NEW BUILD, EXTENSION AND REFURBISHMENT ENERGY CONSERVATION DESIGN GUIDE

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INTRODUCTION

THE AIM OF THE GUIDE

This design guide aims to help the University of Bristol build more energy efficient buildings.

HOW TO USE THE GUIDE

The guide specifies certain standards and features that the 'design team' should include in any new build, extension or refurbishment project.

The guide should be used in the initial design brief of any project.

The Energy and Environmental Manager will be available to answer any queries the design team may have regarding any elements of the design guide.

THE STRUCTURE OF THE GUIDE

This guide is split into 21 numbered sections relating to building design and services (see contents page).

Each of the 21 sections is split into two parts, new build and refurbishment. The relevant part should be applied to the project under design (these are often the same features).

THE ENERGY CONSERVATION DESIGN GUIDE CHECKLIST

As the Design Guide is a generic document, some elements of it may not be applicable or relevant to the design under consideration and do not need to be included.

To establish what has been included and excluded, the attached 'tick box checklist' noting all sections of the design guide should be filled out and submitted to the University's Energy and Environmental Manager. This should be done before the final designs are agreed.

Any energy conservation features not included (use non-applicable on the checklist) need to have a brief reason given as to why they weren't, this could simply be that the client (the University) agreed to exclude them.

Certain Energy Conservation features in the design guide may be excluded on technical or economic grounds. For the University to assess these grounds, a brief report from the 'designer' will be needed. This report should include details of additional costs as well as potential savings for all aspects of the design feature in question, including estimates for capital, energy and maintenance costs/savings. The phrase 'briefly assess and report on' denotes where such a report is needed (also noted

on the checklist). The report should be brief, no more than a page of A4. These reports should be submitted with the checklist.

This checklist, the reports and the initial designs will be discussed within the 'design team' (including the University's Energy and Environmental Manager and relevant members of Building Services) to agree what elements of the energy conservation design guide will be included in the final design.

MINOR WORKS AND BUILDING SERVICES PROJECTS

Minor works carried out by the Building Services should adhere to the standards and recommendations of the design guide, whether designed by Building Services or by a consulting engineer/architect. Brief discussions between Building Services staff and the Energy and Environmental Manager should be held for minor works that have a 'significant' impact on energy use.

Any queries regarding this design guide should be directed to the University's Energy and Environmental Manager - Martin Wiles on 0117 928 8034, email m.r.wiles@bristol.ac.uk.

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IMPORTANT NOTE : ANY DESIGN SHOULD USE THE ADOPTED STANDARDS OF THE UNIVERSITY WITH RELATION TO ALL BUILDING FEATURES AND SERVICES. CONSULT WITH THE UNIVERSITY'S ASSISTANT DIRECTOR (BUIDLING SERVICES) FOR DETAILS.

1.0 SITE FACTORS AND BUILDING LOCATION

NEW BUILD

1.1 The orientation of the longest facades of a building should be within 45^{o} of due south.

1.2 Overshadowing by other buildings/trees within 30^{o} of due south should be avoided.

1.3 The distance between buildings should be twice their height to avoid over shadowing.

1.4 Exposed sides of buildings should use landscaping to reduce wind exposure, for example, by the use of trees.

1.5 **Briefly assess and report on** the potential for including passive solar design features.

REFURBISHMENT

1.6 Evaluate and report applicability of new build points 1.1 to 1.5 for any refurbishment.

2.0 BUILDING FORM AND INTERNAL LAYOUTS

NEW BUILD

2.1 Where possible avoid designing deep plan buildings (10 meters depth from windows), as these are less easy to naturally light and ventilate. Ensure all fire regulations are consulted such as building bulletin 7, "Fire and the design of educational buildings".

2.2 If deep plan buildings are required due to factors such as space constraints, the potential use of atria or courtyards should be **briefly assessed and reported on** for inclusion within the design. Access for maintenance must be included in any design using atria. Use of borrowed light from internal corridors should also be considered.

