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HVAC System for Low Energy Buildings

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Abstract: Today, the resolution is auxiliary generators, frequently run on filthy fuels which turn out towering emissions of CO2 and supplementary gases. In addition, huge reserves must recurrently be made in the power sector to manage with intensifying crest demand, though peaks are only 5% of the complete twelve-monthly demand. There's an enhanced way. The low-energy HVAC system which adds thermal energy storage into new building structures which has low energy. The energy storage space technology added to concrete floor slabs can translate to 20-60% less energy for heating and cooling, and a 75-90% reduction in peak cooling loads. This unique method of using the concrete floor slabs with their hollow centers make then work as minuscule heat exchangers, warming or cooling air before it enters rooms.

Keywords – HVAC system, Low energy, Thermal Storage

I. Introduction

The main focus is on low energy utilization in commercial building HVAC systems focuses on energy use for generation of heating and cooling, i.e. in equipment such as boilers and furnaces for heating and chillers and packaged air-conditioning units for cooling [1]. The freeloading energy use, the energy required to allocate heating and cooling within a building, reject to the environment the heat discharged by cooling systems, and move air for ventilation purposes. freeloading energy use in commercial building HVAC systems accounts for about 1.5 quads of primary energy1 use annually, about 10% of commercial sector energy use and the opportunities for energy savings in commercial building HVAC systems [3]. The energy use estimates presented in this report have been developed using a rigorous bottom-up approach which has not previously been used to estimate national parasitic energy consumption. Models for cooling and heating loads were obtained and were based on a set of over 400 prototype building models. Models of HVAC equipment design loads and operating characteristics were developed based on engineering calculations, product literature, discussions with equipment suppliers, and actual building site-measured data collected for demand-side management (DSM) program [5]. The data was also used for checking the building energy use models. Energy use estimates were developed for more than 1,500 technology/market segments representing the different building types, regions, system types, and equipment considered in the study.

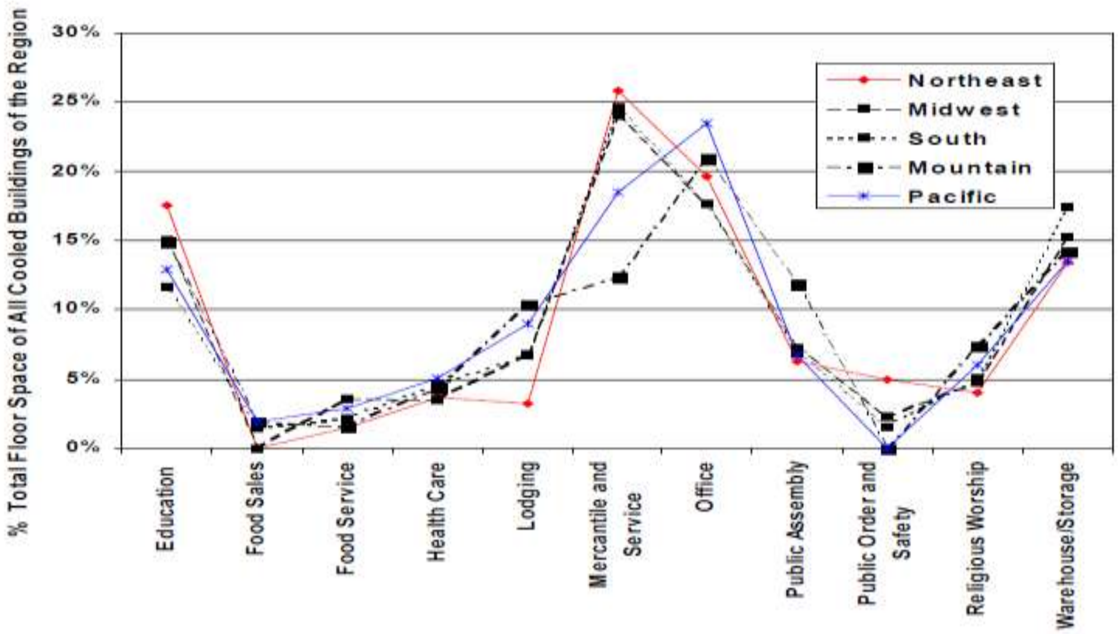

Fig. 1 Typical Regional Variation of Building type for Low Energy Buildings for SVAC Systems

II. Proposed Net Zero Energy Buildings: Efficient HVAC Design

As we move along the path to a Net Zero Energy Building, we can vastly lower our energy demand using passive strategies. But it may not be enough. If you can’t entirely achieve thermal comfort passively, you’ll need to make up the difference with active HVAC systems. People's thermal comfort mainly depends on temperature and humidity.

