



RENEWABLE ENERGY IN BUILDINGS

Unleashing the potential of thermal mass for electricity grid flexibility

One of the challenges which we face today in terms of renewable energy is the mismatch between when this energy is generated and when it is needed. In order to make the most of the energy generated by renewables, such as wind and solar, flexibility is needed in the electricity grid. Heavyweight buildings can provide this flexibility by allowing for consumer energy demand to be shifted in time by using structural thermal energy storage.

Thermal mass has traditionally been used to improve the energy efficiency of buildings and provide a stable indoor temperature. A further - previously untapped - benefit is to use the thermal storage capacity offered by the structure to provide flexibility in energy grids and boost the uptake of renewable energy.

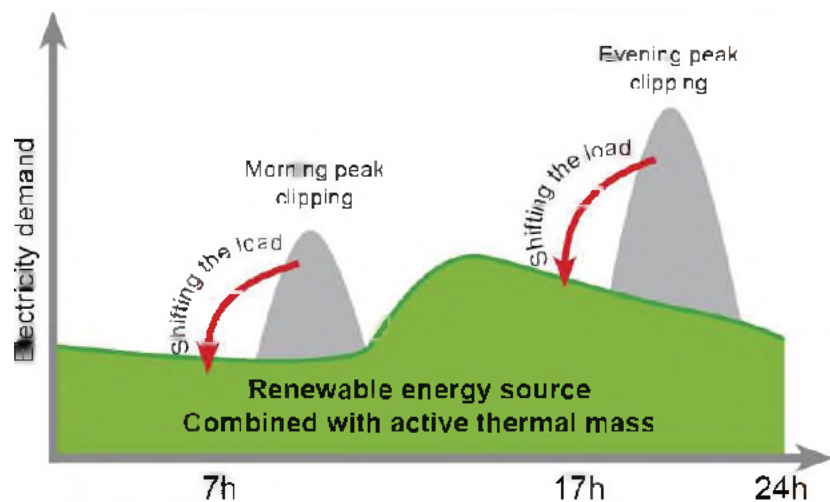
Thermal Mass

Is the ability of heavyweight materials, such as concrete, to store energy, which is later released. This avoids overheating in buildings and keeps temperatures comfortable.

Active structural thermal energy storage

Active use of the thermal energy storage capacity of the building structure to reduce peak loads and shift loads in time (e.g. by actively pre-heating/cooling the building).

Flexibility concept



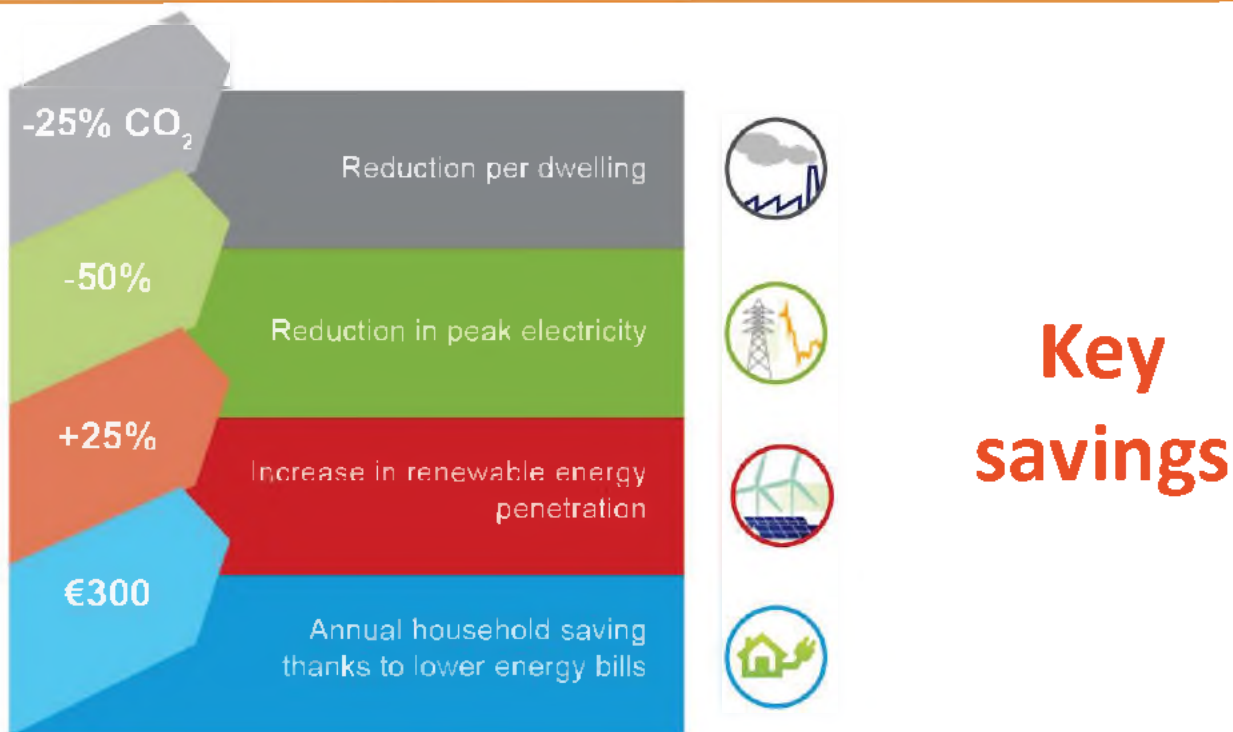
Active structural thermal energy storage

A key part of any strategy to increase renewable energy uptake is matching demand with supply. One form this can take is known as active demand response (ADR), where smart controls and energy storage help balance the electricity grid. Here, structural thermal energy storage capacity of a heavyweight building has huge potential – as this requires no additional investment costs, unlike other storage systems. By actively pre-heating or pre-cooling a building during off-peak times (such as early in the morning), the energy which is generated is absorbed and stored in the building fabric, and released over the course of the next few hours.



What are the benefits?

- ✓ For the environment: By boosting renewable energy use and reducing reliance on fossil fuels, it reduces CO₂ emissions
- ✓ For consumers: Because consumers will use energy during off-peak times when electricity prices are lower, it reduces energy bills
- ✓ For energy grids: It reduces demand for energy during peak times. This reduces the need for additional investment in power generation capacity



POLICY RECOMMENDATIONS

1. Energy performance calculation models must evolve to take thermal energy storage into account. These models must consider the dynamic use of thermal energy storage in a load shifting context
2. Recognise the benefits of structural thermal energy storage by taking the “available structural storage capacity” into account in the EPBD
3. Promote the interoperability between building heating/cooling systems and the energy market in order to deploy ADR
4. Encourage energy storage incentives to make it economically viable for end-users today

Source for all figures: “Structural thermal energy storage in heavyweight buildings – analysis and recommendations to provide flexibility to the electricity grid”, 3F, 2016