2.3 Where multi-storey buildings are designed, ensure major stairwells are self contained from the main working or living areas, as they do not need to be heated to the same temperature and can therefore be zoned separately. But ensure they do not increase the heating loads of adjacent rooms and that condensation is prevented.
2.4 Do not design large lobbies within the 'heated envelope' of the building that are difficult to heat, they add cold walls within the building and increase heat loss.
2.5 Rooms with lower heating demands (e.g. storerooms and toilets) should be located on the north side of the building and have smaller windows.
2.6 Rooms with high internal heat gains e.g. computer rooms or canteens, should be located on the north side of the building.
2.7 Rooms with highest heating loads should be located in the southern part of the building to benefit from solar gain. Shading devices to avoid excessive heat in summer or glare close to windows should be included.

REFURBISHMENT
2.8 Evaluate and report applicability of new build points 2.1 to 2.7 for any refurbishment.

3.0 VENTILATION

NEW BUILD
3.1 The University's Assistant Director (Building Services) should be consulted with on all proposed designs.
3.2 Design building so only natural ventilation will be needed, but ensure air quality is maintained, specify controllable background ventilation, e.g. 'trickle' ventilators or fanlights. **Briefly assess and report on** potential ventilation system options based on static cooling and displacement ventilation, as well as systems such as chilled ceilings
3.3 Where deeper plan buildings are needed and/or external/internal conditions require mechanical ventilation, **briefly assess and report on** the potential of designing a controllable 'partial' mechanical ventilation system that will achieve the desired conditions as opposed to a fully mechanically ventilated system. Also refer to regulation 6 of the Workplace Health, Safety and Welfare Approved Code of Practice.
3.4 Ensure that the users needs are identified correctly, controlling humidity and temperature.
3.5 Ensure the system is as flexible as possible, i.e. if the room lay out alters, will the ventilation system cope?.
3.6 Consider whether air conditioning is needed or just ventilation.
3.7 For all mechanical ventilation systems, incorporate appropriate time and occupancy control which has a clear use strategy, e.g. lecture theatre occupancy control (also see 15.16).
3.8 **Briefly assess and report on** the potential for demand control of the mechanical ventilation systems.
3.9 Provide humidistat-controlled extract fans to kitchens and bathrooms (as well as simple manual on-off controls). Ensure building regulations are complied with.

3.10 In areas that need high air quality, monitor and control mechanical ventilation rates via air/carbon dioxide or other appropriate sensors.
3.11 **Briefly assess and report on** the potential for designing all mechanical ventilation systems (partial or full, including simple extract fans) with high efficiency, low energy fans and motors, ensuring that fans and motors match predicted loads avoiding part loading.
3.12 Separate summer and daytime ventilation loads from 24 hour loads, this will avoid part loading of fans and pumps.
3.13 **Briefly assess and report on** the potential for provision of central, zonal and room controls for ventilation, including in the assessment of the financial implications for both capital outlay and running costs of these systems. Enable control and monitoring of ventilation rates via the University's BMS.
3. 14 **Briefly assess and report on** the potential for use of two speed motors or variable speed drives for motors, pumps or fans compared to standard motors, or the use of two smaller motors, fans etc. rather than one large motor that may run at half load for long periods.
3.15 **Briefly assess and report on** the potential for the use of high efficiency motors as compared to standard motors for pumps, fans, etc.
3.16 Keep smoking areas separately ventilated.
3.17 **Briefly assess and report on** the potential for installing heat recovery or heat pumps on partial and full mechanical ventilation systems, including where applicable preheating fresh air with computer room condenser air or heat from conservatories or atria.
3.18 Design ventilation plant, where possible, near to the space it is serving, this will reduce fan sizes and heat losses/gains to and from ductwork.
3.19 Any ventilation system must ensure a comfortable internal working environment, especially with regard to air quality and temperature, whilst ensuring as low an energy use as possible to achieve this.

REFURBISHMENT
3.20 Evaluate and report applicability of new build points 3.1 to 3.19 for any refurbishment.

4.0 GENERAL INSULATION STANDARDS

4.1 Sections 4.0 to 10.0 detail insulation standards for the University of Bristol, and are written for a standard type of building construction. Due to the generic nature of this design guide there will be situations where these standards may not be applicable or an alternative method of insulation will be needed. In these situations contact the University's Assistant Director (Building Services) and the Energy and Environmental Manager. For all insulation, fire regulations must be adhered to.

NEWBUILD

4.2 Current Building Regulations state that the minimum U-values for the buildings should be;

- External walls U value 0.45 W/m^2K
- Roofs U value 0.25 W/m^2K
- Floors U value 0.45 W/m^2K
- Windows/Roof lights U value 3.3 W/m^2K

4.3 The University of Bristol wants to improve upon these minimum values by applying the following standards to all new buildings, extensions and refurbishment's (the highlighted figures show the figures that have been increased).

