APPLICATION NOTE

How to comply with submetering requirements of IECC / ASHRAE 90.1 energy codes ?

When **energy** matters

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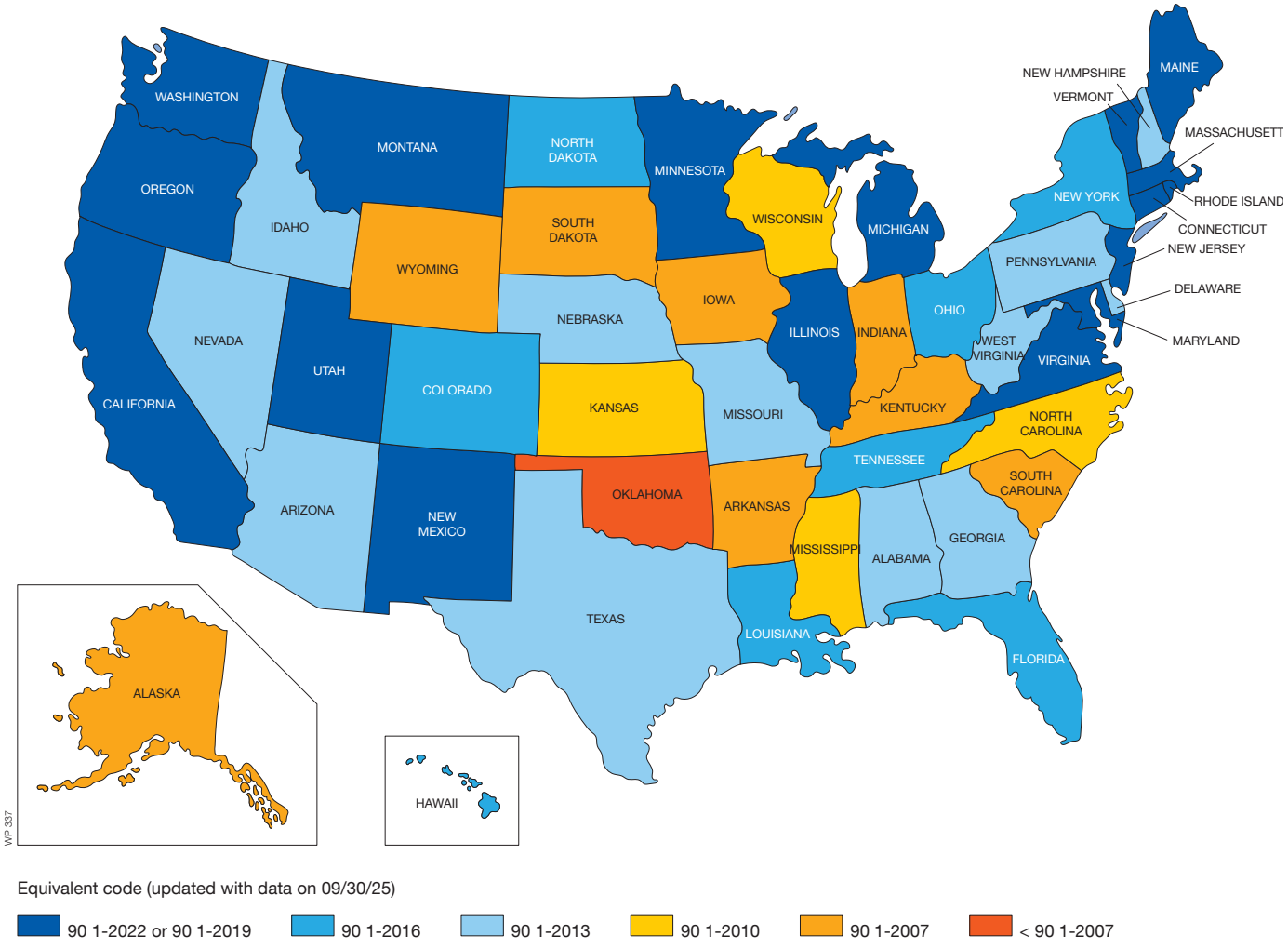
Introduction

Energy efficiency standards and building codes play a critical role in reducing energy consumption in buildings.
The most widely adopted model energy codes for commercial buildings are the International Energy Conservation Code (IECC) and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1.
While a majority of state or city codes are based on the IECC, ASHRAE 90.1 is recognized by the DOE (Department of Energy) as the national reference standard, and is recognized by IECC as an alternative compliance standard. Both model codes are updated every three years.

As a result, the United States is a patchwork of code adoption, as shown in this status of code adoption map produced by the DOE:



Source: www.energycodes.gov/state-portal

Contents

Scope of IECC and ASHRAE 90.1 energy codes

The IECC and ASHRAE 90.1 codes apply primarily to **new buildings**, setting energy conservation standards for new construction projects. However, any existing building undergoing significant modifications such as renovations, alterations or additions must comply with the codes' guidelines.

- **Renovations or Alterations:** When an existing building undergoes significant changes, such as major renovations or system replacements (e.g., HVAC or lighting).
- **Additions:** If new spaces are added to an existing building.
- **Repairs:** Repairs to existing buildings.

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Are there penalties for not complying with energy codes?
Many jurisdictions adopt ASHRAE 90.1 and/or IECC as part of their building codes. Failure to comply could potentially result in penalties or fines imposed by these jurisdictions under local laws.

