5 standout technologies from the Winter 2023 Tech Roundup

By Barend Dronkers, Dannah Moore
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Key takeaways

- Occupancy-based HVAC controls provide comfort in large buildings and integrate with occupancy-based lighting sensors.
- New innovations in heat pump technology are filling marketplace gaps.
- ENERGY STAR recently certified Samsung's SmartThings product through its program for smart home energy management systems (SHEMSs). We recommend utilities pilot this and other SHEMS products.
- There's a growing demand for ultrafast Level 2 chargers among residential EV owners, but utilities need to plan for the increased electrical capacity this technology needs.
- Thermal energy storage can provide cheaper and cleaner energy than ever before thanks to advancements in phase-change materials.

Our Tech Roundup webinars keep you up to date on the latest developments in efficiency, load management, and decarbonization technologies. At the Winter 2023 Tech Roundup, we highlighted nine technologies or concepts we think define the emerging technology opportunity for the start of 2024.

We chose to highlight five promising technologies here. If you missed the webinar, you can watch the recording and download the slides from the Winter 2023 Tech Roundup page.

Occupancy-based HVAC controls

Watch the video segment at 11:30

Business owners don't want the heating or cooling to shut off in a room where an employee is working late. Occupancy-based HVAC controls solve this problem by detecting which rooms in a building a person is in and turning the heating or cooling on and off, even when it's outside of scheduled hours.

While it's not a new technology, we think utilities should now consider these controls more than they have in the past. Recent case studies show that occupancy-based HVAC control upgrades can increase

energy savings when they're combined with lighting sensors.

The benefits of occupancy-based HVAC controls

Like other HVAC controls, occupancy-based HVAC controls save energy by reducing runtime and fan speeds. But occupancy-based HVAC controls provide better comfort in large buildings with scattered occupancy.

Utilities can combine this technology with occupancy-based lighting sensors that many customers, including small and midsize businesses, already use or plan to install.

Case study: Occupancy-based HVAC controls at Tinker Air Force Base

The Tinker Air Force Base in Oklahoma City combined an $11,000 occupancy-based HVAC controls installation with a $100,000 lighting upgrade. In a mixed industrial and office space of 26,000 square feet (ft^2), the occupancy-based HVAC controls set the temperature back in unoccupied areas.

The project saved 26% in HVAC energy. The payback on the HVAC part of the upgrade was 1.6 years. This shows that a small, incremental cost on a large sensor installation can have a great payback. For more details read the US Department of Energy's report Lighting System Integration with HVAC and Plug Loads: Tinker Air Force Base (PDF).

The next steps to use occupancy-based HVAC controls

Utilities need to promote and incentivize occupancy-based HVAC controls to get more large business customers to use them. This may mean you'd create custom incentives so you can evaluate savings. We also recommend asking controls contractors to promote this technology to customers.

The following customers could be good candidates for this technology:

- Facilities with many HVAC zones
- Facilities that plan to make lighting upgrades
- Large facilities that already use occupancy-based lighting sensors
- Offices, multispace retail, education, healthcare, and lodging
- Large buildings (50,000 ft^2 or more), which often have best results

E Source is constantly reviewing efficiency technologies

The Tech Roundup is one of many ways we share insights on established and emerging technologies that utilities should consider including in their programs. Visit our Technology Assessment Service to learn more about what we do.

Next-generation heat pumps

Watch the video segment at 33:04

One of the reasons why heat pumps haven't reached mainstream market adoption is that there are gaps

