UNIVERSITY OF LIVERPOOL
CROWN COURT STUDENT RESIDENCES

PLANNING SUBMISSION – ENERGY STRATEGY & RENEWABLES STATEMENT

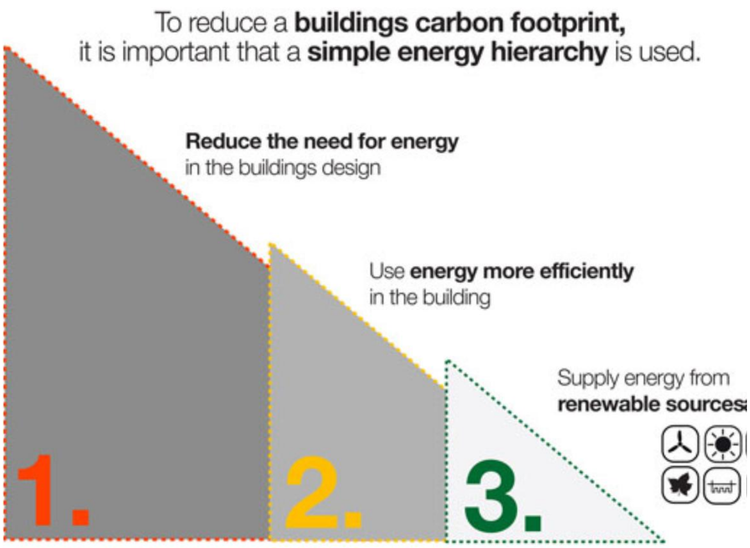
Date: 10th May 2012

Targets:
The proposed design strategy will satisfy the following key criteria:

- Building Regulations Part L2A (2010)
- Planning Policy Statement 22
- BREEAM Excellent

Our preliminary design analysis also confirms that the design strategy achieves an EPC 'B' rating.

Energy Reduction Strategy:
We have adopted a three stage energy reduction strategy which looks to reduce the development's energy demand by passive means in the first instance, then to use high efficiency / low energy building services systems and finally to deploy appropriate on site renewable energy generation. This approach is summarised in the following diagram.



To identify precisely how this approach has been applied to the proposed student residences development, the energy reduction strategy for each system is defined in the following table.

	Measure	**Description**	**Benefit**
Heating	Improvement of thermal performance of the fabric	Improved U-values and air permeability over and above those required by Approved Document L2A.	Reduced heat loss
	Careful design of the glazing provision	Maximised day-lighting and optimised benefit from controlled solar gain in winter.	Reduced annual demand on the heating system
	High performance glazing	Improved U-values and low E internal coating to reflect heat within the building.	Reduced heat loss
	Use of thermal modelling software in design	This allows us to be significantly more accurate in design and take account of known gains in winter which can help to reduce design "margins on margins". The size of emitters, pipework and plant can therefore be selected with greater	Greater system efficiency and reduced fuel consumption

		precision and the system can be designed to be smaller and harder working, hence operating at peak efficiency for greater periods of time	
	Use of the University CHP / District Heating System to satisfy 100% of the total heating and domestic hot water load.	We have quantified the total thermal loads for each block as follows: • Block 1: 611kW • Block 2: 730kW • Block 3: 328kW The total thermal load for the entire development (1.67MW) shall be supplied by the existing energy centre CHP / District Heating System.	Significantly reduced carbon emissions
	Air Source Heat Pumps for Heating	Air Source Heat Pumps shall be employed in the few areas which require comfort cooling. These include: • Server Rooms • Hub Rooms • Social Hub: Control Room, Reception and Sorting / Parcel room.	An alternative means of providing heating in conjunction with mechanical cooling where required.
Hot Water	**Measure**	**Description**	**Benefit**
	Use of flow restricted taps	These deliver a controlled amount of hot water	Reduced consumption, hence reduced wastage of water and heat
	Use of automatic isolation valves to communal toilet areas	This ensures a positive shut off to areas which could be subject to unnoticed leaks. This will limit the impact of any leaks which do occur	Reduced consumption, hence reduced wastage of water and heat
	Use of intelligent metering to provide leak detection	This will allow any unusual usage to be quickly identified, investigated and remedied. Leaks inside and outside the building will be detected, together with any flow rates or periods of use which are outside of normal parameters	Less wastage through leaks, hence reduced heat consumption
	Use of the University CHP / District Heating System to satisfy 100% of the total heating and domestic hot water load.	See heating above.	See heating above.
Small Power	**Measure**	**Description**	**Benefit**
	Phase balanced design	This ensures that the use of electricity is efficiently balanced across all three phases. As the amount of electricity drawn is affected by the peak demand of any one phase, to ensure a similar load	Reduced demand and improved efficiency

