Energy Updates in B3: Part 2

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

Liz Kutschke, Research Fellow, Center for Sustainable Building Research, University of Minnesota

Rolf Jacobson, Research Fellow, Center for Sustainable Building Research, University of Minnesota

May 14, 2020

Webinar

Agenda

- Logistics: Webinar and Education Credits
- Introduction
  - Background on SB 2030 revisions and timeline
  - Status of the program through 2019
- Program updates:
  - Meet both an energy and carbon standard
  - Permit Utility-specific emissions factors
  - Cost effectiveness evaluation update
  - Implement renewables based on hierarchy
  - Hold renovations to the same standard as new construction
  - Upcoming Tool Updates and Future Program Development Considerations
- Questions (collected via the chat) addressed periodically throughout and at the end

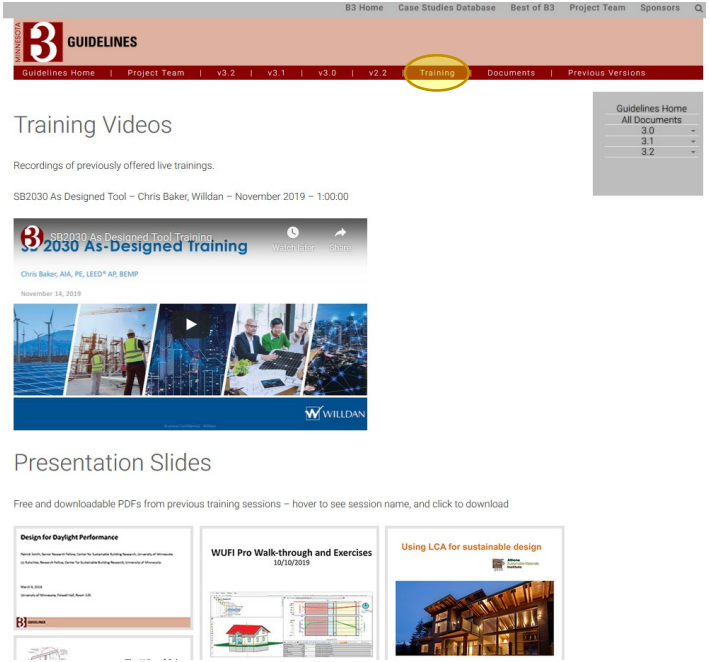
Logistics

- Training will being recorded, will be posted on our training site at b3mn.org
- Those needing AIA credit – please send your AIA # in the chat, to the panelists
- Due to the number of attendees we'll be keeping non-presenters on mute
- Please note questions in the chat as they come up; we'll leave time at the end of each topic to address them.

B3 News

B3 Training Website is live!

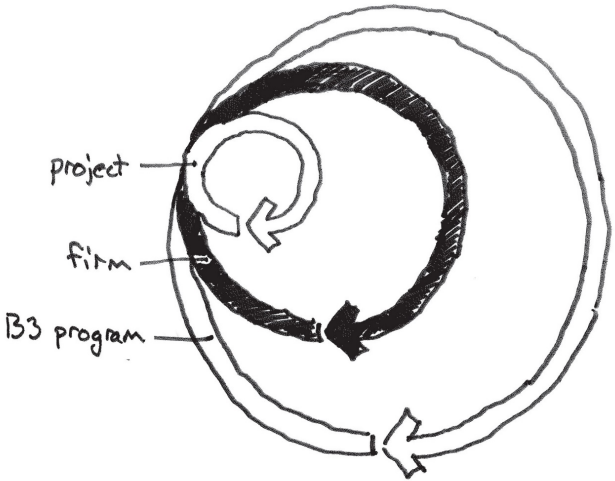
- Recordings of previous live training sessions
- Slide decks from previous live training sessions
- Slides from Monday are there now!
- Today's slides will be posted here

