
BUILDING HANDBOOK

A Guide to the Energy Efficiency Design of Educational Buildings

March 1998

ENERGY EFFICIENT DESIGN OF EDUCATIONAL BUILDINGS

This guide is **aimed at** Project Managers, Architects, Services Engineers and the other members of the team involved in the design and planning of educational building projects.

Its **purpose** is to set the standards and outline good practice on services for energy conservation and to highlight the main issues to be considered by the design team from the pre-planning stage of a project.

Topics are not covered in depth, since a considerable quantity of useful information has already been published on this subject in recent years. These are detailed in Part 7 of this guide.

Part 1 describes the approach required of a design team and the issues they should address at the pre-planning stage of a project.

Part 2 introduces the major design issues regarding the building envelope.

Part 3 refers to energy performance targets.

Part 4 deals with energy efficient mechanical services.

Part 5 deals with energy efficient electrical services.

Part 6 deals with water usage.

Part 7 refers to other publications and sources of information.

Appendix A is a desktop checklist.

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INTRODUCTION ENERGY EFFICIENCY STANDARDS

PART 1	-	DESIGN FACTORS
1.1-1.2	-	Integrated Approach
1.3-1.4	-	Occupants and Operators
1.5	-	Site Features
1.6	-	Plan Form
1.7	-	Orientation
1.8-1.10	-	Passive Solar Energy
1.11	-	Location of Services
PART 2	-	FABRIC
2.1	-	Construction
2.2-2.3	-	Insulation
2.4-2.6	-	Ventilation
2.7-2.8	-	Daylight
2.9	-	Finishes
PART 3	-	ENERGY TARGETS
3.1	-	Values and Standards
3.2-3.3	-	Design Energy Targets
PART 4	-	MECHANICAL SERVICES
4.1	-	Thermal Environment
4.2-4.6	-	Boilers and Boiler Efficiency
4.7	-	Chemical Treatment
4.8-4.11	-	Heating Design
4.12	-	Domestic Hot Water
4.13-4.15	-	Heating Controls
4.16-4.19	-	Building/Energy Management Systems
4.20-4.21	-	Ventilation
4.22	-	Smoking Policy
PART 5	-	ELECTRICAL SERVICES
5.1	-	General
5.2-5.3	-	Lighting
5.4-5.5	-	Power
PART 6	-	WATER USAGE
6.1	-	General
PART 7	-	OTHER SOURCES OF INFORMATION
7.1	-	Energy Efficiency Office 'Best practice' Programme
7.2	-	DfEE Building Bulletins

INTRODUCTION

ENERGY EFFICIENCY STANDARDS

The design of buildings has a major influence on energy usage and educational buildings which perform well in energy terms will reap significant environmental and economic benefits for years to come.

A considerable quantity of useful information has been published on energy efficiency in recent years. In England, the Department for Education and Employment's **Building Bulletin 87** - 'Guidelines for Environmental Design in Schools 1997' (which replaces Design Note 17 'Guidelines for Environmental Design and Fuel Conservation in Educational Buildings' 1981) (see 7.2) provides practical advice on standards and a companion document, the Building Research Establishment Conservation Support Unit (BRESCU) **Good Practice Guide 173** - 'Energy Efficient Design of New Buildings and Extensions - for Schools and Colleges' (see 7.1) addresses those issues which distinguish school design from other buildings and looks at the way these issues influence energy efficiency at a strategic level.

Although there are some minor differences between English and Northern Ireland standards for environmental design, much useful information is contained in these guides and it is strongly recommended that all consultants involved in the design of new educational buildings in Northern Ireland should read them.

DENI has decided that the energy targets and CO2 emission targets recommended in Building Bulletin 87 should be complied with (Part 3 refers).

All the other environmental standards specified in the DENI Building Handbook and in the current Building Regulations(NI) must be complied with. These include lighting standards (levels of intensity and glare), room temperatures and guidance on ventilation levels.

