 2030 program after the predesign phase, the design team may need to revisit earlier design decisions to ensure that the final constructed project will meet SB 2030 requirements.

During operations annual energy consumption is reported through the B3 Guidelines Tracking Tool, and the Energy Standard Tool may be updated if the building's operation changes. If a project exceeds the standard the accuracy of the inputs to the SB 2030 Energy Standard Tool should be verified and a plan for corrective action should be established.[4]

[2] Energy simulation is not required for Small Buildings.
[3] At "Final Design" an energy simulation is not required, though construction documents are needed to verify compliance with the selected Building Performance Standard.
[4] A Plan for Corrective Action is not required for Small Buildings; though exceeding the SB 2030 Standard does indicate that the project is using more energy than predicted.

The SB 2030 program increases its energy use-reduction requirements every five years. Because for many buildings, the available efficiency-only technology may not reduce energy use enough to meet the 80 percent and better thresholds, the SB 2030 Project Team anticipates that design teams must look to a broader set of strategies to lower buildings' energy consumption.

Shown below is a graph of Minnesota office projects Energy Use Intensity and the estimated payback time (the length of time it takes for an energy conservations measure to pay for itself) for their implemented efficiency measures. The orange line indicates the approximate 80 percent SB 2030 Target, the dotted line indicates the limits of energy efficient improvements and indicates that projects the achieved a lower EUI saw an increase in their payback period.

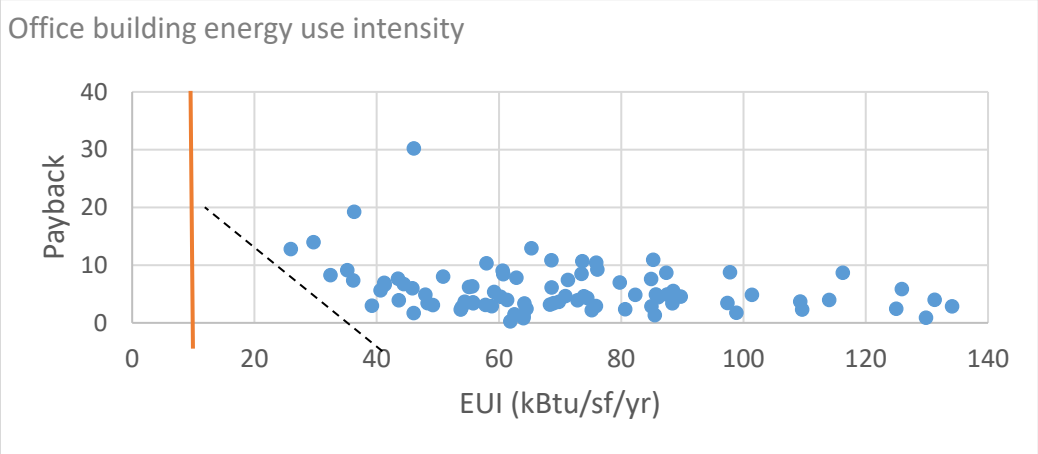

Figure 2: EUI and Payback comparison for office buildings evaluation—data from Willdan Midwest EDA programs

The SB 2030 program is required to evaluate cost-effectiveness "based upon established practices used in evaluating utility conservation improvement programs."[5] An analysis in 2019 using 115 buildings and an assortment of energy conservation measures determined that an appropriate determinant of whether a strategy was cost-effective was whether it had a simple payback of less than 12 years. This translation of utility program evaluation to a simple-payback metric permits teams to readily evaluate whether a strategy is cost-effective.[6]

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

The SB 2030 Program uses the NREL characterizations of energy efficiency and renewable energy sources to create a hierarchy of preferred options. SB 2030 combines and expands some of these options by considering campus and in-portfolio approaches available for some program participants. The NREL classification system is shown below with the SB 2030 hierarchy noted:

[5] 2020 Minnesota Statutes 216B.241 Energy Conservation Improvement, Subd. 9.
[6] Smaller projects pursuing the Small Building Method are permitted to pursue prescriptive or alternative approaches in lieu of an in-depth payback analysis.

