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Battery Operated Thermal Energy Storage for HVAC Systems

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Inventors

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Background

Heating, ventilating, and air conditioning systems (HVAC) utilize thermal energy storage (TES) to store energy as thermal mass. When electricity or other energy sources are available, the HVAC system generates thermal energy. That thermal energy can then be used at a different time for heating or cooling purposes. Stored energy must be extracted using fans and pumps, but these elements require significantly less energy than is needed for standard HVAC operations. In the event of a complete loss of power, stored thermal energy cannot be extracted without a backup generator or battery. Thus, in off-grid locations or locations with unreliable primary power, TES-HVAC systems are underutilized unless backup power for TES extraction is included. Unfortunately, typical technologies for inclusion of a backup power source are unreliable, expensive, and inefficient.

Invention Description

Researchers at Arizona State University have discovered a method of incorporating an electrical battery backup into a TES-HVAC system, creating heating or cooling capabilities when standard energy sources are unavailable. This technology does not require a large and expensive capacity of electrical energy storage. It uses only about 10% of already existing thermal energy storage. This low-capacity battery system, which is combined with a thermal energy storage system, has a much lower capital and operating cost using current technology than alternative systems (e.g., a battery backup system capable of directly operating the HVAC systems compressor or heating element).

Potential Applications

- New residential developments
- Construction industry
- Retrofit existing residential buildings for improved energy efficiency
- Off-grid applications where reliable HVAC/refrigeration is required
- Operation of building HVAC systems where electrical power is unreliable
- Building energy management
- Smart Power Grids
- Micro-grids
- Electrical power load management

Benefits and Advantages

- **Lower Costs** - Lower capital and operating costs using current technology.
- **Adaptable** – Precise system proportions and electrical power requirements can be tailored to each specific building/application.
- **Off-Grid/Micro-Grid Use** – Allows operation of the HVAC system without the availability of the primary energy source (grid) or an expensive full-size battery backup system.
- **Portability** – Battery backup system size is reduced by a factor of roughly ten.
- **Efficiency** – Expensive electrical storage replaced by low-cost thermal energy storage.

Intellectual Property Status:

Pending

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