The design team should regard the energy conservation requirements of the Building Regulations as an absolute minimum. Insulation levels in excess of these should be readily attainable with conventional building methods.

Where an existing building is to be extended and/or refurbished, every opportunity should be taken to improve its thermal performance, so that it will be as close as reasonable possible to the standard for a new building.

Appendix A provides the team with a desktop checklist which indicates at a glance the tasks to be completed during the design process.

PART 1 - DESIGN FACTORS

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|--------------------------------|-----|--|
| Integrated Approach | 1.1 | The successful introduction of energy efficient measures in an educational building requires close co-operation between the members of the design team and the client, with a coherent approach to the design. Services' engineers must be involved at the pre-planning stage. This integrated approach to design should ensure that sufficient resources are allocated to realise the design intention. The cost effectiveness and environmental of the proposed energy measures should be demonstrated. |
| benefits | 1.2 | The design process should bring together the following elements in an integrated package: ventilation; daylight and sunlight; flexibility; educational needs; heating; domestic hot water; solar gains; existing premises. Too often energy efficiency measures are list for economies. As a result, the building will not perform adequately. Value for money and common-sense energy efficiency measures should <u>not</u> be sacrificed. |
| top of the | 1.3 | The design team should always bear in mind that ultimately it will be up to the users whether the building performs well in energy terms. The design team should ensure that only equipment and controls which are robust, easy to understand and operate, are specified. If controls are too complicated they will be ignored or overridden, with adverse consequences for energy efficiency. |
| Occupants and operators | 1.4 | The design team should prepare a User Manual which provides operational instructions, maintenance details (including a schematic diagram of the heating system and a record of the correct settings for the controls) and details of the commissioning carried out. Clear operating instructions must be given for the Building/Energy Management System, windows, light switches, thermostats, ventilation grilles, thermostat radiator valves (TRVs) and any other equipment the occupants have to use. |

PART 1 - DESIGN FACTORS

Site Features	1.5	Site features can contribute to an energy efficient building. Existing site characteristics should be utilised and where necessary, the building's immediate environment should be enhanced. The solar features of the site should be examined. This will help to identify opportunities for solar gains to the proposed development. Shelter belts can be introduced to provide protection from the prevailing wind. Ground finishes can be selected to control or enhance reflection.																						
Plan Form	1.6	While compact plan forms may be more economical to build than extended plan forms, the difference in energy consumption may be minimal. Any extra heat loss with a shallow-plan building may be compensated for by increasing levels of insulation, solar gains and greater opportunities for day-lighting. The recommendations in Building Bulletin 87 regarding daylight levels in working areas and views from teaching spaces are easier to achieve with shallow-plan forms than with deep-plan multi-storey designs.																						
Orientation	1.7	<p>A south-easterly orientation has traditionally been favoured because it can maximise pre-heating and reduce summer overheating. The general rule is that the rooms used most frequently should face within 30 degrees of due south to take advantage of solar gains for both heating and lighting. In schools, orientation might be:</p> <table><tr><td>Classrooms</td><td>S(SE)</td></tr><tr><td>Art rooms</td><td>N</td></tr><tr><td>Hall, gym, theatre</td><td>N, NE</td></tr><tr><td>Toilets</td><td>N, NE, NW</td></tr><tr><td>Kitchen</td><td>N, NE, NW</td></tr><tr><td>Staffrooms, offices</td><td>S, SE</td></tr><tr><td>Library</td><td>N, NE</td></tr><tr><td>Workshops</td><td>N</td></tr><tr><td>IT rooms</td><td>N</td></tr><tr><td>Circulation</td><td>Any</td></tr><tr><td>Changing rooms</td><td>N</td></tr></table>	Classrooms	S(SE)	Art rooms	N	Hall, gym, theatre	N, NE	Toilets	N, NE, NW	Kitchen	N, NE, NW	Staffrooms, offices	S, SE	Library	N, NE	Workshops	N	IT rooms	N	Circulation	Any	Changing rooms	N
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PART 1 - DESIGN