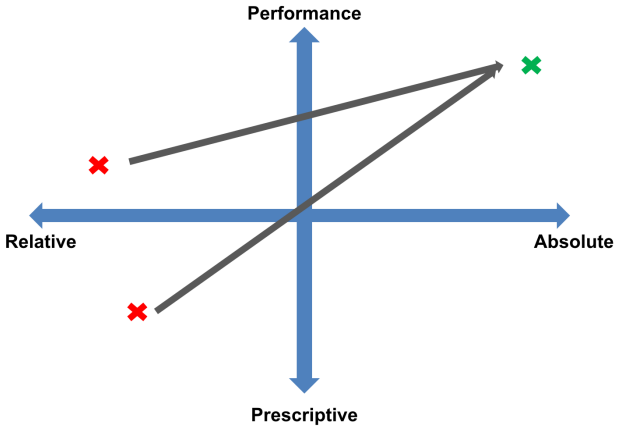


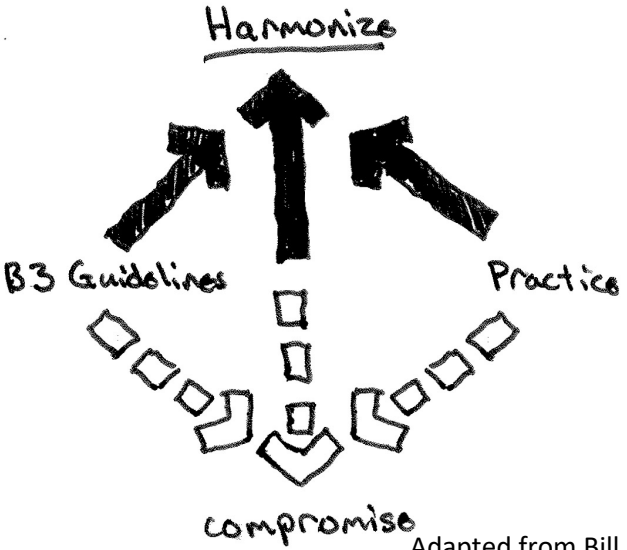
Learning Objectives

- Be able to describe options for calculating the new SB 2030 Carbon emissions reduction target, and its use in conjunction with the energy reduction target.
- Be able to describe the updated cost-effectiveness test and its use for determining energy efficiency and renewable energy requirements in the SB 2030 program.
- Understand how the SB 2030 program ranks and evaluates different approaches to renewable energy procurement (on-site, campus, portfolio, and purchase of renewable energy credits (RECs)), as well as potential issues with participation in utility programs, solar leases, and REC purchasing.
- Understand the operation and new additions to the SB 2030 Energy Standard Tool, including how it incorporates renewable energy inputs.

B3 Process – providing a feedback loop that works at different scales



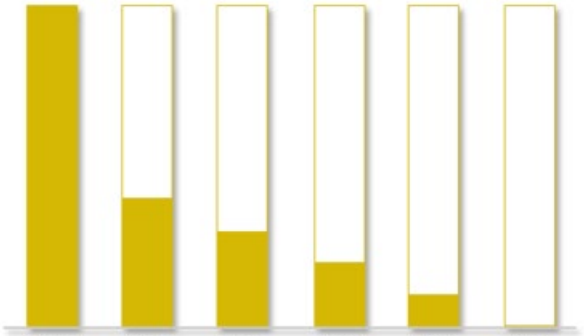




Adapted from Bill Reed

Introduction

SB 2030 is a progressive energy and carbon reduction program, initially based around the Architecture 2030 program though customized to better fit Minnesota's buildings, climate, and policies; also adjusted to include a broader array of building types in the program.



Legislation highlights

The current legislation for the SB 2030 program includes the following[1] (emphasis added):

(a) The purpose of this subdivision is to establish cost-effective energy-efficiency performance standards for new and substantially reconstructed commercial, industrial, and institutional buildings that can **significantly reduce carbon dioxide emissions** by lowering energy use in new and substantially reconstructed buildings. For the purposes of this subdivision, the establishment of these standards may be referred to as Sustainable Building 2030.

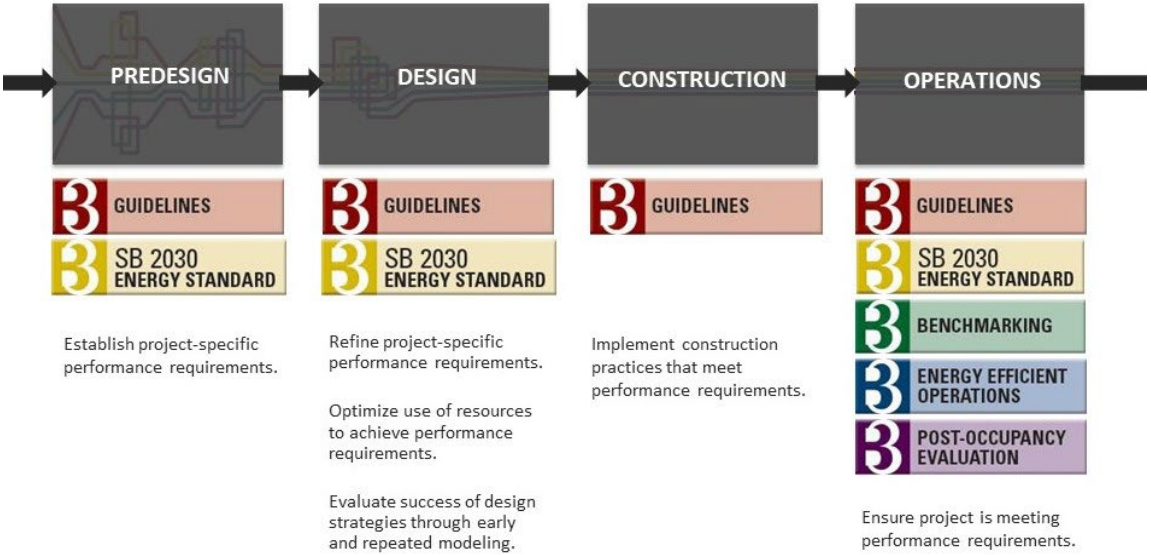
…

[1] https://www.revisor.mn.gov/statutes/cite/216B.241

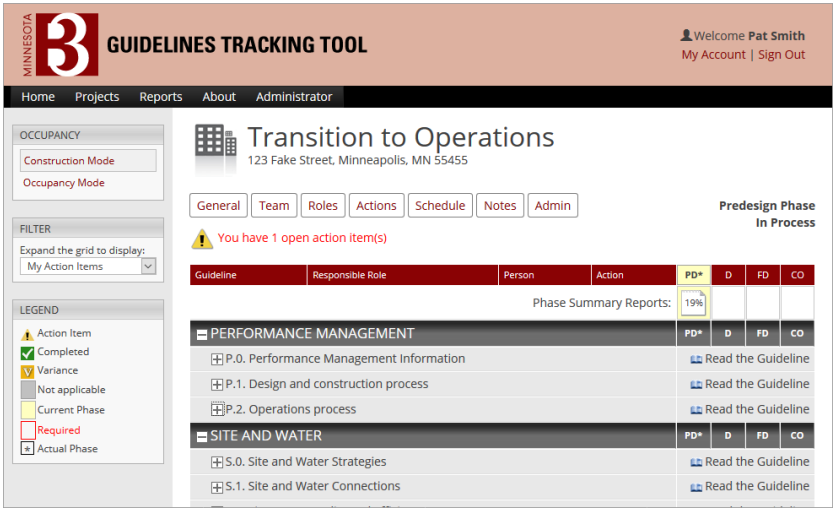
Legislation highlights (continued)