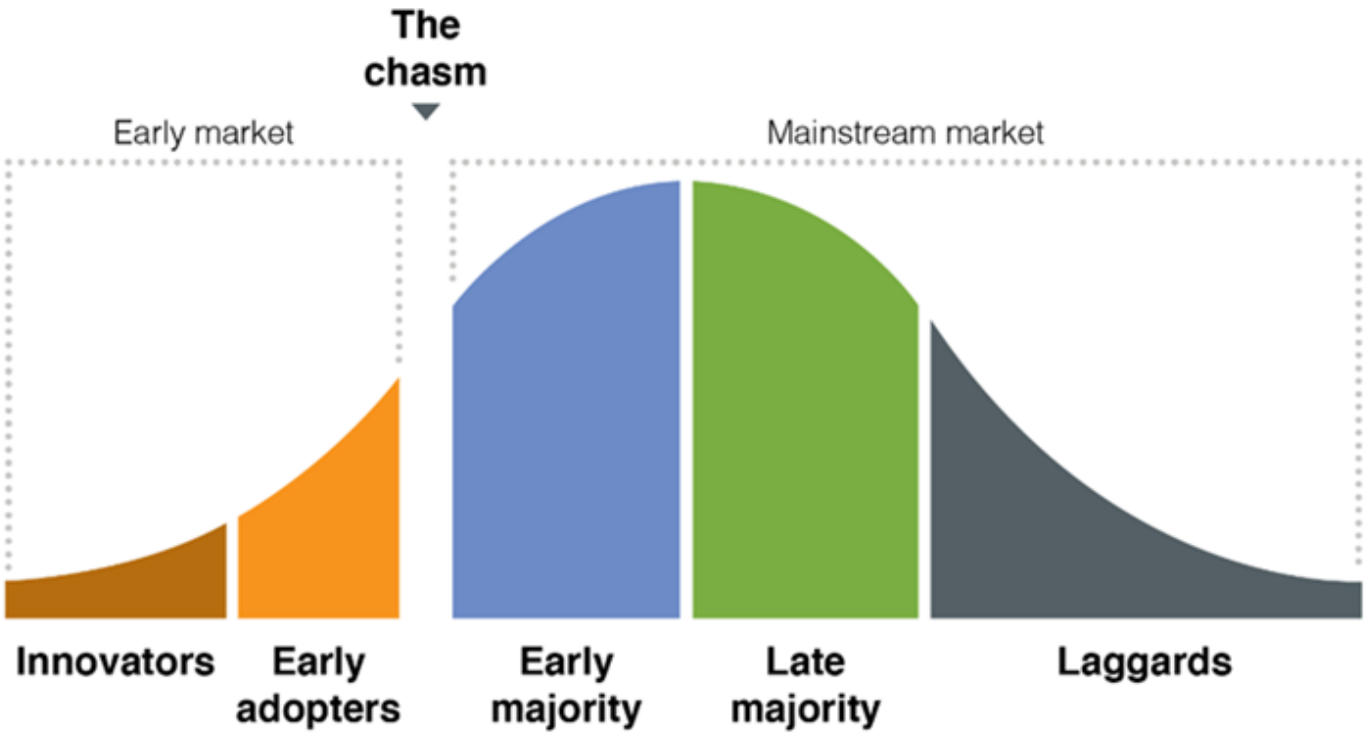
in the variety of available models. But new innovations in heat pump technology are filling those gaps.

The benefits of next-gen heat pumps

We're seeing more and more innovative designs filling niches in the heat pump market. This can help heat pumps move past the early adoption phase and into the mainstream market. If heat pumps don't move past the early adoption phase, the technology could fall into what Everett Rogers calls the chasm.

Rogers's diffusion of innovation curve and the chasm that heat pumps need to cross

The chasm is the barrier all new technologies must overcome. We're seeing a lot of innovators and early adopters who love heat pumps, but most residential and commercial utility customers haven't adopted heat pumps yet.



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Initiatives like the Department of Energy's Cold Climate Heat Pump Challenge, which had the goal to speed up the adoption of ductless heap pumps in cold climates, help get heat pumps into the mainstream market. Because a key challenge to the wider adoption of heat pumps is performance in cold weather, the Department of Energy challenge required manufacturers to get government support to design, test, and scale up manufacturing for the new heat pump models. The first commercialized models will hit the market early in 2024.

The challenge also prompted the Rocky Mountain Institute to say in its article Now Is the Time to Go All In on Heat Pumps that heat pumps are viable and efficient in the Lower 48 states.

Example of next-gen heat pumps: Ephoca

There are many next-gen heat pumps to look out for, like Stash Energy's thermal energy storage heat pumps and Gradient's 120-volt wall-mounted product, which sits in a windowsill.

Another exciting producer filling the heat pump market is the Italian company Ephoca. Ephoca specializes in heat pumps that don't have an outdoor unit. Instead, Ephoca's heat pump compressor is inside the building. Compressors can be placed in the ceiling, walls, or other places in the building's architecture.