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).

Figure 3: SB 2030 Program Energy Efficiency and Renewable Energy Supply Options. Table adapted from Net-Zero Energy Buildings: A Classification System Based on Renewable Energy Supply Options, page 10.

Shown below is an example of the how this combination of measures could be used to meet the SB 2030 Standard. Off-site measures may only be used once the cost-effective measures available on-site are exhausted.

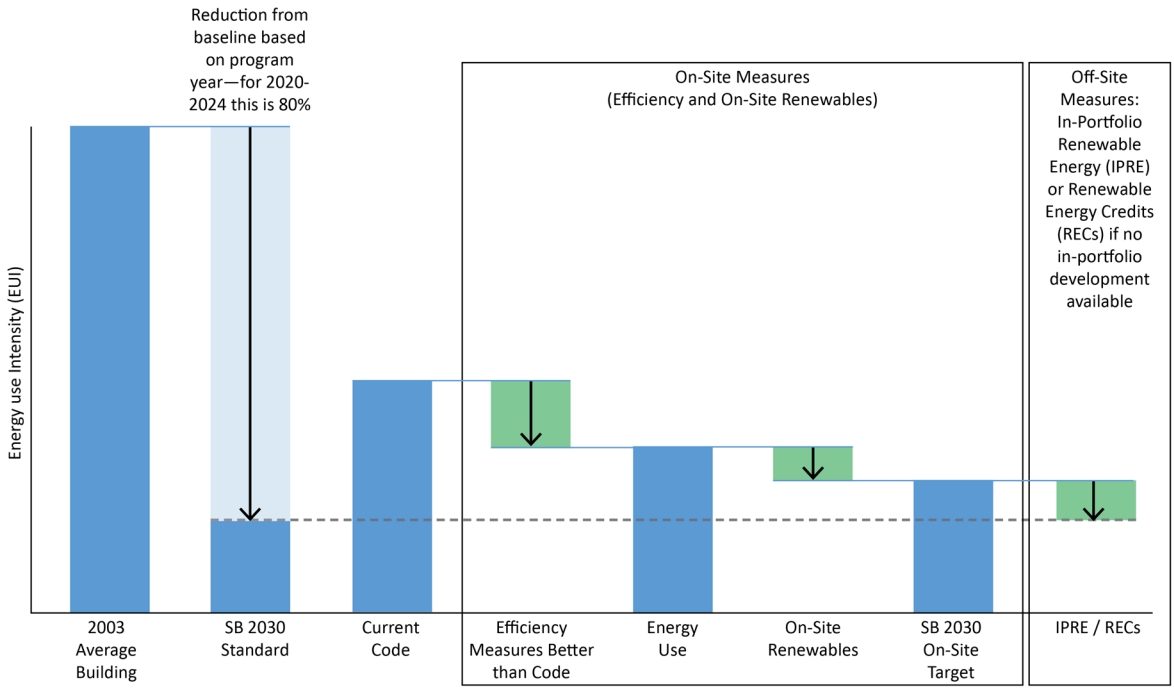

Figure 4: The reduction from the baseline and additional measures used to meet SB 2030 at an 80% reduction.

Projects set an on-site target through the combination of cost-effective efficiency measures and on-site renewable energy. Some projects may fully meet the SB 2030 Standard using only on-site measures; in this case no in-portfolio or RECs are needed.