FACTORS

Passive Solar Energy

- 1.8 Careful consideration should be given to the design and orientation of the building to take advantage of solar gains and natural illumination, since solar energy, if properly utilised, can make a significant contribution towards reducing a building's energy consumption.
- 1.9 The aim should be to make the maximum use of daylight and to optimise solar heat gain while reducing any adverse effects to a minimum. Obtaining a positive energy balance for the windows whilst avoiding overheating is one of the most important design issues. The heating system must be responsive enough to adjust to solar gains.
- 1.10 Although the inclusion of an atrium or conservatory can provide savings in heating energy, such features may not automatically result in energy savings. A heated atrium, if not carefully designed, may turn out to be extremely wasteful energy. The cost-effectiveness of such measures throughout the life of the building must be evaluated, taking into account the projected savings in running costs.

Location of Services

- 1.11 The siting of boiler houses, plant rooms and other services should be considered in the early design stage, taking account of energy usage, health & safety and possible future developments.

Construction

2.1 Occupancy patterns can vary and the structural mass of the building should be matched to the intended use. Usually thermally light-weight buildings are specified for intermittent use and heavy-weight buildings for continuous use. If in doubt, traditional medium-weight construction should be used. Excessive thermal mass is not appropriate in intermittently occupied and heated zones. The fixing of pinboards/display boards to wall surfaces will reduce the available thermal mass.

Insulation

2.2 Thermal insulation of the building fabric is a key element to energy efficiency. The standards of thermal insulation required by the Northern Ireland Building Regulations should be regarded as the absolute minimum and insulation levels in excess of these should be readily achievable with conventional building methods. Attention to detail here will result in lower running costs and less capital expenditure on heating plant. It is essential that the workmanship is of a high standard and that the insulation is correctly installed, otherwise the thermal performance of the building envelope will be compromised.

2.3 U-values should be calculated using the Chartered Institute of Building Services Engineers (CIBSE) Guide A3 'Thermal Properties of Building Structures'. In calculating U-values, account should be taken of any thermal bridges, such as joints and framing. As standards of thermal insulation are improved, greater care should be taken to check that the structure is not susceptible to harmful interstitial condensation.

- Ventilation (see also 4.20 & 21)**
- 2.4 Designing for natural ventilation must be considered from the beginning. While the standards of ventilation referred to in the Building Regulations should be complied with, the guidance contained in Building Bulletin 87, Section D should also be followed. While maximum use should be made of natural ventilation, supplementary mechanical ventilation may be required in spaces with high functional heat gains or areas having a high risk of condensation. Where mechanical ventilation is necessary, the benefit of the use of heat recovery should be considered. This can reduce heat losses by up to 50%.
- 2.5 The main method of controlling ventilation in most buildings is by the opening and closing of windows. Controls should be robust and easy to operate. Trickle vents can be a very effective way of providing controlled natural ventilation. Care should be taken in the design of the ventilation system to ensure that air movement at the occupants' level does not result in discomfort.
- 2.6 In a well insulated building, ventilation heat losses account for a major part of the energy consumed, so it is important to minimise air infiltration through joints in the external envelope, around door and window openings and service penetrations. Window and door seals should be adequate for the degree of exposure. Appropriately sized draught lobbies should be provided wherever possible.
- Daylight**
- 2.7 The standards for daylighting as recommended in Building Bulletin 87, Section B 'Lighting', should be complied with (ie daylight factors, daylight uniformity ratios, daylight illumination levels). Natural light should be the prime means of lighting, with electric light to supplement it. Windows should be of a size to provide adequate daylighting. They should not be oversized as this increases heat losses in winter and solar gains in summer. Vertical glazed areas should be between 20% and 40% of the internal elevation of the exterior wall. Reasonable daylighting can be achieved 6-7 meters from a window.

