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Heat pump benefits in Heating Ventilation & Air conditioning

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ABSTRACT

Heat pumps are a part of the environmentally friendly technologies using renewable energy and have been utilized in HVAC systems. A heat pump water heater unit with frozen type evaporator was designed and developed. And a test bed was constructed to determine the performance of the unit. In the experiment, a parallel helical coil type evaporator was used in the unit to extract latent heat from the sewage. The data (dynamic COP and other parameters) was obtained in three processes (including the first freezing, melting, and the second freezing) at different water temperatures (8.2℃ and 13.8℃). Results show that compare with traditional water source heat pumps, the newly designed unit with the frozen evaporator can reduce the required water amounts as a heat source by more than 90%. The higher initial temperature of hot water and sewage, the higher temperature of sewage after melting. Meanwhile, with the increase of the initial temperature of hot water and sewage, the comprehensive

Heat Pumps work on a similar principal to a refrigerator. The objective of a heat pump is to transfers heat from a low temperature medium to a high-temperature one. This is accomplished by absorbing heat from a low temperature source, such as return chilled water or a maintain and transfer this energy into a refrigerant. The heat energy is upgraded using a refrigerant cycle. This energy is transfer radiation to the water.

1. Introduction

Heating Ventilation and Air Conditioning (HVAC) systems are responsible for a major part of the energy consumption of the building, but it is recognized that a great part of them, about 90%, is not run optimally. The non-optimality of operation is majorly due to two aspects: the lack of a supervisory control operating on all the components together, and the lack of involving occupants' presence and behavior in the energy management For Humidity control the Heating coil is used into HVAC system of CFS clean room But Heating coil consumes more electricity so need of alternate solution to Heating coil. Due to this Indirect GHG exhaust into atmosphere. So, team works to optimize the HVAC energy consumption without compromising the stringent

process controls of Clean Rooms & thus have an environmental impact reduction (GHG) So, team search for equivalent option to heating coil.

If you are exploring options to heat and cool your home or reduce your energy bills, you might want to consider a heat pump system. Heat pumps are a proven and reliable technology in Canada, capable of providing year-round comfort control for your home by supplying heat in the winter, cooling in the summer, and in some cases, heating hot water for your home.

Heat pumps can be an excellent choice in a variety of applications, and for both new homes and retrofits of existing heating and cooling systems. They are also an option when replacing existing air conditioning systems, as the incremental cost to move from a cooling-only system to a heat pump is often quite low. Given the wealth of different system types and options, it can often be difficult to determine if a heat pump is the right option for your home.

1.1 Objectives

The objective of a heat pump is to transfers heat from a low temperature medium to ahigh-temperature one. This is accomplished by absorbing heat from a low temperature source, such as return chilled water or a maintain and transfer this energy into a refrigerant. The heat energy is upgraded using a refrigerant cycle. This energy is transfer radiation to the water.

1.2 Problem

In HVAC System more energy consumable part is Heating coil which used to heat the system or De-moisturize the air. Heating coil gives less outputs with compared to the input energy given. And Energy losses will not recover in the Heat coil used in Heating Ventilation and Air Conditioning Need to find the relevant system to the heating coil. Also, GHG indirect emission through system is more because most of the energy generates by burning the fuels like Coal, Wood. This more impact on the Atmosphere and Life cycles.

System in overall electrical power consumption 40% to 50% of electricity is used for HVAC system for heating using electrical heater.

2. Generic Example: Comparison of Other Heating Options:

Here the various heating sources and with there thermal output and energy input comparison shown, these are the main heating options mainly used in many of the industries and the organization for producing the heat.

Alternative cost comparison

System	Efficiency /COP	Input Energy (kCal/day)	Energy Cost (INR/day)	INR/Mcal
Electrical heating	1	400,000	3,256	8.14
HSD fired boiler	0.85	470,588	2,182	5.45
LPG fired boiler	0.85	470,588	1,609	4.02
Heat pump	2.6	153,846	1,252	3.13

Hot water requirement	:	10,000 liters/day
Energy requirement	:	4,00,000 kcal/day
LPG unit cost	:	INR 45/kg
HSD unit cost	:	INR 60/Liter
Electricity unit cost	:	INR 07/kWh
Inlet water temp	:	20^0C
Outlet water temp	:	60^0C

Performance Comparison

	Oil Heating	Electrical Heating	Heat Pump
Thermal Output	0.85 kW	1 kW	2.6 kW
Energy Input	1 kW	1 kW	1 kW

Overall comparison

System	Infrastructure Requirement	Relative Safety Levels	Emissions	Payback
HSD fired boiler	New required	Low	Exhaust	High
LPG fired boiler	New required	Low	Exhaust	Medium
FO fired boiler	New required	Low	Exhaust + Handling	High
Heat pump	Equipment	High	None	Low

Heat Pump is the most energy efficient option

Chart -1: Comparison of other heat sources

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2.1 HVAC System Model

The HVAC system consists of an Air Handling Unit (AHU) equipped with a plate heat exchanger for Heat Recovery (HR), a mixing chamber, a preheat, cooling and dehumidification, and reheat coil heat exchangers, an adiabatic humidifier, a chiller, a boiler or an air-to-water heat pump, and fans. The model has been extensively described in recent papers by the authors, and its representation in the baseline configuration, a hydraulic scheme and constant flow rate fans is presented in figure.