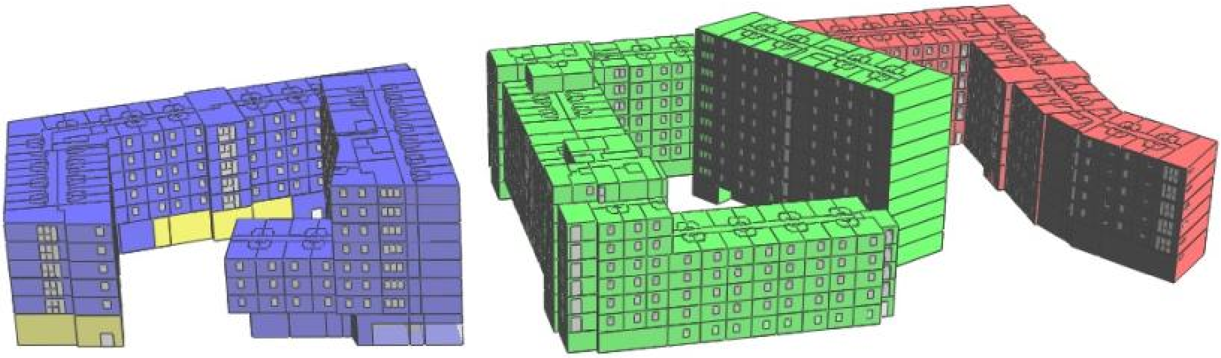
		profile across all three phases reduces the peak and hence ensures that electricity is used efficiently	
	Power factor correction	To balance still further the phases and deal with the occupant driven phase imbalances which cannot be designed out	Reduced demand and improved efficiency
	Mechanical systems will be selected to maximise energy efficiency and reduce electrical demand	This will be achieved through the use of such technologies as demand matched variable speed pumps and fans, high efficiency motors, etc	Reduced electricity consumption
Ventilation	**Measure**	**Description**	**Benefit**
	Social hub Areas: Mixed mode localised ventilation systems.	Reduction in electricity consumption due to limited usage period of fans	Reduced electricity consumption
	Heat recovery	To maximise heat reclamation from exhaust air	Reduced demand on heating system
	Demand matched ventilation	Systems will only operate at boost levels when required through the use of zoned controls and variable speed fans	Reduced electricity consumption, reduced demand on heating system and reduced demand on cooling system
	Occupancy sensors	In conjunction with the lighting controls, these will be provided where appropriate (with manual override) to ensure that localised MVHR systems in the Social Hub are not left on when rooms are unoccupied.	Reduced electrical demand
Cooling	**Measure**	**Description**	**Benefit**
	Limited scope of cooling	Only employ cooling where absolutely unavoidable, i.e. as a consequence of the internal process such as heat gains emanating from the server room equipment.	Reduced electrical demand from condensers and fans
	High coefficient of performance	Systems with will be specified to ensure that where cooling is used it is extremely energy efficient	reduced electrical demand from condensers
	Air Source Heat Pumps for Cooling	Air Source Heat Pumps shall be employed in the few areas which require comfort cooling. These include: • Server Rooms • Hub Rooms • Social Hub: Control Room, Reception and Sorting / Parcel room.	An alternative means of providing heating in conjunction with mechanical cooling where required.
Lighting	**Measure**	**Description**	**Benefit**
	Dynamic modelling	Using our IES dynamic simulation modelling software) we are able to design the quantity, size and	Reduced operating periods for electric lighting system,