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Which state requires submetering?
*Refer to **ANNEX 1** to identify which states enforce submetering requirements under **ASHRAE 90.1** or **IECC** energy code compliance.*

ASHRAE 90.1-2022 (and its 2019, 2016, and 2013 versions) as well as IECC 2024 (and the 2021 version) include specific submetering requirements for monitoring energy use across various load categories. While there are nuanced differences between these codes, they share similar objectives: tracking energy consumption by load type in aggregate to enable informed decision-making and targeted efficiency improvements. However, because states often adopt these codes with amendments, the submetering provisions may not always apply.

Once an energy code is adopted at the state level, local jurisdictions are responsible for adopting and enforcing it. The state code sets the minimum requirements, but local jurisdictions can voluntarily go beyond the base code by implementing an enhanced or "stretch" code, a more recently updated or more aggressive standard designed to achieve greater energy savings.

For example, the city of Austin, TX implemented the IECC 2024 revision in July 2025, even though the state of Texas continues to follow the 2015 IECC and ASHRAE 90.1-2013 revisions. Another example is Denver, CO, which adopted the Denver Green Code 2022, a code closely aligned with the latest IECC and ASHRAE 90.1 standards, despite Colorado not enforcing a statewide energy code.

This application note aims to clarify the submetering requirements outlined in these standards, focusing on their application in new construction and major renovation projects.

** Uptime Institute study (2020).*

Submetering requirements of the latest IECC 2024 and ASHRAE 90.1 2022

The U.S. Department of Energy estimates a 5-15% savings when a building or energy manager becomes conscious of his energy usage through a monitoring device such as a submeter.

What is Submetering?
Submetering involves the installation of meters downstream of the service entrance utility meter (also called master meter) to measure and monitor energy consumption of specific loads or load types within a building. Unlike the master utility meter, submeters provide granular monitoring, helping identify inefficiencies, optimize energy use and allocate costs.

While submetering doesn't directly lower utility costs, it helps building owners and facility managers to:
- gain deeper visibility into energy usage patterns,
- become more conscious about their energy usage,
- support energy management strategies to reduce overall consumption,
- track and analyze the effectiveness of code compliance efforts.

IECC 2024 energy code applies to new commercial buildings > 10,000 sqft.

Site size

- ASHRAE 90.1-2022 concerns commercial buildings > 25,000 square feet.
- The IECC 2024 revision has just lowered thresholds for mandatory submetering implementation in commercial buildings from 25,000 square feet in IECC 2021 revision to 10,000 square feet.

Load categories to submeter

ASHRAE 90.1-2022 and IECC 2024 require the use of meters to collect electrical energy use for each of the following end-use category separately:

Load category	Description	Required by IECC	Required by ASHRAE 90.1
Total system		No	Yes
HVAC systems	Heating cooling and ventilation, including but not limited to fans, pumps, boilers, chillers and water heating	Yes	Yes
Interior lighting	Lighting systems located within the building	Yes	Yes
Exterior lighting	Lighting systems located on the building site but not within the building (example parking lot lighting)	Yes	Yes
Plug loads	Devices, appliances and equipment connected to convenience receptacle outlets	Yes	Yes
Process load	Any single load that is not including that is not included in an HVAC, lighting or plug load category and that exceeds 5% of the peak connected load of the whole building, including but not limited to data centers, manufacturing equipment and commercial kitchens	Yes	No
Renewable energy systems	Solar, wind, or other renewable energy sources must have dedicated meters to track generation and integration with the building's energy systems	Yes	No
Water heating systems	Electricity used to generate hot water, for uses other than space conditioning	Yes	No
Refrigeration systems	Added in 2022 revision of ASHRAE 90.1 standard when refrigeration exceeds 10% of total building load	No	Yes

Data acquisition system

- Buildings must include a data acquisition system (EMS, BMS etc.) capable of collecting, storing, and reporting data from the required meters.
- The system shall provide hourly, daily, monthly and yearly logged data for each end-use category listed previously.
- The system shall be capable of providing site total peak electric demand and the exact date/time within the month at which the peak occurs.
- The system shall be capable of maintaining all data collected for a minimum of 36 months.

