Sheet-Based Insulation with Switchable Thermal Properties

ID: 2024-008

Executive Statement:

A revolutionary low-cost dynamic insulation system designed for significant HVAC energy savings in various climatic conditions.

Description:

The proposed technology introduces a dynamic insulation (DI) system that utilizes low-cost materials and mature manufacturing processes to modulate thermal properties, targeting energy efficiency in buildings. By adjusting the orientation of reflective layers in response to air pressure, it exploits natural thermal gradients to reduce HVAC energy consumption, especially in environments with high cooling loads and large diurnal temperature swings. The system is adaptable, modular, and can be integrated into existing buildings to enhance or replace current insulation solutions.

Key Advantages:

- Significant reduction in HVAC energy usage through dynamic modulation of thermal properties.
- Cost-effective at approximately $1.94 per square foot, making it accessible for widespread adoption.
- Modular and switchable design allows for easy installation and adaptability to various building types and climatic conditions.
- Offers over 50% heat gain reduction in poorly insulated homes and more than 25% in well-insulated structures.
- Minimizes waste and expenses by allowing for retrofitting without the necessity of removing existing insulation.

Problems Solved:

- High HVAC energy consumption in buildings, particularly in warm climates with significant diurnal temperature variations.
- Challenges of retrofitting insulation in older, poorly insulated buildings without incurring high costs or waste.
- Need for an affordable, efficient insulation solution that can adapt to different environmental conditions and building designs.

Market Applications:

- Residential and commercial building retrofitting for improved energy efficiency.
- New construction projects seeking sustainable and cost-effective insulation solutions.
- Adaptation in regions with extreme temperature variations, particularly in southwestern desert climates.
- Low-income housing upgrades, providing energy savings and improved living conditions.