CITY UNIVERSITY LONDON

Energy Standard Guidelines

	Requirement
General	City University London is determined to reduce its carbon footprint through good standards of design of its buildings and services. Many mechanical and electrical practices are tried and tested and have not changed for many years which can be out of step with modern equipment and technologies. As a learning institution, the University expects that designers will try and push the boundaries and look to new techniques and solutions to make the University an exemplar to both its own students and its peers in the higher education sector
Design	The approach of project managers and design engineers/consultants generally depends on whether the project is a new build or a refurbishment. However, regardless of this, it is vital to avoid over design for active systems. New build needs to focus on designing energy efficient systems and making best use of passive measures by designing out building services where possible. Refurbishment may prevent the exploitation of passive measures due to limitations of the building and/or spaces in question and therefore, should concentrate on upgrading systems through repair or replacement and general upgrading. In view of this, project thinking needs to be challenged and a close eye kept on what is being specified. The long term operating and maintenance costs are often several times that of the installation costs and life cycle costing should be carried out in all situations where there is a more expensive and efficient alternative. One past issue for the University has been the lack of joined up thinking regarding the integration of refurbishments and project work into the existing infrastructure and buildings. Consultants tend to prefer to look at their projects in isolation as they are not willing to take on the risk of existing systems where there are “unknowns” which may cause their design to not function in the intended manner. The University needs to take this on board and be willing to take on some of the risk in these situations provided that they have been outlined from the outset.

	The University assesses projects using the RICS SKA Assessment model. Therefore, any Good Practice Measures identified at the pre design assessment must be included, unless they have been proven technically unviable.

The lists below set out some of our requirements for minimum energy standards. They are intended to act as guidance but it is not our intention to stifle innovation and alternative means of achieving efficient and consistent designs. We welcome feedback both good and bad on these guidelines so that we can develop and refine them for the future.

All items should be cross referenced with all other City University Standard specifications as appropriate.

Heating and Boiler Plant	It is the University's position that wherever possible and reasonable heating and hot water systems should be fed from existing central plant. • Electric heating and hot water provision should be avoided where possible. If there is no other option then it will be required to be fitted with effective controls to ensure operation is only when required. • Look for opportunities to provide additional controls if appropriate such as TRVs zone controls, weather compensation, etc. • Discuss any alterations to systems with maintenance and energy staff beforehand as there may be other implications from undertaking a piece of work. • Where complaints are received regarding under- heating, investigate the possible causes including air/sludge in the system, under-sizing of heat emitters, poor insulation, draughts etc. • Look at opportunities to improve pipework insulation to all heating and hot water pipes such as when ceilings are removed or risers are exposed. • Insulate pipework passing through spaces that provide no useful heat to reduce heat gain to the space. This is especially critical where air conditioning is installed. • All valves, flanges and fittings should be insulated using flexible removable covers with Velcro and string fasteners. • New heating designs on existing systems should use 90°C flow 60°C return to improve operating efficiency of existing plant and incorporate 2 port control. New installations with condensing boiler plant should look to operate on 65°C flow and 45°C return. The 20°C ΔT means that pipe and pump sizes are reduced (minimising electrical load and system noise) and the boilers will condense for most of the year.

	• Where new boiler plant is to be installed, condensing boilers should be favoured over other types. They must have fully modulating burners and where they use forced draught burners these should be of the variable speed drive type rather than use of an air damper to control combustion rates. • Multiple boiler installations should be specified as a single boiler installation is not acceptable with the exception of domestic properties. • Multiple condensing boilers should be operated at their lowest possible load and therefore will require different control strategy to enable all of them to operate simultaneously rather than once each one reaches its full load. • In multiple boiler installations, provision should be made to isolate boilers hydraulically when not on line to minimise standing losses using the control system and motorised valves. • New pumps must be inverter driven variable speed drive with high efficiency motors and set to ensure that they alter automatically to suit system requirements. • Older panel radiators (see standard radiator specification) should be replaced during refurbishments to improve heat output and efficiency. • Underfloor heating should be considered in refurbishments which require significant alterations to floor construction.
Hot Water	• Hot water should be derived from central systems where they exist and are within a reasonable distance of the proposed location. • Electric water heating should be avoided where possible but if it is required then it should be fitted with full time and temperature control. • Plate heat exchangers and buffer vessels where required should be selected in preference to storage calorifiers. • Consideration should be given to providing hot water independently to heating depending on boiler configuration. Condensing gas fired water heaters should be specified for this situation. • All pipework should be insulated and flexible insulation jackets should be installed on all valves, flanges and fittings.