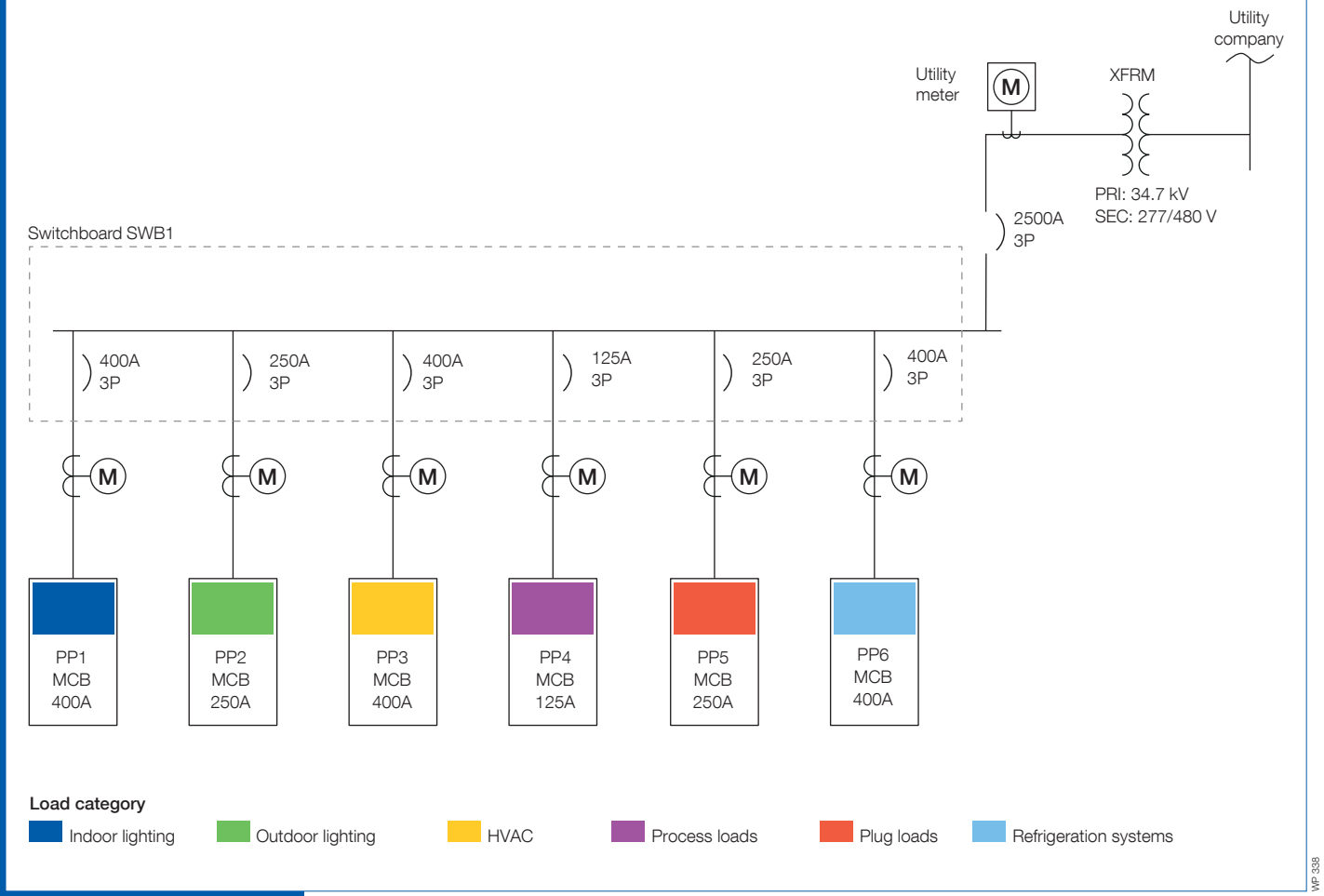
What if my building lacks a data acquisition system? *Socomec's* ***DATALOG H80*** *with embedded* ***WEBVIEW-L*** *software can log data for up to 30 years thanks to its* ***80 GB memory card****. Refer page xx of this document for more information on the DATALOG H80.*

Typical challenges

In electrical installations, load disaggregation can vary significantly.
Ideally, each load category is isolated upstream in the electrical distribution system. In this case, upstream metering alone is sufficient to measure the kWh consumption for each load category. However, in many installations, panelboards may supply multiple load categories, making measurement more complex.

Situation 1: Loads Separated Upstream

In the example below, each subfeed from the SWB1 switchboard is dedicated to a single load category, and each panelboard contains circuits for only that category. Under these conditions, kWh consumption can be accurately measured either by installing upstream meters on each panelboard's main feed or by using multi-circuit metering at the switchboard level to monitor each subfeed.

