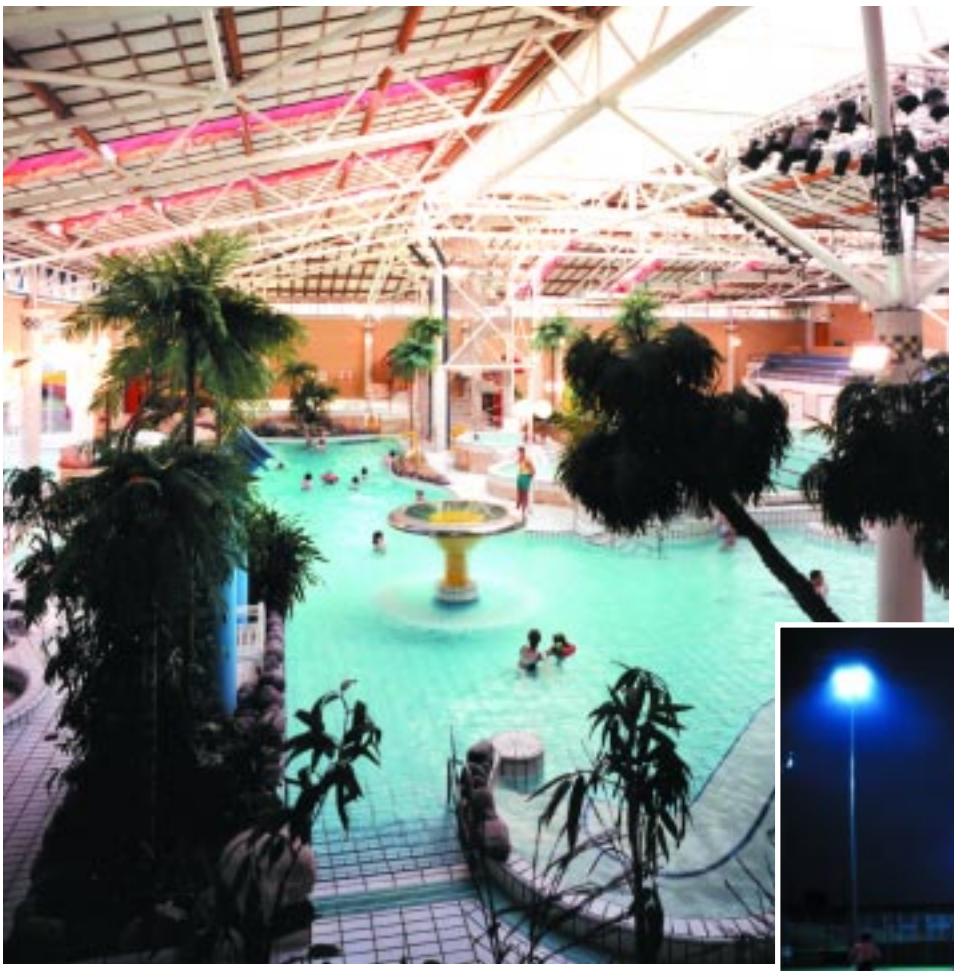
Energy use in sports and recreation buildings



- Covers seven centre types
- Simple energy cost benchmarks
- Energy benchmarks tailored to your centre
- Advice on energy efficiency improvements

BEST PRACTICE PROGRAMME

ENERGY EFFICIENCY

BEST PRACTICE PROGRAMME

ENERGY CONSUMPTION GUIDE 78

CONTENTS

BRECSU gratefully acknowledges the collaboration and assistance of Sport England in the selection and illustration of typical sports centre buildings as the 'reference types' in this Guide.

1 INTRODUCTION

THE SPORTS SECTOR

Sports facilities include swimming pools, dry sports halls, exercise rooms, internal and external courts, ice rinks, team game pitches and associated changing and social functions. They may exist either as single activity centres or as combined centres with more than one facility.

The UK's sports sector buildings spend £700 million on energy every year, resulting in annual emissions of 10 million tonnes of carbon dioxide (CO_2) – the principal contributor to climate change. Sports facilities, such as swimming pools, can have high associated energy costs.