		position of windows to maximise the provision of quality daylight into the building. We analyse daylight factors, uniformity and glare to ensure that we provide daylight levels which are useful and do not result in a "blinds down, lights on" scenario on sunny days	hence reduced electrical consumption
	High efficiency fittings	The electric lighting system will be designed around energy efficient products, utilising high frequency ballasts and energy efficient lamps	Reduced electrical consumption
	High efficiency external lighting	All external lighting shall incorporate daylight (photocell) sensors and time controls to ensure that the system is only operational when needed	Reduced electrical consumption
	Daylight linking technology in Social Hub Areas	All electric lighting systems in occupied rooms with windows will be provided with daylight linking technology. This will ensure that the lights will dim or even turn off whenever there is sufficient natural daylight available. The lighting system will be designed to operate as a top up to the natural daylight design, rather than from a "default on" perspective	Reduced electrical consumption
	Occupancy sensors in Social Hub and Circulation Areas.	These will be provided where appropriate (with manual override) to ensure that lights are not left on when rooms are unoccupied. Again, the default scenario for the lighting system will be off. NB: Circulation areas will have maintained minimum lux levels for emergency circulation at all times.	Reduced electrical demand

We have used IES dynamic thermal modelling software to provide guidance on the following key issues:

- Building Thermal Performance
- Solar Overheating Risk
- Energy Performance
- Carbon Performance
- Demonstrate compliance with Building Regulations Part L
- Likely EPC Rating

Using this software, we are able to augment elements of proposed construction material (i.e. fabric U Values) in conjunction with alternative energy strategies, in order to deliver a best value holistic solution. With each iteration, we are quickly able to run a performance model to assess impact on Part L Compliance etc.



IES Thermal Model for Blocks 1, 2 & 3

It has been agreed that the development will aspire to exceed Part L by around 25%. To this end, we have used the following 'enhanced' U Values for the purposes of our initial proposals:

- Walls 0.28W/m2K
- Roof 0.25W/m2K
- Ground 0.2W/m2K
- Glazing 1.76W/m2K (g=0.66)
- Air permeability 5m3/m2/h

All of our modelling calculations have been based on an assumed carbon factor for the CHP system of 0.13kgCO2/kWh.

BEMS Controls:
An approved Controls Specialist shall be appointed for the design, supply, installation, testing and commissioning of the BEMS to control and monitor all engineering systems and specialist equipment where appropriate.

The control and monitoring of the services will be carried out by a BEMS system utilising DDC techniques and will be installed to provide and integrate the following functions:

- Control, optimum stop/start monitoring and data logging of all centralised plant
- Monitoring and data logging of equipment failure alarms/faults
- Graphic displays of building system status
- Remote connection from other areas on the university campus to enable change of set points of all plant and equipment and general monitoring of alarms
- Sub Metering Analysis
- Interface with Fire Alarm System
- Interface with internal & external lighting systems
- Interface with CCTV system

BREEAM credits have been taken for the following areas, which will benefit from plant performance monitoring control functions provided by the BEMS:

- Commissioning Monitoring
    - Commissioning shall be carried out in line with best practice and all current Building Regulations and BSRIA/CIBSE guidelines where applicable
    - A specialist commissioning agent shall be appointed for all complex systems

- Seasonal commissioning shall be carried out during the first year of occupation

The BEMS shall interface with the external lighting system and the internal lighting system in the social hub space and all primary circulation spaces (but excluding corridors).

A BEMS compatible PC shall be provided within the social hub reception area to provide localised control function however, all primary control management is envisaged to be done remotely by the University Central Estates Team via the ICT network.

Metering:
The sub-metering proposals for visual display energy monitoring purposes shall be as follows:

- Electric meters per cluster (which may be combined lighting & power providing TM39 is met)
- Communal areas shall be metered separately (lighting only, as cleaners sockets shall be fed via cluster distribution boards)
- External lighting shall be metered separately
- Water metering shall be per building
- Each block will however have a heat meter on both the heating and domestic hot water circuits

The BEMS shall be linked to a designated information screen within the Social Hub to display Energy Performance Data for each block / cluster, which has been gathered via cluster sub-meters and block wide heat meters for both heating and domestic hot water.