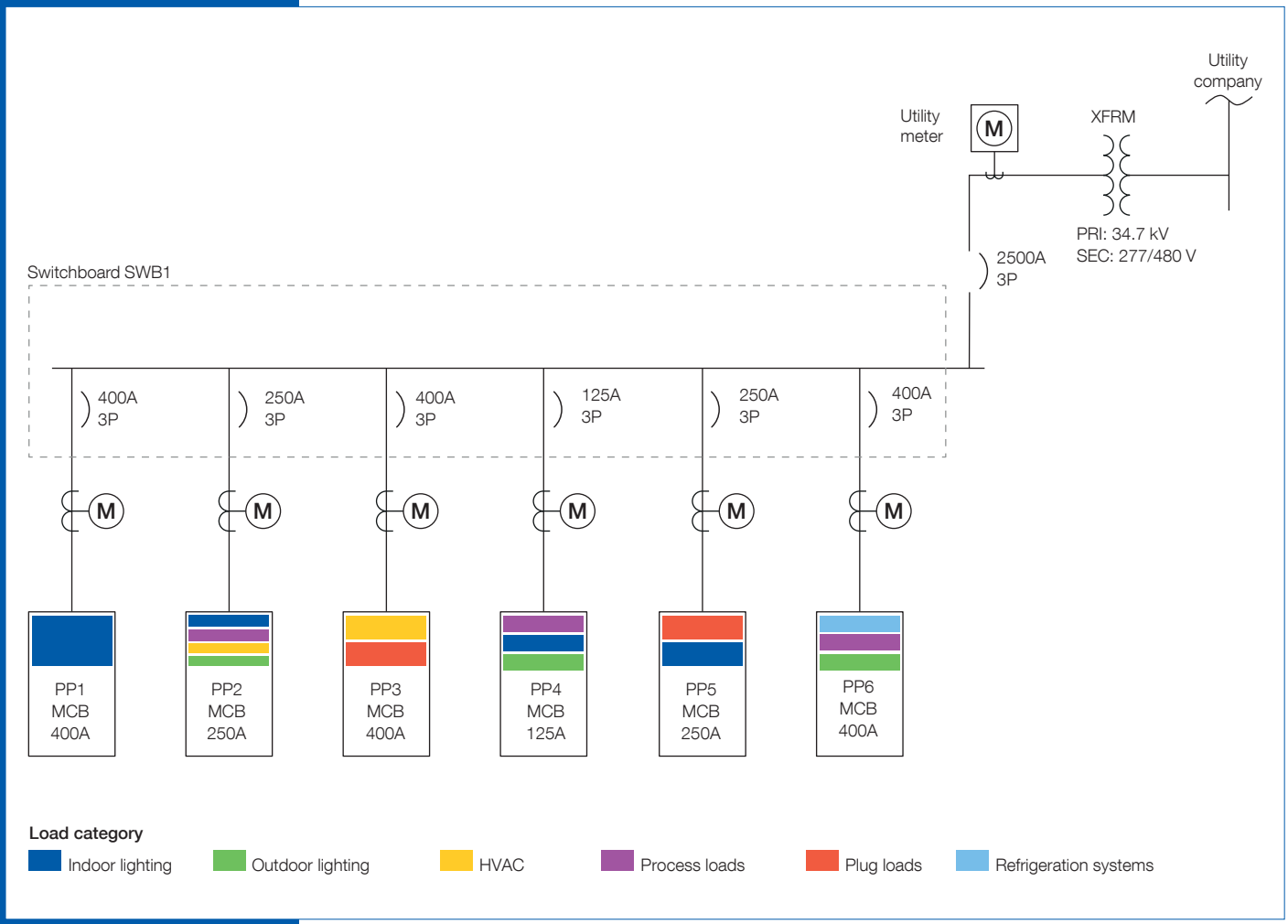


Typical challenges (cont.)

Situation 2: Loads Not Separated Upstream

In many electrical installations, upstream feeders supply panelboards that contain circuits for multiple load categories. Because these categories are mixed within the same panelboard, upstream metering cannot provide the necessary detail for accurate kWh allocation. In this case, granular branch-circuit metering is required—either integrated within the panelboard or via an external multi-circuit meter box in order to be able to capture consumption data for each individual load category.

This is illustrated in the diagram below where panel PP1 only feeds one load category (Interior Lighting), but panels PP2, PP3, PP4, PP5 and PP6 each feed multiple load categories.



Typical challenges (cont.)

Comprehensive electrical designs with detailed circuit schedules enable submetering companies to develop optimized metering architectures that ensure compliance with energy codes.

The image below shows the PP4 panel schedule which contains circuits feeding several different load categories. Each breaker is associated to a numbered note in the “Note” column, which refers to the load category classification details at the bottom of the schedule. This level of detail in the electrical design stage ensures the correct metering solution is used and also helps the BAS/BMS (Building Automation/Management System) team assign and report each breaker’s kWh consumption to the correct load category.

PANEL NAME: PP4 — **PANEL SCHEDULE** — **LOCATION: ELECT CL 1780B**

OPTIONS: SERV... 208/120 VOLT
COPPER BUS, BOLT-ON BREAKERS 3 PHASE AIC RATING: 10,000
SOLID COPPER GROUND BUS, NEUTRAL BUS, AND FEED-THRU LUGS 4 WIRE MOUNTING: SURFACE
ENCLOSURE: TYPE 1 SERVED FROM: T-BL1-56-2PP2 BUS SIZE: 400.0 A MCB SIZE: 250A