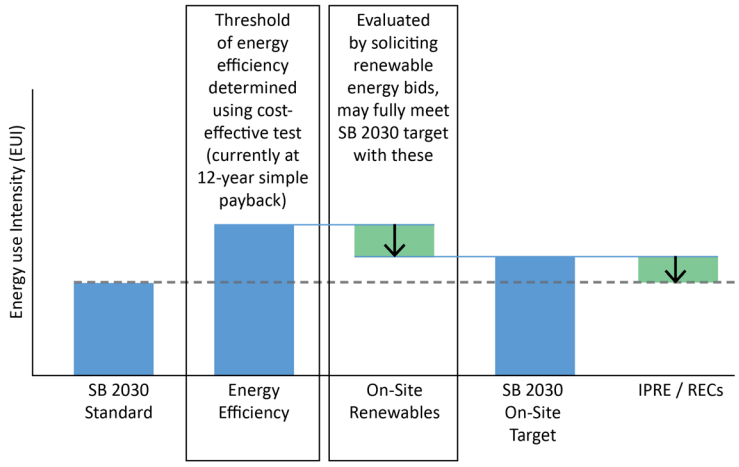

Figure 5: Project sets an energy target by evaluating measures that can be considered cost-effective; also looking at renewable resources that can be considered cost-effective before procuring off-site resources.[7]

[7] Measure-by-measure cost-effectiveness evaluation not required for projects using the Small Building Method.

Part 1: Establish an SB 2030 Energy Standard

Project teams using the Small Buildings version of the SB 2030 Energy Standards must complete the online Energy Standard Tool at the Predesign, Design, and Final Design phases in the B3 Guidelines tracking 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.

The reduction (currently 80%) is then taken from that baseline to determine the SB 2030 Standard. This modeled baseline approach permits flexibility in accommodating various building types and operational parameters and provides a customized standard depending on the program of the project.

