POPE

SUSTAINABILITY REPORT &

MECHANICAL & ELECTRICAL SERVICES REVIEW

FOR

NEW PARK COMMUNITY CENTRE, CHICHESTER

ALTERATIONS AND EXTENSIONS

Project Nº:	**1808**
Date:	**February 2008**
Client:	**New Park Community and Arts Association Ltd**
Rev:	**1**

Pope Consulting Ltd
Building Services Consulting Engineers
1 North Pallant
Chichester
West Sussex PO19 1TL
Tel: 01243 788955
Fax: 01243 788466
E-mail: office@popeconsulting.co.uk
Website: www.popeconsulting.co.uk
Registered Office: Holt Place Birdham Chichester England
Registration No: 03837976

ISO 9001:2000 Registered
Certificate No: FS 531080

DOCUMENT REVISION SHEET

ORIGINAL

Prepared by:	Derrick Pope	**Date**	February 2008
Checked by:	Neil Champion	**Date**	February 2008

REVISIONS

Rev.	Pages Revised & Re-Issued	Date	Chkd.
1	10	28 March 2008	NC

CONTENTS

NEW PARK COMMUNITY CENTRE

Sustainability Report and Mechanical and Electrical Services Review

1.0 Introduction and Brief

The New Park Community and Arts Association is proposing to extend the existing New Park Centre with the construction of a new wing and reception area and internal alterations to the existing building, including the upgrading or replacement of the existing building services.

For any new construction, early consideration should be given to reducing the building's impact on both the local and greater environment. The initiatives listed below should all be considered for a modern building expecting to demonstrate good environmental credentials.

Quite often, sustainable measures have a very long payback on investment but the environmental advantages, in the form of reduced energy use and CO_2 emissions or water consumption, need to be taken into consideration.

Each initiative has been considered in isolation, however, and they may not all be mutually compatible or return the predicted paybacks in conjunction with other energy saving measures.

Pope Consulting Ltd was commissioned to review sustainability in the design and to provide a supporting document to accompany the planning application. In order that the planning application accurately represents the proposed development, Pope Consulting was also asked to review the M & E services to see whether external plant or plant rooms need to be identified on the planning application.

2.0 Orientation and Design

Careful selection of the building orientation and design can reduce areas exposed to high summer heat gain, reducing the need for mechanical ventilation or cooling, as well as allowing the lower winter sun to give passive solar gain during the heating season. These are low cost strategies which can more easily be incorporated in the design on an unrestricted site.

In this case, there are clear constraints which dictate the building form and orientation. The developed design, however, with much of the new accommodation sheltered from direct solar gain from the south by the link corridor, offers some amelioration of heat gain.

3.0 Building Weight

Heavier weight of construction helps to absorb daytime heat gains and reduces diurnal temperature swings. This can either improve comfort conditions or reduce thermal loads, where cooling is provided. Best results are achieved with exposed wall surfaces and soffits and night cooling ventilation to pre-cool the building before occupancy.

4.0 Insulation Levels

Increased levels of insulation will reduce energy loss and this has historically been a cost effective method with fast payback. The 2006 Part L2 Building Regulations already stipulate that the building must have 25% less carbon emissions than a similar building under the previous regulations. Higher insulation levels than the previous elemental levels can help to achieve this, although they may not provide compliance in isolation. One of the major elements of energy loss is through the glazing. High performance glazing and framing is becoming more readily available and will be considered here.

5.0 Airtightness

Reduced fabric losses make the air leakage element of energy loss much more significant. Part L of the Building Regulations sets minimum standards for larger buildings but adherence to robust details can improve the performance of this development.

6.0 Natural Ventilation

Good natural ventilation not only improves the quality of the environment but can reduce summertime overheating and subsequent demands for energy consuming mechanical cooling. Good quality crossflow ventilation is most easily achieved by providing controllable ventilation openings on opposite sides of the room, effectively in different pressure zones. This can be achieved through high level glazing but may be supplemented by other controlled ventilation.

Proprietary “wind towers”, mounted on the roof, are proposed for parts of the new development. These use the pressure zone principle to divert wind flow into the space, exhausting warm, vitiated air in the process. The units can be controlled on space temperature with occupancy or weather overrides.

7.0 Daylighting

Adequate daylighting allows use of the rooms without using electric lighting. We would expect designs to try to achieve good daylighting levels (4-5%), where possible. This normally requires getting additional daylight to the darker back of the room, away from glazing on the outside walls. The current design development can allow good provision in rooms where rooflights can supplement normal fenestration.

8.0 Green Roof

Green (intentionally vegetated) roofs can provide a number of environmental benefits to a new construction and a sedum planted roof is proposed for the new development. It will add both mass and insulation to the roof structure, improving both environmental conditions inside and reducing energy consumption, as described earlier.

Green roofs are said to extend the life of the roof by protecting the membrane from the elements and mechanical damage.

Environmental benefits include increased planting with its oxygen generation, absorption of atmospheric heavy metals and pollutants from rainwater run-off, attenuation of rainwater run-off, requiring less drainage and improvements in sound insulation.

