Police and Crime Commissioner for Merseyside - OCC

Energy Statement

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1.0 Introduction

1.1 This Energy Statement supports the Full Planning Application for the proposed new Merseyside Police OCC seeking approval from Liverpool City Council.

1.2 This Energy Statement seeks to fulfil Liverpool City Council's policy requirements for new developments which are outlined in Liverpool City Council's emerging Local Plan as well as also other relevant national, regional and local policies and legislation.

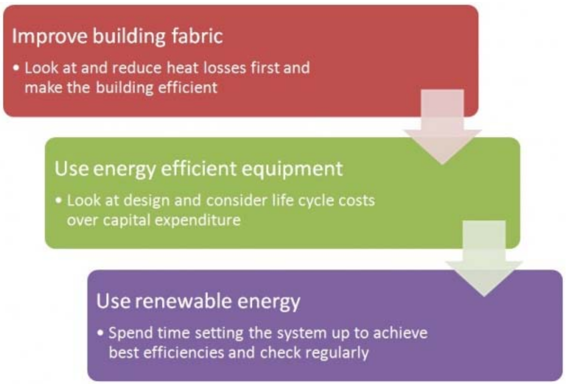
1.3 Liverpool City Council's emerging Local Plan Core Strategy (submission draft 2012) details requirements for energy efficient and low carbon design to which this Energy Statement responds. Specifically, this Energy Statement seeks to outline our design approach in line with the requirements of Core Strategy policies 31 and 32:

- **Strategic Policy 31**. Ensure high levels of energy and water efficiency and a sustainable approach to construction and use of materials. This should include meeting higher levels of the BREEAM standard. (Level of BREEAM standard not specified).
- **Strategic Policy 32**. Development proposals should incorporate decentralised or LZC energy production to account for 10% of energy. This is applicable to non-res developments over 1000m2 gross floorspace.

1.4 In addition to compliance with planning policy requirements, Merseyside Police's overarching carbon target requires a 34% reduction in carbon emissions (estate and fleet operations) from 2008-09 baseline by 2019. The new OCC is expected to play a considerable role in achieving this target.

2.0 Energy Efficient Design Approach

2.1 In order to achieve inherent energy efficiency and associated carbon and cost savings, the OCC design follows the Energy Hierarchy approach:



2.2 Command centres are intrinsically high users of energy. A solution has been found that maximises free cooling, free daylight and energy efficient LED lighting. Further environmental loads are dealt with efficiently through use of base load CHP. Finally, green energy is provided by a PV array.

2.3 The following sections outline how OCC design at Stage C responds to the principles of the Energy Hierarchy.

2.4 Improve Building Fabric & Form

- Fabric improvements U values improvements over current Building Regulations to maximise the thermal performance of the building envelope and minimise heat loss and solar gain;

Element	Description	u-value
Wall/ spandrel	Lightweight external rainscreen; insulation and gypsum wallboard lining	0.26
Internal partition	12.5mm layers of gypsum wall board either side of framing system with empty cavity	1.8
Roof	External insulation sat on exposed concrete soffit. No suspended ceiling.	0.19
Soffits	Exposed concrete soffit. No suspended ceiling.	N/A
Raised access floor	Raised access floor comprising chipboard flooring and service void	N/A

- Insulated glazed facade with carefully coordinated clear and solid elements
- Solar control glazing with solar exposed g-values of 0.23 or less
- Reduction of air permeability levels to mitigate uncontrolled heating and cooling loads;
- Window frames with thermal brakes and multiple glazing with insulating layer to provide thermal brakes and reduce heat losses;
- Building envelope designed to achieve high levels of thermal insulation;
- The strategy depends on spectrally selective solar control glazing. In comparison to reflective or absorptive solar control, spectrally selective glazing retains a relatively neutral appearance (it’s usually slightly tinted) whilst simultaneously filtering out solar gain and allowing daylight in.

2.5 Energy Efficient Building Services

Energy Efficient Lighting:

- Energy efficient lighting which has external Passive Infra Red (PIR) sensors or time switch controls that switch off the lights when they are not needed;
- Low energy LED lighting to reduce energy consumption;
- Zoned internal and external lighting scheme to reduce unnecessary lighting when the hotel is less busy;
- External lighting uses energy efficient luminaires that provide a more even light distribution thus reducing the number of lights required and so reducing the energy requirement across the site.
- Open plan offices utilise local task lighting (this doesn't demonstrate any benefit in the NCM calculation but will have a real world energy benefit);
- Small cellular offices do not have task lighting;
- Photoelectric dimming is used (applied via simple SBEM method);
- Occupancy sensing is used throughout;

Heating & Ventilation:

- Central VAV air handling with low SFP (effective or diversified SFP < 1.51 W/l/s)
- High efficiency cooling with SEERs > 5.5 (including heat rejection)
- Condensing boilers with weather compensation
- Variable speed pumping with multiple sensors in the system
- Accurate space heating controls for core areas;
- 'A' rated class 5 high-efficiency gas boilers;
- Heat from the exhausted air (via thermal wheel or plate heat exchanger) to pre-heat incoming fresh air supply;
- Demand control ventilation;
- Demand control ventilation optimises efficiency of supply.