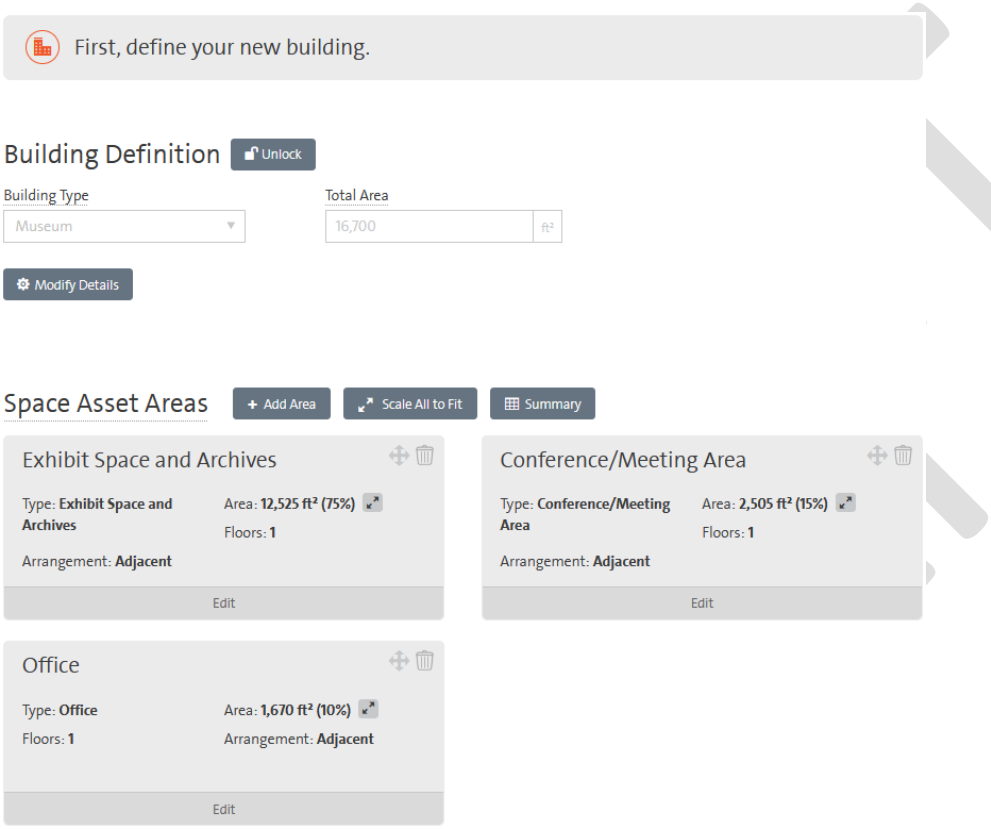

Figure 6: Energy Standard Tool space area inputs

Buildings are defined by using “Space Asset Areas” which represent programmatic functions of a building that include attendant space such as corridors, etc. These space asset areas have default characteristics that can be updated as the design progresses. Further information on Space Asset Areas can be found at https://www.b3mn.org/2030energystandard/ and at https://netenergyoptimizer.com/resources/training-videos/ (the Energy Standard Tool uses the same modeling engine and space characterization as Willdan’s Net Energy Optimizer tool).

Part 2: Implement Energy Efficiency Measures

Minimum energy efficiency measures required may be established for Small Buildings by both by adhering to one of the listed standards in Section 1 and by selecting equipment and water fixtures meeting the standards listed in Section 2.

Part 2 Section 1: Building Performance Standards

Projects may meet this section by meeting any of the following Building Performance Standards. Where key reviewed requirements are listed note that the review may also include verifying other energy conservation measures comply with the selected Building Performance Standard that are not included on these lists.

Commercial

ASHRAE 90.1 – 2019

Projects choosing this option must document that the design meets all the applicable "Mandatory" and "Prescriptive" requirements in each section of the standard. The table below shows the key items that have higher impact on building energy use. Project teams may NOT use the Energy Cost Budget Method in lieu of the prescriptive requirements of the standard's sections.

Reviewed Requirements		Reviewed Requirements	
		Mechanical Requirements	Air Economizer-Unity Controls
Envelope Requirements	Roof Insulation		Air Economizer-BAS Controls
	Above Grade Wall Insulation		Economizer FDD-Unitary Controls
	Slab Edge Insulation		Economizer FDD-BAS Controls
	Window U-Factor		Economizer High Limit Shutoff
	Window SHGC		Demand Control Ventilation (DCV)
	Window Area--Whole Building WWR		Energy Recovery Ventilation (ERV)
	Window Orientation [Window Area - East]		Duct Sealing & Testing
	Window Orientation [Window Area - West]		Supply-Air Temperature Reset for Multizone
			Pool Cover
Electrical Requirements	Automatic Off Lighting Controls		Low Leakage Intake and Exhaust Dampers
	Daylight Zone Control		HVAC Commissioning
	Multi-Level Lighting		Heating Setback
	Interior Lighting Power Density		Cooling Setback
	Exterior Light Control - auto off		Thermostat Deadband
	Exterior Light Control - 50% off		Fan Power - VAV
	Automatic Outlet Shutoff*		Optimum Start
	Lighting System Functional Testing		Fan Speed Control on Medium Sized Units
			Demand Control of SHW Recirculation Pump

New Buildings Institute 40% Stretch Energy Standard: Path B Stretch Prescriptive Measures

Project must meet ASHRAE 90.1-2019 following the prescriptive path. Additionally, projects must meet all technical requirements under each item listed in NBI Path B. The table below shows the key items under this path that have higher impact on building energy use, in addition to those noted under the ASHRAE 90.1-2019 section. For item B.2.1 Efficiency HVAC Equipment, refer to code ASHRAE 90.1-2019 or IECC 2018 instead of the versions listed in NBI.

