Milieu Consult
Engineer| Energy| Environment

Energy Statement

For

Weedington Road Play Centre

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TABLE OF CONTENTS

1 Introduction

This report has been produced by Milieu Consult to provide an energy statement to support the planning application for the proposed sports facility at Weedington Road Play Centre.

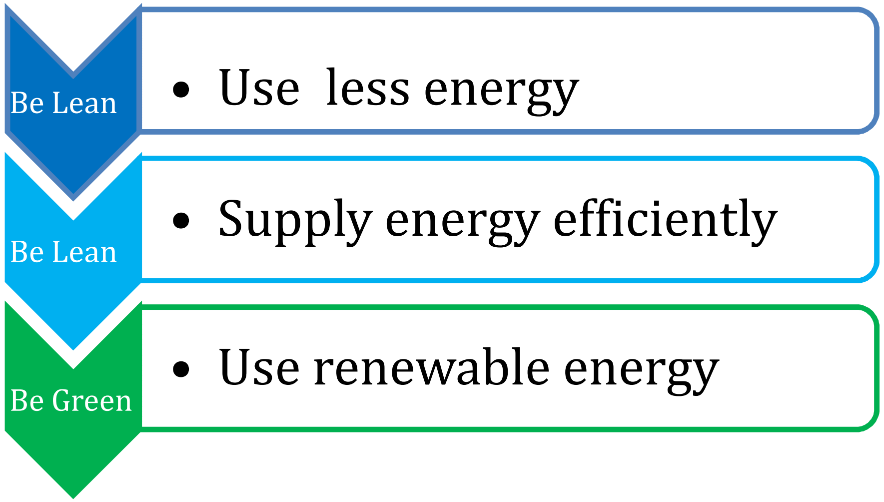
The development consists of an inflatable air dome built over the existing outdoor space. The proposed dome shall be used by both the school and local community for physical education and recreation. The current size of the air dome is equivalent to a 6 badminton court sports hall as per the architect's latest proposal. This study is based on an air dome supplied by Yeadon Airdomes Ltd.

1.1 Relevant Policy

Camden Councils Core Strategy 13, Development Policy 22 and Camden Planning Guidance (CPG) 3 provide guidance on the local policy for reducing energy. They all provide information on ways to reduce carbon emissions and make more sustainable developments. The key messages from these documents are:

- All developments are to be designed to reduce carbon emissions as is feasible and viable
- Energy strategies are to be designed following the steps set out by the energy hierarchy

The three steps of the energy hierarchy are as follows:



The proposed sports bubble is a temporary structure and as such has been assessed against what a traditional structure in the same location could achieve.

2 Be lean

In following the energy hierarchy the first stage in reducing energy and carbon emissions is to use passive features and energy efficient measures. The follow measures have been investigated:

- Natural Daylighting
- Natural Ventilation
- Low Energy Lighting
- Insulation
- Heat Recovery

2.1 Natural Daylighting

Maximising natural daylight within the building can reduce the need for artificial lighting. In a traditional building careful design of the windows is necessary to increase the levels of daylight. The sport bubble has the advantage that the material of the whole roof is translucent. This allows daylight to enter the building. Due to their not being any direct solar gain, daylight entering the space is of a diffused nature and as such there is no glare from direct sunlight. This means that compared to a traditional building the sports bubble can make greater use of natural daylight.

There will be a trade off between the amount of light allowed to enter and the impact on issues arising from high contrast from the natural daylight. For example trying to find a badminton shuttlecock against what is a "white sky". It is recommended that a daylight study be carried out to ensure this does not cause any issues.

It has been found in existing air domes that artificial lighting is at times not even necessary due to the high levels of daylight entering the dome.

2.2 Natural Ventilation

Unfortunately, unlike a traditional building, the sports bubble cannot make use of natural ventilation. The sports bubble requires mechanical ventilation to ensure the bubble is under constant pressure to keep it inflated. Openings in the structure would destabilise the structure.

2.3 Low Energy Lighting

Traditional sports facilities make use of metal halide or fluorescent fittings to provide lighting. Yeadon Airdomes can provide a low energy fitting which can provide up to 40% reduction in energy consumption compared to these. The Hammelite fitting also has a lifespan of more than three times the fluorescent fitting.