Information to be displayed:

- Per Block:
  - Total Water Consumption
  - Total Heating Energy
  - Total Domestic Hot Water Energy
  - Total Electricity Consumption

- Per Cluster:
  - Electricity Consumption (via sub-meter)

- Water Consumption (as proportion of block overall)
- Heating Energy (as proportion of block overall, via heat meter)
- Domestic Hot Water Energy (as proportion of block overall, via heat meter)

Energy / Carbon Usage Predictions:
We have used IES Virtual Environment (a dynamic thermal modelling software package) to estimate the energy demands of the building over a typical year. Our preliminary modelling work demonstrates that for each block the Building Emission rate (BER) is less that the corresponding Target Emission Rate (TER) as follows:

Block	Target Emission Rate (TER) $kgCO_2/m^2$	Building Emission Rate (BER) $kgCO_2/m^2$
1	40.8	30.5
2	39.1	28.4
3	40.8	29.9

BER vs TER Summary

We have used various iterations to demonstrate the energy/ carbon saving benefits of employing Mechanical Ventilation with Heat Recovery (MVHR) as opposed to Mechanical extract Ventilaion (MEV) only. Example excerpts below:

	$kgCO_2/m^2.yr$	Heat	Cool	Aux	Lights	DHW	Equip*	BER	TER/ NER	% difference
MVHR	Total	4.36	0.08	2.77	5.85	17.44	7.60	30.5	40.8	-25.3
MEV		8.68	0.08	1.27	5.85	17.44	7.60	33.3	39.6	-15.9
*-Equipment excluded when producing rating										

Block 1: **Carbon** Performance Summary

	$kWh/m^2.yr$	Heat	Cool	Aux	Lights	DHW	Equip*
MVHR	Total	33.32	0.15	5.35	11.32	127.93	14.71
MEV		66.47	0.15	2.46	11.32	127.93	14.71
*-Equipment excluded when producing rating							

Block 1: **Energy** Performance Summary

Block	System	kWh/year	Kg CO2/year	Total Energy Cost £ / year
1.00	MVHR	2301985.98	454952.1	£139,356
	MEV	2663320.64	627021.91	£152,338
2.00	MVHR	2728459.07	537030.51	£166,331
	MEV	3178579.92	578705.62	£182,416
3.00	MVHR	1342632.57	274271.25	£83,707
	MEV	1559855.4	294351.23	£91,492

Annual Total Energy Costs

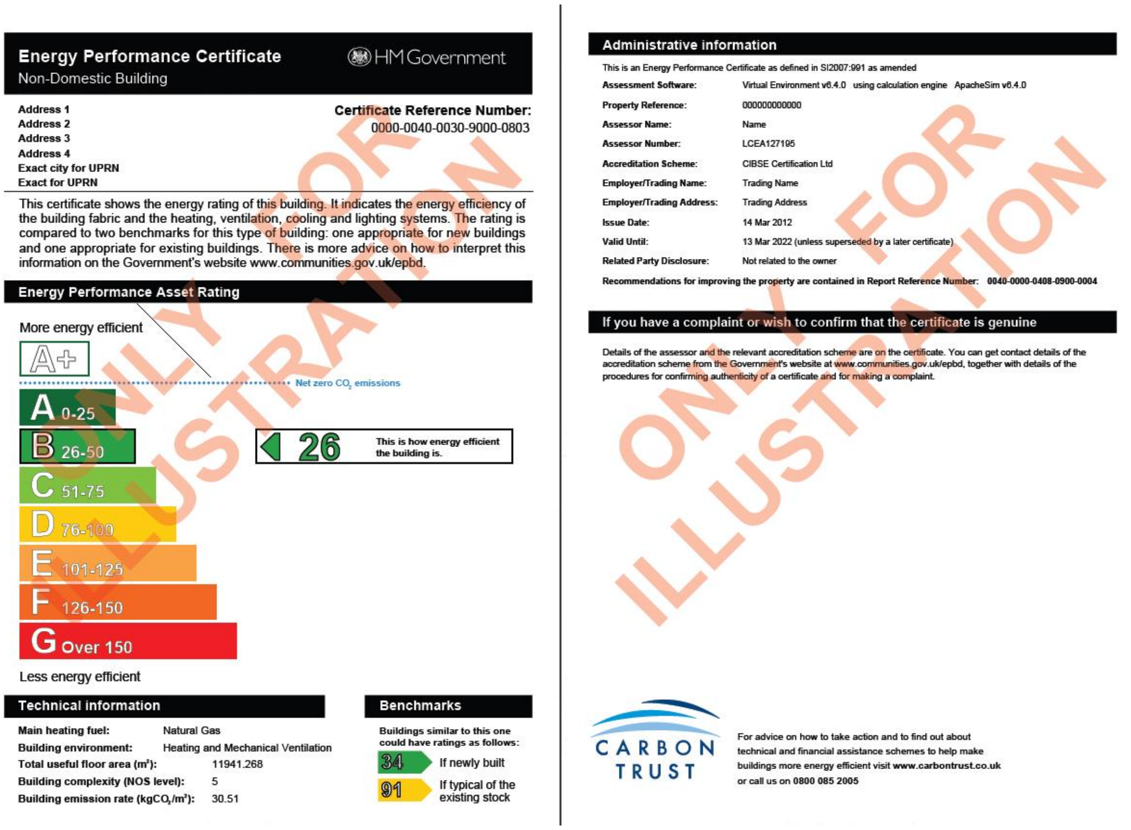
So based on the proposed MVHR approach, the total annual energy cost for the entire development (based on the compliant 1053 bed scheme) is circa £389,394.