- External walls U value **0.3** W/m^2K
- Roofs U value 0.25 W/m^2K
- Floors U value **0.3** W/m^2K
- Windows U value **3.0** W/m^2K

Specific instances where these U values may differ are given in sections 5.0 to 10.0.

4.4 Designs must ensure continuity of insulation, e.g. avoidance of cold/thermal bridging, if in doubt consult with the University's Assistant Director (Building Services). For further advice consult Department of the Environment good practice guide 174 'minimising thermal bridging in new dwellings'

4.5 Designs must ensure draught proofing/sealing is specified where ever needed.

4.6 With all insulation/reduction of air filtration, appropriate action should be taken to ensure that the risk of condensation is avoided, consult with the University's Assistant Director (Building Services) if in doubt. For further advice see BRE report BR 262, *thermal insulation : avoiding risks*.

4.7 Lower U values as noted in 4.3 may increase cooling loads, consideration must be given to utilizing internal heat gains and thus avoiding excessive cooling loads.

REFURBISHMENT

4.8 Evaluate and report applicability of new build points 4.1 to 4.7 for any refurbishment.

5.0 ROOF INSULATION

5.1 Consult with the University's Assistant Director (Building Services) on the suitability of all roof insulation.

NEW BUILD

5.2 Evaluate and report applicability of refurbishment points 5.3 to 5.4 for any new build.

REFURBISHMENT

5.3 Pitched Roofs

5.3.1 If uninsulated specify 200mm mineral wool or equivalent.

5.3.2 If partially insulated bring up to 200mm standard.
5.3.3 Provide eaves ventilation to cross ventilate the loft space.
5.3.4 Draught seal and insulate the loft hatch.
5.3.5 Where there is a cavity and the roof finish is being renewed, specify that insulation be placed over the cavity closer at eaves level to help minimise thermal bridging. Note that insulation should not block the ventilation path into loft area otherwise condensation can occur.
5.3.6 Where roof tiles need to be removed, the loft insulation should be draped over the brick cavity closer.
5.3.7 Where access is only available from inside the building, strips of insulated dry-lining should be added to the wall at brick closer and to any sloping ceiling.
5.3.8 When ceiling follows the slope of the rafter, take the opportunity to add insulation.

5.3.8.1 Where the roof finish is being renewed, specify 50mm thick mineral wool batts between the rafters, and a 50mm deep ventilation path above the insulation.

5.3.8.2 Where the roof finish is not being renewed specify a minimum 50mm thick insulated dry-lining, fixed to the sloping part of the ceiling.

5.3.9 For solid walled buildings, when the ceiling follows the slope of the rafter and the ceiling is to be replaced, add to insulation between the rafters, whilst maintaining ventilation between insulation and sarking.

5.3.9.1 Specify combination of 50mm mineral wool batts wedged between rafters and 25mm insulated dry-lining fixed to the underside of the rafters to achieve a U-value of at least 0.35Wm^2K if not better.

5.3.9.2 Provide eaves ventilation and a minimum 50mm deep ventilation path above the insulation.

5.4 Flat Roofs

5.4.1 When the roof covering is to be renewed, add insulation to achieve a U-value of 0.35 W/m^2K or better.
5.4.2 Specify insulation above the roof deck to create a 'warm roof', in preference to a ventilated 'cold roof' design.
5.4.3 Avoid dark coloured sheeting/coverings on roofs, this is prone to large thermal expansion and contraction.

6.0 WALL INSULATION

6.1 Consult with the University's Assistant Director (Building Services) on the suitability of all wall insulation.

NEW BUILD

6.2 Evaluate and report applicability of refurbishment points 6.3 to 6.4 for any new build.

REFURBISHMENT

6.3 External Cavity Wall

6.3.1 Where walls are in a suitable condition insulate cavity.
6.3.2 To avoid difficulties with site installation leading to problems such as rain penetration;

6.3.2.1 Specify that the installer is part of the Cavity Insulation Guarantee Agency.
6.3.2.2 Specify that the suitability of walls for cavity insulation should be assessed in accordance with procedures in BS 8202:Part 1.
6.3.2.3 Specify that the installer or manufacturer shall carry out a visual inspection of the cavities and prepare a schedule of any remedial work needed.
6.3.2.4 Specify that the installer should price for carrying out the schedule of remedial works as well as the cavity fill installation.