As the air dome allows large quantities of daylight, linking the lights to daylight sensors can further reduce energy consumption. These sensors will dim the internal lighting whilst maintaining the correct internal illuminance.

2.4 Insulation

It is possible to insulate the air dome however there is a trade-off between reducing energy from heating and reducing the level of natural daylight. If the structure of the dome is insulated it becomes an opaque structure which does not allow light to pass through.

Yeadon air domes has stated that the heating is used infrequently in the air dome due to the high physical activity. This means that reducing light consumption is of far greater importance. For this reason it has been decided to not insulate the dome to allow natural daylight to enter. The table below shows the comparison between heating consumption and the energy required from lighting without any contribution from natural daylight.

Insulation vs Daylight	
Lighting energy consumption (assuming lights are on 10 hours a day, 360 days a year)	43,200 kWh
Heating Energy Consumption (taken from Yeadon estimates)	24,000 kWh

2.5 Heat Recovery

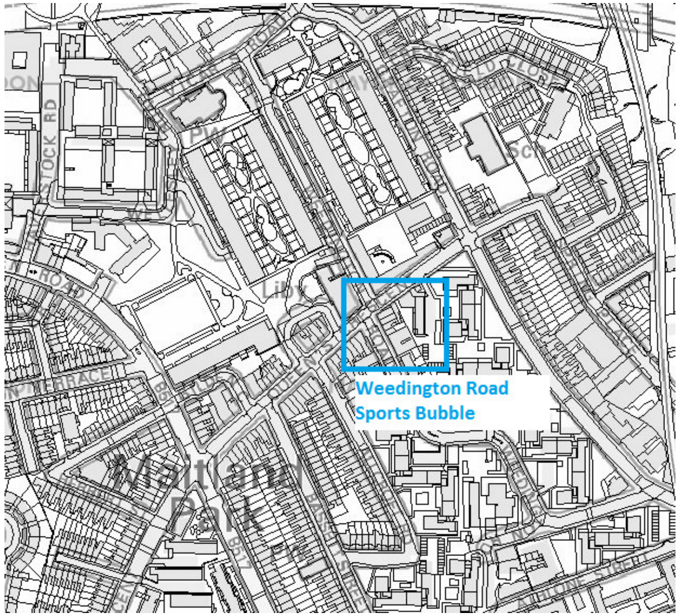
The air dome is inflated using mechanical air handling units. These units supply a large volume of air into the space. To maintain the necessary pressure within the dome the units must supply a proportion of fresh air to overcome leakage from the structure. Unfortunately it is not possible to collect the leaked air and as such it is not possible to recover heat.

3 Be Clean

The London Plan indentifies two methods of supplying energy efficiently. These are through district heating and combined heat and power.

4.1 District Heating

Currently there is no district heating network near the Weedington Road Play Centre that is feasible to connect to. All networks are currently more than a mile from the development and it is expected that the install costs of running any pipework to the site would make the scheme unviable.



4.2 Combined Heat & Power

When considering the suitability of combined heat and power (CHP) the nature of the development must be taken into account. The most important factor is the heat demand of the building. CHP units require a steady heat demand to ensure they run most efficiently and reduce the number of start-ups. This means CHP units are suitable for buildings such as swimming pools or hospitals where there is a high demand for hot water.

The air dome does not have a domestic hot water demand and the heat demand of the air dome is unlikely to be constant. This means CHP is not suited to this application. Although there is a high enough electricity demand because there would be many times when there is no heat demand the heat generated would need to be rejected and this has an economic and environmental penalty.

5 Be Green

The final step is to use renewable technologies to reduce the energy demand of the building. The London Renewable's Toolkit identifies the following technologies as being applicable for a development in London:

- Wind
- Biomass
- Solar Hot Water
- Ground Source Heat Pumps
- Air Source Heat Pumps

5.1 Wind

The city centre location of Weedington Play Centre means wind power would be unviable for both a traditional building and the sports dome. The city centre location with surrounding buildings would create uneven and turbulent win patterns which would reduce performance. Added to this are concerns over the visual appearance and noise of wind turbines on an urban environment.

