

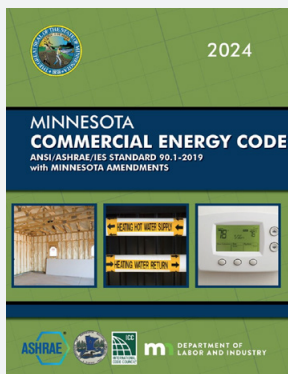
IN THE KNOW

Q2.24

THE KNOWLEDGE YOU NEED DIRECT FROM THE MINDS OF MEP ENGINEERS

New Energy Code and Sub-Metering: It's a Thing

With the adoption of the new commercial energy code (ASHRAE 90.1 2019) earlier this year in Minnesota, sub-metering in commercial buildings is now required for interior lighting, exterior lighting, receptacles, and mechanical equipment. Here's what you need to know:



What is Sub-Metering?

Electrical sub-metering refers to the practice of using additional meters to measure the consumption of electricity in specific areas, systems, or individual units. Sub-metering is done in addition to the main utility meter that measures the total consumption for the entire building.

What are the Benefits?

- **Measurement and Improvement:** Sub-meters can provide detailed data on energy consumption for different parts of a building, such as individual apartments, specific floors, departments, or even specific equipment or systems (e.g., HVAC systems, lighting circuits). By identifying how much energy each area or system is using, building managers can better manage energy consumption, identify inefficiencies, and implement energy-saving measures. The hope is that building owners, occupants, and tenants become more aware of their energy usage, which can encourage more responsible and efficient consumption behaviors.
- **Allocation of Energy Costs:** Sub-metering also allows for accurate allocation of energy costs to different tenants or departments based on their actual usage rather than dividing the total cost by square footage or other less precise methods.



- **Optimization and Maintenance:** Detailed sub-metering data can also help in early detection of equipment malfunctions or inefficiencies. If one area or piece of equipment is consuming more energy than expected, it can be a sign that maintenance is needed.

What's it Look Like?

In a sub-metering scenario, the electrical panel plays a central role in distributing electricity and providing points for installing sub-meters. For example, in a multi-tenant office building where each tenant is responsible for their own electricity usage, the main panel would receive power from the utility via the switchgear and house the main meter for the entire building. Each floor or tenant space might have its own sub-panel, which distributes electricity to all circuits within that space. Sub-meters are installed in each sub-panel, measuring the electricity usage of the entire floor or tenant space.



What You Need to Know Now:

For now, the energy code is only concerned with overall interior lighting, exterior lighting, receptacles, and mechanical equipment: you are not required to go further than that. But taking these first steps gives you a tailwind to going further if there's a desire to tap into some of the benefits outlined above.

Other Things to Consider:

The design team should consider the implications of sub-metering early and make sure that building owners are consulted and have input on the appropriate design and layout.

Perhaps the thorniest issue with sub-metering is the coordination of the sub-meters and the reporting method. The entire design and construction team — especially the engineers, electrical contractors, and

controls contractors — need to be clear on the scope of work, particularly who is responsible for the “last mile” of the reporting setup. This question needs to be asked and answered clearly: are the sub-meters appropriately set up to deliver usable data to an online tool (or a BAS)?

Even if going the code-minimum route, sub-metering can add significant cost to a project as there are additional equipment costs. Also, building automation systems (BAS) — helpful in some instances to fully leverage the benefits of sub-metering — and software can add significant cost.



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Technology Spotlight: CO₂ Heat Pumps

Many have claimed that we're entering the golden era of the heat pump. And while heat pumps can offer extraordinary upsides, the slow-but-steady phase-out of high GWP (Global Warming Potential) refrigerants that began earlier this year will cause engineers and other building design professionals to look closely at the options when specifying heat pumps. Here's what you need to know:

The Basics

Powered by electricity, a heat pump is a system that transfers heat between indoor and outdoor environments to provide both heating and cooling, enhancing energy efficiency. It utilizes refrigerant cycles to absorb heat from one area and release it into another, effectively maintaining comfortable indoor temperatures.

Why is the Refrigerant Important?