Note	CIRCUIT SIZE	CIR	LOAD DESCRIPTION	BKR	P	KVA PER PHASE A		KVA PER PHASE B		KVA PER PHASE C		P	BKR	LOAD DESCRIPTION	CIR	CIRCUIT SIZE	Note
1	2#10+1#10G-3/4"C	1	REC RM 1780C, 1780D	20	1	0.36	0.50					1	20	DOOR POWER - 1790-1	2	2#10+1#10G-3/4"C	
	2#10+1#10G-3/4"C	3	DOOR POWER - 1776A-1, 1776A-2	20	1			1.00	0.50			1	20	MISC GRADE D CORRIDOR 1770	4	2#10+1#10G-3/4"C	
1	2#10+1#10G-3/4"C	5	REC CNC CORRIDOR 1780F	20	1					0.72	0.50	1	20	DOOR OPERATOR ROOM 1792	6	2#10+1#10G-3/4"C	
2	2#10+1#10G-3/4"C	7	OIT CHARGER ROOM 1792	20	1	0.50	0.90					1	20	REC GRADE D CORRIDOR 1795	8	2#10+1#10G-3/4"C	1
2	2#10+1#10G-3/4"C	9	REC FZR-89970 - MEDIA PREP 1788	20	1			0.18	0.00			2	20	SPARE	10	–	
	2#10+1#10G-3/4"C	11	TP-89480-TP-008 CNC JAN CL 1790B	20	1					0.50	0.00				12		
1	2#10+1#10G-3/4"C	13	REC GRADE C LOGISTICS CORRIDOR	20	1	0.36	0.50					1	20	DOOR OPERATORS 1797A-1, 1797A-2	14	2#10+1#10G-3/4"C	
1	2#10+1#10G-3/4"C	15	REC 1782,1782A,1783	20	1			0.36	0.18			1	20	BUG LIGHT REC WALKABLE CEILING...	16	2#10+1#10G-3/4"C	1
	–	17	SPARE	20	2					0.00	0.90	1	20	REC SMALL SCALE MEDIA PREP 1788	18	2#10+1#10G-3/4"C	2
		19				0.00	0.00					2	20	SPARE	20	–	
	–	21	SPARE	20	2			0.00	0.00						22		
		23								0.00	0.50	1	20	DOOR OPERATORS 1797B-1, 1797B-2	24	2#10+1#10G-3/4"C	
1	2#10+1#10G-3/4"C	25	REC 1770A&B, 1774A, 1781	20	1	0.72	1.20					1	20	PT-81990 INOC 1 1797	26	2#10+1#10G-3/4"C	2
2	2#10+1#10G-3/4"C	27	PT-81991 INOC 1 1797	20	1			1.20	1.20			1	20	PT-81992 INOC 1 1797	28	2#10+1#10G-3/4"C	2
2	2#10+1#10G-3/4"C	29	PT-81993 INOC 1 1797	20	1					1.20	0.50	1	20	DOOR OPERATOR 1777-1	30	2#10+1#10G-3/4"C	
	2#10+1#10G-3/4"C	31	DOOR OPERATOR 1778-1	20	1	0.50	0.50					1	20	DOOR OPERATOR 1779-1	32	2#10+1#10G-3/4"C	
	2#10+1#10G-3/4"C	33	DOOR OPERATOR 1714-1	20	1			0.50	1.20			1	20	PT-89990 WASH 1779	34	2#10+1#10G-3/4"C	2
2	2#10+1#10G-3/4"C	35	PT-89991 WASH 1779	20	1					1.20	0.18	1	20	CALIBRATION REC. CLEAN PREP 1778	36	2#10+1#10G-3/4"C	2
2	2#10+1#10G-3/4"C	37	REC FZR-89971 - MEDIA PREP 1788	20	1	0.18	0.80					1	20	FCU-08	38	2#10+1#10G-3/4"C	3
2	2#10+1#10G-3/4"C	39	REC FZR-89972 - MEDIA PREP 1788	20	1			0.18	0.80			1	20	FCU-15	40	2#10+1#10G-3/4"C	3
2	2#10+1#10G-3/4"C	41	REC FZR-89973 - MEDIA PREP 1788	20	1					0.18	0.36	1	20	REC COND. PUMP FCU-08, FCU-15	42	2#10+1#10G-3/4"C	1
			TOTAL CONNECTED KVA PER PHASE:			13.30 kVA		13.56 kVA		12.09 kVA							
			TOTAL CONNECTED AMPS PER PHASE:			112.4 A		114.6 A		100.7 A							

LOAD CLASSIFICATION	CONNECTED LOAD	D.F.	REMARKS	DEMAND LOAD
EQUIP	600 VA	100.00%		600 VA
HVAC	2091 VA	100.00%		2091 VA
MISC	8900 VA	75.00%		6675 VA
REC	22560 VA	72.16%		16280 VA
PASS THRU	4800 VA	75.00%		3600 VA
TOTAL CONNECTED LOAD:	38.95 kVA		TOTAL DEMAND LOAD:	29.25 kVA
			TOTAL DEMAND CURRENT:	81.2 A

CONNECTED CURRENT TOTALS	
PHASE A CONNECTED CURRENT:	112.4 A
PHASE B CONNECTED CURRENT:	114.6 A
PHASE C CONNECTED CURRENT:	100.7 A
NEUTRAL CONNECTED CURRENT:	12.9 A

NOTES:
1. LOAD SHALL BE INDICATED AS PROCESS LOAD WITHIN THE BUILDING MANAGEMENT SYSTEM
2. LOAD SHALL BE INDICATED AS INTERIOR LIGHTING LOAD WITHIN THE BUILDING MANAGEMENT SYSTEM
3. LOAD SHALL BE INDICATED AS EXTERIOR LIGHTING LOAD WITHIN THE BUILDING MANAGEMENT SYSTEM

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Considerations for implementation of submetering solutions

BAS/BMS integration

- Select submeters that integrate with Building Management Systems (BMS).
- Ensure compatibility with universal and open protocols like BACnet or Modbus.

Installation and Commissioning

- Select submeters that are easy and quick for contractors to install, lowering the overall project cost.
- Work with qualified contractors to ensure proper installation.
- Work with metering vendors offering startup services to ensure meters are correctly programmed and they measure reliable data.

Data Management

- Implement software platforms to analyze and visualize energy data.
- Provide training to facility managers on interpreting sub metered data.

Granularity

- Not all load categories are grouped together at the switchboard level. This means that granular monitoring (individual circuits) at the power panel or panelboard level is often needed to collect kWh data for each load category.

Space Constraints

- Monitoring individual circuits, may be challenging in panels with limited internal space. In such cases, enclosed metering solutions that can be wall-mounted near the panel or installed in a separate room offer a more practical alternative.
- Multi-circuit meters housed in a single enclosure help save space and simplify installation compared to deploying multiple single-point meters.
- Using 333 mV current transformers (CTs) allows for flexible placement of meters, as CT leads can be extended 100 feet or more.