5.2 Biomass

Biomass is not suitable for the air dome. Biomass systems require a fairly constant heat demand to enable the biomass boilers to run constantly. Biomass boilers are not suitable when only supplying heat to the air handling units as they do not have the turn down ratios to cope with the fluctuations in heating coil of the air handling unit.

5.3 Solar Hot Water

As there is no domestic hot water demand for the building solar hot water is not a suitable technology for reducing carbon emissions of the air dome.

5.4 Ground Source Heat Pumps

Ground source heat pumps are deemed unviable for the development. There is insufficient space for horizontal collectors and vertical bore holes are extremely expensive. As this is a temporary structure ground source heat pumps would not pay back in the lifespan of the air dome.

5.5 Air Source Heat Pumps

As stated previously the air dome is pressurised using a mechanical ventilation unit. The peak energy demand occurs when the unit is supplying full fresh air to the dome. In this instance the heat would be too high to run off air source heat pumps.

It could be possible to install a heating coil run from an air source heat pump to preheat the fresh air requirement. However as the table below shows the payback compared to gas means that it is not economically viable to use an air source heat pump.

Total Energy Demand (To maintain 15 deg during occupied hours)	3518 kWh		
	Energy Consumption (kWh)	Cost (£)	CO2 Emissions (kgCO2/yr)
Gas	3703	681	203
Air Source Heat Pump	879	391	126
ASHP Cost	£7,500		
ASHP Payback Compared to Gas	25.9 years		

5.6 Photovoltaics

Photovoltaics (PV) may provide a viable technology for reducing carbon emissions for the air dome. As the air handling unit is running constantly throughout the day there is a good electrical baseload which PV could offset. The air handling unit contains a 5.5kW electrical motor and as such a 6kWp solar array would match this load.

The neighbouring school building has a suitable roof area facing South West. A 6kWp solar array would take up approximately 40m^2 of roof space. The table below summarises the savings that could be made by PV. It assumes that 100% of the energy generated would be used by the air dome and the panels are at 35° angle.

By generating electricity onsite the development would be eligible for the Feed-In Tariff. This pays a certain amount for each kWh of electricity generated by the PV. It is thought the air dome would not achieve an EPC rating of 'D' or greater and as such would only receive the lower feed-in tariff of 6.85p/kWh.

The electricity saving is based on a tariff rate that would apply if PV was not used to generate the electricity.

Solar PV Savings*	
Electricity Generated	4721 kWh/yr
Income from Feed-In Generation Tariff @ 6.85 p/kWh	£323.39
Electricity Saving @ 14.4 p/kWh	£679.77
Total Benefit	£1,003.16
Payback Time (Based on estimated install of £10,000)	10 years
CO_2 savings @ 0.44548 $kgCO_2$/kWh	2103 $kgCO_2$/year

Due to the temporary nature of the structure it may be unviable to use PV due to the long payback of 10 years.

* Calculations from solarguide.co.uk

6 Conclusion

This report provides an energy statement for the new development at Weedington Road Play Centre. The development consists of an inflatable air dome built over the existing outdoor space.

Following Camden Councils planning guidance including Camden Planning Guidance (CPG) 3 the follow advice has been followed:

- All developments are to be designed to reduce carbon emissions as is feasible and viable
- Energy strategies are to be designed following the steps set out by the energy hierarchy

In assessing the performance on the air dome it has also been compared to what a building of traditional structure could achieve.

In reducing energy from passive and energy efficient measures the air dome can take advantage of natural daylight to reduce energy consumption. The translucent material of the air dome allows large amounts of natural daylight to enter reducing the need for artificial lighting. The artificial lighting can also be linked to daylight sensors to further reduce energy consumption.

Unfortunately due to the nature of the site it is not feasible to connect to either a district heating network or combined heat and power unit.

In assessing the renewable technologies applicable to the site it has been found that only photovoltaics may be suitable. As the air handling unit required to inflate the air dome requires to be run constantly, photovoltaics can offset much of the energy required to run the fan. It has been shown that a 6kWp solar array would produce approximately 4,721 kWh/yr and save 2103 kgCO_2/year.

However due to the temporary nature of the structure PV may be unviable due to the long payback of 10 years.