Power Management:

- Energy Efficient Small Power Items to reduce unnecessary waste;
- BMS with capability for Automatic Measurement and Targeting
- Extensive sub metering to CIBSE TM 39 standards. Meters provide real-time data to BEMS;
- A rated energy efficient white goods. Low energy catering equipment;
- Development of an energy efficient ICT strategy for general office space and Data Centre in collaboration with the Merseyside Police ICT Working Group.

3.0 Low Carbon Technologies

3.1 At Stage C, a renewable energy feasibility study was undertaken in order to establish which technologies may be suitable for the OCC.

3.2 The table below summarises the low and zero carbon energy technologies were considered as part of the renewable energy feasibility study.

LZC Technology	Photovoltaics	Solar Hot Water	Combined Heat and Power (Co-Generation)	Combined Cooling Heat and Power (Tri-Generation)	Ground Source Heat Pump
					
Overview	Photovoltaic cells transform the sun's energy into electricity. Southerly facing pitched roofs over the development would be suitable for PV installation. Feed-In-tariffs may assist with economic viability of this option.	Solar water collectors harness the direct and diffuse thermal radiation from the sun and transfer it to a water circuit to provide low grade heat.	Combined Heat and Power technologies generate heat and electricity simultaneously. The efficiency of these units is high in comparison to traditional supply of gas and electricity.	CCHP energy schemes integrate Combined Heat and Power (CHP) systems with absorption chillers. Waste heat provides energy to produce chilled water which is then used for cooling.	Ground Source Heat Pumps (GSHP) use the energy stored in the ground to provide low grade heat in winter. They can also be used to provide cooling in summer.
Landuse	PVs are generally installed at roof level, south-oriented to maximise solar heat absorption..	Solar hot water panels are generally installed at roof level, south-oriented to maximise solar heat absorption.	Space required in the plant room for the generator and for its maintenance.	Space required in the plant room for the generator and for its maintenance.	A vertical borehole heat exchanger array could be considered in the car park area although this may be difficult to achieve in practice.
Noise	A PV system is completely silent in operation.	Solar collector is silent in operation.	There may be noise and vibration associated with generation of energy.	There may be noise and vibration associated with generation of energy.	Noise levels of ground source heat pump installations are generally low.
Applicability to OCC	Sufficient roof area is available on the main building and the energy centre to accommodate a PV array on the south/south-east aspects.	The occupancy of the OCC is likely to require a considerable hot water supply (toilet areas, laboratory cleaning facilities, catering) and therefore	To be cost effective the unit needs to run between 4,000 and 5,000 hours each year. The consistent 24 hour substantial electricity demand of the data centre and the heating	As for CHP. Energy profile is favourable towards CCHP due to the high constant cooling demand of the Data Centre.	Ground conditions may preclude the application of GSHP. Potentially large capital cost associated with bore hole geotechnics.

		STHW may be suitable to meet this demand in part.	demand presented by the high occupancy of the OCC would lend itself to efficient operation of a CHP.		
Recommendations	To be considered.	To be considered	To be considered. Energy profile would be suitable for efficient operation of CHP and space is available for housing the unit within the energy centre.	Preferred option at this stage. Energy profile would be suitable for efficient operation of CCHP given high electricity, heating and cooling demand year round.	Potential. Likely other technologies will be more viable.

3.3 Following the renewable energy feasibility study a Building Regulations Part L2A assessment for the OCC was undertaken. The Part L2A report (BDP, 29/06/15) outlines the following low carbon technology strategy which, in conjunction with the aforementioned energy efficiency measures demonstrates compliance with the Part L2A building regulations and achieves a 7.5% improvement margin above the TER (Target Emissions Rate):

3.4 Photovoltaics

300m2 of PV, oriented south at an inclination of 10degrees. This equates approximately to 47kWp with an annual yield of 800kWh/kWp

3.5 CHP

- 2No. 75kWthermal CHP units run in series
- 49% thermal efficiency at 100% output
- 31% electrical efficiency at 100% output
- 49% thermal efficiency at 50% output
- 26% electrical efficiency at 50% output
- Initial findings showed that such a unit should operate for > 6000 run hours per annum

4.0 BREEAM Energy Credits

4.1 A BREEAM 2014 New Construction assessment is being undertaken for the OCC in line with Merseyside Police's requirement for the development to achieve a BREEAM 'Very Good' rating.

4.2 Of the 23 available credits achievable within the BREEAM Energy section 11 credits are assumed likely, with potential to achieve a further 5 considered possible.