How Socomec can help

Socomec offers a complete range of metering solutions that support building owners and engineering firms in finding the most effective path towards energy code compliance.

Socomec's solutions are flexible in their deployment: enclosed power meters can be installed on-site by electrical contractors in existing installations, while loose power meters can be integrated directly inside switchboards, power panels, panelboards during their manufacturing.

Enclosed Power Meters for electrical contractors

Enclosed power meters are designed for contractor-led projects to quickly deploy code-compliant submetering on-site without the need for custom assembly inside the panel.
This makes it a practical choice when construction timelines are tight, ensuring that all required load categories are metered accurately and in full compliance with submetering provisions of the energy code.

DIRIS MCM

DIRIS MCM 007

The **DIRIS MCM** is a multi-circuit enclosed power meter with up to 48 current sensor (CT) inputs, allowing to monitor multiple branch-circuits within a switchboard or panelboard.
A single DIRIS MCM can also be used to monitor circuits in several panels, to lower hardware and installation costs.
The DIRIS MCM is best suited for panels with circuits feeding multiple load categories.

To learn more about the DIRIS MCM, go to
www.socomec.us/en-us/p/diris-mcm

DIGIBOX A

DIRIS 1041

For panels where all sub feeds feed the same load category, the **DigiBOX A** enclosed single-circuit power meter is ideal to monitor the panel's main feed.

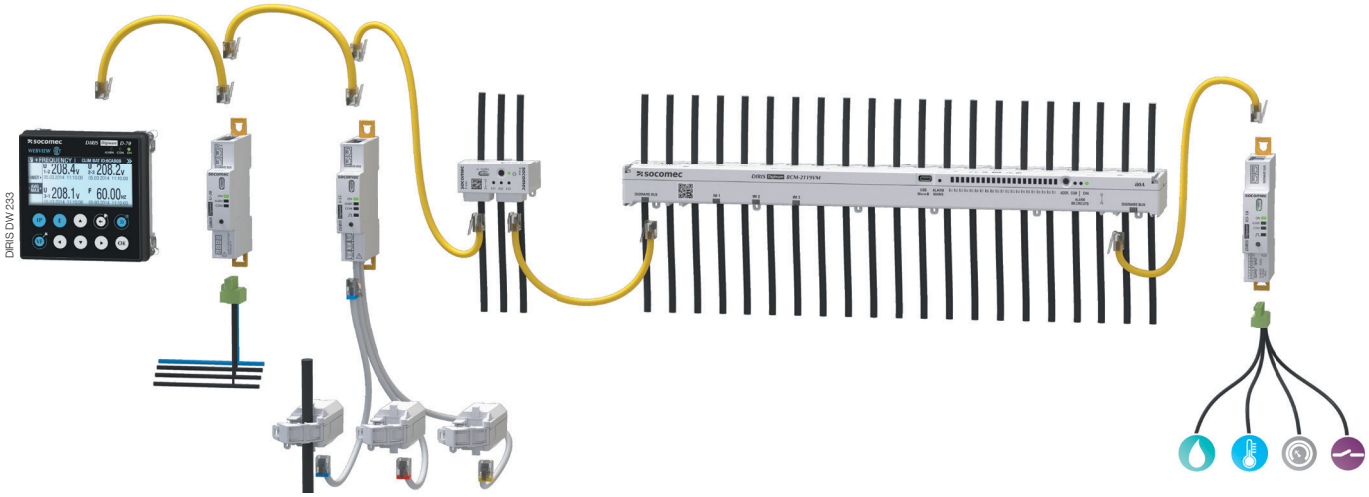
To learn more about the DigiBOX A, go to
www.socomec.us/en-us/p/diris-digibox-a

How Socomec can help (cont.)

Built-in modular metering for electrical panel builders

DIRIS Digiware

The **DIRIS Digiware system** is designed for panelbuilders who need to deliver electrical panels that are compliant with energy code submetering requirements from day one.
The DIRIS Digiware system can be customized with meter modules connecting to external CTs including solid-core, split-core and Rogowski coil CT, but also branch-circuit meter strips that can mount directly inside the panelboard.



As a modular multi-circuit metering system, DIRIS Digiware allows branch-circuit monitoring to be built directly into switchboards, panelboards, or any distribution panel during manufacturing.
This OEM integration at the factory ensures that all required load categories are measured, without the need for contractors to add external submeters on-site. While this approach reduces labor and wiring complexity in the field, it must be planned earlier in the project since the electrical panel is engineered as a custom design.

To learn more about the DIRIS Digiware system, go to www.youtube.com/watch?v=VK3nKhlodZM

How Socomec can help (cont.)