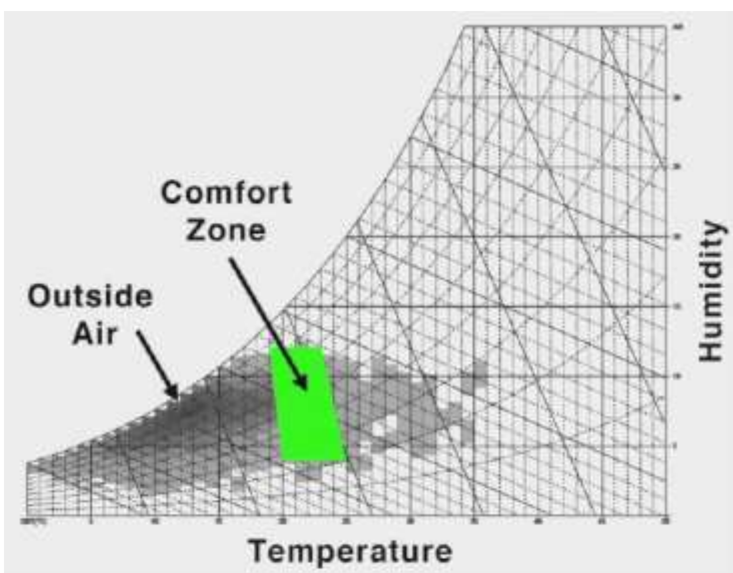

Fig 2. Thermal comfort difference with active HVAC systems

When exterior air is too hot or too cold, or the dampness is too low or too high, conditioning the outside air brings it into the building. A human being always in need of fresh air and air circulation plays a key role in thermal placate [1]. Moving air can help people feel cooler, even if the temperature is higher. But other forms of heat transfer used besides air to improve efficiency. Glowing floors, panels or beams are frequently heated or cooled by liquid; then they radiate energy directly to people and objects, avoiding the need to heat or cool all the air in the space. No matter what tools we use, we want to size it correctly and choose components with the highest energy efficiency ratings. For instance, heat pumps are rated by Coefficient of Performance, or "COP". It's the amount of heat energy moved, divided by the energy used to move it.

It's also imperative to optimize the complete system, and not just its parts. For example not throw away the energy previously spent heating or cooling the inside air when bringing in fresh air. Heat exchanging systems can get better that heat, coolness, or even humidity before the air's exhausted. The enhanced controls and feedback, the more energy saved while still keeping people contented, as both the weather and building use changes. Looking for passive strategies of those will get a long way on your path to Net Zero Energy Buildings. Elegant active strategies are often needed to get all the way there. It's the combination of the two that makes Net Zero Energy Buildings achievable [2].

Based on balanced ventilation, with filter in inlet and the outlet air, the pressure Drop is distributed as (Pa):

Ducts (inlet – plus Outlet air	500	40%
Filters (inlet – plus outlet air)	350	28%
Heat exchanger (inlet – plus Outlet air)	240	19%
Cooling Coils	60	5%
Heater	50	4%
Sound reduction (inlet – plus Outlet air)	40	3%
Joint duct	10	1%
	1250 Pa	

Fig. 3 Typical HVAC Energy Use: Pressure Drop

Once in operation the filter is the only thing in an HVAC system that can be changed at a reasonable cost.

III. HVAC System Types

HVAC system types in marketable buildings are busted down into four extensive categories for the purposes of this study: central, packaged, individual AC and uncooled. Central systems are clear as those in which the cooling is generated in a chiller and disseminated to air-handling units or fan-coil units with a refrigerated water system. Heating in central systems is produced in a boiler and distributed to local fan-coil units, radiators, or baseboard heaters via a steam or hot water system. A packaged system comprises rooftop units or split systems which have direct-expansion cooling coils, with heat denunciation remote from the cooled space. Individual AC systems absorb self-contained packaged cooling units which are accumulated in windows or on an external wall such that cooling occurs inside and heat rejection occurs outside. Uncooled buildings of interest are heated but not cooled.

III. (a) HVAC Central systems

Central systems are distinct as any HVAC systems which use refrigerated water as a cooling medium. This grouping contains systems with air-cooled chillers as well as systems with cooling towers for heat denunciation. Heating in these systems is typically produced in a boiler and is disseminated in hot water or steam piping. A central system serving office space is depicted in Figure 3 below. The space which is habituated by the system is in the lower right part of the given below diagram. The system is broken down into three major subsystems: the air-handling unit, the chilled water plant, and the boiler plant.