Reviewed Requirements		Reviewed Requirements	
Envelope	Slab Edge Insulation	Mechanical	Air Economizer-Unity Controls
	Window Area--Whole Building WWR		Air Economizer-BAS Controls
	Window Orientation [Window Area - East]		Economizer FDD-Unitary Controls
	Window Orientation [Window Area - West]		Economizer FDD-BAS Controls
Electrical	Lighting System Functional Testing		Economizer High Limit Shutoff
			Demand Control Ventilation (DCV)
			Boiler & Chiller System Controls
			Duct Sealing & Testing
			Supply-Air Temperature Reset for Multizone
			Pool Cover
			Low Leakage Intake and Exhaust Dampers
			HVAC Commissioning
			Fan Power - VAV

International Green Construction Code (IgCC)

Project must meet ASHRAE 90.1-2019 following the prescriptive path. The table below shows the key items under this path that have higher impact on building energy use, in addition to those noted under the ASHRAE 90.1-2019 section.

Reviewed Requirements		Reviewed Requirements	
Electrical	Daylight Zone Control	Mechanical	Boiler & Chiller System Controls
	Multi-Level Lighting		Demand Control Ventilation (DCV)
	Lighting System Functional Testing		Supply-Air Temperature Reset for Multizone
			Pool Cover
			Low Leakage Intake and Exhaust Dampers
			HVAC Commissioning
			Fan Power - VAV
			Duct Sealing & Testing

Additionally, projects must meet all technical requirements listed in IgCC Chapter 7 Energy Efficiency, section 7.3 Mandatory Provisions and 7.4 Prescriptive Option, with the amendments below:

1. For requirements that refer to code ASHRAE 90.1, please refer to version 2019
2. For requirements listed below, projects need to meet ASHRAE 90.1-2019 or IECC 2018 instead of IgCC.

REQUIREMENTS	IgCC REFERENCE	ASHRAE REFERENCE	IECC REFERENCE
Air Economizer	7.4.3.4	6.5.1 & 6.4.3.12 (FDD)	C403.5

ASHRAE Advanced Energy Design Guides – Achieving Zero Energy Ready series

The AEDG standards are currently available for K-12 School Buildings and Small to Medium offices. Projects must meet all technical requirements listed in AEDG Chapter 5 How-To Strategies.

Residential:

Certification through the United States Department of Energy Zero Energy Ready Homes program (DOE ZERH)

Certification through the Passive House Institute (PHI) or Passive House Institute US (PHIUS)

Part 2 section 2: Mandatory Equipment Requirements

All projects choosing to apply the SB 2030 Energy Standard for Small Buildings must meet the energy efficient equipment requirements listed below when the type of equipment listed is part of a SB 2030 project.

EnergyStar Applicable Equipment

EnergyStar rated equipment for any application that has EnergyStar rated equipment available. This includes, but is not limited to the following:

- Appliances that have Energy Star product categories
- Computers
- Other Office Equipment
- CFL Light Fixtures
- Light Bulbs
- Small HVAC Equipment
- Televisions

Water Fixtures

The following types of plumbing fixtures must have design flow rates specified and installed at or below the flow rates listed below. More stringent standards may be required for projects that are following a green building rating system with broader scope than the SB 2030 Energy Standard (e.g., B3 Guidelines or LEED-NC) and may include fixture types not listed here.

- Lavatory Faucets ≤ 1.5 gallons per minutes
- Kitchen Faucets ≤ 2.0 gallons per minute
- Showerheads ≤ 2.0 gallons per minute

Part 3: Estimate Energy Efficiency

There are two options available to determine the minimum threshold of energy efficiency and to estimate the projects performance under the Small Building Method:

Option 1: Energy Simulation

Projects using this option document the performance achieved by performing an energy simulation of their project with all energy conservation measures meeting or exceeding the requirements of the selected building performance standard. This option permits projects to account for those measures that exceed the minimum requirements of the selected Building Performance Standard.

