Design Concept

Basic Project and Building Description

The redevelopment of the Campus has come about as a result of Building Schools for the Future funding being made available to Plymouth City Council under the "One School Pathfinder" initiative.

In the early stages of the design work we held many meetings and workshops to secure our 'vision' on how we wanted the building to work and develop. One main concern was disruption to teaching and learning during the build process and this is the over-riding reason why the design concept put forward by Kier Western was eventually adapted and submitted for planning permission. Our ambition is to create an inspirational and integrated education complex, which incorporates the following:

- A landmark building in a landscape setting that incorporates the existing Soundhouse and Plymbridge Children's' Centre and Nursery School into its daily life.
- A place that is welcoming and secure.
- A place that allows everyone to work together – from early years through to adult learning.
- A building which will serve the local community with enriched facilities.
- A building which provides flexibility in the short term and adaptability to meet changing needs over time.

We have carried out two Design Quality Indicator workshops (DQIs) which we used to identify some practical issues which we wanted to ensure where addressed in the new building. These were:

- Spaces that are well proportioned, efficient and fit for purpose.
- A good clear layout which is easy to understand and follow and which is accessible for all.
- Circulation that is sufficiently generous to avoid problems often associated with movement around school premises.
- Long-term flexibility.

We wanted to make sure that the build quality of the new campus was:

- Robust in the use of materials, both inside and outside that will weather and wear well and are easy to maintain.
- Thermally efficient and comfortable with good natural lighting throughout.
- Sustainable in terms of its life cycle costing and CO2 emissions.

We wanted a building which:

- Would integrate into its urban and social setting, considering the needs of the wider community.
- Would encourage community access, make a positive contribution to public spaces and help to provide a secure external environment.

- Has both character and architectural ambition.
- Displays integrity in its design.

Building Research Establishment Environmental Assessment Method (BREEAM)

When Plymouth City Council were awarded the funding for the One School Pathfinder one of the targets set was to gain a rating of "very good" or "excellent" for sustainability and the environment.

BREEAM Assessors have been working with the design team to calculate a series of point scores for many different areas. An initial score of 55.59% was increased to 61.63% at a recent meeting at the College. This gives us a BREEAM rating of "very good".

The table below gives you an idea of how the scoring is calculated:

CATEGORY	NUMBER OF CREDITS AVAILABLE	WEIGHTING FACTOR
Management	20	15
Health and wellbeing	18	15
Energy Transport	19 6	 25
Water consumption	7	5
Materials and Waste	17	10
Land use and Ecology	12	15
Pollution	14	15

The total of these scores is the overall rating and a rating is awarded according to the following scale:

PASS	GOOD	VERY GOOD	EXCELLENT
25	40	55	70 100

See BREEAM Website for more information:
http://www.breeam.org/

Campus Information

Scheme Size

The scheme as designed has a gross floor area of 15,500 m^2 on a site of 120,000 m^2. This provides a Teaching area of 7,800 m^2 with 3,000 m^2 of Circulation space and 800 m^2 of Storage Space.

Some of the facilities of the new Campus will be available to the local community, the Library, Dining Hall, Main Entrance, Multi Use Hall, Sports Facilities, ATC and Youth Club representing 17% of the Campus Buildings. A total of 54% of the Campus grounds will also be available to the local community.

Energy Usage

The baseline annual energy consumption of the college has been calculated by Faber Maunsell using CIBSE (Chartered Institute of Building Services Engineers) good practice benchmarking data and by extrapolating data from the Building Regulations Part L - compliant IES (Integrated Environmental Solutions) models that have been prepared for similarly sized school projects.

A summary of the calculation findings is provided below in *Table 1* and *Table 2.*

Baseline Annual Energy Demand for the Development - Table 1.

Fuel Source	*End use*	*Annual site energy consumption (fuel burnt) (kWh/yr)*	*Annual site energy consumption (fuel burnt) (kWh/yr)*
Gas	Space Heating	1,198,080	1,872,000
	Domestic Hot Water	673,920	
	Lighting	81,096	
Electricity	Small Power	232,960	358,856
	HVAC (heating, ventilation, air conditioning) aux	44,800	

Table 1: Total annual energy consumption for the site broken down into its individual end uses.

Baseline Carbon Emissions Produced from the Development - Table 2

Fuel source	*End use*	*Annual CO_2 emissions by end use ($kg/C0_2/yr$)*	*Annual CO_2 emissions by fuel source ($kg/C0_2/yr$)*
Gas	Space Heating	232,428	363,168
	Domestic Hot Water	130,740	
	Lighting	34,222	
Electricity	Small Power	98,309	151,437
	HVAC (heating, ventilation, air conditioning) aux	18,906	

Table 2: Total estimated annual carbon dioxide emissions by use and fuel source.

Building Costs

The targeted basic building cost including the services costs and external costs is £2.1k/m^2.