PART 2 - FABRIC

2.8 Where necessary, overhanging eaves, external shading or recessed windows on the south facade should be provided to avoid excessive solar gains in the summer (overhanging eaves can, however, significantly reduce the level of daylight within the building). The use of light shelves on larger windows can reduce contrast and improve daylight distribution. Roof-lights, particularly in circulation areas, can reduce electric lighting requirements but can result in increased heat losses. Appropriate glazing can reduce these heat losses to acceptable levels. The security implications of roof-lights should be evaluated.

Finishes

2.9 Light coloured internal finishes will make a significant contribution to reflecting daylight throughout the building, thus avoiding the unnecessary use of artificial lighting.

PART 3 - ENERGY TARGETS

Values and Standards

- 3.1 **Only energy consumption values and standards set out in the Guidelines for Environmental Design in Schools, Building Bulletin**

87, will be accepted.

Design Energy Targets

- 3.2 Design energy targeting should be considered and set at an early stage to assist in producing an energy efficient design and to minimise the running costs of the building. Energy targets should be used as initial design aids in situations where the effects of changes in basic building design concept are being investigated. They should provide clear objectives for the designer, to enable emphasis to be given to the needs of energy conservation and the best method by which this can be achieved. The targets should not be considered as substitutes for detailed cost in appraisals of the building design.

- 3.3 The Design team must be able to demonstrate that the agreed energy and environmental performance targets will be achievable, while providing evidence that the services are correctly commissioned. They should evaluate and state the estimated annual energy performance target (Kwh/m²/annum) and CO₂ emissions target (KgCO₂/m²/annum) each primary energy source (eg, gas electricity, oil or solid fuel). The estimate, which should be based on an operational period of a year, should be submitted to the Department at RIBA Stage D in form BAB1. A revised submission will be required at RIBA Stage E/F in the same form. The Project Manager should verify that the values quoted are in keeping with Building Bulletin 87 and arrange for independent confirmation of their accuracy after the building has been commissioned. Confirmation of actual performance will be required on expiration of the 12 month defects liability period (Form EG1).

for

PART 4 - MECHANICAL SERVICES

- | | | |
|--------------------------------------|-----|--|
| Thermal Environment | 4.1 | Temperatures should be in accordance with Building Bulletin 87 and the Building Handbook, measured at a height of 0.5m above floor level during occupation when the external temperature is -1°C . |
| Boilers and Boiler Efficiency | 4.2 | Fuel selection and flue gas temperatures must be considered when specifying boiler type. High level inlet combustion air louvers in the boilerhouse take advantage of the warm air trapped at ceiling height. |
| | 4.3 | Chimney design is an important factor in boiler efficiency and in limiting and controlling emissions into the atmosphere. Proper drainage from the base of the chimney with local isolation for periodic removal of rain water should be incorporated. Annual maintenance and cleaning of the chimney assists boiler efficiency. |
| | 4.4 | A stainless steel double skin multi-section flue, matched to the boiler smoke box diameter, is considered the most effective method of flue gas dispersal. It can be free standing self supporting, free standing structurally supporting, wall supported or internally supported in an existing brick chimney. A minimum boiler flue angle (rake) of 45° from boiler to vertical stack should be provided. Test points are required for flue gas sampling, balancing and establishing correct smoke test/ CO_2 / SO_2 percentages. Excess air ("cold flame") burning leads to unnecessary heating and further reduces heat transfer time. This contributes to poor efficiency. |

PART 4 - MECHANICAL SERVICES

4.5 Sectional boilers in cast iron or mild steel are generally the accepted form of construction. Oil fired condensing boilers are acceptable but are more suitable when firing natural gas or LPG fuels. Condensing Economisers or heat exchangers are more widely accepted in stainless steel, as they are smaller. Pre-heated return water going to the boiler from the heat exchanger can achieve up to 10% overall improvement on efficiency. On large boiler installations, the secondary heat exchanger should be positioned after a flue gas desulphurisation process. Consideration should be given to the installation of a gas combination boiler for heating and hot water in the kitchen/dining area.