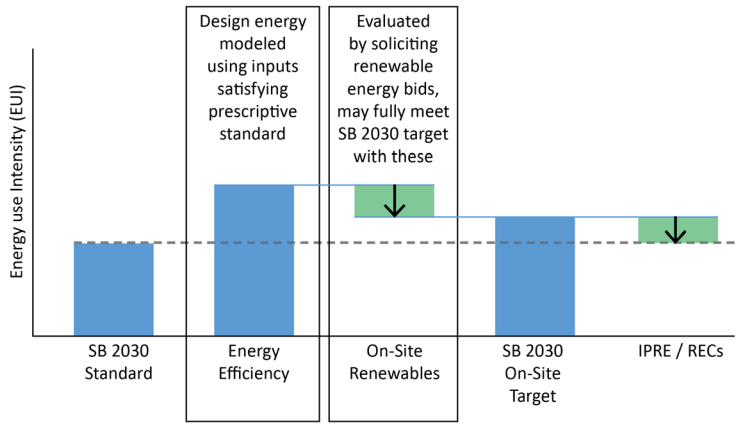

Figure 7: Energy efficiency effectiveness established by energy modeling.

Projects choosing this option will use design simulation to estimate the energy consumption of their project and compare it to the SB 2030 Energy Standard. The amount of on- or off-site renewables needed to then meet the SB 2030 Energy Standard is established by subtracting the SB 2030 Energy Standard from the design energy demand:

$$Estimated\ Energy\ Use\ -SB\ 2030\ Energy\ Standard = Renewable\ Energy\ Needed$$

Option 2: Estimate based on SB 2030 Standard

Projects using this option may estimate the energy demand of their projects using a multiplier dependent on their project type and on the Building Performance Standard selected.

Building performance multipliers:

Building Type	NBI 40%	ASHRAE 90.1	IgCC	AEDG
Office	1.6	1.6	1.6	1.3
Hotel	1.7	1.8	1.8	
Warehouse	2.4	3.3	3.0	
Secondary School	1.1	1.1	1.0	0.6
Primary School	1.2	1.3	1.2	0.6

To use these multipliers, apply the following formula to estimate the performance of a building meeting these Building Performance Standards:

$$(SB\ 2030\ Energy\ Standard) * (Building\ Performance\ Multiplier) = Expected\ Energy\ Use$$

This calculation provides an output of kBtu/sf per year of the expected energy demand of the project prior to the inclusion of on-site or off-site renewable energy. This method is illustrated in the first box in the diagram below.

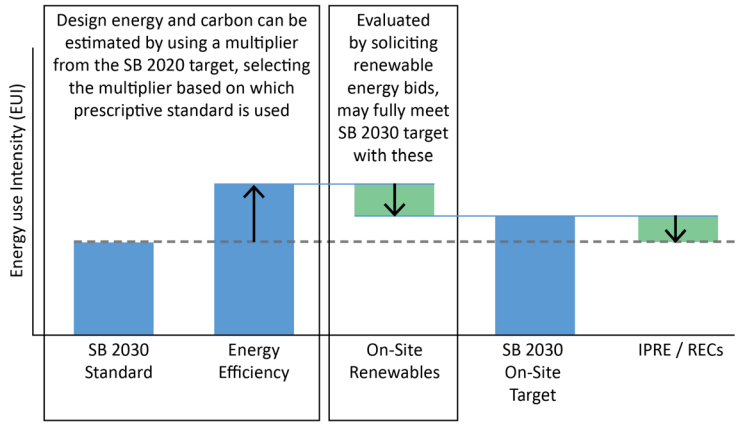

Figure 8: Energy demand estimated by using a multiplier based on which prescriptive standard selected and building type are used.

Under option 2 the amount of needed renewable energy needed to meet the SB 2030 Energy Standard is established—as it is under option 1—by subtracting the SB 2030 Energy Standard from the design energy use:

$$Estimated\ Energy\ Use\ -SB\ 2030\ Energy\ Standard = Renewable\ Energy\ Needed$$

There is variation in alignment with the Energy Standard that these approaches are expected to achieve; selecting a Building Performance Standard with a higher multiplier—though permitted by the SB 2030 Program—does result in higher amounts of required on- or off-site renewable energy. Further, projects using the Advanced Energy Design Guide for primary and secondary school are anticipated to meet the SB 2030 Energy Standard without needing to procure renewable energy.