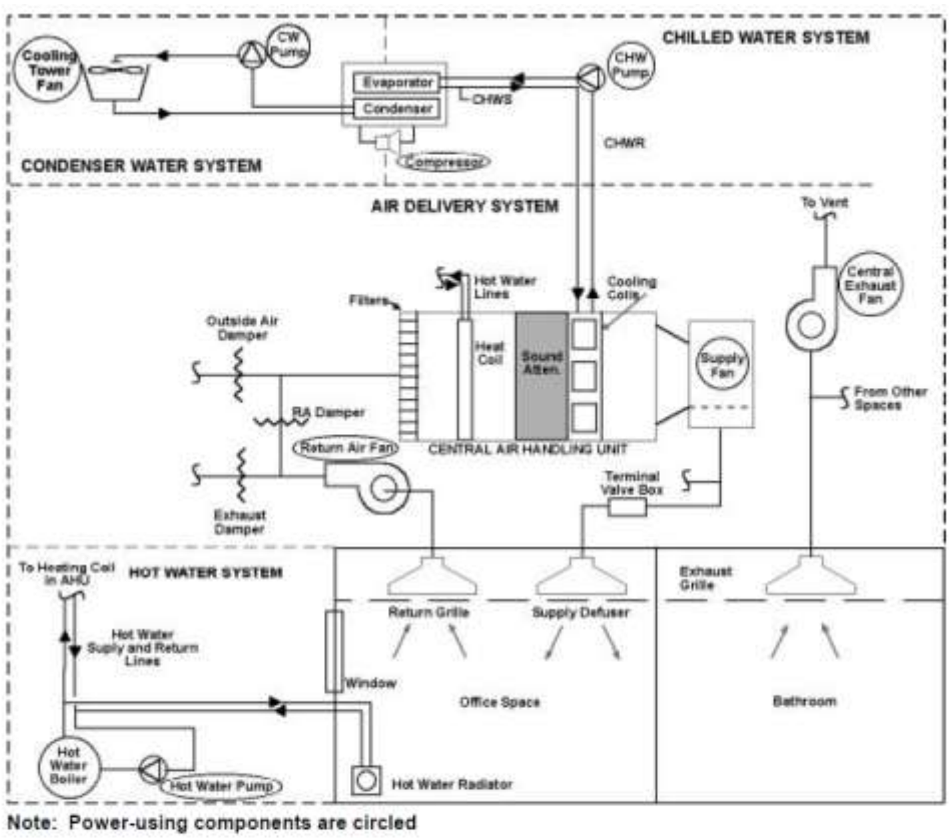

Fig. 4. Schematic Diagram of a Central HVAC system for Low Energy Buildings

IV Other Equipment

Supplementary HVAC parasitic equipment of attention are:

• Condenser Fans
• Pneumatic Controls Compressors
• Burners
• Forced or persuaded Draft fans for combustion air or combustion products

Packaged rooftop units, split-system air-conditioning units, and air-cooled chillers refuse heat in air-cooled condensers. The condenser fans used to shift the cooling air are normally axial propeller fans which are normally mounted unswervingly onto the shafts of the drive motors. Even though the inclination in marketable building HVAC controls is for more unswerving digital control (DDC), the control systems installed conventionally in marketable buildings were pneumatic controls. These controls connect the use of compressed air at 15 to 25 psig to activate dampers or valves. Some big pneumatic controls persistently bleed air to uphold control pressures, but all pneumatic systems use air throughout cycling of controls. Standard reciprocating air compressors are generally used to supply this condensed air. Burner fans and fans for combustion air or combustion products are used in boilers and furnaces. The body of the burner in fact doubles as the fan volute. In the below figure, the motor is incompletely hidden to the left of the fan, and the oil pump is at the right of the fan. Compulsory draft fans for gas furnaces or boilers are correspondingly integrated into the burner assembly. Induced draft fans, used mainly for gas furnaces, are generally disjointedly escalated on the furnace housing, with the motor in the ambient air.

Fig. 5 An Oil Burner : Source : Beckett

Results and Discussions

The segmentation variables used in the study of HVAC system for low energy buildings were:

• Climate or geographic region
• System type
• Building type

There is no study or survey which furnishes a sufficient breakdown of the commercial building stock by all of these variables. The data represents the most complete survey which can be used for such a segmentation, and this database has been used as a basis for the segmentation used in this study. Oversimplification of the segmentation process was needed due to the limitations of the data. Simplifying assumptions are as follows.

• The building type distribution of floor space does not vary significantly with region (see Figure 4 below)
• System type distribution does not vary significantly with region (see Figure 5 above) The following plot shows building type distributions of floorspace for the chosen geographic regions based on data. The plot shows that, although there is some variation in the distributions as we move from one region to another region, the basic shape of the distributions remain similar.

Conclusion

The most important optimizing HVAC solutions for Low Energy Building is that the filtration is considered to be more significant. Advance setpoint control is import; heating, cooling and ventilation is required. The look of buildings HVAC systems from absolute buildings such as a system which includes infiltration, glass, solar and occupancy are been considered for low energy buildings. The demand of reduced energy and reduced pollution is ascertained for Low Energy Buildings for SVAC systems and the augmented health in buildings and outside is considered.

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