

## **Project 1:**

# **Design of a Small Home Energy Storage System for Heating**

And old form of heating buildings was the natural convection water-based *heating radiators* system. The advantage was that it did not require an air duct system and did not rely on electrical fans to circulate air. In this project, a team of students will *re-invent* this system using a heat pump system to extract energy from outside air and pump the heat into a some sort of a *heat storage storage system*. Given the reality of high *time-of-use* electrical rates during peak hours of the day, this system will run during the cheap rate times (off-peak hours) and store energy for later usage. Energy will be retrieved from the storage system and distributed through the home using *natural convection water based radiators* (similar to *thermo-siphoning* and used to cool nuclear reactors in the event of complete electrical power loss, i.e., no pumps).

The team will investigate the feasibility of this system which is required to provide about 5 tons of heating at maximum load for a small home (~2000 ft<sup>2</sup>). The heat storage system must store heat for only a short time (one to a few days) rather than long term use (i.e, several months). Because air-sourced heat pumps are not effective at very cold temperatures, a backup heat system must be installed – one that does not require air ducts. The backup source could be natural gas or even an *electric furnace/heating element*. However, the main electrical power consumption must be at night or during weekends (time of cheap rates).