	• Mixing thermostatic valves should be installed local to the outlets to blend the delivered water to the required temperature level. • All measures taken to conserve energy should not conflict with those required to prevent legionella. However, there are a number of solutions to legionella issues which can be explored where required to ensure that standing losses are reduced and water outlets are useable without the risk of scalding. • All pumps should be high efficiency and should only operate when hot water is required. • Hot water systems should be de-scaled on a regular basis and water conditioning units installed on new installations. • New centralised hot water systems should operate with a piped return and not electric heating tape. Balancing valves should be installed throughout the system.
Ventilation	Provide natural ventilation and avoid mechanical ventilation where possible. • Where mechanical ventilation is required, make sure that it provides the correct number of air changes and that the air flow rates can be adjusted in relation to occupancy. • Where mechanical ventilation exists and is to be retained, ensure that the system is adequately balanced to ensure its effectiveness. • Existing systems should be thoroughly overhauled with measures to upgrade the efficiency of the units e.g. installing variable speed drives and/or high efficiency motors. • Where existing ventilation services are to be removed or altered for an area, assess the impact on the central system and take appropriate action. This may mean installing an inverter on the main fan to reduce the air flow rate or rebalancing. • Direct drive fans should be chosen over belt driven units. • For new systems, heat recovery should be incorporated where practical. Air to air recovery is the preferred method. • For systems serving several areas, consideration should be made for zoning the system so that individual areas can be closed down. This could include the use of dampers that can close and allow the supply and extract fans to ramp down in response. • Ductwork should be designed to minimise air resistance and be suitably air tight and insulated where required. • Night cooling strategies should be incorporated to avoid the use of air conditioning where possible.

	• Humidification where required should be designed to the minimum acceptable levels. Gas humidification or ultrasonic spray humidifiers are preferable to electric units.
Air Conditioning	• Where possible, avoid installing air conditioning and look at alternative methods to cool spaces and reduce heat gains where possible such as Brie Soliel and other methods of solar shading. • Ensure that heat generating equipment such as photocopiers and servers are located where the gains can be removed rather than adding to the load on the air conditioning systems. • Comfort cooling is preferred to full air conditioning i.e. where temperatures are suppressed below external and allowed to float but may not be as low as in an air conditioned space. • Ensure that systems installed are as efficient as possible and contain no ozone depleting substances and have a low global warming potential. • Avoid the use of heat pump systems where heating systems already exist. Electricity is almost 4 times more expensive than gas and has significantly higher carbon content. • All new and replacement air conditioning installations should be referred to PAF major stakeholders before installation. Refer to the University's Space Temperature Policy for additional guidance http://www.city.ac.uk/aboutcity/environment/Facts%20and%20Figures/Facts%20and%20Figures.html
Chilled Water	• The University operates a chilled water ring main serving College, University, part Tait and Drysdale Buildings. Any cooling proposals in these buildings, in the first instance, should be designed to connect to this system. Protocol for flushing, testing and rebalancing to be agreed with City Operations prior to connection. • DX, VRV and VRF units should be avoided at these buildings where possible. Where they are installed they should interface with the BMS system to allow remote control of the spaces being served. • Chiller plant should be selected for the highest CoP possible. Turbocor compressors are currently the most efficient and should be specified. • Plant should be sized with the correct number of compressors to ensure stable operation at low loads. • Free cooling systems should be exploited wherever possible. • Systems should be chosen that can operate on higher flow and return temperatures such as chilled beams, chilled beam