With Ephoca's model, the ugly plastic enclosures that usually house mini split heat pumps are gone. The heat pump doesn't take away from the building's appearance or take up space in the room. What's more, this product is handy for buildings that don't have an outside location to put heat pump equipment. Ephoca says the product is whisper quiet too.

The next steps to use next-gen heat pumps

Double down on your heat pump efforts to help heat pump adoption reach mainstream market adoption. The next 2–4 years are critical to the development of these next-gen heat pumps in the marketplace.

Utilities can help by offering attractive rebates and other incentives to encourage heat pump adoption. If you need inspiration for designing heat pump programs, read our report A catalog of building electrification programs. The report includes a listing of almost 180 relevant programs, and it provides an overview of interesting approaches to specific challenges and incentive design.

Smart home energy management systems

Watch the video segment at 46:45

ENERGY STAR launched its SHEMS program in 2019. SHEMSs are platforms that combine smart home hardware and software in a way that should result in energy efficiency savings. This year, the ENERGY STAR SHEMS program certified products that we recommend utilities incorporate into pilots.

The benefits of SHEMS products

ENERGY STAR–certified SHEMS products give customers a secure platform to control all their energy and nonenergy smart home features in one convenient place. For instance, customers can manage their lighting and thermostats in the same place where they manage their door locks and security cameras.

It also influences customers to use their devices in a way that reduces energy use and therefore their energy bills.

Besides energy savings, ENERGY STAR SHEMS customers get:

- Convenience and automation
- Remote access and control to security, lighting, heating, and more
- Energy education and awareness
- EV charger optimization

Utilities benefit from SHEMS products too:

- Utilities can claim energy savings with low customer impact for many device categories under one program.
- The system lets homes participate in demand response opportunities that they might not otherwise be able to.
- Customers could perceive their utility as innovative or as a leader in energy technologies for offering SHEMS pilot programs.
- It encourages energy-saving behaviors in utility customers.

Examples of SHEMS products: SmartThings and Matter

SmartThings. Samsung's SmartThings, one of the largest smart home ecosystems, is now ENERGY STAR SHEMS certified. SmartThings lets the customer, utility, and the grid get maximum savings because it combines the right hardware and services to reduce energy use.

SmartThings has two active demand response programs: one in New York and one in California. Utilities can pilot SmartThings and confirm the value of SHEMSs as an energy-saving tool.

Matter. In 2022, the Connectivity Standards Alliance unified the smart home industry with a single standard for device interconnection called Matter. Matter connects devices from different brands, even proprietary technology or out of date technology.

Devices that might not result in energy savings on their own can give customers savings when grouped and managed by Matter. As of 2023, Matter 1.2 is compatible with nine new smart device categories:

- Refrigerators
- Room air conditioners
- Dishwashers
- Laundry washers
- Robotic vacuums
- Smoke and carbon monoxide alarms
- Air-quality sensors
- Air purifiers
- Fans

The next steps to use SHEMSs

SHEMS products promise to turn smart homes into energy assets, but since there aren't many programs or pilots, this claim isn't supported by real-world data. We suggest you pilot SHEMS programs and track its ability to help customers save on energy costs.

If this technology can fulfill its promise, it will be a useful tool in delivering flexibility and savings to an energy grid that increasingly needs those services.

Residential ultrafast EV charging

Watch the video segment at 1:04:20

Ultrafast Level 2 chargers refuel EVs for residential customers at their home using 19 kilowatts (kW) of power, instead of a slow Level 2 charger (3 kW) or standard Level 2 (7.7 kW).

The benefits of residential ultrafast EV charging

EV owners like ultrafast Level 2 chargers because they're used to fueling cars quickly, as they did at the gas pump. Ultrafast Level 2 chargers can help you meet customer expectations because charging with this technology is like filling a gas-fueled vehicle at the pump.

But even low-powered home chargers present distribution problems when residential transformers can't support the electrical capacity. And ultrafast Level 2 chargers could more than double a home's peak power demand.