6.3.3 For UF foam, specify that the installer should be a registered firm under British Standards Institute Quality Assured Company scheme.
6.3.4 For other materials, specify that the installer should be on the BBA's latest 'List of Approved Installers'.

6.4 External Solid Wall

6.4.1 Where the cavity is not suitable for cavity insulation, install an insulated dry-lining inside the building.

6.4.1.1 Specify at least 50mm to achieve a U-value of about 0.5W/m^2K or better.
6.4.1.2 Specify a 25mm thick insulated dry-lining for the reveals and soffits of windows and door openings.
6.4.1.3 Return the dry-lining along each wall to avoid thermal bridging.
6.4.1.4 Note dry-lining must be fitted correctly to avoid draughts and even collapse in a fire situation. Therefore when installing a number of points need to be ensured.

6.4.1.4.1 A continuous ribbon of plaster adhesive around the perimeter of each wall area and around each window and door opening should be applied.
6.4.1.4.2 Mechanical fixings should be used in accordance with Manufacturers recommendations, to hold the boards in place while the adhesive dabs dry out and to hold the plasterboard in place if there is a fire (especially important for foamed plastic insulants).
6.4.1.4.3 It is common for existing plaster to be removed before fixing dry-lining. Where this leaves a very uneven, dusty

surface, best results are obtained by applying a render backing before fixing the dry-lining.

6.4.2 If occupants cannot be decanted during refurbishment or re-pointing or re-rendering is occurring take the opportunity to install external insulation instead.

6.4.2.1 Specify at least 50mm thick insulation to achieve U-value of about 0.5Wm^2K or better.

6.4.3 For flats that have a mainly concrete construction,

6.4.3.1 Where practical, specify external wall insulation to exposed areas of concrete, if not specify internal insulation.
6.4.3.2 Where internal insulation is used, specify a vapour control layer on the warm side of the insulation to avoid interstitial condensation.

7.0 FLOOR INSULATION

7.1 Consult with the University's Assistant Director (Building Services) on the suitability of all floor insulation.

NEW BUILD
7.2 Evaluate and report applicability of refurbishment point 7.3 for any new build.

REFURBISHMENT
7.3 Ground Floor

7.3.1 When a new concrete floor slab is to be laid, add insulation.
7.3.2 Specify insulation below the ground slab to provide some thermal mass if no basement is present. Insulate vertically at the edge of the slab to minimise thermal bridging. For basement floors specify the insulation above the ground slab.
7.3.3 When suspended timber ground floor needs repair or there is access from below, insulate and reduce air leakage.
7.3.4 If the floor does not need replacement reduce air leakage.

7.3.4.1 Add insulation between joists, make sure under floor void is ventilated to current building standards.

7.3.5 Specify that skirting's are sealed and square edged floorboards be covered with hardboard or plywood or linoleum. Alternatively a flexible sealant should be applied between floorboards.
7.3.6 If new skirting boards are necessary, specify that draught seal be fixed to the underside of the skirting and compressed immediately before the skirting is fixed. This is to ensure the seal remains effective when the skirting shrinks. Also specify a flexible sealant for the back of the skirting before it is fixed to

the wall. Alternatively for dry-lining the draught seal may be placed between the dry-lining and the flooring.

8.0 DOORS

8.1 Consult with the University's Assistant Director (Building Services) with regards to the type and material of doors and fixings. Also refer to regulation 18 of Workplace Health, Safety and Welfare Approved Code of Practice.

NEW BUILD

8.2 Design so external door entrances are in sheltered positions, preferably not near corners.

8.3 Include draught lobbies within designs, especially where prevailing winds face entrances.

8.4 All external doors must have door closures. Consult with the University's Safety Officer and Energy and Environmental Manager to ascertain exceptions.

8.5 Draught proof remaining external doors, ensuring suitability for disabled access.

REFURBISHIMENT

8.6 Evaluate and report applicability of new build points 8.1 to 8.5 for any refurbishment.

9.0 INSULATION FOR ENCLOSED WALKWAYS AND LINKING PASSAGES BETWEEN BUILDINGS

NEW BUILD

9.1 Where linking passageways between buildings (that are external to the shell of these buildings) are present, insulate their walls to the same standard as external walls.

