

These application notes are for general guidance and information only. Users will need to undertake independent analysis for specific site if any of these measures are to be implemented. Consideration should be given to engaging the services of a suitable consultant to assist with this task.

Summary

Heat recovery systems reduce energy use as well as heating and cooling plant requirements. Key functional areas in hospitals benefiting from heat recovery or heat exchange systems include operating suites and related areas, indoor pools and kitchens where air is generally used on a “once through” basis. Up to 50% to 60% of heating or cooling energy that would otherwise be lost could be recovered with these systems.

Background

The majority of air conditioning systems utilise heat recovery through the recirculation of air from the occupied space. Where operational requirements prevent the reuse of air from the space, higher quantities of external air maybe required, which can impose substantial loads on the cooling and heating systems. In these cases heat can be reclaimed from the exhaust air stream and transferred to the entering outside air steam, to pre-cool or preheat the air reducing plant size and energy use.

Opportunities and Constraints

The most effective heat recovery system available in air handling systems is to filter and recirculate the air, with the required volumes of outside air introduced to meet statutory requirements. This philosophy is used extensively and forms the basis of air conditioning systems.

Where operational requirements indicate that large volumes of outside air need to be introduced into the building then this air, which is at ambient conditions, needs to be heated or cooled to suit the required space conditions. This can be a significant portion of the cooling and heating loads imposed on the plant. In a hospital environment these particular areas include: -

- operating theatres where high outside air rates is used for infection control
- hydrotherapy pools where outside air is used to control humidity within the space.
- kitchens where outdoor air is required to replace exhaust air flow

To minimise the cooling and heating loads, heat recovery systems can be utilised to pre-cool or preheat the incoming ambient air using energy leaving on the exhaust air system.

Heat recovery systems include

| Heat recovery system | advantages | disadvantages | description of system |
|----------------------|--|---|---|
| Return air | <ul style="list-style-type: none"> • 100% efficient in energy • usually low cost | <ul style="list-style-type: none"> • is not suitable for all situations due to particular operational requirements | Air from the space is returned back to the air handling unit and mixed with the incoming ambient air prior to being supplied into the space. |
| Enthalpy wheel | <ul style="list-style-type: none"> • total energy transfer (latent and sensible heat) • reasonable efficiencies can be achieved | <ul style="list-style-type: none"> • air to air contamination is possible although can be minimised by a purge cycle • both air streams need to be next to each other | Both the exhaust air and ambient air streams pass through the wheel. Energy is absorbed by the wheel from one air stream and is reclaimed when the wheel rotates into the second air stream. A small amount of outside air can be used to purge the wheel prior to intake air stream passing through the wheel. |
| Plate heat exchanger | <ul style="list-style-type: none"> • no moving parts • minimal pressure loss when not in use • reasonably efficient with sensible heat transfer | <ul style="list-style-type: none"> • latent heat transfer not possible • both air streams need to be next to each other | The plate heat exchanger splits the two air streams into many parallel channels at right angles to each other. Sensible heat (change in temperature) is transferred across the dividing plates. When not required, bypass dampers remove the heat exchanger and hence the pressure loss from the air path |

| Heat recovery system | advantages | disadvantages | description of system |
|----------------------|---|---|---|
| Run around coils | <ul style="list-style-type: none"> relatively easy to install, particularly as a retrofit air streams do not have to be physically close to each other prevents air to air contamination | <ul style="list-style-type: none"> comparatively low efficiency coils present a continuous pressure loss sensible heat transfer only | Coils are placed in both the exhaust stream and the ambient air stream, with water being pumped around through both coils allowing sensible energy to be reclaimed from the exhaust air stream. Air streams are separated hence air to air contamination can not occur. |

Retrofitting heat recovery systems to existing equipment often limits the choice of system to the run around coil system, due to duct locations. For new equipment all of the heat recovery systems could be considered, with high efficiencies available for heat wheels and plate heat exchangers.

Systems may need to be analysed and selected so that the energy savings are not negated through increased fan energy due to the pressure losses through the heat reclaim system components.

Impact of Implementation

The implementation of a heat recovery system has no impact on staff or patients. During the installation process, the functional area may not be available for normal use. It may therefore be advantageous to coordinate the upgrade works of the mechanical systems into a general refurbishment program.

Analysis

Typically a heat recovery system can “capture” and “re use” up to 50% to 60% of the energy that would otherwise be “lost” through the exhaust system. The overall reduction in energy consumption on an all outdoor air systems using heat recovery can be in the order of some 20% to 30%.

Based on an operating theater air handling unit of 1200 L/s, operating 24 hr/day with full outside air, a run around coil heat recovery system is expected to save around \$1200/pa (gas \$4/GJ, based on energy costs of electricity at \$0.13/kWhr). This provides a simple payback of around 5 years with an installation cost around \$6,000.

Where the hospital heating energy is other than natural gas, this payback period may be reduced.

Conclusions

Heat recovery systems are generally suited to full outdoor ventilation systems, where there is an operational requirement limiting the recirculation of room air through the air handling system. These specialised areas include operating theatres, kitchens, hydrotherapy pools and similar high ventilation requirement areas.

Where not fitted as a component of the initial air handling system, run around coils can provide reasonable operational efficiencies. The sizing of these systems depend on the balance between the energy savings and the increased fan energy caused by the pressure loss of the heat recovery system (heat exchanger, air coils and the like).

The main benefit is in new installations where heat recovery systems can reduce peak cooling and heating demands, thereby reducing the size of central plant which can then help offset the cost of the energy saving measure.

References and Sources for Further Information

- www.seav.vic.gov.au
- www.greenhouse.gov.au
- SEAV "Model Technical Specification"