

Choosing Renewable Technology for the Huish Episcopi new Sixth Form Building

The new Sixth Form block is designed to emit a lot less carbon dioxide (CO₂) into the atmosphere than the other existing buildings at the school.

The local council decided that the new building should have some of its electricity or heating come from a renewable energy source instead of from fossil fuels such as gas, coal or oil.

When choosing which of the many types of renewable technologies to use in the Sixth Form block, we first had to calculate how much energy the building would need for all of its services, such as:

- Keeping the rooms warm in winter
- Stopping the rooms getting too hot in summer
- Lighting all of the spaces
- Providing power to all plug sockets
- Running the air circulation systems to make sure there was enough fresh air is provided

We have calculated that the whole new block will need the following:

- 44,700 kWh of gas heating every year
- 26,100 kWh of electricity every year

Overall, if we put no renewables energy sources into the building, it would emit **19,938 kg** of CO₂ every year.

The average UK home emits 5000 kg of CO₂ every year, so the new sixth form college would emit nearly 4 times as much carbon as the average home in a year.

There are various factors to take into account when deciding which is the most suitable renewable energy source for a particular project. For the sixth form we analysed the following renewable technologies:

Wind turbines

The site has a predicted average wind speed of only 4.6 m/s at 10m high. This would tend to indicate that a turbine would not generate useful amounts of electricity on the site unless it was raised to a very high level (25 metres or more).

Due to limited space on the existing site, a turbine would not be a sensible system as it would require a large area next to it to enable raising and lowering for installation and maintenance. The school site is also surrounded by lots of tall trees and these trees



will interfere with the winds direction making it turbulent so a relatively low amount of power would be generated.

Solar Hot Water Panels

The new block does not require much hot water as it is only needed for hand washing taps so a solar hot water system would not save much gas from being used and so CO₂ savings would be low.



Biomass (wood) heating

Biomass heating could be a great CO₂ saving technology for the block but a wood boiler system requires a large wood fuel store next to it as well as a very big hot water accumulator tank. Unfortunately there is not enough space for this to fit on the site.



Ground Source Heat pump

Ground source heat pumps circulate a fluid through the ground outside a building to heat it up by 2-5 degrees Celsius. This works because the temperature is higher and better insulated underground. Super efficient electrical compressors then push this heated liquid up so that it can be used to heat water and air inside buildings. A ground source system was looked at for Huish but was found to be very expensive due to the extensive ground works required for the heat collector.



Photovoltaic Electricity

A photovoltaic (PV) panel system mounted on the roof of the building was considered. This would provide limited electricity to any appliances or lights that are running during the day and would send electricity back into the National Grid if there is nothing switched on to use it. The PV panel system was not chosen as it worked out to be more than 3 times more expensive than an air source heat pump.

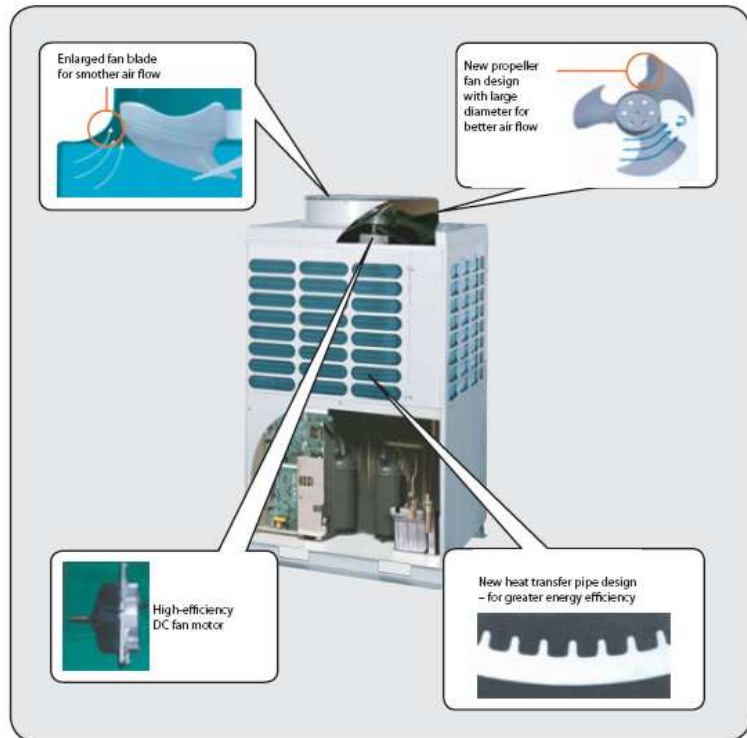


Chosen solution/technology – Air Source Heat pump

A super efficient air source heat pump system has been chosen to provide most of the heating and some cooling to the new sixth form block.

How does it work?

It takes energy from the air using an Air Handling Unit. This is a box which is situated outside and contains a large fan which draws air into the unit, transferring the energy in the air through large heat exchangers. From there, the process is the same as a Ground Source Heat Pump. They work like a fridge by moving energy from one place to another. For example, a bottle of lemonade brought from your local supermarket is at room temperature. If you put it in your fridge and wait a few hours it will be cold enough to drink. If you touch the back of your fridge during that time you will feel heat. The fridge has taken the low temperature energy out of the lemonade, compressed it up to a higher temperature and in effect has warmed the kitchen up slightly. By using the same process Heat Pumps remove solar energy stored in either the earth, air or water around your building, compress it to a higher temperature and transfer it into your central heating system.



The system for the sixth form block operates at a coefficient of performance (COP) of 3.21 and has a seasonal energy efficiency ratio (SEER) of 5.35. This means that for every unit of electricity it uses it outputs 3.21 units of heat into the building. If a normal gas heating system had gone into the new block then it would have run at 90% efficiency whereas this heat pump runs at 321% efficiency.

This means that compared to a normal heating system this heat pump system will save at least **3256 kg of CO₂** every year.

The new building also makes use of many other energy saving technologies such as:

- Energy saving light bulbs in the main percentage of lights
- Light sensors so that lights are not left on and so that lights do not come on in daylight
- Extra thick insulation in the walls
- Auto sensing controls to make sure the heating is never higher than it needs to be
- Solar shades above windows so that in summer the sun does not provide unwanted heat into the building

Conclusion

By utilising the preferred method of the air source heat pumps discussed above, it is estimated that the new sixth form college building will now emit 16,430kg of CO₂ every year, which is a 16.3% reduction.