

Multi-Utility Vapour Compression System



Problem Statement: Conventional VCS provides only air conditioning and cannot provide hot and/or cold utility with air conditioning. Thus, it is not capable of operating as a multi-utility system. It is required to add heat and mass transfer surfaces in VCS to get a multi-utility effect resulting in heating and cooling of the fluid streams and air conditioning. Addressing this need, researchers at IIT Bombay have invented an energy Multi Utility Vapor Compression System (MUVCS) wherein the judicious combination of Heat and Mass Transfer Devices (HMTD) facilitates hot and/or cold utility while conditioning air. This system is capable of conditioning different spaces and conditioning air with high relative humidity. The system is also capable of thermal storage when catering to part air conditioning loads. Multiple hot and cold utilities are co-generated to enable energy conservation, reduce emissions, reduce the use of refrigerants, low economic and environmental life cycle costs.

Uniqueness of the Solution: Novel patented Tube-Tube Heat Exchangers are used, which enable multi-stream heat exchange while offering high reliability and flexibility in terms of quantity and time of harnessing the utilities. The versatile design enables co-generation of air conditioning, water heating and water chilling utilities using a single system while integrating with process fluids while ensuring safety against the mixing of different streams. Once through the exchanger, heating and cooling of fluids through large temperature changes without the use of pumps. Initial and operating costs can be lower than the conventional air conditioner + electric water heater + water cooler while needing less space. The design also builds on an earlier invention that simplified integration using reliable Tube-Tube Heat Exchangers.

Current Status of Technology: Several exchangers have been demonstrated in the field, licensed and commercialised.

Societal Impact: The module significantly reduces carbon footprint, as energy-saving is 66 to 75% for heating while simultaneously catering to multiple cooling applications flexibly.

Patent(s): Filed and Granted

Relevant Industries: Automotive Industries, Food Processing Industry, Hospitality Industry, Residential Sector.

Faculty: Prof. M V Rane, Mechanical Engineering.