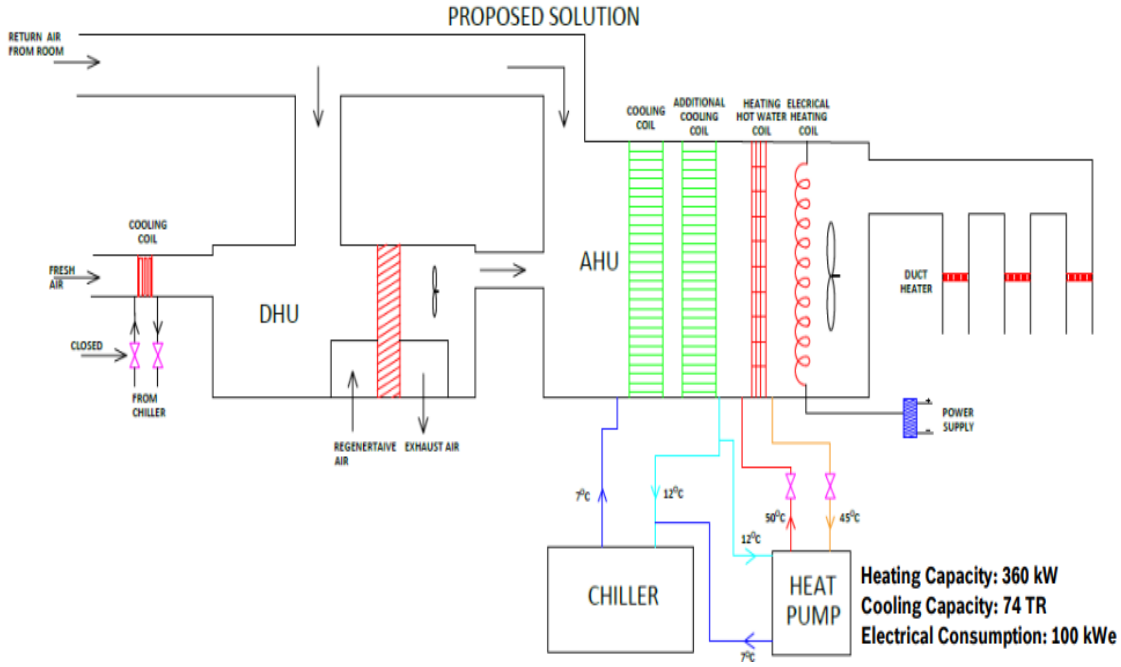

Fig -1: Heat Pump circuit of HVAC system

2.2 Case study

- Observation: Electrical heaters are used to maintaining the temperature and relative humidity in AHU's and DHU's used in process area.
- Objectives: To eliminate the electrical based heating via alternate efficient integrated heating solution.
- Recommendation: Energy efficient water source Heat Pump for hot water generation in AHU and DHU system and chilled water generated will be utilized for overall chiller load reduction.

3. Benefits and Applications:

Heat pumps operate less efficiently as the temperature of their outside heat source falls. Air-source heat pumps therefore generally require a supplemental heat source in order to meet heat needs on the coldest winter days. Ground-source heat pumps do not require this because the ground doesn't get cold enough to limit performance. Heat Pump Applications in Vermont there are four types of heat pumps used to condition space and provide hot water, which are described below. Ductless mini split (Air Source, Single Inverter, Single Head): Air Source Ductless heat pumps (DHPs) are not a new technology but through innovative design they have developed to the point where they have practical applications in Vermont. These units are inverter driven and have the potential to reduce the amount of fossil fuel used for heating during the winter and are referred to as cold climate Heat Pumps (ccHP) as well displacing any air-conditioning load in the area where they are installed over the summer period. A single unit is likely to displace between 25% and 60% of a home's fossil fuel use. These numbers are highly dependent on the correct sizing of the heat pump for the space it is intended to heat, how the building owner operates the heat pump in conjunction with the secondary heat source, the quality of the thermal envelope, the number of air changes an hour experienced in a building and the 'openness' of the building's floorplan. As the name suggests a ductless mini split has no air ducts, so they avoid the energy losses associated with the ductwork of central forced air systems. Duct losses can account for more than 30% of energy consumption for space conditioning, especially if the ducts are in an unconditioned space such as an attic. Mini splits have two main components -- an outdoor compressor/condenser and an indoor air-handling unit. A conduit, which houses the power cable, refrigerant tubing, suction tubing, and a condensate drain, links the outdoor and indoor units.

4. CONCLUSIONS

From above we conclude that the Heat pump system is energy saving technique used in recently the heating ventilation and air conditioning system, it recovers the heat lose as compared to other heating sources and due to this the greenhouse gas emission controlled as compared to the other physical heating sources due to absence of physical burning of fuel.
It consumes very less amount of energy and gives more amount of power outputs compared to other systems. With working as an eco-friendly structure.

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