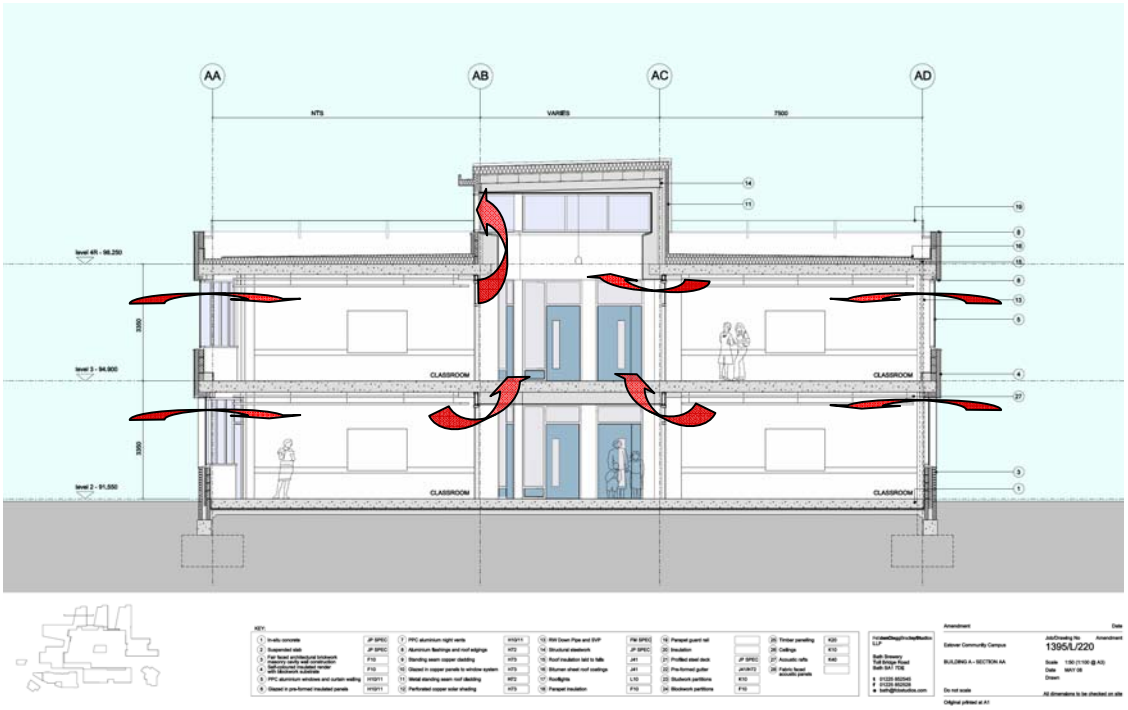
Sustainability

Key Innovative and Low Impact Features

The design of the new Campus incorporates various key and innovative features aimed at minimising the impact to the environment whilst improving the internal environment for the buildings occupants.

Natural Ventilation

The school design and choice of materials allows the buildings temperature to be regulated naturally controlling overheating in the summer months by the application of night time ventilation.



This diagram depicts airflow through the building, facilitated by the use of openable louvers fitted both internally and externally. The raised roof height in the centre of the clusters provides a ‘stack effect’ promoting the air to circulate through the building by drawing it through the internal space cooling the space within.

The high mass materials used within the structure cool overnight resulting in slowing the rate of heat gain during the proceeding day. Conversely in the winter months these same high mass materials store heat radiated internally during the day and thus slow the rate of internal cooling over the night time period.

Light and Occupancy Sensitive Lighting

The lighting controls within the new school will be light and occupancy sensitive so that lights are automatically dimmed or turned off depending on natural light levels and occupancy.

Localised Metering & Controls for Services

Services such as Gas, Water and Electricity will be installed with meters local to their point of use across the campus to assist in the monitoring and adjustment of building management and energy use.