9.2 Insulate the floor voids over passageways with 100mm mineral wool quilt, unless the space above is a roof, then insulate with 200mm. Do not provide ventilation to the floor void. **Alternatively** fix an insulation/building board laminate to the underside of the passageway ceiling.

REFURBISHIMENT

9.3 Evaluate and report applicability of new build points 9.1 to 9.2 for any refurbishment.

10.0 WINDOWS

10.1 Consult with the University's Assistant Director (Building Services) with regards to the type and material of window frames. Also refer to regulation 14,15 and 16 of the Workplace Health, Safety and Welfare Approved Code of Practice.

NEW BUILD

10.2 If windows are to open, e.g. in naturally ventilated buildings, specify windows that are simple to operate. The University Safety Officer should also be consulted on aspects of window design
10.3 Fit double glazed units, sealed in window frame or draught stripped. An air gap of 12mm should be used (if there is a large enough rebate). Ensure they are internally beaded. Pilkington glass (or equivalent) should be used as standard.
10.4 Use the Building Regulations for guidelines for U-values for frames, especially thermally broken ones.
10.5 **Briefly assess and report on** the potential for the use of low emissivity coated glass. Also report on its suitability in conjunction with laminated glass, which is specified in line with University policy.
10.6 Use trickle vents where possible, especially in bedrooms and kitchens.
10.7 A general target to aim for regarding the overall area of windows in relation to the building area as a whole, should be to not exceed 30% of the floor area if double glazed, 15% for single glazing, whilst maintaining as much natural lighting as possible.

REFURBISHMENT
10.8 Evaluate and report applicability of new build points 10.1 to 10.7 for any refurbishment.

11.0 COLD WATER SERVICES

11.1 Consult with the University's Assistant Director (Building Services) with regard to all cold water services.

NEW BUILD
11.2 Taps should be push types, with correctly regulated flow or have restrictors fitted where necessary, unless greater flows are required. Consult with users and Assistant Director (Building Services) for exceptions.
11.3 Spray taps are not to be specified.
11.4 Urinal flushing and ventilation should have controls based on presence detection within the toilets. Consult with the Assistant Director (Building Services) to ascertain where this control should be extended to all water services and whether similar controls should be used in female toilets.
11.5 Control of the lights in toilets should also be considered using the same presence detector as point 11.4, but consultation with the University's Senior Engineer on the type of lighting needs to occur to ensure the right type of lighting is used.
11.6 Cisterns should be not exceed 7.5 Litres per flush.
11.7 Water bye laws must be adhered to.

REFURBISHMENT
11.8 Evaluate and report applicability of new build points 11.1 to 11.7 for any refurbishment.

12.0 HOT WATER SERVICES

12.1 Consult with the University's Assistant Director (Building Services) with regard to all hot water services.

NEW BUILD

12.2 Taps should be push types with correctly regulated flow or have restrictors fitted where necessary, unless greater flows are required. Consult with users and Mechanical Section Manager for exceptions.
12.3 Spray taps are not to be specified.
12.4 **Briefly assess and report on** keeping heating and hot water systems separate, unless there is a high summer hot water load.
12.5 Where localised hot water systems are needed ensure they are well insulated and have temperature and 7 day time control.
12.6 Avoid secondary circulation of water.
12.7 Insulate pipe work and provide valve/flange jacket insulation in boiler rooms and areas that do not require heating.

REFURBISHMENT

12.8 Evaluate and report applicability of new build points 12.1 to 12.7 for any refurbishment.

13.0 HEATING

NEW BUILD

13.1 Do not over size plant, consider inputs from solar gain and internal uses (e.g. computers etc.) and the future development of the building. Also refer to regulation 7 of the Workplace Health, Safety and Welfare Approved Code of Practice.
13.2 Consider different heating scenario's and therefore different mediums when evaluating the heating needs of the building, for example under floor heating or wall mounted radiators.
13.3 Locate plant to minimise distribution system loses.
13.4 **Briefly assess and report on** the potential for using condensing boilers, especially in a multi-boiler situation, against high efficiency boilers and a modular system.
13.5 Ensure correct sequencing controls are in place for modular systems.
13.6 Ensure boilers are not kept up to temperature when there is no demand for them.
13.7 Ensure that gravity circulation or valve let-by heating zones and air handling units which are not in operation, is avoided.
13.8 **Briefly assess and report on** any opportunities for the potential inclusion of CHP or district heating within the design.
13.9 **Briefly assess and report on** any opportunities for the potential inclusion of heat recovery systems (electricity used in this type of system will have to be set against the value of the heat recovered).
13.10 **Briefly assess and report on** the potential for use of two speed and/or variable speed drives for motors as compared to standard motors, or the use of two smaller motors rather than one large motor that may run at half load for long periods.

