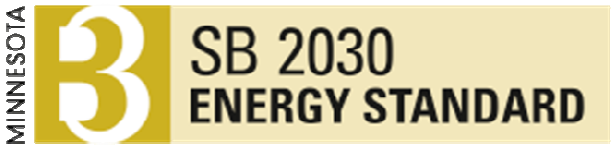

Metering Requirements

Version 3.0

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January 2014

A critical aspect of the SB 2030 Energy Standards is that the actual energy performance is reported in a way that allows for direct verification of the building's energy use after construction is complete and the building is occupied and operated under real-world conditions. The metering conducted by utilities for billing purposes does not always provide adequate information to allow for an adequate level of building performance verification against a project's SB 2030 Energy Standard. This document outlines the level of metering required for SB 2030 projects for the purposes of reporting actual total energy use. ***For most projects the only requirement beyond utility meters is the submetering of plug loads. However, there can be additional requirements for SB 2030 projects that encompass only a portion of the building area on a utility meter, have an energy source that is not metered by a utility, or which have large process loads.*** More detail on these can be found below.

Each project team must prepare a metering plan for each SB 2030 project that will define exactly how the building's actual energy performance will be calculated for comparison against the SB 2030 Energy Standard. This metering plan will include a listing of utility meters, along with any other meters or measurements that will be used as a basis for energy performance verification and a clear definition of any calculations that are needed to translate metered data and/or measurements into an energy performance value that can be directly compared to the building's SB 2030 Energy Standard.

Total Energy Metering/Submetering Requirements:

The intent of the metering requirements is to provide a reasonable balance between accurate verification of actual building performance and keeping added expenses for initial construction and ongoing performance tracking appropriate for the scale of the project. Most projects will require at least one submeter that is not read by a utility, so the building owner will have to establish a protocol for recording submeter readings at least monthly for later use in reporting actual energy use. ***For whole building SB 2030 projects that are not on a campus, the only requirement beyond typical utility meters is submeter(s) that measure plug loads separately.***

For projects where there are not separate utility billing meters serving only, and all of, the SB 2030 project area, the project team shall develop a metering plan that details what additional monitoring will be done and how the utility and submeter results will be combined to calculate the SB 2030 project Energy Use Index (EUI in units of kBtu/sf) for comparison against the SB 2030 Energy Standard. Projects that wish to exclude unusually large process loads (>20% of building energy use) from the SB 2030 Energy Standard, may also use submetering or other monitoring to do so (in a manner that is consistent with how the project's SB 2030 Energy Standard is established). The sample metering requirements and table on the following pages provide guidelines for when submetering or other monitoring is needed. Other monitoring could include, but is not limited to, BAS trending of equipment runtimes, valve positions, and

thermal output measurements. Non-utility meters and other monitoring should be chosen to provide a margin for error that is less than 2% of the total building energy use. Below the thresholds in the table, prorating of energy use for utility meters may be used based on ratios of square footages, historical utility usage, and/or expected energy use intensities. Within the general guidelines noted in this document, the project teams have the flexibility to propose an approach that is most appropriate for each project.

Typical Project Metering Requirements:

Below is the listing of some typical project types and the most common metering requirements for each. Table 1 provides more detail on the requirements outlined here.

1) **A New Construction Project Greater than 10,000 sf:**
    a. Use dedicated, building utility meters (and/or submeters) to record energy consumption and install separate electrical submeter for plug loads
    b. With district system: install energy meters to record energy consumption for each source and install separate electrical submeter for plug loads

2) **Addition Greater than 10,000 sf:**
    a. Install energy submeters to record energy consumption of addition and install separate electrical submeter for plug loads
    b. District system: install energy meters to record energy consumption for each source and install separate electrical submeter for plug loads

3) **Whole Building Renovations:**
    a. Use dedicated, building utility meters (and/or submeters) to record energy consumption
    b. District system: install energy meters to record energy consumption for each source

4) **Partial Renovation:**
    a. Install energy meters (and/or submeters) to record energy consumption
    b. Report prorated building energy consumption with the new lower energy consumption in the partially renovated area

5) **New Addition with Partial Renovation:**
    a. Install energy meters (and/or submeters) to record energy consumption of the addition and install separate electrical submeter for plug loads in the addition (these meters could optionally include just the addition and renovation areas).
    b. Report prorated building energy consumption with the new lower energy consumption in the partially renovated area

If you have a project that doesn't fit these types or extenuating circumstances that precludes the metering requirements outlined in this document, please contact the SB 2030 Coordinator at SB2030@b3mn.org no later than the project's Schematic Design completion date.