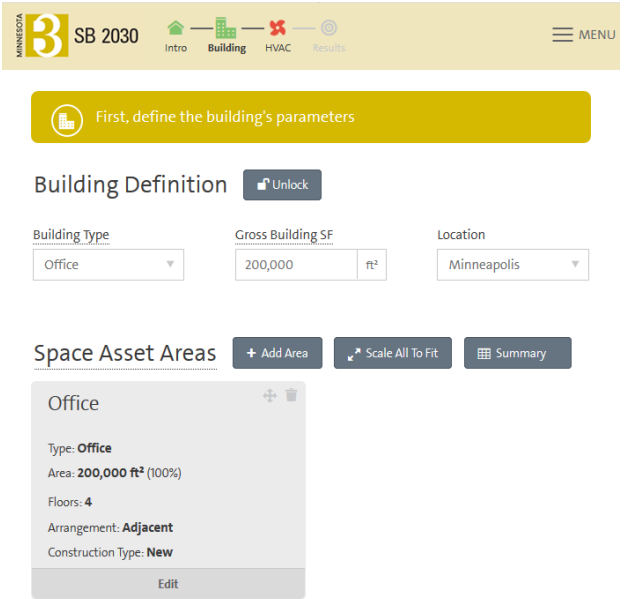
(c) Sustainable Building 2030 energy-efficiency performance standards must be firm, **quantitative measures of total building energy use and associated carbon dioxide emissions** per square foot for different building types and uses, that allow for accurate determinations of a building's conformance with a performance standard. Performance standards must address energy use by electric vehicle charging infrastructure in or adjacent to buildings as that infrastructure begins to be made widely available. The energy-efficiency performance standards must be updated every three or five years to incorporate all cost-effective measures. **The performance standards must reflect the reductions in carbon dioxide emissions per square foot resulting from actions taken by utilities to comply with the renewable energy standards in section 216B.1691.** The performance standards should be designed to achieve reductions equivalent to the following reduction schedule, measured against energy consumption by an **average building in each applicable building sector in 2003: (1) 60 percent in 2010; (2) 70 percent in 2015; (3) 80 percent in 2020; and (4) 90 percent in 2025.** A performance standard must not be established or increased absent a conclusive engineering analysis that it is cost-effective based upon established practices used in evaluating utility conservation improvement programs.

SB 2030 and B3 Programs



Tools – Tracking Tool and SB 2030 Energy Standard Tool

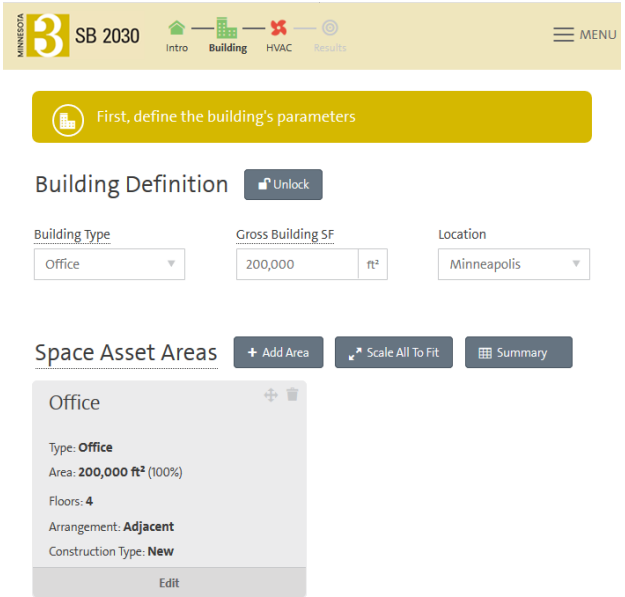




Energy Standard Tool

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.

The reduction (60%, 70%, 80%, or 90% depending on the year) 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.



Status of the program through 2019

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

- During Predesign an initial Energy 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 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. schedules if changed)

Status of the program through 2019

- **Evaluated on Site Energy Consumption (EUI)**
  - Through 2019, SB 2030 had evaluated compliance based only on EUI. Carbon emissions reported but not used to determine compliance
  - As electricity is currently more carbon-intensive than other fuel sources -- a minority of projects compliant with the SB 2030 the Energy Standard are not meeting the SB 2030 Carbon Standard

- **Major Renovation Projects**
  - Currently held to a more relaxed standard -- half of the reduction percentage of new construction projects
  - Initially done to accommodate those renovations that did not impact all energy efficiency related portions of the building; though in practice many opportunities are present in major renovations which are untapped with this approach.