4.6 The installation of a single large boiler may not always be the best solution, especially when operating at low demand without a shunt pump. Where space is available, modular boilers have the advantage of multiple turn-down stages, allowing individual units to operate close to their maximum efficiency at all times. 'Cascade sequencing', a short circuit prevention valve system, reduces heat loss potential in a well designed system. A full financial assessment is required to determine the ideal modular boiler set for a particular installation.

Chemical Treatment

4.7 Chemical treatment in Low Pressure Hot Water (LPHW) heating systems is mandatory and subject to the COSHH Regulations. Chemical agents such as **Inhibitors** to help control corrosion scale and microbiological growth, **Non-acid Descaler** for elimination of lime scale, **Cleansing Agent** for removal of excess flux residues, grease oily contaminants and sludge, all contribute to the efficiency of boiler and plant. All pipework and shower heads should be sterilised by chlorination in order to minimise the risk of legionella.

PART 4 - MECHANICAL SERVICES

Heating Design

- 4.8 LPHW heating systems, with feed and expansion tank, are preferred. The use of other systems, for example pressurised heating systems, can be an option but should be justified. Composite boilers would not be suitably utilised within a school design. A combination of condensing and conventional boilers is a recognised possibility in plant room arrangements.
- 4.9 The two pipe reverse return system provides common resistance when balancing equal index circuits. This can be a fundamental characteristic in schools. Fan assisted convectors have a high maintenance cost, due to clogged finned coils and noisy fan units. This should be costed in the Appraisal when deciding on the type of system to be used.
- 4.10 The system should be zoned and controlled appropriately to take account of differing functions, different operating hours for different departments and orientation. Heating circuits should be divided into suitable sub-zones, automatically varied by a weather compensation control system. For example, administration offices and other rooms or areas with variable occupation rates should be zoned separately with alternative forms of heating for outside normal hours of use.
- 4.11 Under-floor heating and/or radiant ceiling panels could be considered for particular applications, eg nursery schools, Science/IT/Technology classrooms, special schools, kitchen/dining area, multipurpose assembly halls and sports halls. High-level heat emitters will require special attention, to ensure a satisfactory level of heat output.

PART 4 - MECHANICAL SERVICES

Domestic Hot Water

- 4.12 When designing for hot water, the following should be taken into account:
- i. the quantity of hot water to be stored should be related to the predicted minimum consumption rate and available recovery period;
 - ii. instantaneous or semi-instantaneous hot water generation by installing modular non-storage calorifiers and plate exchangers should be considered when sizing the primary boiler capacity;
 - iii. the system can be directed to high recovery heat for domestic hot water without sacrificing the comfort conditions of the building to any significant degree;
 - iv. direct fire calorifiers can provide efficient and cost effective hot water, particularly in school kitchens, thereby eliminating the possibility of legionella bacteria;
 - v. a primary hot water circuit can provide heating in a dining area and radiant panels or under floor heating in kitchen areas;
 - vi. trace heating of single hot water flow pipework on deadlegs may be used;
 - vii. non-concussive shower and sink taps reduce hot water demand and save water;
 - viii. immersion heaters should be time controlled (run-back timer) with their temperature set correctly; and
 - ix. localised point of use water heaters should be considered for certain applications such as small nursery and primary schools, staff room, mobile classrooms (science) and cleaners store (see 5.5 vii.).