Table 1: Guidelines for Submetering:

SB 2030 Project Area	Plug Load Sub-Metering Required?	Additional Submetering is Needed Where ANY of the Following is True:
≤ 10,000 sf	No	Process Load Exclusion--If the project team wishes to exclude large process loads (>20%) from the SB 2030 Energy Standard and actual energy use. Typical office equipment and residential appliances may not be excluded.
10,000 to 100,000 sf	Yes*	Unmetered Energy Source--The SB 2030 building has an energy source (e.g. electricity, fuel, or district energy) representing 15% or more of the expected total energy use that is not on a utility meter dedicated to the building. Partial Building Area Limit--The SB 2030 project is 70% or less of a building's area. Partial Building Energy Limit--The SB 2030 project's expected energy use is less than 60% of the total building usage. Large Conduit Opportunity--More than 20% of the SB 2030 project's expected energy use crosses the SB 2030 project boundary (i.e. between buildings or within a building) in a single conduit (e.g. electrical feeder or boiler system supply pipe) that could be submetered or monitored. Process Load Exclusion--If the project team wishes to exclude large process loads (>20%) from the SB 2030 Energy Standard and actual energy use. Typical office equipment and residential appliances may not be excluded.
>100,000 sf	Yes*	Unmetered Energy Source--The SB 2030 building has an energy source (e.g. electricity, fuel, or district energy) representing 10% or more of the expected total energy use that is not on a utility meter dedicated to the building. Partial Building Area Limit--The SB 2030 project is 80% or less of a building's area. Partial Building Energy Limit--The SB 2030 project's expected energy use is less than 75% of the total building usage. Large Conduit Opportunity--More than 15% of the SB 2030 project's expected energy use crosses the SB 2030 project boundary (i.e. between buildings or within a building) in a single conduit (e.g. electrical feeder or boiler system supply pipe) that could be submetered. Process Load Exclusion--If the project team wishes to exclude large process loads (>20%) from the SB 2030 Energy Standard and actual energy use. Typical office equipment and residential appliances may not be excluded.

***Plug Load Submetering:** New construction SB 2030 projects larger than 10,000 sf are required to sub-meter plug loads in a way that will capture a project's total plug load energy use separately from other loads. The definition of plug load is: *all energy consumed by appliances, office equipment, and anything else that is not a part of the facility's primary hvac, lighting, water heating or conveyance (elevators, escalators, etc…) systems.*This includes just about anything that is actually plugged into an outlet.

Metering Plan Submittal:

In order to confirm that SB 2030 project team will install and read the meters necessary for verification of total and plug load energy usages, each project must submit a metering plan that includes the following:

1) Schematic Metering Diagram & Narrative—Graphics and text as needed to provide a clear indication of the relationships between SB 2030 project building area and adjacent building areas, as well as utility and thermal systems (e.g. district energy or heated/chilled water piping) that cross the SB 2030 project's boundary and all meters. If the SB 2030 project is an entire building that only has meters serving the whole building, a simple statement of this may be provided in lieu of a schematic diagram. Where needed, the diagram shall include:
    a. Clear indication of the spatial relationship between SB 2030 and non-SB 2030 building areas (e.g. annotated floor plans), including square footages of each.
    b. Clear notations of what systems cross the boundary between the SB 2030 and non-SB 2030 space (electrical, fuel, and thermal systems).
    c. Clear indication of locations and names for all planned utility and submeters (or other type of monitoring).
2) Metered/Monitored Value List—A listing of every meter included in the project (and any other monitored values that will be used) with an indication of the following:
    a. Meter name on plans and/or metering diagram
    b. What is metered or monitored (e.g. electrical usage, natural gas usage, BTU for hot water). For hot water and chilled water thermal meters, the location of supply and return water temperature and flow rate sensors should be clearly noted on the metering diagram. Note that all meters or other monitoring must have a total usage indication recorded on a monthly basis.
    c. The type of meter—i.e., whether the meter it is a utility meter (read monthly by a utility), a totaling submeter or some other form of readout. For anything other than a utility meter, provide an indication of who will be responsible for recording the monthly readings along with directions for finding the data to record, making any scaling or other conversions, and for long-term recording of this monthly data.
    d. Whether the meter measures: only energy for SB 2030 building areas, only energy for non-SB 2030 building areas, or both SB 2030 and non-SB 2030 building areas.
3) Calculations—A clear presentation of formulas for any calculations that will need to be used to convert utility and/or submetered/monitored data into values that can be directly compared to the project's SB 2030 Energy Standard. This section must include an explanation of the basis for the calculations—including any pro-rating factors used. Proposed approaches to metering and calculations will be evaluated on a case by case basis, and a few examples are presented below to help clarify the type of information needed for this section of the Metering Plan and some acceptable approaches. If no calculations are needed, a simple statement indicating this is adequate for cases where the SB 2030 project is an entire building that only has meters serving the whole SB 2030 building.

Example A. SB 2030 Project is a Renovation of 75% of the Area of a 60,000 sf School Building.

SB 2030 Electric Use = Metered Electric Use – 25% X 1.15 X Pre-Renovation Electric Use

Note: The factor of 1.15 is used because the non-renovated area's schedule and office space type would have an SB 2030 Energy Standard that is 15% higher than the SB 2030 Energy Standard would be for the building as a whole. This is because of a mix of the lower use schedules and energy intensities for the classrooms and corridor spaces that are included in the SB 2030 renovation. [In this case, additional document should include documentation of previous annual electric use and the downloaded spreadsheet summaries of Energy Standard Tool inputs and results for these test project runs.]

Example B. SB 2030 Project is an Addition of 40,000 sf to a 100,000 sf Office Building.

Energy supplies to the SB 2030 addition are:

-- All electricity serving the addition is fed through a single new run from the main panel. This includes a rooftop DX unit and VRFZ units that provide all of the cooling.

-- All heating is provided from a pre-existing boiler system through one set of supply and return pipe extensions that exclusively serve the SB 2030 project area. The heating use is projected to be 35% of the SB 2030 project's total energy use and will be submetered at the main pipe at a location that captures only the thermal energy going to the SB 2030 project addition. Note that because the SB 2030 project scope does not include the building's boiler plant, it will be treated as if it is served by a district energy heating system. Note that the boiler system is kept off in the summer so there is no air-conditioning reheat between May and September.

-- DHW is provided from the pre-existing system and is expected to be 6% of the SB 2030 project energy use. Space type ratios are consistent between the existing building and the addition.

SB 2030 Electric Use = Sub-Metered Electric Use
SB 2030 District Heating Use = Sub-Metered Thermal Energy Use
SB 2030 Gas Use (for DHW) = 29% X 12 X Average Monthly Metered Summertime Gas Use
[29% based on 40,000 sf ÷ 140,000 sf]

Table 2: Potentially Helpful Energy Unit Conversion Factors:

1 kWh	=	3,412 Btu	=	3.412 kBtu
1 therm	*=*	*100,000 Btu*	*=*	*100 kBtu*
1 kBtu	=	1,000 Btu	=	1 kBtu
1 KJ	=	0.9478 Btu	=	0.0009478 kBtu
1 ton	=	12,000 Btu/hr		12 kBtu/hr
1 lb steam*	=	1,194 Btu		1.194 kBtu

*Energy content of steam varies with pressure; figure here is for saturated vapor @ 130psi