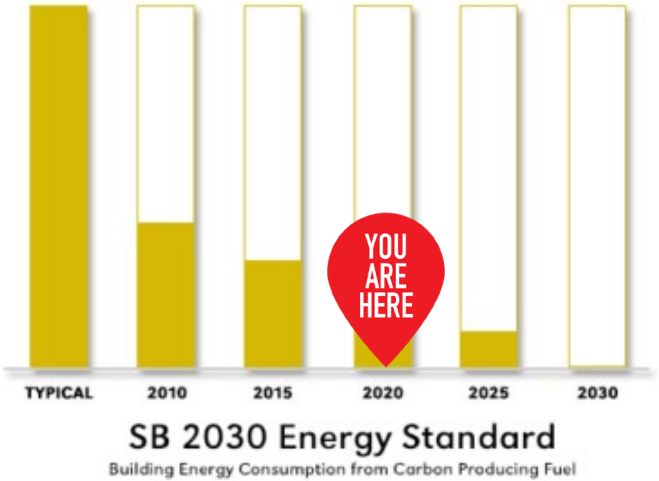
SB 2030 Program—Alternative Paths

- ***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 to evaluate and benchmark existing facility (if any), document energy conservation measures considered for the project, and provide anticipated performance metrics.
- ***Cost-Effective Adjusted Standard (as part of these updates this method is transitioning to apply to the renewable hierarchy):*** 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.

Timeline

- 80% Better-than-2003 Baseline target is active for projects starting schematic design or later on or after Jan 1, 2020.
- Note on project timelines:
  - SB 2030 – Schematic Design or equivalent start date determines version (60%-better, 70%, 80%...)
  - B3 – Predesign start date determines version, starting with version 3.1
- The approach outlined here would take effect for most 80% better buildings, including:
  - Updated tracking tool, Energy Standard Tool, and SB 2030 As-Designed Tool June 1, 2020 supporting these updates
  - Updated Tracking Tool supporting B3v3.2 in the upcoming weeks

Program Updates: Moving to 80% Better



Program Updates: Moving to 80% Better

Other related program references

Architecture 2030 Challenge: The Architecture 2030 Challenge currently uses the following: “All new buildings, developments and major renovations shall be designed to meet a fossil fuel, GHG-emitting, energy consumption performance standard of 80% below the regional (or country) average/median for that building type.”

Defining Net-Zero: Researchers at the National Renewable Energy Lab (NREL) have classified Net-Zero approaches as part of Technical Report NREL/TP-550-44586 (Net-Zero Energy Buildings: A classification System Based on Renewable Energy Supply Options) based on the source of renewable energy generation. This proposal uses the definitions outlined in this and related work with minor modifications.

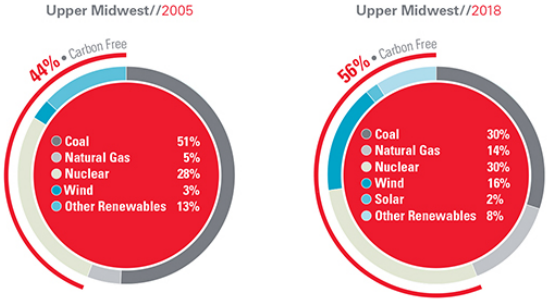
Program Update: Meet Both Energy and a Carbon Standard

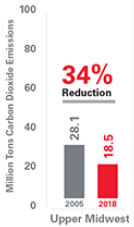
- Legislation notes that the SB 2030 program should involve both energy and carbon reductions
- Expand compliance determination to include requiring compliance with the SB 2030 Carbon Standard.
- For most projects the energy standard will be the operative standard for projects which use a mix of both natural gas and electricity.
- For an all or almost-all-electric building the carbon standard would act as a backstop to ensure that fuel switching leads to a net decrease in carbon emissions, at least for the next few years.
- As electric utilities decarbonize the operative standard for these all-electric buildings would return to being the energy standard.

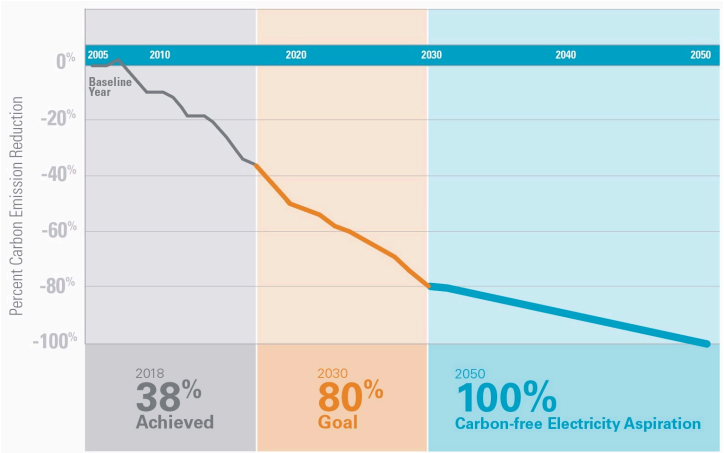
Program Update: Meet Both Energy and a Carbon Standard

For example:

Xcel's carbon emission reduction targets







https://www.xcelenergy.com/company/corporate_responsibility_report/library_of_report_briefs/a_carbon_free_future

https://www.xcelenergy.com/environment/carbon_reduction_plan

Program Update: Meet Both Energy and a Carbon Standard

Example from earlier this month: Great River Energy, planned decommissioning of Coal Creek in 2022:

ALL SECTIONS | StarTribune

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BUSINESS

Minnesota's Great River Energy closing coal plant, switching to two-thirds wind power

Coal Creek Station in North Dakota is one of the largest coal electricity plants in the Upper Midwest.