PART 4 - MECHANICAL SERVICES

Heating controls

They

- 4.13 Automatic control systems should be provided to operate the plant safely, maintain conditions within permitted tolerances and to conserve energy. They should be of the direct digital control (DDC) type, flexible and intelligent, and suitable for operating in conjunction with a Building Management System (BMS) or Energy Management System (EMS).
- 4.14 Local control of heating in classrooms is possible with thermostatic radiator valves (TRV) on selected radiators, or combined temperature/sonic sensors controlling 2 port motorised valves with a set back temperature facility. The possibility of vandalism to these controls should be considered.
- 4.15 When detailing the specification for automatic control systems, the following should be taken into account:
- i. the output to the system is provided from two or more plant items, sequence selection facilities should be provided to alter lead/lag functions and to even out plant wear;
 - ii. turn down burner facilities, whether high/low on/off, or modulating by variable speed using frequency inverters, are desirable;
 - iii. multiple motor starter control panels having duty and standby motor starters should be sectionalised, with duty starters in a separate compartment from standby starters and each section provided with a compartment isolator;
 - iv. all control valves should be capable of being locally isolated for maintenance purposes;
 - v. control panels should incorporate run and trip indicator lights with manual, auto and off, switches for plant motors;

PART 4 - MECHANICAL SERVICES

- vi. control functions should be in accordance with the requirements of individual sections (eg optimum start/stop, flow temperature weather compensation, flow interlocks, run-on timers etc);
- vii. optimum Start/Stop controls should be incorporated on a central basis. Controls should be programmable and enable day extension, day(s) omit (holidays and weekend) night set-back and frost protection override facilities; and
- viii. all control panels should be coded and a suitable description should be provided for use/information of maintenance/premises staff.

Building/Energy Management Systems (BMS/EMS)

- 4.16 An Energy Management System (EMS), or in some circumstances, a Building Management System (BMS), should be included in all designs.
- 4.17 The Client's agreement to and understanding of the BMS/EMS should be obtained prior to incorporation into the works. A BMS should be installed where it is economically viable and practicable to have all services within a building monitored and controlled. It should be arranged to undertake all controls, status and condition monitoring, alarm signalling and reporting, plant operating and switching functions and should include maintenance and inventory scheduling and life safety/security monitoring.
- 4.18 The BMS should comprise one or more 'intelligent' stand alone type outstations, located in positions to suit the layout of the services to which they are connected. The outstations should be linked to a central processor unit. A colour monitor and printer should be included.

PART 4 - MECHANICAL SERVICES

- 4.19 When detailing the specification for the BMS/EMS, the following should be implemented:
- i. it should have some spare capacity both in the out stations and in the central processor to allow subsequent enhancements;
 - ii. it should be capable of stand alone and remote monitoring/control operation;
 - iii. the design must ensure electromagnetic compatibility with other electronic systems or devices in the building;
 - iv. it should not prevent manual overriding control of any item of plant or equipment;
 - v. it should be capable of logging performance data;
 - vi. all safety devices and interlocks should be hardwired;
 - vii. all necessary software should be programmed into the system including colour graphics of all plant and systems with all monitoring or control points clearly identified;
 - viii. it must be fully commissioned and left in complete working order without the need for further software input; and
 - ix. the supplier should provide, as part of the contract, a minimum training period to enable users to become familiar with the operation of the system prior to hand-over.

PART 4 - MECHANICAL SERVICES

- Ventilation (see also 2.4-6)**
- 4.20 A naturally ventilated building is preferred to one relying on mechanical ventilation. In mechanically ventilated areas, design should not attempt to achieve conditions significantly better than those which would have resulted had natural ventilation been an accepted solution.
- 4.21 Consideration should be given to the installation of 'mixed mode' systems, whereby natural ventilation is relied upon for the majority of the year, reverting to the operation of mechanical systems only when internal or external temperatures reach a predetermined maximum. The infiltration (natural ventilation) rate should be assessed, adopting the calculation method defined in BRE Digest 339, assuming windows will be closed in the unoccupied period.
- Smoking Policy**
- 4.22 The Consultant should seek advice from the client regarding the policy to be adopted on smoking, since this will influence a number of design parameters.