Part 4: On-Site Renewable Energy

On-site renewable energy should be evaluated/implemented pursuant to the following intent:

If feasible, projects should meet the SB 2030 Energy Standard using on-site resources—i.e., develop sufficient renewable energy on-site to offset any use exceeding the SB 2030 Energy Standard.

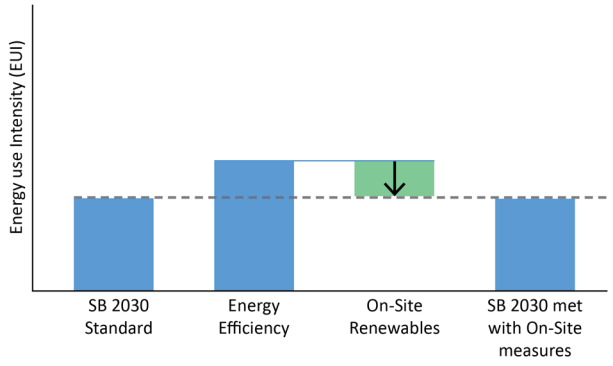

Figure 9: Meeting the SB 2030 Standard with On-Site measures (no On-Site target needed)

If building, site, or campus conditions do not permit sufficient cost-effective renewable energy development to fully meet the SB 2030 Energy Standard, renewable energy development should be pursued to maximize the system size within the cost-effective threshold.

Renewable energy development contributing (both on- and off-site) to meeting the SB 2030 Standard are subject to the following:

1. RECs associated with the RE developed on or off site must be retired by the project.
2. 3rd party ownership of a RE system is permitted if item 1 is met, or if the project purchases back the RECs AND a power purchase agreement is entered with a period of at least 10 years for the full portion of the system capacity contributing to meeting the SB 2030 Standard.
3. The on-site renewable energy-generating source shall be photovoltaic systems, solar thermal power systems, and/or wind turbines.

After determining the applicable on-site renewable energy, the SB 2030 On-Site target is set:

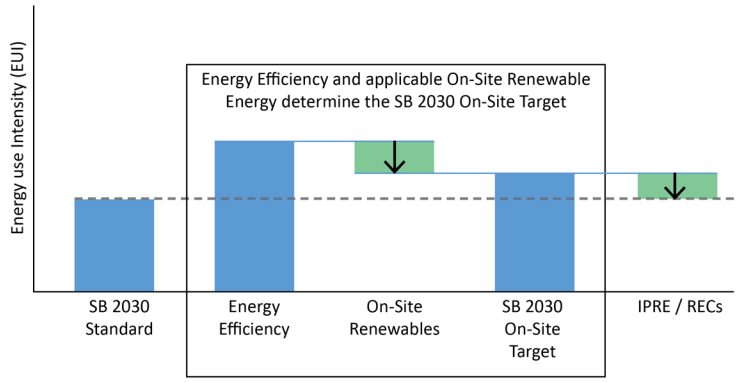

Figure 10: Establishment of the SB 2030 On-Site Target

Part 5: Off-Site Renewable Energy and Renewable Energy Credits

The remaining energy required to meet the SB 2030 Energy Standard should be sourced from in-portfolio renewable energy development (IPRE). IPRE is subject to the renewable energy development considerations listed under part 4.

For projects without access to in-portfolio development opportunities, renewable energy credits (RECs) may be procured to meet the SB 2030 Energy Standard.

To contribute to meeting SB 2030 these RECs must:

1. Have term of not less than 10 years. These do not have to come from Minnesota sources, although it is preferred.
2. RECs and other environmental attributes associated with the procured off-site renewable energy shall be assigned to the building project for the duration of the contract.
3. The off-site renewable energy producer shall maintain transparent accounting that clearly assigns production to the building.