At a high level, heat pumps operate with a refrigerant that moves in a circuit, soaking up heat in one place and releasing it in another. But some common refrigerants used in heat pumps (including R-410A and R-407C, among others) are in the process of being phased out. This will



require engineers to understand the new refrigerants being used in heat pumps, their properties, and how they impact system design, performance, and maintenance.



What's a CO₂ Heat Pump?

A CO₂ heat pump is a type of heat pump that uses carbon dioxide (CO₂, also known as R-744) as the refrigerant for heating and cooling applications.

What are the Benefits?

- **Environmentally Friendly:** CO₂ is a natural refrigerant with a GWP of only 1, making it significantly less harmful to the environment compared to other refrigerants. And given the phase-out of synthetic refrigerants – [a trend that is likely to continue](#) – considering CO₂ as an option now may be worthwhile.
- **Highly Efficient:** CO₂ heat pumps often have a high COP (coefficient of performance), meaning they are extremely efficient at converting electrical energy into heat. They are particularly efficient in applications where both heating and cooling are required, allowing for effective heat recovery.
- **High Temp Capable:** CO₂ heat pumps can produce hot water at temperatures higher than many conventional heat pumps – often up to 90°C (194°F) – making them suitable for domestic hot water and industrial applications.



- **Safe:** CO₂ is non-toxic and non-flammable, making it a safer option compared to some synthetic refrigerants.

What are the Challenges?

- **Operating Pressure:** CO₂ systems operate at higher pressures compared to conventional refrigerant systems, which requires robust equipment and components.
- **Cost:** The initial cost of CO₂ heat pump systems can be higher due to the need for specialized components to handle the higher pressures.
- **Design and Installation:** Proper design and installation are crucial to optimize the efficiency and safety of CO₂ heat pump systems.

As environmental regulations become stricter and the need for sustainable solutions grows, CO₂ heat pumps are likely to see increased adoption. Their ability to efficiently provide heating and cooling while minimizing environmental impact makes them an attractive option for various applications.



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New Power: Hydrogen Fuel Cell Technology

While the concept of fuel cells and the use of hydrogen as an energy carrier are not new, hydrogen fuel cell technology has been accelerating

in development and its applications as a clean energy source seem to be broadening by the day.

What is it?

At a high level, hydrogen fuel cell technology generates electricity through a chemical reaction between hydrogen and oxygen, producing water and heat as byproducts. In a fuel cell, hydrogen molecules pass through an anode, splitting into protons and electrons. The protons move through an electrolyte membrane to the cathode, while electrons travel through an external circuit, creating an electric current.

Is it a Clean Technology?

It is considered clean because its primary byproducts are water and heat, with no carbon dioxide or other harmful emissions at the point of use. This makes it an environmentally friendly alternative to fossil fuel-based energy sources. *(Note: depending on the process, the production of the hydrogen fuel can potentially produce emissions.)*

What are Other Pros and Cons?

The benefits include zero emissions, high efficiency, reliability, and scalability. However, challenges such as high initial costs, hydrogen production and storage issues, infrastructure limitations, and safety concerns exist and should be addressed early in a project.

Where is it Being Used?

Right now, hydrogen fuel cell technology is used primarily in the transportation and logistics industries (frequently to power charging stations for electric vehicle fleets), as stationary power generation, and as backup power for critical infrastructure like data centers, telecommunications, and emergency services.

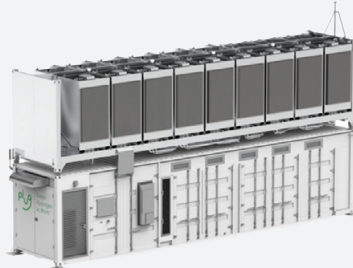


IMAGE COURTESY OF PLUG POWER



From a design standpoint, while the benefits of hydrogen fuel cell technology are exciting, creating the appropriate power distribution system can be extraordinarily complicated and require close coordination between several project partners. As an electrical engineer, my role is to not only design the power distribution system but to also understand the end-goals of the project. In particular, understanding the “need now” and “need later” power demands makes it possible to plan for scalability while minimizing cost and time.

Fuel cell technology is exciting, and it will continue to evolve, providing clean (or near clean) energy to an ever-expanding range of project types.

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