PART 5 - ELECTRICAL SERVICES

General

- 5.1 Although electricity usage represents about 25% of all energy consumption in a school, it may account for up to 75% of the expenditure on all energy fuels. It is important, therefore, to 'fine tune' the load to the building to meet known demand and to consider in some detail the electric consuming equipment within the building.

Lighting

- 5.2 The lighting installation should be designed using levels of intensity and glare as specified in the Building Handbook. Each room should be carefully designed on its own merits for lighting layout with luminaries parallel to windows. The most advantageous local switching arrangements with separate controls should be considered and the control range should be from 100% to 5%. The range of different sizes and types of lamps should be limited to reduce replacement and maintenance costs.
- 5.3 The following types of luminaries and controls should be installed:
- i. luminaries with high frequency regulating ballasts, high frequency or low loss gear with automatic daylight sensors for dimming in classrooms, if appropriate;
 - ii. movement or sound presence/absence detectors with time delay facilities. Detectors should dim luminaries to 5% where rooms are not occupied for short periods;
 - iii. 'PL' and '2D' fluorescent luminaries, instead of spotlights and tungsten wall washer type fittings; and
 - iv. low energy discharge flood lights for outside and for security lighting. Outside and security lighting should be controlled by photocells and time switches with hand/off/auto facilities.

PART 5 - ELECTRICAL SERVICES

Power

- 5.4 The electricity load for new or extended buildings should be discussed with DENI/ELBs before a formal request for terms is submitted to NIE. Existing tariffs and load should also be checked.
- 5.5 When detailing the specification for general electrical works the following should be taken into account:
- i. the existing load should be balanced over 3 phases;
 - ii. electric kitchen equipment should be 3-phase;
 - iii. pumps in the boilerhouse should also be 3-phase with variable speed drives;
 - iv. electric motors for fans and pumps should be high efficiency types and the proper size;
 - v. two speed or variable speed drive motors should be considered for areas where demand can be flexible (ie Sports Hall/Swimming Pool);
 - vi. electric heating or storage heating should incorporate automatic controls such as time switches, tamperproof thermostats and presence detectors;
 - vii. in cleaners' stores and where hot water requirements are low, point of use water heaters with a run back timer (0-2 hour) should be used;
 - viii. time switches should be capable of being programmed for day(s) omit (school closures and weekends); and
 - ix. low power consuming equipment should be specified where practicable. Automatic shutdown facilities should be incorporated into items such as computers and photocopiers.

PART 6 - WATER USAGE

- 6.1 The control of water consumption can be achieved by installing push-button taps on showers, economisers on urinals, restrictors on hot/cold taps and by ensuring that the water supply to the site is appropriately sized. Water meters with a capability for remote monitoring should be installed for each facility.

PART 7 - OTHER SOURCES OF INFORMATION

- Energy Efficiency Office
'Best Practice' Programme** 7.1 A large number of Energy Consumption Guides, Good Practice Guides and Good Practice Case Studies has been published under the Energy Efficiency Office, Department of the Environment, 'Best Practice' programme.
- For the complete list of Best Practice programme publications contact;
- Industrial Research & Technology Unit (IRTU)
Energy Efficiency Section
17 Antrim Road
Lisburn
Co Antrim
BT28 3AL**
- Tel: (028) 9262 3029**
- DfEE Building Bulletins** 7.2 The Department for Education and Employment publishes a number of Building Bulletins, Guides, Design Notes etc. Details are available from:
- Department for Education & Employment
PROLOG
PO Box 5000
Sudbury
Suffolk
CO10 0JY**
- Tel: (0845) 6022260**
- Building Bulletin 87 'Guidelines for Environmental Design in Schools' is considered to be essential. It costs £13.95 and it, and other priced publications are available from The Stationery Office bookshops.
- DENI Building Handbook** 7.3 **The Building Handbook** provides advice and guidance on the planning and design of school premises. The following sections have been published:
- SECTION 2 Nursery Schools
SECTION 3 Primary Schools
SECTION 4 Secondary Schools
- They are also available from The Stationery Office bookshops, price £18.30 each.

