Reducing energy cost for a Georgian hotel in Derbyshire

The brief

The Georgian building style is not renowned for low energy standards. It was, therefore, no surprise that the owners of this 175 year old hotel were looking at ways to reduce their energy cost.

The challenges

We identified the following areas for potential improvement:

The property has solid stone walls without cavities or insulation. This type of wall does not allow for improvements to the insulation value, unless internal insulation is considered, which would also need extensive redecorating. This was no option due to costs and the need to keep the hotel open and running.

Three 15 year old gas heating boilers needed to be replaced. Their efficiency was estimated at 72%.

The restaurant is located in a large conservatory, which was added in 1988. A number of design errors made the conservatory too hot in summer and uncomfortably cold in winter:

- Lack of thermal mass, resulting in an immediate rise in temperature due to solar gain
- The position of the radiators alongside the outer wall, increasing heat loss and generating a draft along the floor
- The ventilation was too noisy and was therefore never switched on

Limited ventilation in bathrooms resulted in some complaints about damp and mould.

A thermostat located in the hall, a relatively cold and drafty location, controlled the temperature for the whole of the building. Staff had to manually open and close the radiator thermostats in the bedrooms.

The main source of artificial lighting in the corridors was low voltage halogen, which was permanently switched on. Lights could not be centrally switched off in unoccupied rooms.

The recommendations

<u>Heating</u>

Two options were proposed to deal with the old gas heating boilers. Option 1 was to replace the boilers with higher efficiency ones, which would reduce the heating bill with 5%. Option 2 was to replace them with a small CHP (combined heat and power) plant, which converts some of the energy into electricity in addition to heat. CHP plants are used extensively in hotels on the continent. Payback time was estimated to be similar for the two options. Although the initial investment would be larger for the CHP plant, it would additionally reduce electricity bills by 50% and would continue to do so at the end of the payback time.

Either heating option would still generate an above average temperature in the plant room. This could be used to preheat the hot water using an air to water heat pump.

<u>Conservatory</u>

The following options were proposed to have better control of the temperatures in the conservatory restaurant, enabling a more pleasant dining experience:

- Replacing the lightweight floor with a solid concrete floor with handsome slate would improve the indoor climate by providing thermal mass. Underfloor heating to replace the radiators would get rid of the drafts and would introduce an additional 10kW heating to the conservatory, removing the need for electric fan heaters. Insulation under the concrete floor would prevent heat loss into the sub soil.
- As some parts of the roof also needed resealing, it was worthwhile looking into changing to another roof material. Using 25 mm five wall polycarbonate would reduce

heat loss through the roof by approximately 30%, whilst athermic polycarbonate would reduce solar gain by approximately 50%.

- Modern ventilation methods, for example with heat recovery, could provide ventilation with reduced noise levels.
- Curtains would prevent further heat loss, however, this was not considered an aesthetically pleasing option by the hotel owners.

Bathroom ventilation

To increase ventilation in the guest bedrooms without heat loss, ventilation with heat recovery was recommended. Although a centralised system has a higher efficiency (up to 90% of the heat is recovered), this was not recommended in this case, due to the need for substantial duct work, potential noise transference between rooms and potential smoke transference in case of fire. Instead, a decentralised system in each room (see figure 1) would provide fresh air, preheated with the exhaust air.

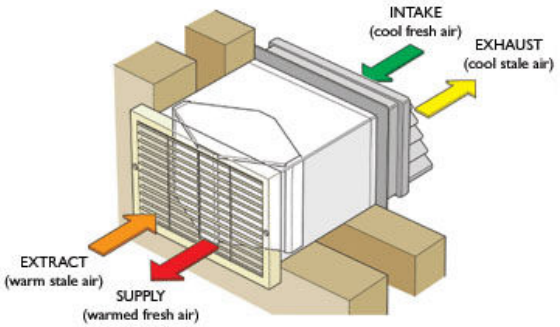

Figure 1 Typical installation of a local ventilation with heat recovery unit

Although not as efficient as a centralised system (approximately 75-80% of heat is recovered), it would not need any ducting and could be installed in a room within a day.

Heating control

Several options were proposed to make heating control less error prone: for example thermostatic valves could be set automatically via the reservation system or the hotel could be divided into several heating zones, where only rooms in the heated zone would be allocated. Both these options would need a software upgrade to the reservation system.

Lighting

To lower electricity usage, it was recommended to investigate a system to switch off electricity in unoccupied guest bedrooms. It was recommended to replace the halogen lighting in the corridors with high power LED lights as soon as they would become available on the market. *Note: these are starting to become available now (end of 2009).*