13.11 **Briefly assess and report on** the potential for the use of high efficiency motors as compared to standard motors for pumps, fans, etc.
13.12 **Briefly assess and report on** any opportunities for the use of 'on-demand' controls for intermittently used areas.
13.13 Keep room controls for users simple and allow ‘fine-tuning’ control by the user where possible.
13.14 Do not over or undersize heat emitters, ensure the system is correctly balanced.
13.15 Ensure hot water cylinders/calorifiers are fully insulated and have a temperature thermostat.

REFURBISHMENT
13.16 Evaluate and report applicability of new build points 13.1 to 13.15 for any refurbishment.
13.17 If an electric heating system is to be refurbished **briefly assess and report on** the potential for replacing it with an efficient gas-fired system.
13.18 Where electric heating is used ensure that it is based on off-peak electricity and has an optimiser control.

14.0 HEATING CONTROLS

NEW BUILD
14.1 Control heating systems via the University's Building Energy Management System (BEMS), unless otherwise directed by the University’s Assistant Director (Building Services).
14.2 **Briefly assess and report on** the potential for the use of compensation controls.
14.3 Optimum on and off controls must be included.
14.4 Frost and condensation protection must be included.
14.5 **Briefly assess and report on** potential zoning scenario's for the buildings heating system. Especially consider infrequently used areas which could be isolated when not in use or could be heated using push button timer controls.
14.6 Locate sensors effectively, do not control widely different areas with one sensor.
14.7 Fit thermostatic radiator valves in rooms with a high level of incidental gain.
14.8 If thermostatic radiator valves (T.R.V.'s) are used, ensure they are fitted correctly (horizontally at the top of the radiator/heat emitter), except where this would make live maintenance to the valve impossible.

REFURBISHMENT
14.9 Evaluate and report applicability of new build points 14.1 to 14.8 for any refurbishment.

15.0 LIGHTING

15.1 Lighting design should adhere to CIBSE guidelines (especially the code for interior lighting 1994) and must comply with current building regulations (approved document L1). Also refer to regulation 8 of the Workplace Health,

Safety and Welfare Approved Code of Practice. The University of Bristol wants all its lighting installations to correspond to the highest possible standards of lighting using the most energy efficient sources possible (weighed against increased capital and maintenance costs). The following section contains clauses that exceed current standards and recommendations with the intention of achieving greater energy efficient design.

NEW BUILD

15.2 Maximise as much natural daylight as possible without creating excessive glare or over heating.

15.3 **Briefly assess and report on** the potential for the use of light shelves, prismatics and other natural light enhancing devices, but ensure beam radiation is avoided.

15.4 Consider users needs, especially needs for brightness and contrast (consultation with the University's Learning Support Manager on aspects of design relating to disability)..

15.5 Avoid over illumination, 'special needs' should be met locally with 'task' lighting. Also ensure that colour appearance and rendering requirements by the client are met efficiently. CIBSE guidelines especially for light levels and the position of light measurement should be used for ensure correct illumination. Health and safety (display screen equipment) regulations 1992 must also be complied with. Install efficient lighting in all areas, including corridors and toilets.

15.6 Ensure the right type of lamp is used for the right type of environment, consult with the senior engineer to ensure this is achieved.

15.7 Where possible, do not specify tungsten lamps, unless agreed by the University's Assistant Director (Building Services) and Energy and Environmental Manager.

15.8 For tubular fluorescent lighting specify high frequency control gear. Also **briefly assess and report on** the inclusion of 'soft-start' to help prolong lamp life.

15.9 Specify Triphosphor or multi-phosphor lamps unless other wise directed by the University's Assistant Director (Building Services) and Energy and Environmental Manager.