As the roof will be visible from East Walls, it will clearly indicate the sustainable aspirations of the new development

9.0 Rainwater Harvesting/Grey Water Recycling

Rainwater harvesting collects rainwater run-off from roof surfaces into a tank (usually below ground). It can then be pumped to a header tank for gravity circulation. The header tank is supplied from the mains when rainwater is not available. Water is generally used for toilet flushing or other non-critical applications.

Grey water recycling works in a similar way but using waste water separately collected from “clean” wastes such as handwash basins, showers etc.

Both water and sewage charges are avoided on the harvested water but payback will be over a fairly long period.

With the embodied energy in the construction of below ground collection tanks, separate pipe distribution systems, pumps and water treatment plant, the energy required for pumping and treating all water collected and recycled and the energy associated with the maintenance of these systems, this is unlikely to be a sustainable measure on this scale. The provision of a green roof will also reduce the available surface run-off and the viability of the system.

A cheaper and simpler alternative is to have rainwater butts served from downpipes, which can be used for grounds irrigation.

10.0 Water Flow Controls

Water flow controls will be provided at draw-offs to limit water consumption. Automatic taps and shower controls will ensure that there is no wastage of water resource.

11.0 Solar Thermal Collectors

Solar thermal collectors are used in this country to heat domestic hot water, where there is a year round demand for energy, particularly in summer, at the maximum output of the collectors. Thermal output is usually supplied to a central storage cylinder serving all outlets.

At the moment, domestic water systems are decentralised. Although there is a vented cylinder serving the shower block, local electric point of use water heaters serve more outlying draw-offs. The new development will stretch hot water demand to more distant areas. It is expected, however, that water services will be rationalised in the development works and it may be possible to incorporate a central cylinder with a solar collector.

Heat collectors are often in evacuated tubes to maximise recovery. They are usually sized to provide 25-50% of the annual domestic hot water requirements, so further input from other heat generation is required.

Collectors need to be sited on a south facing roof, reasonably close to the hot water plant. Capital cost of the plant and installation is relatively low although payback is still lengthy. The technology will be considered for this building.

A Low Carbon Buildings Programme grant is available for 30% of the installation costs

12.0 Photovoltaics

Photovoltaic panels produce electricity at low DC voltage which is then fed through an inverter and synchronised to feed into the building's existing AC distribution system. Once installed, there are no charges or additional metering necessary since selling energy back to the Electricity Company would not be economic. There are no CO_2 emissions from the generated electricity and they are virtually maintenance free.

The benefit of using photovoltaic cells is that they do not rely on sunshine but on daylight, so are operational for the whole year. They will have greater output in direct sunshine, however, and optimum output is obtained with a south facing array tilted at 30-40° to the horizontal.

Panels require quite a lot of area for a modest output capacity and they are unlikely to be viable on this development, despite the 50% grant available through the low carbon buildings programme.

13.0 Biomass Boilers

Biomass boilers burn wood fuels, in the form of pellets or wood chips to allow automatic handling. The fuel burned has a very low carbon rating, as the carbon dioxide released in burning is the exact equal of that absorbed during growth.

Biomass installations are more expensive than conventional installations because of the need for fuel storage and automatic stoking. They require a secure supply of good quality biomass fuel which in turn, requires an element of management to ensure that stored fuel supply is adequate. As they produce ash, further management is required for cleaning and disposal. There may also be an environmental impact from the flue gases, dependent on the fuel burnt and the efficiency of combustion.

A Low Carbon Buildings Programme grant is available for 35% of the installation.

Biomass boilers, by their nature, do not cope easily with intermittent loads and they are often installed with a buffer vessel to absorb excess heat. Because of this, the maintenance issues and the space required for fuel storage on a limited site, they are not felt suitable for this development.

14.0 Ground Source Heat Pumps

Ground source heat pumps (GSHP) can be used efficiently to a heat a building by drawing free heat from the ground, concentrating it and delivering it to the building. Systems use a pump and compressor to remove heat from one side of the circuit and eject heat to the other side. Heat pumps are based on the vapour compression refrigeration cycle and use electricity for their operation. Like the domestic refrigerator, the heat pump has few moving parts and is in a sealed system. It is therefore very reliable, has a long life expectancy and has no regular servicing costs. There are no flue or ventilation requirements and no local pollution is generated. By utilising the free energy in the ground, they are a low carbon source of heat (about half the carbon of condensing gas boilers).

System costs are substantially more expensive than conventional systems. This arises partly from the need to bury the ground heat exchanger at a depth that is less subject to seasonal temperature variation, either with ground loops in trenches or using deep boreholes.

Although GSHP systems can work well with underfloor heating systems and can be reversed to provide underfloor cooling, they cannot reach radiator or domestic hot water temperatures without a substantial loss of efficiency. They are therefore unsuited to refurbishment projects for older buildings and this together with high cost and external space requirements, rules them out for this development.