By Mike Hughlett Star Tribune | MAY 7, 2020 — 10:26PM

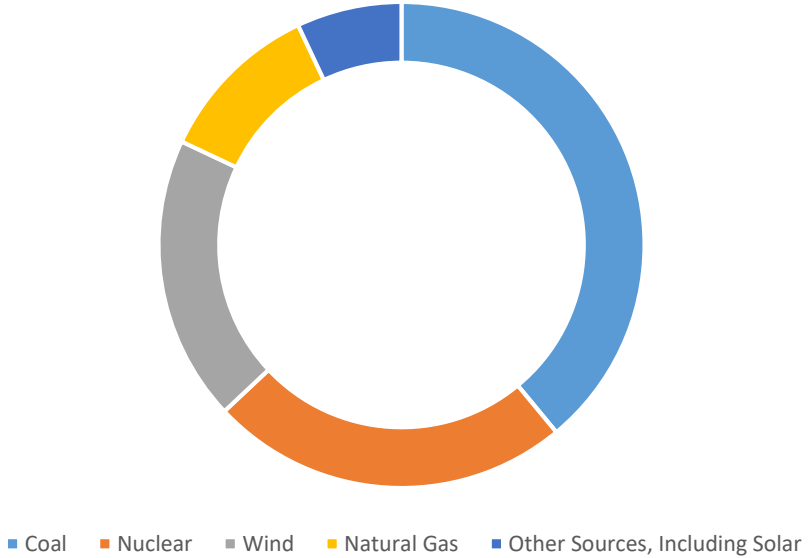
RICHARD TSONG-TAATARII/STAR TRIBUNE

Great River Energy will close the Coal Creek Power Station in North Dakota, saying it is losing too much money.

Program Update: Meet Both Energy and a Carbon Standard

Current Mix:

- 39% from coal
- 24% from nuclear
- 19% from wind
- 11% from natural gas
- 7% from other sources, including 1% from solar.



Values from Energy Information Agency, whole of Minnesota

Program Update: Meet Both Energy and a Carbon Standard

This change:

- Emphasizes those cost-effective measures that would achieve immediate carbon savings
- Enables stakeholders to make informed decisions about the resources that their projects use.
- Further meets the intent of 16B.325: to achieve energy conservation and associated carbon emissions and lowest lifetime cost for new buildings and major renovations.

Program Update: Permit Utility-Specific Emission Factors

Permitting utility-specific CO2 emission factors to be used by utility territory will:

- Allow design teams to calculate the utility territory specific carbon intensity and baseline.
- Enable evaluation of fuel switching strategies
- Allow the SB 2030 Program to reflect utilities' efforts in decarbonizing the grid

Initially the program will estimate the carbon intensity from the MRO-West emission rate, then

- A utility will submit their carbon intensity (both current and representative of 2003)
- The submitting utility will then be disaggregated from the MROW emission rates

Projects are permitted to lock in an emissions factor to ensure that future change in the emissions rate will not endanger compliance.

Questions?

Program Update: 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 from a combination of a 2009 Department of Energy Resources (DER) memo providing direction to natural gas utilities for their 2009 filings and inputs used in 2008 CIP filings submitted by Xcel Energy and CenterPoint Energy.
- Used a parametric analysis of 115 buildings to find this cost effective boundary.

In 2019 this cost-effectiveness evaluation was updated, permitting a verification of the metric (simple payback period) and the value to ensure that this program continues to adhere to the cost-effectiveness outlined in the authorizing legislation. This analysis resulted in a verification that the simple payback window is an appropriate metric, and changing the threshold of cost-effectiveness to **12 years**.

Questions?

Program Update: Implement Renewables Based on Hierarchy

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.

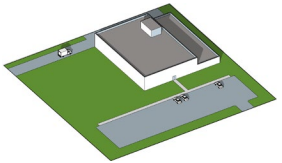
SB 2030 uses the NREL characterizations of on-site and off-site resources, which largely aligns the program with this NREL classification system (though with some considerations based on the type of buildings and ownership organizations that participate in the SB 2030 Program)

Table 1. NZEB RE Supply Option 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.

SB 2030 Program Requirements

NZEB Supply options 0, 1, and 2 would be required to be considered first and implemented to the extent that they are cost-effective. On-campus development of supply option 2 is included in this evaluation and considered equivelant to on-site supply option 2.



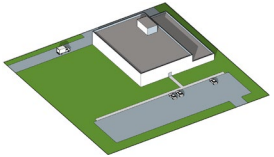
If the SB 2030 Standard cannot be met cost-effectively using the supply options above, additional RE should be developed from within the project owner's portfolio (note that this in-portfolio RE development is not listed as a supply option number here). NZEB Supply Option 3 would also be permitted, subject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

Table adapted from Net-Zero Energy Buildings: A Classification System Based on Renewable Energy Supply Options, page 10

Program Update: Implement Renewables Based on Hierarchy

First: **On-site** - Evaluate and implement NZEB Supply Options 0, 1, 2 (note- under this program option 2 would include RE developed on a campus[2]) to the extent that it cost effective or can be fit on-site or on-campus.



Second: **Off-site/Portfolio** - Evaluate and implement NZEB Supply Option 3, RE at off-site locations. This in-portfolio RE is required in addition to cost-effective on-site measures (i.e., cannot replace cost-effective on-site options).

Third: Provide the remainder of the RE needed to meet the SB 2030 Energy and Carbon Standards with Supply Option 4 (RECs).

[2] Campus here is defined as contiguous property owned by a single entity and which includes areas that are separated by a public right-of-way.

