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SESSION 3

HVAC and DHW Electrification Opportunities

This session focused on HVAC and DHW Electrification Opportunities. The primary objectives were to understand the context of electrification and how it applies to buildings, explore technologies for HVAC and DHW electrification and discuss key considerations for design, implementation and the operation and maintenance (O&M) of electrified systems.

Setting the Context

There are six key steps to decarbonization. The process begins with system optimization and improving energy efficiency, followed by implementing heat recovery measures, low-carbon electrification (the focus of this session), renewable energy supply and finally the use of renewable energy credits, offsets, or biofuel to reduce any remaining carbon emissions.

Electrification 101

Low carbon electrification (LCE) is defined as "Replacing fossil fuel equipment with electricity; where the electrical energy is generated from processes or technologies that produce power with substantially lower CO2 emissions than conventional fossil fuel power generation." To maximize benefits, it is important to take a strategic approach to LCE and consider factors such electrical capacity and demand management. For commercial buildings, LCE of heating and domestic hot water (DHW) systems offer the greatest potential for impact.

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LCE Technologies

The table below outlines key LCE heating technologies and their associated efficiencies.

Heating Technology	Description	Efficiencies
Condensing Combustion Equipment	Burns fuel such as natural gas or propane to produce heat and captures/ reuses heat from exhaust gases by condensing water vapor.	85% – 95%
Electric Boilers &Heaters	Use electricity to heat water or produce steam for space or water heating.	100%
Air Source Heat Pumps	Transfers heat between indoor air and the outside air, providing climate control by extracting heat from the air (e.g., air-to-air, air-to-water).	150% - 250% (COP 1.5 – 2.5)
Variable Refrigerant Flow System	A complimentary technology to various heat pumps that enables operators to vary the flow of the refrigerant to distributed indoor units based on changing heating/cooling demands (e.g., water-to-air, water-to-water).	250% - 400% (COP 2.5 – 4.0+)
Water Source Heat Pumps	Transfers heat to or from a building using a shared water loop, allowing individual units to provide heating or cooling based on demand.	250% - 400% (COP 2.5 – 4.0+)
Heat Recovery Chiller	Provides cooling while simultaneously capturing and repurposing waste heat, typically from the condenser, to supply heating.	200% - 400% (COP 2.0 – 4.0+)

Typical combustion equipment and potential LCE replacement options can be seen below.

End Use	Replacement Options
Gas-fired Boiler	Air Source Heat Pump: Dual Fuel (Hybrid), Electric Backup Electric Boiler: Dual Fuel (Hybrid) or Full electric Ground Source Heat Pump Heat Recovery Chiller
Gas-fired Rooftop Unit	Packaged Air Source Heat Pump: Dual Fuel or Full electric
Gas-fired Domestic Hot Water	Air Source Heat Pump (CO_2) Heat Recovery Chiller

Considerations for Design and Implementation

1. **Start by designing systems** that are right sized to match building heating & cooling needs and that prioritize load reduction. Load reduction can be done through building insulation, window solar radiation control, heat recovery, etc.
2. **Assess electrical capacity** on facility infrastructure to identify any upgrade requirements.
3. **Consider hydronic system compatibility** to make sure hydronic system terminal units are compatible.
4. **Ensure the new system integrate**s with existing infrastructure, is appropriately located to manage noise, and is a high-quality solution best suited to the application.
5. **Commissioning is important for complex** systems, such as those combining heat pumps and boiler back-up. Ensure the system is properly installed and functioning as intended by verifying zoned temperature and humidity control, adjusting temperatures in unoccupied areas, and confirming that automatic controls are operating correctly and are regularly calibrated.
6. **Ensure staff are properly trained** to maintain equipment and support halocarbon tracking and reporting requirements.
7. **Prioritize implementation** based on established criteria, such as capital equipment replacement cycles, emission reduction potential, climate resilience, and return on investment.

Access Resources and the session tool kit here:

Access the Session recording here:

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