

Smart Water and Heat Micro-network Hub (SWHMH)

System integrates water resilience and energy efficiency to ensure uninterrupted water supply and heat sharing between appliances in residential and small commercial spaces

US Patent 12540457B1

Technology Readiness Level (TRL) 2

Business Problem

In residential and small commercial buildings, water supply and energy efficiency are not connected. Current systems are static and cannot adjust to seasonal changes that present opportunities to exchange heat to save energy. Additionally, the need for resilient water systems that can adapt to varying conditions is increasingly important, especially in areas susceptible to drought, such as the southwestern United States. Utility pressure losses and potential contamination events can disrupt water service, posing risks to public health and safety. These challenges require innovative solutions that can effectively address the complexities of modern water and energy management. There is a need for systems that can operate independently or aggregate with other micro-systems to form a connected community network of coupled energy and water management.

Customer Need

Building occupants and facility managers require a reliable and efficient system that ensures continuous water supply while maximizing energy efficiency. There is a demand for technology that can seamlessly integrate water management with energy-saving measures, particularly in the

face of utility pressure losses or contamination events. Customers seek solutions that not only provide immediate access to water but also enhance the overall performance of their heating and cooling systems. Additionally, there is an increasing expectation for systems that contribute to reduced environmental impact and lower operational costs. This calls for advanced technologies that can adapt to diverse building needs and guard against evolving challenges.

Sandia Approach

Researchers at Sandia National Laboratories have conceptualized the Smart Water and Heat Micro-network Hub (SWHMH), an innovative system that uses artificial intelligence to connect water loops and appliances in a building. It features control valves and pumps managed by a single smart controller to optimize water flow and heat exchange. SWHMH uses waste heat from appliance to save energy by routing it to appliances that need the heat. The added pumping and valves also enable isolating the system and maintaining water service when utility services are down. This addresses immediate water supply challenges and contributes to long-term sustainability goals by integrating water management with energy-saving technologies. SWHMH is envisioned to operate independently or aggregate with other micro-systems, forming a connected community system. It is flexible and adaptable to ensure compatibility with a wide range of existing and future appliances.



Competitive Advantage

SWHMH stands out by providing a holistic solution that combines water management with energy efficiency. Unlike current thermal water networks, it is agnostic to the types of appliances it connects to if sufficient heat rejection is available, allowing for future integration with high-efficiency devices. This flexibility positions SWHMH as a forward-thinking solution in the evolving landscape of building management technologies. This conceptual design is poised for partnerships with any building developers, water utilities, and energy management firms that are interested in advancing it through demonstration in a lab environment.

Technical Benefits

- **Uninterrupted Water Supply:** Maintains service during utility disruptions using local water storage and internal pumping.
- **Energy Efficiency:** Optimizes heat exchange between circulating water and utility water, reducing overall energy consumption.
- **Smart Control:** Incorporates advanced algorithms to manage water quality, pressure levels, and thermal storage, enhancing system performance.
- **Future-Facing:** Future appliances that use water loops in integrated systems have significant energy savings potential!

Industries & Applications

- **Residential Buildings**
- **Small Commercial Buildings**
- **Water Utilities**
- **Energy Management Systems**
- **Water Micro and Nanogrids**

Next Steps

Sandia is seeking partners to develop and commercialize this technology. For more information, please contact Sandia National Laboratories' Licensing and Technology Transfer office.

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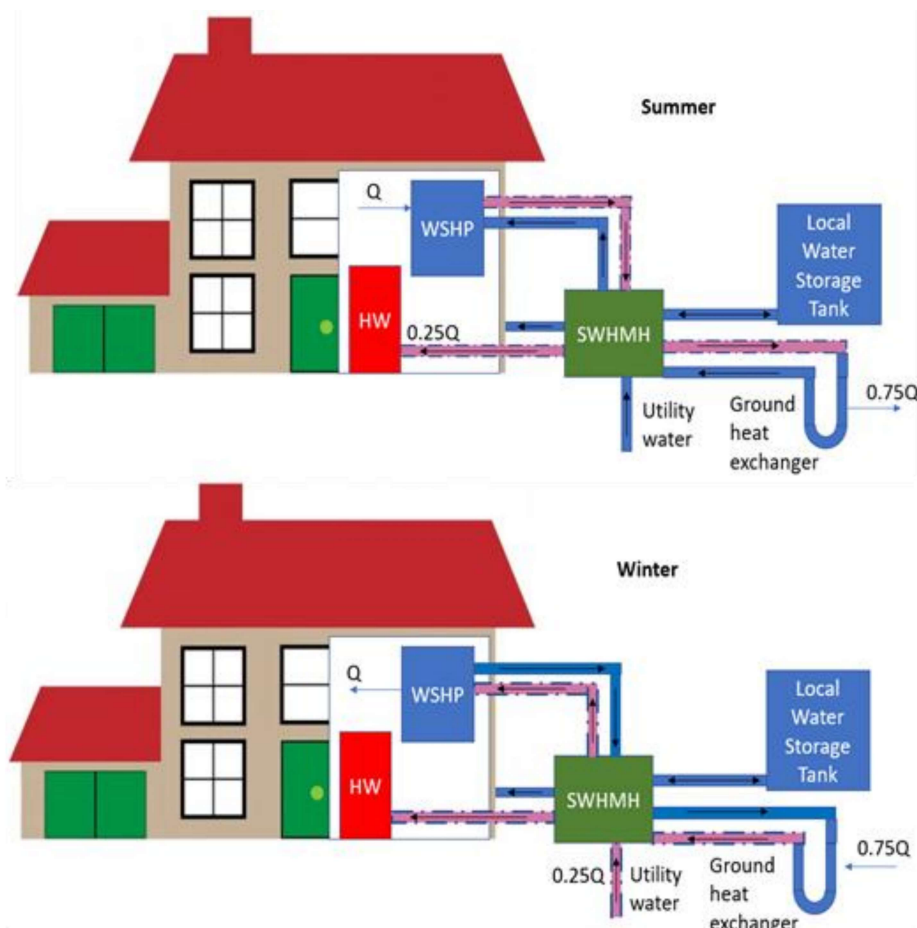
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Technical Figures



Summer (above) and winter (below) energy efficiency operation of an example SWHMH configuration. (The pink lines represent warm water, and the blue lines represent cooler water.) SWHMH provides a compact solution for managing water supply and energy efficiency in residential and small commercial buildings.