Use of Renewable Energy in the Sustainable Buildings Replacement Programme

The first way to address the issue of renewable energy is to design a building that uses very low levels of energy in the first place, using the following strategies:-

- High levels of insulation to retain warmth in winter and prevent overheating in summer.
- Natural solar gain (free!) from glazing with the correct orientation in winter, and shading for summer sun to prevent overheating.
- Natural lighting from glazing and low energy lighting (LEDs) to reduce light energy use.
- Water-saving devices to reduce wastage of mains water
- Highly insulated hot water system to reduce energy needs and wastage of hot water.
- Standby protection, with electricity auto cut-off out of hours.
- Low level under-floor heating with thermal mass heat storage.

Having created a building that needs as little energy as possible, the remaining energy requirements could be met with the following technologies:

(Consideration also has to be given to the energy used in creating the equipment required.)

1 Solar photovoltaic panels (PVs)

PVs produce electricity from sunlight, so will only create energy during daylight hours.

The excess electricity produced can be sold back to the grid at a 'Feed-in Tariff' which is set higher than the cost from the grid, as an incentive to install renewable technologies.

The high capital cost of the units, which would be in the region of £20,000, is offset by this Feed-in Tariff, and by the savings on electricity produced, to provide an income of approximately £1,500 per year.

In addition to this, grants might possibly be available for community groups of 50% from the Community Sustainable Energy Programme, Low Carbon Buildings Programme Phase 2, and energy companies with green energy funds.

The above schemes, and others, make PV a viable option financially.

The panels should be installed on a south-facing roof to work effectively, but unfortunately the area for the new buildings has considerable shading from the trees to the south.

Other buildings on the site without shading should be considered for PV as part of this project.

2 Solar thermal panels

Solar thermal panels heat water with sunlight, and are the lowest capital cost renewable energy option.

A suitable system would cost approximately £5,000 and would provide 50-60% of the hot water requirements of the buildings all year round.

Again, 50% grants are available as for PV.

The shading issues also apply to Solar thermal.

Both PV and Solar Thermal can be considered for this project but greater benefit will be gained from energy-saving measures.

3 Biomass

Wood pellets, chips or logs are all low-carbon heating options. The buildings should require very low levels of heating, and a wood pellet boiler with an automatic hopper feed supplying under floor heating and hot water would be a low carbon option, but wood pellets would cost a similar amount to run as oil, with a high capital outlay.

Grants might be available from the same sources as before.

Pellet storage requires a lot of space, which is not at a premium on the site.

Simple wood burners require a lot of input to achieve comfort levels, due to the collecting, storing and managing of wood.

Biomass would seem to be a poor option for this project due to the high running costs

4 Heat pumps

Heat pumps are fridges working in reverse, taking heat from the environment in small amounts and transferring it into the building, they can also be used in reverse to cool the building.

Heat pumps are best suited to low level under-floor heating in highly insulated buildings, and providing background heat for hot water to be ‘topped up’ by another heat source.

There are three types of heat pump:

A Ground source heat pump (GSHP) this requires a buried loop of pipe to extract heat from the ground. The site is not suitable for this technology. Although there are grants available to offset the high capital cost.

B Air source heat pump (ASHP). ASHPs have a lower capital cost, typically £6,000 to supply 70% of space and hot water heating, topped up with solar thermal

C Water source (WSHP). There is no suitable water resource on site

5 Wind

A wind turbine requires non-turbulent airflow to work efficiently, the nature of the site, surrounded by trees, is unlikely to provide these conditions. A very large turbine may overcome this problem, but would raise severe planning issues and very high capital cost.

6 Rainwater harvesting

The site already harvests rainwater for the nursery, this system should be extended to incorporate other buildings on the site.

The rainwater runoff from the new buildings will be collected and used for toilet flushing, and external, non-potable water supplies to conserve mains potable water, but the energy required for pumping, filtering and treating rainwater far exceeds the energy consumed by using mains water.

Water saving devices such as low flow button taps and waterless urinals will ensure the use of mains water is as low as possible.

In conclusion, unless the shading issues can be resolved, the most effective solutions for energy supply to these buildings are:

- Energy saving measures, high levels of insulation, design for solar gain, natural lighting and low energy lighting, standby shutdown, and low energy consumption appliances (fridges, washing machines, driers etc)
- Air Source Heat Pump, running low-level under floor heating and background heat for hot water
- Solar Thermal Panels to top up heating and hot water, subject to shading issues.
- Photovoltaic Panels are very sensitive to shading, other buildings on the site without shading should be considered for PV as part of this project.