4.3 The table below demonstrates how the design will performance against each of the Energy section credit requirements and the strategy for achievement.

		Achievable	Target	Potential	Comments
Ene 01	Reduction of energy use and carbon emissions	12	3	6	Based on the proposed building services strategy and envelope performance it is predicted that the building will exceed the requirements of Part L 2013. Achieving a 7.5% improvement over Building Regulations in all areas will achieve 3 credits.
Ene 02	Energy Monitoring	2	2	2	**Credit 1:** Design should ensure that LV, low temperature hot water, chilled water and gas achieve or exceed the requirements of CIBSE TM39 and Part L 2013, and that all meters are read by the building energy management system. Main plant should be directly metered, with individual gas meters to each boiler and CHP unit. The outline schematics appear to be compliant, subject to detailed design development. **Credit 2:** Each floor plate is to be separately metered for lighting and small power, preferably with wings of the building metered. High load areas should be sub-metered, such as on floor comms rooms, the data centre and possibly laboratory areas.
Ene 03	External Lighting	1	1	1	**Credit 1:** External lighting achieves an efficacy of at least 60 lumens per circuit Watt and is controlled by timer and/or daylight controls. This credit should be simple to achieve with current high efficiency fittings, although careful selection of uplighters and bollard luminaires may be required. This credit is targeted.
Ene 04	Low Carbon Design	3	2	2	**A** study has been undertaken at Stage C in to the application of passive design measures, resulting in some areas of the building that are naturally ventilated, with others that are designed to operate as mixed mode spaces. In order to achieve this credit the energy savings achieved through adopting the passive design strategy will need to be quantified using the Part L compliance software. This credit is targeted. **Credit 2:** Whilst the building utilises a free cooling approach to some areas of the building, as it is not applied throughout this credit is not achievable. **Credit 3:** BDP has undertaken an initial LZC feasibility study, resulting in a combination of technologies and approaches being proposed for the building. In order to achieve this credit the savings from LZC technologies must be at least 5%. This will contribute to achieving MPA's carbon plan targets. This credit is targeted.

Ene 06	Energy Efficient Transportation Systems	3	3	3	**Credit 1:** It was agreed that the Contractor's tendering Lift Contractors should be required to undertake lift traffic analysis and an energy review of the lifting strategy as part of their Stage 1 tender in line with CIBSE Guide D, and select an energy efficient lifting strategy. Energy consumption for the optimum solution should be calculated in accordance with IS 25745. The viability of regenerative drives should be tested. This credit is targeted. **Credit 2:** Energy efficiency measure to be specified including VVVF drives, low energy lighting and standby mode. Regenerative drives should be specified if they prove to be viable. This credit is targeted.
Ene 08	Energy Efficient Equipment	2	0	2	The feasibility of achieving this credit should be reviewed by the design team, dependent on the extent of reuse of IT equipment from other buildings and the design of the data centre. This will depend on Merseyside Police's requirements.

5.0 Conclusion

5.1 Based on the energy strategy outlined in this report, the Building Regulations Part L2A assessment BRUKL output document provided within the Energy (BRUKL 2013) Report (BDP, 29.06.15) provides the following conclusions on energy consumption and production via low carbon/renewable technologies.

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	13167.5	13167.5
External area [m^2]	18463.8	18463.8
Weather	MAN	MAN
Infiltration [m^3/hm^2@ 50Pa]	3	3
Average conductance [W/K]	6067.65	5481.65
Average U-value [W/m^{2}K]	0.33	0.3
Alpha value* [%]	9.74	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
3	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Inst.: Hospitals and Care Homes
	C2 Residential Inst.: Residential schools
	C2 Residential Inst.: Universities and colleges
	C2A Secure Residential Inst.
	Residential spaces
	D1 Non-residential Inst.: Community/Day Centre
	D1 Non-residential Inst.: Libraries, Museums, and Galleries
	D1 Non-residential Inst.: Education
	D1 Non-residential Inst.: Primary Health Care Building
	D1 Non-residential Inst.: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs and Theatres
	Others: Passenger terminals
88	Others: Emergency services
10	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others - Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	64	35.03
Cooling	28.48	33.35
Auxiliary	46.89	29.63
Lighting	46.21	56.51
Hot water	42.49	23.26
Equipment*	195.87	195.87
TOTAL**	198.35	177.77

* Energy used by equipment does not count towards the total for calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	2.86	0
Wind turbines	0	0
CHP generators	29.73	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	549.8	563.71
Primary energy* [kWh/m^2]	402.59	428.77
Total emissions [kg/m^2]	67.6	73.1

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable

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5.2 The BRUKL output demonstrates that energy production via the proposed CHP and PV will produce 32.59kWh/m2. Based on predicted building energy consumption of 198.35kWh/m2, renewable energy contributes to 16.4%of the building's total energy demand and is in compliance with the requirements of Local Plan Core Strategy Strategic Policy 32.