Household Electrification Grid Demand Study

Final Report Distributed Janurary 2025

The Challenge

As households electrify end uses, peaks in grid demand for electricity are expected to increase, resulting in higher greenhouse gas (GHG) emissions and energy costs to customers under utility time-of-use (TOU) rates.

The Impact

Efficient air-to-water heat pump (AWHP) technologies with coupled thermal energy storage (TES) systems could shift space-heating loads to off-peak times to alleviate grid constraints and reduce costs. VEIC evaluated commercially available efficient AWHP technologies with integrated TES systems and supplemental air-source heat pump (ASHP) cooling. One AWHP-TES technology was then trialed in four residential homes in mild climate zones to analyze load shift outcomes.

Key Findings, Data Points, & Suggestions

- **The share of peak load shifted** in our pilot studies ranged from 36-66%.
- **The coefficient of performance (COP) efficiency penalty** for our evaluation sites was 15-21% with operating COPs ranging from 2.52-3.84.
- **Customer economics vary considerably** depending on utility rates, installation costs and user load profiles.
- **Degree of load shift** and cost savings depend on occupant behaviors/usage and building thermal performance.
- **System performance** is constrained by the ability to meet heating loads. It is critical to size equipment appropriately and reduce heating loads to within capacity.
- **Consider customer incentives** for AWHP-TES based on public benefit, GHG savings, and low-global warming potential refrigerant use.
- **Develop Performance Standards** to enable a competitive market for AWHP technologies and ensure that systems are sized appropriately to meet household loads.

To access the final Household Electrification Grid Demand Study, go to the VEIC website or scan this QR code.