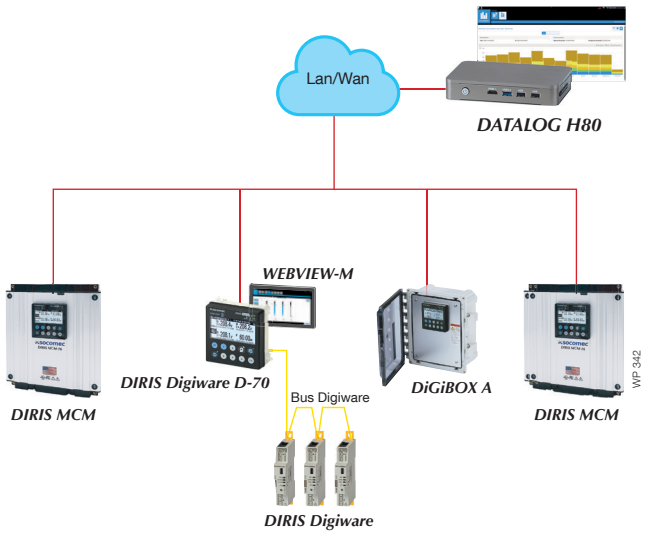
Datalogging and energy monitoring software

DATALOG H80 - WEBVIEW-L

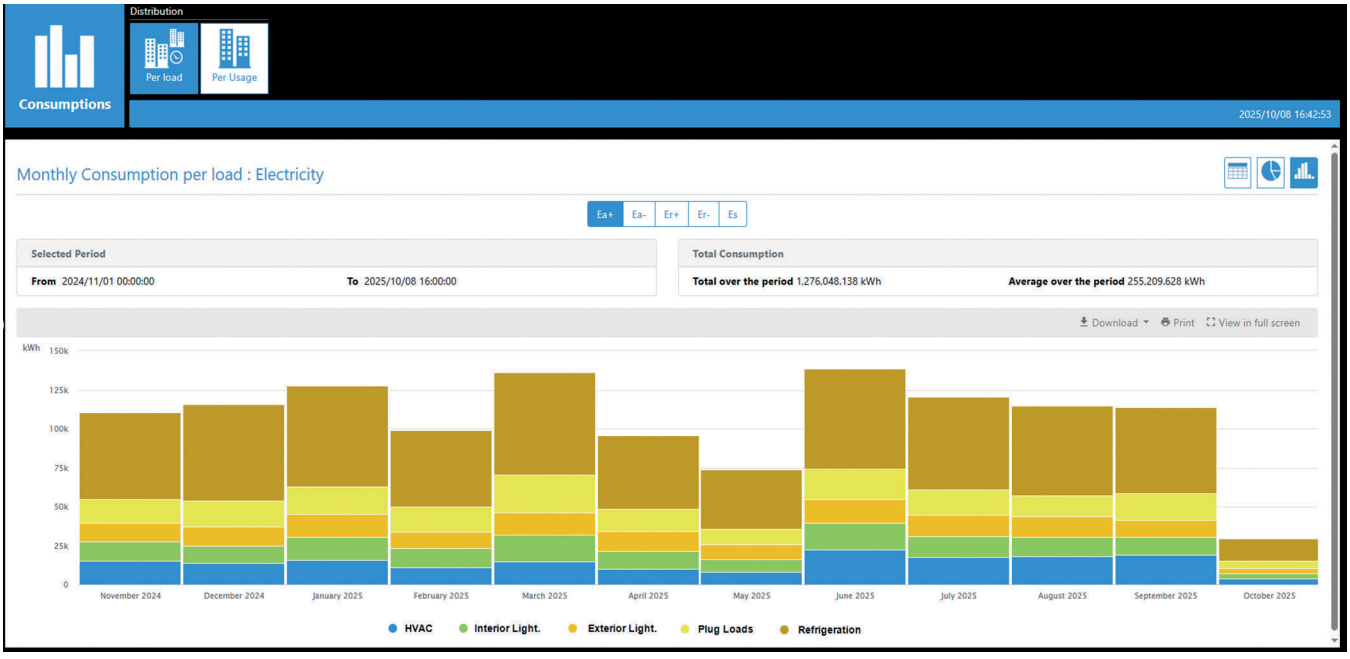
WEBVIEW is a web based software embedded in the **DATALOG H80 datalogger**. The DATALOG H80 comes with an 80 GB memory card allowing to store measurements 15 to 40 years depending on the number of devices connected and amount of data being stored.

A simple use case with 200 power meters, recording energies (kWh, kvarh, kvAh), demand (kW, kvar, kVA) and traditional measurements such as (amps, volts, frequency) allows to store data for 35 years with a 15-min reading interval.

To learn more about the WEBVIEW software, go to www.socomec.us/en-us/p/webview



Below is an example of a dashboard available in WEBVIEW-L, used to monitor consumption across different load types. The report provides annual, monthly, weekly, daily, and hourly breakdowns for detailed analysis.