	cassettes and chilled radiant ceilings. • All pipework, valves and flanges should be thoroughly insulated. Plastic pipework is preferred for chilled water installations to remove issues relating to corrosion caused by condensation on the exterior of the pipework should the insulation become damaged. • Buffer vessels should be included within system designs to prevent the chiller from repeated starts which can cause damage to the compressors.
Controls	• The University operates a Trend BMS system across its estate and all new control installations must interface with this. • All controls proposals must be approved by the Energy & Environmental Manager before implementation. Early discussion regarding strategies and equipment is recommended. • Controllers should be based around the IQ2 and IQ3Xcite controllers. IQL controllers are not acceptable to the University. • Schematic graphics are to follow the new University format and should incorporate dynamic representation of the systems. • Packaged plant will need to utilise Trend controllers for their final control or be fitted with a full read/write control interface with the Trend BMS. • IQ3 controls with sufficient I/O inputs and outputs are to be suitable for the task with 20% I/O spare capacity. • The controls philosophy, controller strategy design and control panel wiring diagrams are to be submitted to the University Energy & Environmental Manager for approval prior to commencement on site. A copy of the final SET drawings shall be supplied as part of the evaluation. • Control panels are to use LED indicator lamps and be fitted with a lamp test button. • Trend IQView (colour) touch screen displays shall be fitted to the major plant control panels and mounted 1.5 metres from floor level. • The University operates a multi-LAN system based on remote Ethernet connections. Care will be required to avoid duplication of LAN numbers to avoid conflict. • Drawings of network cable routes will be required. • All points in the controllers will need to be meaningfully labelled.

	• Connection to the University network shall not take place until the system is fully commissioned, witnessed and accepted by the University • It is preferable to give occupants a degree of control over their space conditions. Where appropriate wall mounted sensors should be fitted with a setpoint knob adjuster to allow local trim of temperatures. - Heating to a maximum temperature of 22^{c} - Cooling to a minimum temperature of 21^{c} • Prior to witnessing the following documentation is required: a) LAN or Ethernet wiring diagram b) Description of operation c) Panel wiring diagrams d) SET strategy diagrams e) Commissioning data sheets. • Following witnessing, the approved schematic pages can be loaded onto the supervisor and the operation witnessed. Access to the supervisor will be controlled and will not be permitted without the necessary permissions. • The documentation listed below will be required at the end of a project in both hard copy and PDF/SET format and is over and above the standard O&M requirements: a) System Control Schematic showing the BMS architecture and interface with existing installation b) Description of each controller and plant covered c) SET control strategy diagrams d) Description of operation of plant e) Schedule of equipment f) Control panel wiring diagrams g) Network cable routes
Water Installations	• All new water using equipment should be selected to minimise and conserve the use of water with preference given to products on the Defra Water Technology list. • The University has standardised on Savaflush urinal controls that also operate the lighting and these should be specified where flushing cisterns are installed

	• All taps should be of a type that automatically turn off (concussive or infrared). There is a standard specification covering WCs which specify the tap manufacturer. • Taps and outlets should be fitted with water restrictors to reduce flow rates with the exception of specific areas such as catering kitchens where higher flow rates may be required. • WCs should be of the low volume flush type (4 litres) • The use of infra-red controls for operating washroom equipment is encouraged. • Thermostatic mixing valves should be installed for all shower and wash hand basin outlets to prevent scalding and reduce waste. • Internal overflows should be avoided where possible. All overflows should be made visible/audible so faults can be rectified quickly. • All pipework should be insulated to prevent heat loss/gain with flexible removable covers for all valves and flanges. • Kitchens in office areas should be fitted with a Zip hydro taps, or approved alternative to provide boiling and chilled drinking water. These should be fitted with time controls. • Where chilled drinking water is not required in a kitchen, a Zip hydrotap hot only or approved alternative should be installed complete with time control. • The University is seeking to move away from bottled water coolers to use mains fed filtered units instead. Provision should be made for mains cold water to enable these units to be plumbed in. • Items such as dishwashers should be A* rated and a good quality brand chosen to ensure longevity.
Lighting	• In office and classroom areas install PIR and daylight control. Approved manual override to turn off to be installed. In other areas look at suitable control systems to ensure that lighting only operates when required. • Where manual switching is to be used, ensure that these are located in logical easily accessible positions and clearly labelled where required. • In larger schemes, DALI based control system should be specified such as the Luxmate system installed in College building and connected to a head end to enable user adjustment. • Avoid luminaires with complicated designs that may create dirt and dust traps thereby reducing light output and creating maintenance issues. • Ensure that the lighting design meets current regulations regarding light level, glare and efficiency. Remember that