15.0 Wind Powered Generators

Wind generators prominently demonstrate a building's sustainable credentials and can be a useful teaching tool. Electrical output is conditioned by an inverter to be synchronous with the building's mains supply and is continuously fed into the building supply upstream of the meter. Excess output is exported to the grid without financial benefit. The average output, however, is small and it is generally recognised that small scale units are not viable unless in an area with a high wind resource. They will not be used here.

16.0 CHP

Combined Heat and Power (CHP) plant comprises an engine, usually driven by Natural Gas, coupled to an electrical generator. Electricity is generated for the use of the building and the hot engine jacket water can be utilised in heating systems, leading to very high efficiencies for the generated power. Electrical output is conditioned by an inverter to be synchronous with the building's mains supply and is continuously fed into the building supply upstream of the meter. Excess output is exported to the grid without financial benefit.

For CHP to be viable, it has to achieve a minimum number of hours operation each year with a continuous demand for its electrical and thermal output. This will not be the case at the New Park Centre and it will not be used here.

17.0 Heat Recovery

Heat recovery systems recover free heat from outgoing exhaust air to pre-heat fresh incoming air. Mechanical heat recovery air systems will be provided, where natural ventilation cannot provide adequate fresh air ventilation. The second auditorium proposed in the existing building will require mechanical supply air ventilation, as will any internal workspaces. There is already a heat recovery air plant serving the main auditorium, although this may benefit from upgrading and improved energy controls in the refurbishment.

For small extract systems in sanitary accommodation, there is little energy to be gained by heat recovery. Occupancy controls can provide a more efficient way of reducing energy consumption.

18.0 Heating Controls

Mechanical services will require the normal controls for efficient operation of the heat source and heat emitters but further gains will be made by zoning areas to allow partial occupation out of hours without heating the whole site.

19.0 Lighting

All lighting will be low energy, where possible. Lighting is often switched on or left on without consideration. It may be a management function to control this, but automatic controls can be provided to prevent lighting operating when daylighting is adequate or if the room is unoccupied. Dimming can also be provided linked to controls and these measures are usually cost effective.

20.0 Mechanical and Electrical Services Review

The building has had intermittent investment in building services over the years, which has resulted in diverse, uncoordinated and sometimes poorly controlled installations. Current building development budgets have made adequate allowance for addressing these problems and updating the engineering services.

Current installations comprise;

Heating – there are a number of gas fired room heaters (one an unflued ceramic plaque heater), some electric panel and storage heaters, two domestic boiler installations linked to radiator systems and a warm air heat recovery system serving the main auditorium and projection room, also linked to one of the boiler systems. There is a gas fired warm air heater serving the Dojo. The building has a 50mm incoming gas supply.

Domestic hot water - provided to the shower area by a vented cylinder in the area, heated by one of the boiler installations. The remainder of the provision appears to be by vented or unvented point of use electric water heaters. Most outlets, apart from in the shower area, are served from the mains.

Ventilation – Apart from the auditorium heat recovery plant and the Dojo unit apparently supplying 100% outside air, there is an extract system in the projection room and some small toilet extract fans. Other areas are naturally ventilated.

Electrical Supplies – the incoming service from New Park Road is only a single phase supply and this has caused supply problems in the past.

Options to serve the new development are:

1. The heat recovery plant serving the main auditorium is new and this would be retained. It hasn't been commissioned to its full capacity, apparently due to the site power limitations. The new development proposes a further auditorium, which will be used for films. This will also require ventilation and possibly cooling. We suggest this is served by a separate plant to allow flexibility and economy in the use of the two spaces. The existing plant could be recommissioned to its full capacity and provided with inverter controls to allow more efficient operation at part occupancy.
2. The second auditorium, if provided with cooling, would need only sufficient fresh air ventilation to cover occupancy requirements. For the expected occupancy of 70, this could be achieved by small individual heat recovery units, which would not need external plant space.
3. Public rooms in the new wing, including the new Jazz Hall, will make use of "wind towers", mounted on the roof to provide natural ventilation.
4. If a small VRF heat pump system is used to provide cooling to the second auditorium, this will need an external condensing unit, probably sited along the west boundary. These are relatively small and quiet running and do not usually raise planning issues. The same plant could serve the Jazz Hall, if this is found to need mechanical cooling.
5. We would expect that new central condensing boiler plant is provided to serve the additional load of the new extension, new radiator installations to the existing building and possibly centralised domestic hot water. Modern, room sealed boilers need little more than cupboard space and they can probably be accommodated on the mezzanine floor, where the current air plant is sited.
6. A new 3ph electrical supply should be sought for the new development and this may be easier to achieve following recent developments in the area. A new upgraded water supply may also be required. The gas supply will probably be adequate when the small gas heaters have been removed.
7. The new development will have to satisfy Part L2a Building Regulations for carbon emissions. We would expect that it could achieve this with conventional gas fired plant and high performance building fabric and glazing, without the need to introduce other low carbon technologies. It is possible that solar thermal collectors may assist in meeting compliance. The expenditure on new modern building services will meet the requirements for Consequential Improvements.

In summary, we would not expect any of the M & E services proposals to have an impact on planning.