

# DR12.20: Evaluation of Permanent Load Shift Technologies and Development of Pre-Feasibility Tool

## Opportunity

What is the potential for PLS technologies and their uses?

The state of the technology and policy has evolved significantly in the last four years, with emergence and significant advancement of battery storage technologies, as well as new thermal energy storage technologies. This is an evolving market that is closely being monitored. Permanent load management technologies have undergone significant evolution in the last decade, especially in the area of customer side systems.

## Technology

How does permanent load shift technology work?

Permanent load shift (PLS) technology can accomplish routine shifting of energy-use from one time period to another during the course of a day to help meet peak loads during periods when energy-use is typically high and improve grid operations in doing so (economics, efficiency, and/or reliability).

Three main segments are considered: active thermal storage, electrical storage, and building controls-based storage. All three segments can provide varied levels of load management at varied cost levels and operating characteristics.

## M&V

How did variable capacity air conditioning systems perform in M&V?

This project had three main objectives: (1) to provide a market characterization and technology review of energy storage and load shift technologies, (2) to review and advance existing EnergyPlus™ building simulation models used for predicting thermal energy storage savings, and (3) to develop a free, open-source, cloud-based tool based on EnergyPlus to estimate energy savings and implementation costs for thermal energy storage systems used in buildings.

## Results

What were the outcomes and findings from the study activities?

Extensive investigation of programs and technologies led to a comprehensive, documented list of thermal, electrical and building controls storage technologies available on the market.

Thermal Energy Storage Screener (TESS) predictive tool developed to support participation in the statewide PLS program by providing customers with an easy to use simulation resource at no cost.

EnergyPlus models were developed for both baseline scenarios and incorporation of thermal energy systems. The research involved revealed bugs in the controls systems for chiller operations, which have been corrected.

## Next Steps

What are the conclusions and next steps following the study?

## Demand Response Potential from Other Sources and Building Types

One of the unintended benefits of developing the TESS tool was that it showed a pathway to actually understanding DR potential of buildings using measured AMI data. The same philosophy as used for PLS evaluation can be extended to estimate lighting, plug and process loads, which can provide a better understanding of the DR capabilities, and required technologies. The tool can also be extended to other types of buildings beyond the limited building set targeted towards the PLS program.