Program Update: Implement Renewables Based on Hierarchy

Scenario 1: "All On-site", 100,000 kWh needed per year

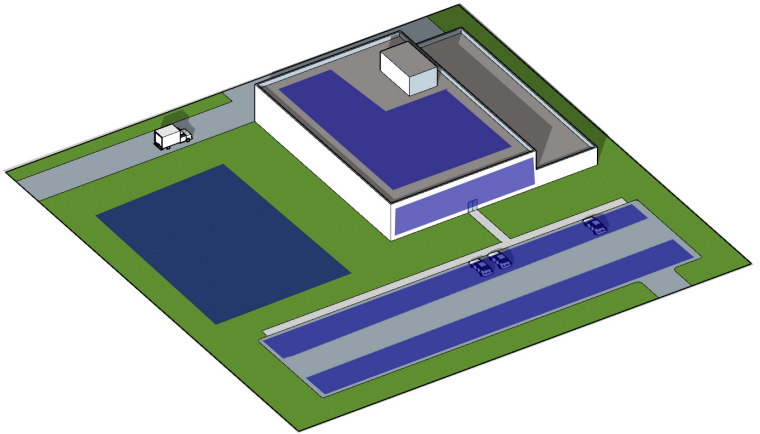
Ground mount, base system: 6 year payback, can generate 40,000 kWh/yr

Rooftop: incremental costs have 10 year payback, can generate 30,000 kWh/yr

Parking canopy: incremental costs have a 15 year payback, generates 25,000 kWh/yr

Building-integrated: incremental costs have a 20 year payback, generates 5,000 kWh/yr

Total system: 100,000 kWh/yr, **10.2 year payback**



Program Update: Implement Renewables Based on Hierarchy

Scenario 2: "On-site + Portfolio", 100,000 kWh needed per year

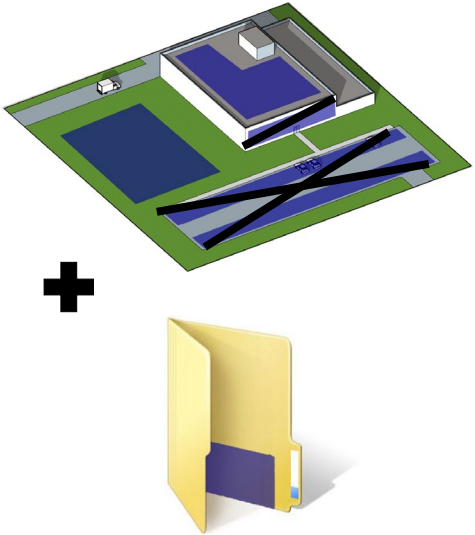
Ground mount, base system: 6 year payback, can generate 40,000 kWh/yr

Rooftop: incremental costs have a 10 year payback, can generate 30,000 kWh/yr

~~Parking canopy and Building integrated: replaced~~

Off-site/Portfolio: 30,000 kWh/yr, 4 year payback

Total system: 100,000 kWh/yr, **6.6 year payback**



Program Update: Implement Renewables Based on Hierarchy

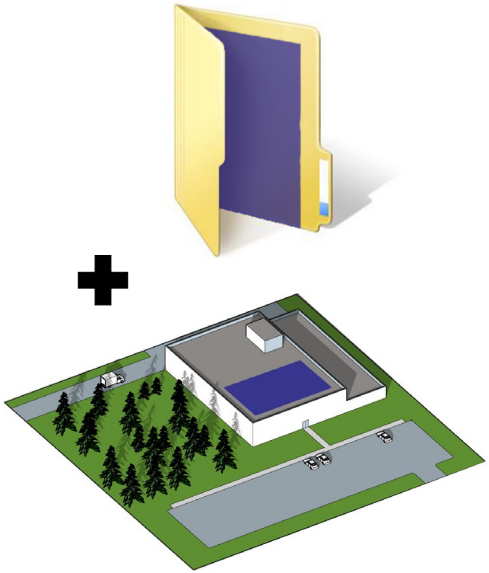
Scenario 3: "Portfolio", 100,000 kWh needed per year

Ground mount-based system is shaded, other on-site options have payback > 12 years

Off-site array, base system: 90,000 kWh/yr, 4 year payback

Rooftop, 10,000 kWh/yr, 14 year payback
(Does not meet SB 2030 cost effectiveness test, but passes LCOE calculation and needed to meet state's 2% RE on-site requirement, B3 guideline E.2A)

Total system: 100,000 kWh/yr, **5.0 year payback**



Program Update: Implement Renewables Based on Hierarchy

Scenario 4: "RECs", 100,000 kWh needed per year

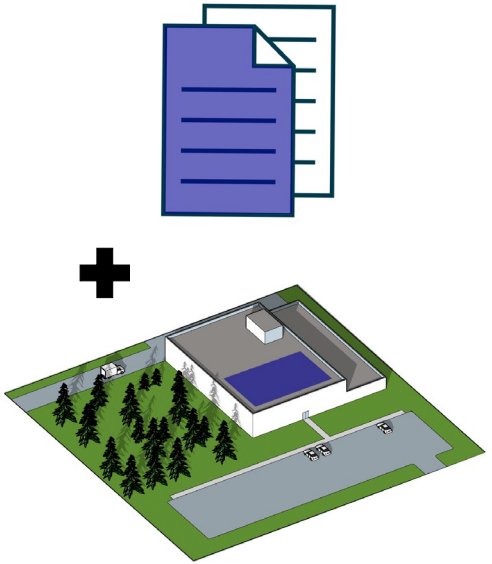
Ground mount-based system is shaded, other on-site options have payback > 12 years

Offsite array: no off-site RE development options exist within owner's property portfolio, or payback > 12 years

RECs: RE credits worth 90,000 kWh/yr under contract for 10yrs

Rooftop, 10,000 kWh/yr, 14 year payback
(Does not meet SB 2030 cost effectiveness test, but passes LCOE calculation and needed to meet state's 2% RE on-site)

Total system: 100,000 kWh/yr, **payback N/A**



Update: Implement Renewables Based on Hierarchy

RE contributing to meeting NZEB Supply Options 1, 2, or 3 (on-site and off-site RE development) are subject to the following:

1. RECs associated with the RE developed on or off site must be retired by the project. (Could be an issue with 3rd party-owned systems, such as solar leases.)
2. 3rd party ownership of a RE system is permitted if item 1 is met or the project purchases back the RECs *REC arbitrage) 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 renewable energy generating source shall be photovoltaic systems, solar thermal power systems, and/or wind turbines.