The next steps to use residential ultrafast EV charging

If you want to meet your EV customers' demands for the ultrafast Level 2 chargers, there are a few things to consider:

- *Cost.* Ultrafast Level 2 chargers are three to five times more expensive than the slower Level 2 chargers for residential customers because of the cost of the equipment and service panel upgrades.
- *Equity.* Since upper-income customers are more likely to invest in ultrafast chargers, particularly in the near term, utility incentives or investments to support the deployment of this technology may not be very equitable.
- *Growth.* There are capacity requirements for ultrafast charging that you should consider in light of other electrification needs and distribution system planning requirements.
- *Experimental rate tariffs.* New or modified tariffs could be an option for residential customers installing this equipment to help recover the cost of serving these new loads.
- *Partnerships.* It's important to have partnerships with dealers in your service area and charger manufacturers to understand where customers will want ultrafast chargers in your service territory.

For more information on how to make the EV charging experience better for your residential customers, read our report How to improve the EV customer experience.

Thermal energy storage

Watch the video segment at 25:05

Thermal energy storage relies on phase-change materials, which release thermal energy when they change from solid to liquid and liquid to gas. While it's not a new technology, thermal energy storage is now safer and more cost-effective thanks to recent advancements. And it's capable in more applications.

Thermal energy storage is a good solution for large industrial customers, especially for refrigeration and cold storage.

The benefits of thermal energy storage

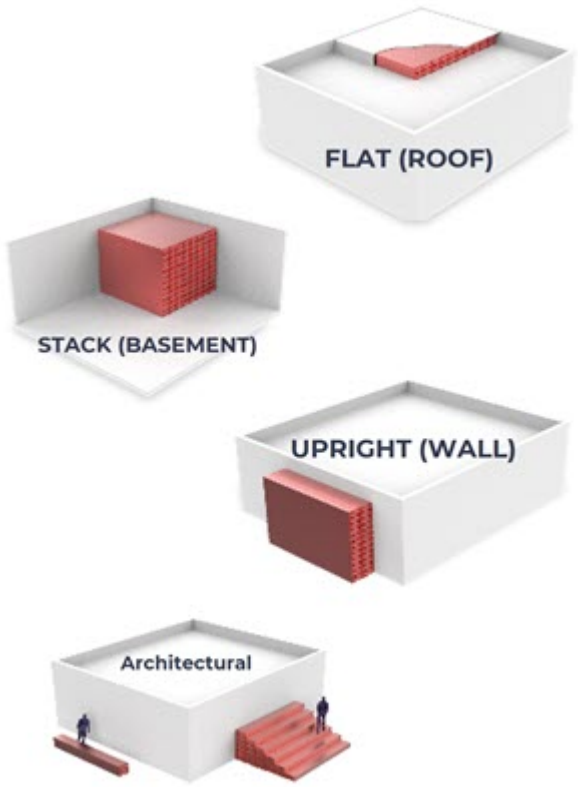
Thermal energy storage freezes or superheats a medium, often phase-change materials, during off-peak hours or when there is plenty of clean energy. The stored heat or cold in the material can heat or refrigerate a building or process during peak hours when energy is more expensive. Or the system can charge or hold onto the heat or cold when prices are lower.

Recent advancements created different melting points in phase-change materials, so this technology can better help in these areas:

- *Load shifting.* Facilities can switch to thermal energy storage to heat or cool during peak hours.
- *Energy efficiency.* Especially helpful in cold climates because it can freeze the phase-change material with less energy using outside air.
- *Demand response.* Facilities can switch to thermal energy during demand response events, even those lasting multiple days.

Example of thermal energy storage: IceBrick

IceBrick placement



Source: Nostromo

Nostromo's IceBrick Energy Storage Array is one example of innovative thermal energy storage packaging. (Another is Viking Cold Solutions.) Each brick holds the equivalent of 0.7–1.1 kW of energy. The IceBrick can be stored or stacked anywhere. It can even be incorporated into the building's architecture. The brick won't catch fire or leak harmful materials.

The IceBrick uses a cloud-based energy-storage management platform. Utilities can use the platform to control the system, optimize its performance, and integrate it with the grid.

The next steps to use thermal energy storage

We recommend utilities market thermal energy storage programs to customers that:

- Have large facilities because the larger the system, the more cost-effective it will be
- Are working on new construction to avoid high retrofit costs
- Have large refrigeration systems, like in industrial cold-storage centers, large grocery stores, and breweries

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