Sustainable Technology

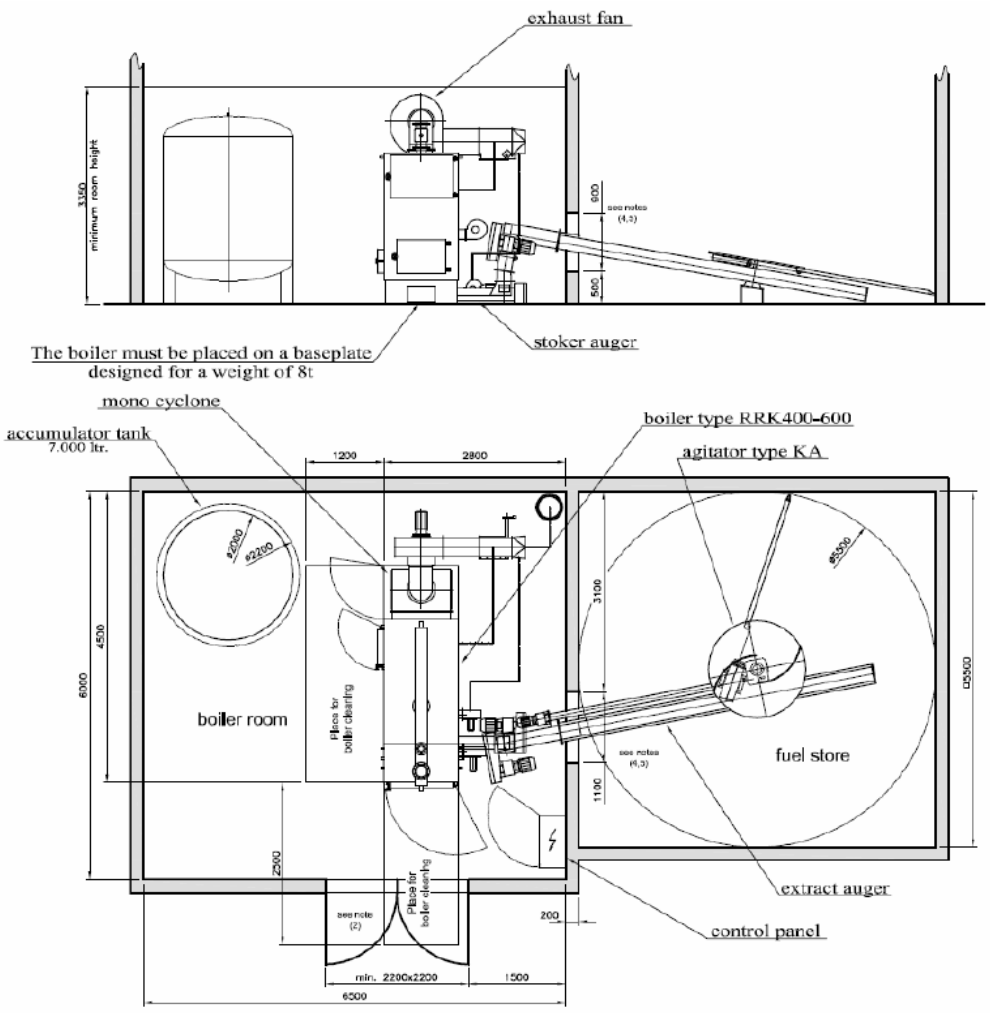
Biomass Boiler

A Biomass Boiler is to be installed to supply the hot water requirements of the Campus reducing the CO^2 emissions and the impact to the environment. Biomass is normally considered a carbon neutral fuel, as the carbon dioxide emitted during burning has been (relatively) recently absorbed from the atmosphere by photosynthesis and no fossil fuel is involved.

The Biomass used can be a by-product of other industries and the small quantity of energy needed for drying, sawing, pelleting and delivery are discounted. Building Regulations attributes some carbon emissions to Biomass (0.025kgCO2/m2), mainly to account for emissions created for its transportation.

Wood from forests, urban tree pruning, farmed coppices or farm and factory waste can be burnt directly to provide heat in buildings. Nowadays, most of these wood sources are commercially available in the form of wood chips or pellets, which makes transport and handling on site easier.

Modern systems can be fed automatically by screw drives from fuel hoppers. Electric firing and automatic de-ashing are also available and systems are designed to burn without emitting smoke to comply with the Clean Air Act.



This typical arrangement is representative of the type and size of system that is being installed.

Calculations indicate that a 513kW biomass boiler would be able to provide 80% of the annual energy demand, with the remaining energy demand being provided by a standby gas boiler.

The energy output and carbon savings associated with the installation of a 513kW biomass boiler are shown in Table 3 below:

Building	Annual DHW and space heating energy consumed by campus (kWh/yr)	Annual energy output that the biomass boiler must provide (kWh/yr)	Power capacity of biomass boiler selected (kW)	Annual C02 emissions saved ($kg/CO_2/yr$)
Entire campus	1,872,000	1,347,840	513	248,414
% of overall annual site energy consumption			60%	
% reduction in total site CO_2 emissions			48%	

Table 3: Annual energy output and carbon savings derived from a 513kW Biomass Boiler

The following assumption was made during the above calculations:

- The biomass boiler is assumed to have the same efficiency as a conventional gas-fired boiler (≈ 87%)

Photovoltaic (PV) Panels

PV Panels are to be installed as part of the scheme to help provide some of the electricity requirements needed by the Campus.

PV systems convert energy from the sun into electricity through the use of semi conductor cells connected together and mounted into modules. These modules are connected to an inverter that converts direct current (DC) into alternating current (AC), which is then usable in buildings. PV systems can either supply electricity to the buildings to which they are attached or, when the building demand is insufficient, to the electricity grid, called 'exporting'.

There are three principal types of photovoltaic cell, polycrystalline, mono-crystalline and thin film. A fourth variety, a hybrid, utilises both thin film and polycrystalline silicon to combine the improved efficiencies of thin film in overcast conditions with the greater conversion efficiencies of polycrystalline to improve performance.

Faber Maunsell has selected monocrystalline cells because they require the least surface area per kWp (Kilo Watt Power) generated.

Mono-crystalline PV Panels