Program Update: Implement Renewables Based on Hierarchy

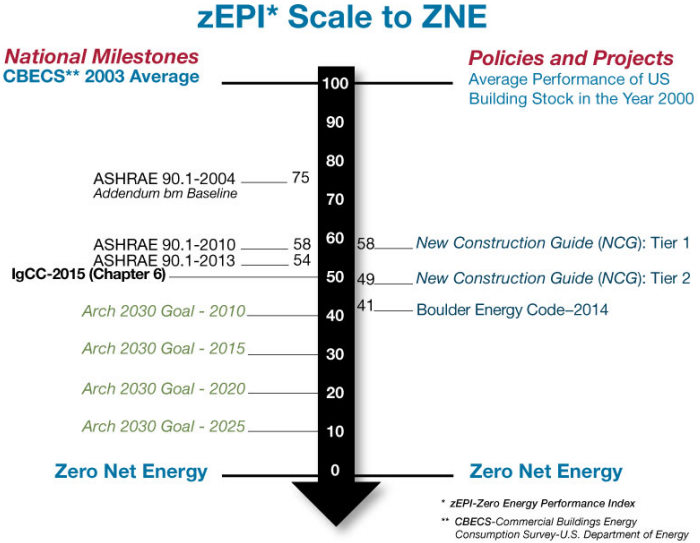
RE contributing to meeting NZEB Supply Option 4 (RECs) must:

1. Have term of not less than 10 years. These do NOT have to come from MN sources, although it's 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 renewable energy generating source shall be photovoltaic systems, solar thermal power plants, geothermal power plants, and/or wind turbines.
4. The off-site renewable energy producer shall maintain transparent accounting that clearly assigns production to the building.

Questions?

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.
- Minnesota's Energy Code has been updated since the inception of the SB 2030 Program, meaning these renovation projects represent a much less significant improvement over a code-base building than new construction projects in the program, as code advancements have achieved close to parity with the SB 2030 renovation requirements.



Program Update: Hold Renovations to the Same Standard

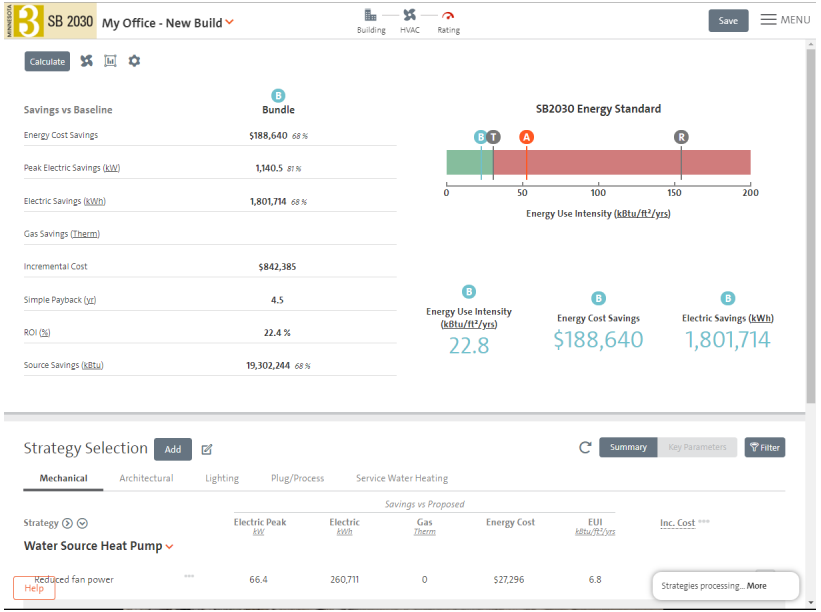
- Analysis of renovation projects by Willdan indicates that additional savings potential is possible and that additional savings are achievable but not being currently realized with this relaxed standard
- The increased availability of cost-effective carbon neutral renewable energy generation further supports a move away from different standards for new construction and major renovation projects.
- Approximately one-third of the 23 renovation projects on the B3 Case Studies Database would have met the SB 2030 Standard for new construction without changes to their design.
- 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.