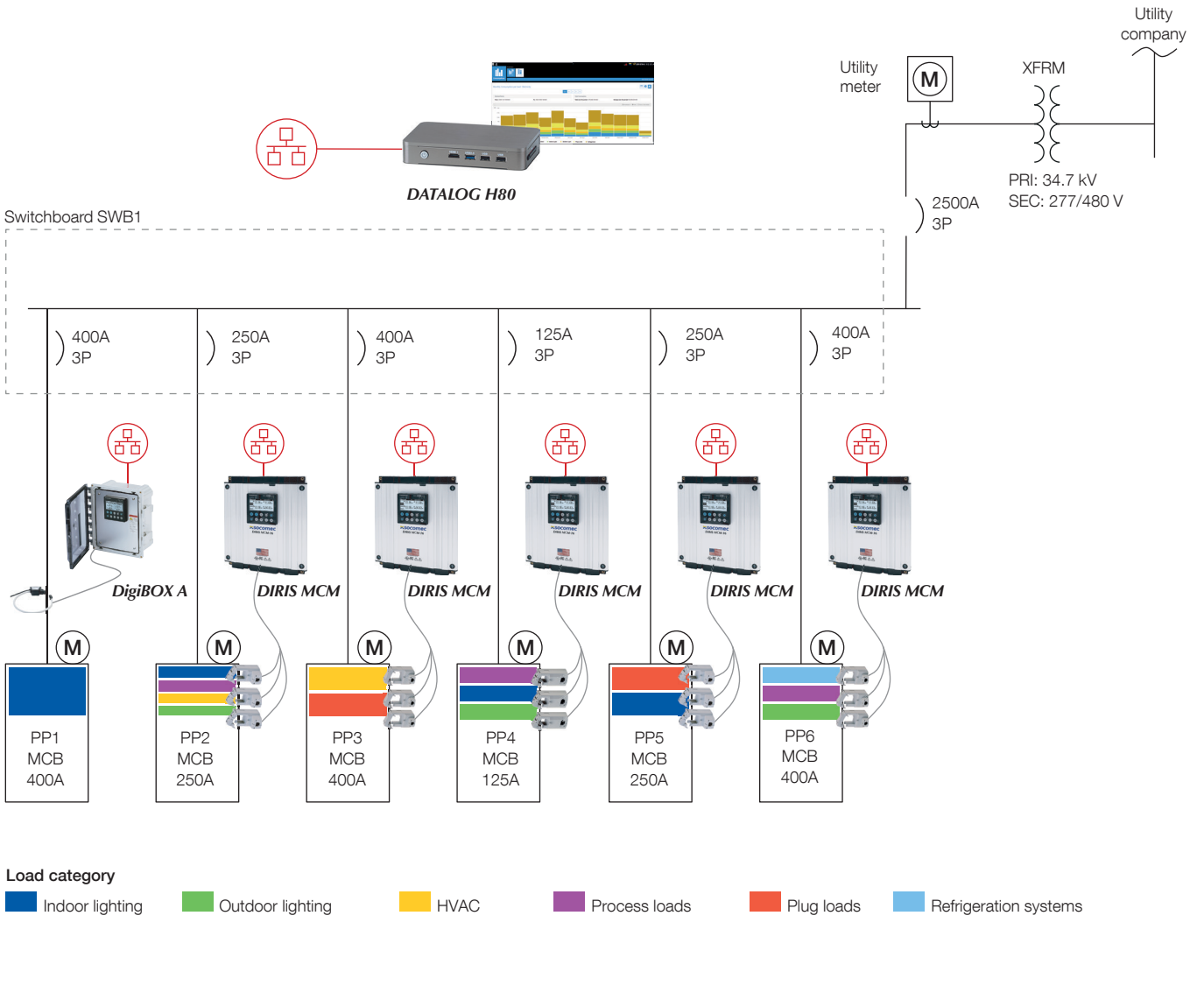


Typical submetering architecture

Below shows a possible submetering architecture to situation 2 previously mentioned in this document:

- DigiBOX A to monitor the consumption of the entire PP1 panel,
- DIRIS MCM to monitor the different circuits within panels PP2 – PP6,
- DATALOG H80 to collect and store measurement data, and provide a web interface to visualize consumption for each load categories.

All power meters and the DATALOG H80 are connected to the local network by Ethernet.



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Conclusion

Compliance with energy codes such as IECC and ASHRAE 90.1 is essential for new construction and major renovations in commercial buildings across the United States.

These codes increasingly require submetering to monitor energy consumption by load category, with thresholds for mandatory implementation now as low as 10,000 square feet in the latest IECC revision.

Submetering enables building owners and facility managers to gain granular insights into energy use, optimize consumption, and support code compliance efforts. Implementation challenges—such as load disaggregation and integration with building management systems—can be addressed with flexible metering solutions like Socomec's DIRIS Digiware, DIRIS MCM, DigiBOX A, and DATALOG H80.

Ultimately, effective submetering supports energy efficiency, cost allocation, and regulatory compliance, helping organizations meet both current and future energy standards.

Annex

Annex. 1
Energy usage submetering requirement by state

State	Submetering Requirement?
Alabama	Yes
Alaska	No
Arizona	No
Arkansas	No
California	Yes
Colorado	Yes
Connecticut	Yes
Delaware	No
District of Columbia	Yes
Florida	No
Georgia	Yes
Hawaii	Yes
Idaho	No
Illinois	Yes
Indiana	No
Iowa	No
Kansas	No
Kentucky	No
Louisiana	Yes
Maine	Yes
Maryland	Yes
Massachusetts	Yes
Michigan	Yes
Minnesota	Yes
Mississippi	No
Missouri	No

State	Submetering Requirement?
Montana	No
Nebraska	No
Nevada	Yes
New Hampshire	No
New Jersey	Yes
New Mexico	Yes
New York	Yes(1)
North Carolina	No
North Dakota	No
Ohio	No
Oklahoma	No
Oregon	Yes
Pennsylvania	No
Rhode Island	Yes
South Carolina	No
South Dakota	No
Tennessee	No
Texas	No
Utah	Yes
Vermont	Yes
Virginia	Yes
Washington	Yes
West Virginia	No
Wisconsin	No
Wyoming	No

(1) Per New York Local Law 88 (NYLL88), all commercial buildings larger than 50,000 square feet are required to install submeters for any tenants who lease at least 10,000 square feet of space by January 1, 2025.

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