15.10 Do not specify T12 (38mm) tubular fluorescent tubes.

15.11 Ensure that lamp fittings/holders/diffusers enable the maximum amount of light output possible, but within guidelines to avoid glare. No fitting should give a light output ratio of less than 0.5 (50%) unless requested by the University's Assistant Director (Building Services) and the Energy and Environmental Manager.

15.12 **Briefly assess and report on** the potential for incorporating reflectors within light fittings.

15.13 Lamp switches should be in view of the lamps being switched and large gangs of switches should be avoided. Part L building regulations stipulates that a maximum distance of 8 metres from a person to a light switch is allowed.

15.14 Switch lamps with day light conditions, e.g. parallel to windows.

15.15 **Briefly assess and report on** the potential for the use of photocell control. Avoid blanket use of photocell control unless justified by use.

15.16 **Briefly assess and report on** the potential for the use of automatic occupancy sensing in intermittently used areas and areas with large lighting loads.
15.17 **Briefly assess and report on** the potential for the use of daylight control and dimming sensors to maintain lighting levels.
15.18 Use light colours for surfaces and furniture internally to help achieve required lighting levels.
15.19 Where possible, external lighting should use high pressure sodium (SON) lamps, unless otherwise directed due to security or safety reasons. Control these lights using photocells. Light fittings should be 'anti-light pollution' where possible.
15.20 Consult with University's Assistant Director (Building Services) relating to type of luminaries and switchgear to be used to enable standardisation of fittings.

REFURBISHMENT
15.21 Evaluate and report applicability of new build points 15.1 to 15.20 for any refurbishment.

16.0 METERING

NEW BUILD
16.1 Install one meter with a pulsed output for electricity, water, gas and/or heat.
16.2 Consideration should be given to sub-metering zones/units/floors, especially computer rooms, kitchens and equipment rooms with predicted high energy use. Options to be recommended to the Energy and Environmental Manager.
16.3 Ensure meters are located where they are easily accessible for manual reading.

REFURBISHMENT
16.4 Evaluate and report applicability of new build points 16.1 to 16.3 for any refurbishment.

17.0 NEW UTILITY SUPPLIES

NEW BUILD
17.1 Any new supply of electricity, oil, gas or water must be agreed with the University's Energy and Environmental Manager and Assistant Director (Building Services) in advance of installation.

REFURBISHMENT
17.2 Evaluate and report applicability of new build point 17.1 for any refurbishment.

18.0 COMMISSIONING & TRAINING

NEW BUILD

18.1 Provide site and services drawings, operation and maintenance manuals.
18.2 Train key staff (including specified building users) in the use of systems including, heating, lighting, water controls and monitoring equipment where necessary to be agreed with the University's Assistant Director (Building Services) and client department/faculty.

REFURBISHMENT

18.3 Evaluate and report applicability of new build points 18.1 to 18.2 for any refurbishment.

19.0 MAINTENANCE

NEW BUILD

19.1 Ensure that installations are situated so they can be accessed for regular maintenance.

REFURBISHMENT

19.2 Evaluate and report applicability of new build point 19.1 for any refurbishment.

20.0 APPLIANCES

NEW BUILD

20.1 When installing tumble dryers (and where a gas supply is available) specify gas powered ones, but consult with the University of Bristol before making a final decision
20.2 If selecting office equipment, choose low energy consuming items and/or ones, which have a timed automatic low energy standby mode.
20.3 Provide insulated time controlled hot water urns for staff.
20.4 When installing kitchen appliances please ensure that they are energy efficient, preference should be given to fridges, freezers and other items that are rated A to C using the European Energy Labelling system.

REFURBISHMENT

20.5 Evaluate and report applicability of new build points 20.1 to 20.4 for any refurbishment.

21.0 GENERAL ISSUES

21.1 All components of the building from its structure to its services should work together to help achieve a high quality environment at the lowest achievable energy use.
21.2 All controls and monitoring systems should be easily accessible for regular resetting and reprogramming.
21.3 Avoid excessive complication of systems, passive systems will be favoured.

21.4 Consult with the University's Energy and Environmental Manager on all areas of energy design.
21.5 Outside the improved conditions set out in sections 1.0 to 20.0, all elements of the building regulations must be adhered to, but treated as minimum standards, not maximums.

MARTIN WILES
ENERGY AND ENVIRONMENTAL MANAGER
28/06/01