Program Update: Hold Renovations to the Same Standard

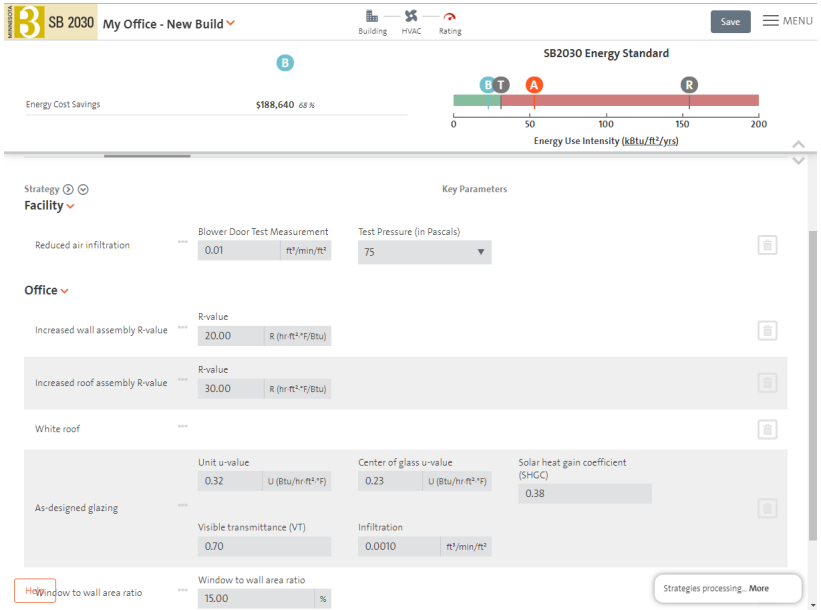
- National programs such as the AIA 2030 Commitment currently use the same standard for major renovations as for new construction.
- An evaluation of renovation projects within the EDA program suggests that major renovations achieve similar energy savings as new construction.
- The elimination of the relaxed standard for renovation projects is in-effect for those projects beginning predesign on or after January 1, 2020.
- Projects which have already begun predesign are allowed use the more relaxed standard relative to the reduction requirement of the SB 2030 Program in order to avoid re-budgeting for increased stringency in efficiency requirements.
- Durability and historic considerations can be noted as rational to not pursue some potential strategies, in particular for legacy masonry structures.

Questions?

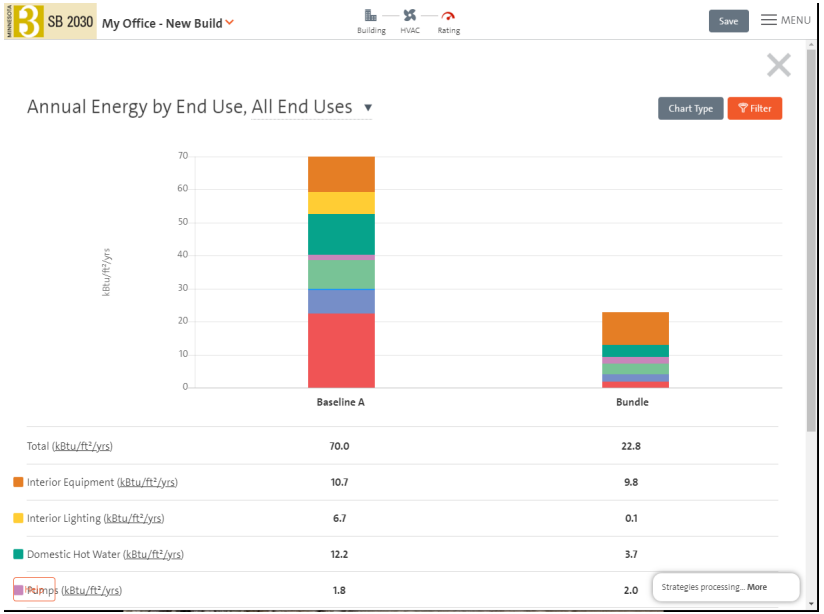
Upcoming Tool Updates—Cost Testing



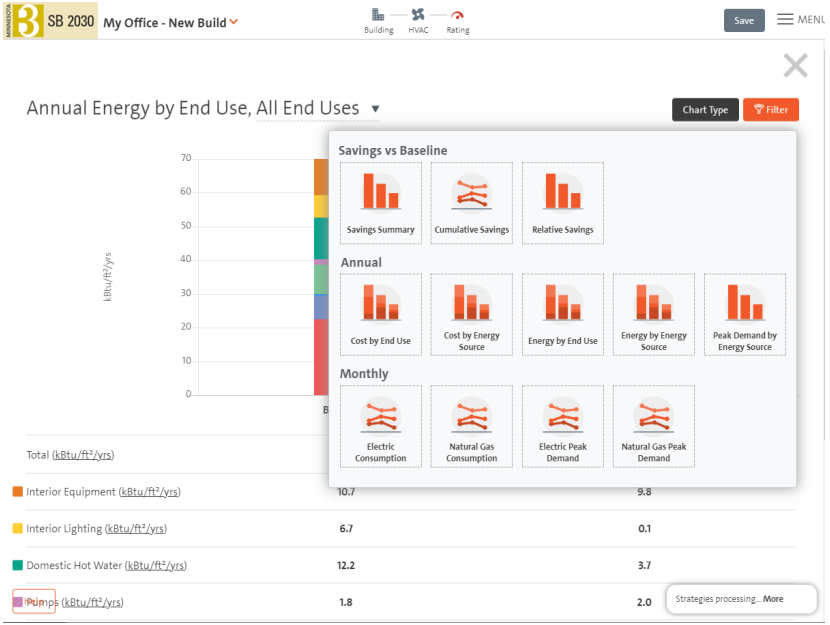
Upcoming Tool Updates—Additional Strategies



Upcoming Tool Updates—Load Breakouts



Upcoming Tool Updates—Load Breakouts



Future considerations: Program Development

Continue to exclude EV charging and process loads from SB 2030 Project scope

Electricity consumption associated with electrical vehicle (EV) charging is not considered part of the building load for SB 2030 compliance determination, and is considered a process load.

Consideration of time-of-day CO2 emissions factors to be evaluated:

The time of day CO2 emissions factors could allow the SB 2030 Program to encourage strategies that decrease energy use when the grid is the most fossil fuel dependent, and could be used by design teams to accurately adjust the carbon intensity relative to the efficiency strategies that they select. Emissions factors are needed to begin determining the best method of using time of day carbon emissions rates.

Questions?

Final Notes