

7. Affordable Heating and Cooling of Buildings Innovation Challenge

Our objective: To make low-carbon heating and cooling affordable for everyone.

Globally, buildings account for almost a third of final energy consumption, with space heating and cooling, and the provision of hot water, accounting for approximately half of this consumption. The ultimate goal of the affordable heating and cooling of buildings Innovation Challenge is to develop core building heating and cooling systems and measures to improve building envelopes that deliver affordable heating and cooling without the carbon emissions.

The Issue

The relative energy demand for heating and cooling varies globally. In the Northern Hemisphere energy consumption for space and water heating is steadily increasing. Cooling currently represents a smaller proportion of global energy demand, though it is an area of significant future growth, with an 80% increase in space cooling demand anticipated by 2050 in emerging and developing economies. Increasing global temperatures resulting from the effects of climate change will also contribute significantly to this growth.

Currently, three quarters of the global energy requirement for heat is met by burning fossil fuels, and one third of global energy-related CO₂ emissions can be attributed to the provision of heat. Energy consumption for space cooling is primarily dependent on electricity and to a lesser extent natural gas, so is also associated with a high carbon load.

In order to encourage low-carbon heating and cooling uptake, solutions should cost the same or less than fossil fuelled alternatives. A particular challenge relating to low-carbon heating and cooling is the mismatch between supply and demand. Significant daily and seasonal variations in heating and cooling demand are compounded by daily and seasonal variations in the supply of energy from renewable sources. This results in a need for intra-day and, in some regions, inter-seasonal energy storage. Affordability needs to be judged at a systems level, with energy efficiency also an essential element within this Innovation Challenge.

The Opportunity

Innovation through the use of new materials, processes, and systems provides a significant opportunity to reduce energy consumption and CO₂ emissions. Such innovative technologies and practices have important economic and social potential with respect to reducing energy bills, enhancing global access to energy, increasing the competitiveness of renewable technologies and improving energy security.

This Innovation Challenge will provide a platform for international collaboration with the potential to considerably accelerate innovation in the heating and cooling arena. It will involve the development of new solutions and taking cost out of existing and emerging solutions. This will be achieved through the collective research effort and the commitment to double spend on clean energy research.

MISSION INNOVATION

Accelerating the Clean Energy Revolution

The Implementation

This Innovation Challenge has four main areas of focus. In each case the need is to develop lower cost, practical alternatives to today's fossil fuel based solutions:

- Energy savings and energy efficiency technologies and materials to **reduce demand** for heating and cooling.
- **Low-carbon integrated equipment and systems** to provide heating and cooling.
- **Storage** solutions to match energy supply to heating and cooling demand.
- Efficient **transfer of heat** from point of production / storage to point of use.

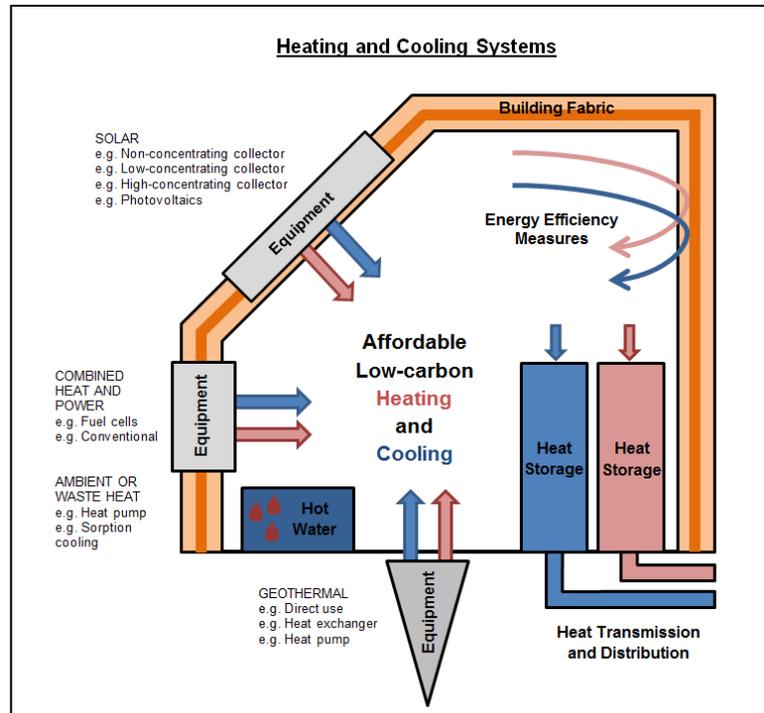


Figure: Heating and Cooling Systems for Buildings.

This is a systems problem that requires integrated solutions across all four focus areas to provide a complete solution tailored to the needs of different regions and cultures. For new and existing renewable heating and cooling technologies, innovation is required to improve competitiveness, efficiency, reliability and the potential for integration within energy management systems. This requires cross-border and cross-sector collaboration between Mission Innovation governments, private investors and research leaders. Collaboration is the foundation of this challenge, facilitating rapid identification of the baseline and innovation opportunities, and accelerating research and development. Ultimately, international collaboration will bring the best methods of affordable, low-carbon heating and cooling solutions to the global market as quickly as possible.