	lighting is now covered by Part L of the building regulations and complies with the relevant SKA Good Practice measures. • Ensure that areas are not overlit. The appropriate lux levels should be adhered to and should be designed on the lower side if a range is given i.e. for offices the recommended level is 300-500 lux so we should aim for 400 lux to avoid over lighting. Only specialist areas should require a lighting level of over 400 lux. • Do not rely solely on manufacturer's literature regarding light output. Modern light fittings with built in light sensors can be programmed regarding their light output. • Do not use mains or low voltage tungsten halogen lighting. There are low energy alternatives that are available using LED lamps. The only exception to this is for specific schemes where there are justifiable reasons and these will need to be approved on a case by case basis. • Make the most of daylight availability by using light coloured surfaces and décor and avoid obscuring windows. • Where applicable and appropriate, try to encourage designs that incorporate a level of visual interest e.g. using wallwashers or coloured LEDs to avoid the institutional look. • External lighting should be controlled by photocells set to operate at around 70 lux. • External lighting should be designed as efficiently as possible and should minimise light pollution.
Sub-Metering	• Sub metering is covered by the building regulations and therefore, projects will have to conform to these. • All sub meters should be suitable to connect to the SCADA system. • All meters installed will be required to be connected to the BMS system and set up to monitor consumption as part of the project • Sub metering requirements should be discussed with the Energy & Environmental manager prior to installation.
Electrical Installations, including Lifts	• All other electrical installations should be designed to be as efficient as possible and switches should be positioned to encourage isolation of equipment. • Where lifts are required, traction should be specified over hydraulic and regenerative braking systems should be specified. • Provision should be made so that lifts can be switched off out of hours to reduce auxiliary power consumption. • The University has standardised on BioDrier BioLite (in white) under hand dryers for all washrooms • Replacement motors should be high efficiency and sized correctly. Invertors should be installed where possible and

	practical. • All equipment such as fridges, dishwashers etc should be rated as high as possible and no lower than A. Equipment other than white goods should conform to Energy Star or similar requirements. • Consideration should be given to control via master switches or occupancy detection where appropriate.
Consequential Improvements	• Where refurbishments take place there may be opportunities to make energy saving improvements to adjacent areas or take future proofing actions to enable integration in the future. Examples would include installing riser pipework that is sized to take account of future expansion, insulating pipework within a project area that may not be part of the project. • It is recognised the there may not be funding from project budgets for this type of work so these implications and opportunities should be discussed with relevant staff in Property and Facilities at the outset of projects to see if a business case can be made for additional funding.
General Points	• Do not replace like for like without considering whether there is an opportunity to improve efficiency e.g. high frequency lighting, high efficiency motors. • Fabric insulation should be applied where practical as part of assessing the installation of new heating or air conditioning equipment. • Draughtproofing should be applied where practical and this would include the use of propriety silicone systems which enable windows and doors to operate as intended. • Renewable energy installations should be considered if appropriate.

Important note:

This standard sets out the basic functional requirements. The actual work required for a particular project will be determined in a separate SCOPE OF WORKS DOCUMENT- some elements may not be present or require replacement.