NB: We must clarify that all energy / carbon data and approximated energy costs are indicative only based on the preliminary modelling data which has been used for the Stage 2 tender submission model. At this stage, these figures should not be relied upon for any other purpose than indicative guidance. Clearly, all such data will be developed and fully validated during the detailed design process.

Use of Renewable Technologies:
The entire heating and domestic hot water load is delivered via the existing energy centre gas fired CHP / district heating system. This strategy surpasses the requirements of Building Regulations Part L2 (2010) and Planning Policy Statement 22 in respect of the percentage of overall energy / carbon which should be provided by on site renewable / low energy technologies.

Building Regulations Part L2A (2010):
An initial Part L2A (2010) BRUKL simulation has been run for each block. Refer to the attached BRUKL Output Documents for Blocks 1, 2 and 3.

EPC:
We have run the EPC calculation check and can demonstrate that the current Block 1 model achieves an EPC rating of 26, which equates to a comfortable 'B' rating.



Energy Performance Certificate
Non-Domestic Building

HM Government

Address 1
Address 2
Address 3
Address 4
Exact city for UPRN
Exact for UPRN

Certificate Reference Number:
0000-0040-0030-9000-0803

This certificate shows the energy rating of this building. It indicates the energy efficiency of the building fabric and the heating, ventilation, cooling and lighting systems. The rating is compared to two benchmarks for this type of building: one appropriate for new buildings and one appropriate for existing buildings. There is more advice on how to interpret this information on the Government's website www.communities.gov.uk/epbd.

Energy Performance Asset Rating

Technical information

Main heating fuel:	Natural Gas
Building environment:	Heating and Mechanical Ventilation
Total useful floor area (m^2):	11941.268
Building complexity (NOS level):	5
Building emission rate ($kgCO_2/m^2$):	30.51

Benchmarks

Buildings similar to this one could have ratings as follows:

34 If newly built
91 If typical of the existing stock

Administrative information

This is an Energy Performance Certificate as defined in SI2007:991 as amended

Assessment Software:	Virtual Environment v6.4.0 using calculation engine ApacheSim v6.4.0
Property Reference:	000000000000
Assessor Name:	Name
Assessor Number:	LCEA127195
Accreditation Scheme:	CIBSE Certification Ltd
Employer/Trading Name:	Trading Name
Employer/Trading Address:	Trading Address
Issue Date:	14 Mar 2012
Valid Until:	13 Mar 2022 (unless superseded by a later certificate)
Related Party Disclosure:	Not related to the owner

Recommendations for improving the property are contained in Report Reference Number: 0040-0000-0408-0900-0004

If you have a complaint or wish to confirm that the certificate is genuine

Details of the assessor and the relevant accreditation scheme are on the certificate. You can get contact details of the accreditation scheme from the Government's website at www.communities.gov.uk/epbd, together with details of the procedures for confirming authenticity of a certificate and for making a complaint.

CARBON TRUST

For advice on how to take action and to find out about technical and financial assistance schemes to help make buildings more energy efficient visit www.carbontrust.co.uk or call us on 0800 085 2005

EPC Asset Rating – Block 1 (but will apply to all blocks)