APPENDIX A - DESKTOP CHECKLIST

PART 1 - DESIGN FACTORS - 1.1-1.11

1. Windows shaded, where necessary to reduce solar gains.
2. Glazed area optimised for natural daylighting and solar gain.
3. Landscaping.

PART 2 - FABRIC - 2.1-2.9

1. Structural mass of the building matched to the intended use.
2. Thermal bridges taken account of in U value calculations.
3. Thermal insulation standards exceed Building Regulations requirements.
4. Design checked for avoidance of harmful condensation.
5. Structural air leakage (air infiltration) minimised.
6. Window and door seals are suitable for the degree of exposure.
7. Maximum use made of natural daylighting.
8. Double glazed units specified.
9. Light coloured internal finishes are specified.

PART 3 - ENERGY TARGETS - 3.1-3.3

- Building Bulletin 87 Guidelines for Environmental Design in Schools Section F: Energy (Carbon Dioxide Rating)

APPENDIX A - **DESKTOP CHECKLIST**

PART 4 - MECHANICAL SERVICES

Heating and Hot Water - 4.2-4.12

1. Cost effective heating plant selected to meet the design heating load and working near peak output.
2. Time, temperature and zone controls specified to effectively meet user needs.
3. Separate heating installations are provided to meet seasonal loads.
4. Length of service runs minimised.

Energy Management Controls - 4.13-4.18

1. Utility meters are specified on the oil, electricity and water supplies.
2. Power factor correction equipment is specified on the electrical services.
3. Electricity meters specified are capable of registering 30 min demands.
4. For control, monitoring and maintenance purposes a Building Management Systems (BMS)/Energy Management Systems (EMS) has been specified.

Ventilation - 4.20-4.21

1. Maximum use made of natural ventilation.
2. Ventilation levels complied with.
3. Plan layout takes account of the movement of moist air.
4. Robust and finely controllable window furniture specified.
5. 'Free cooling' is used to minimise the need for air conditioning.
6. Minimum use made of mechanical ventilation and/or air conditioning.
7. Heat recovery or cool air recovery specified.

APPENDIX A - **DESKTOP CHECKLIST**

PART 5 - ELECTRICAL SERVICES

Lighting - 5.2-5.3

1. High efficiency lamps are specified for all suitable areas.
2. Lighting is switched to minimise use and provide flexibility of use.
3. Daylighting controls are specified for suitable areas.
4. Occupancy sensing controls are specified for intermittently used areas.
5. Feature lighting and inefficient lamp types are not specified.

Power - 5.4-5.5

1. Load balanced over 3 phases.
2. High efficiency, variable speed, 2 speed motors and pumps are specified
3. Automatic controls for electrical heating are specified and time controls can be programmed.
4. Shutdown facilities provided in areas where large numbers of Equipment provided.

FORM EG1: 12-MONTH DEFECTS LIABILITY PERIOD

DEPARTMENT OF EDUCATION (NI) BUILDING HANDBOOK

Energy Guidelines Form of Compliance

(Return complete to Department of Education, 2nd Floor, Rathgael House)

Educational Building: _____ Ref: _____

Full Postal Address: _____

Energy Targets

Estimated Performance as Bulletin 87	Energy Target Kwh/m ² /annum	CO ₂ Emissions Target Applicable Kg CO ₂ /m ² /annum

Actual Performance	Energy Use Kwh/m ² /annum	CO ₂ Emissions Kg CO ₂ /m ² /annum

Remarks

Projects Manager/Lead Consultant
Signed: _____ Date: _____

*I certify that this project has been designed and constructed
in accordance with the Energy Guidelines.*

Architect Signed: _____ Date: _____

M & E Consultant Signed: _____ Date: _____