There is often substantial scope for improvement to:

- services and controls
- fabric (especially for buildings constructed when energy efficiency standards were lower)
- management of technical systems.

The introduction and upgrading of energy-saving measures can therefore be very rewarding, both financially and in terms of user comfort.

ENERGY COSTS AND CONSUMPTION

To allow comparison between centres of different sizes, annual energy consumption (by fuel) is usually expressed in relation to the total floor area in m^2. This can then be compared with benchmarks in a number of ways to help manage energy use and reduce costs. For example:

- a **centre business manager** can compare a centre's annual energy cost with benchmarks to identify how well it is performing, and the likely potential for energy cost savings
- a **local authority leisure officer** (or sports/leisure client) can use the annual energy consumption to benchmark technical performance of contracted-out management
- a **property manager** of a sports/leisure management company can assess energy efficiency when considering a property for purchase; and can identify which part of their estate has relatively high energy costs, and so merits priority attention for investigation and improvement
- a **local authority 'Best Value' cost controller** can check that energy costs are performing well against benchmarks in general, and review any facilities with problems
- an **energy manager, facilities management contractor or consultant** can look at a centre to assess the scope for energy and cost savings.

INTRODUCTION

Benchmark comparisons are also useful for:

- routine assessments to show progress against benchmarks, not only year-on-year, but also quarterly or monthly
- opportunistic assessments when a facility is being acquired or upgraded, or when management changes are planned.

USING THIS GUIDE

This Energy Consumption Guide is published as part of the Government's Energy Efficiency Best Practice programme (EEBPp), the building-related aspects of which are managed by BRECSU. The Guide incorporates a range of benchmarks against which the actual performance of sports centres can be compared.

The benchmarks are derived from data collected from over 200 sports centres across the UK. The two core benchmarks are ***typical*** and ***good practice***. ***Typical*** represents the average energy performance of the sample surveyed, whereas ***good practice*** indicates what is achievable using widely available and well-proven energy-efficient features and management practices.

The Guide describes a number of approaches for comparing performance, depending on the available data and level of sophistication required. The simplest of these requires only straightforward information, while the more complex approaches refine the procedure to match an individual sports building and its facilities more closely. Whichever benchmarking approach is used, it is worth considering some of the energy-saving measures outlined in section 3. The Guide's structure is described below.

Undertaking a simple assessment

The simple assessment method is described in section 2 and is based on total energy costs per m^2 of floor area, with benchmarks for seven types of centre. This assessment is intended for use by sports centre managers, or as an initial step by property or facilities managers.

To assess your sports centre, first select which of the seven listed types is closest in its composition of facilities to your own. Then simply divide your total annual energy cost by the gross area of the centre (in square metres) and compare the result with the selected centre benchmarks.

- If it is more than ***typical***, then you need to take urgent action to reduce energy consumption. Some measures are suggested in section 3.
- If it is between ***typical*** and ***good practice***, then action is still needed in order to get the best out of your centre.
- Even if it is less than ***good practice*** there are nevertheless further measures which can be taken, but with less urgency.

Appendix 1 provides a worked example and a blank proforma.

INTRODUCTION

Identifying energy efficiency measures

Section 3 contains a checklist of measures for saving energy, including references to some useful publications produced under the EEBPp. The measures can be applied to an existing centre, or at the design stage for new buildings or major refurbishments. The checklist also outlines key aspects of useful energy technologies for existing buildings and design principles for applying to new-build developments.

A detailed assessment

A more detailed assessment of each of the seven reference types of centre is described in section 4. This assessment enables you to take account of differences in size, specification, equipment and/or use between your centre and the basic types used in the simpler cost benchmarks assessment described in section 2.

The two pages on each centre type start with a description of:

- the sports facilities included in the reference type, eg the types of pool included in a local swimming pool centre
- the areas of the centre taken up by each facility (compared in the graph on page 16)
- a typical size and plan of centre type
- notes on construction and servicing.

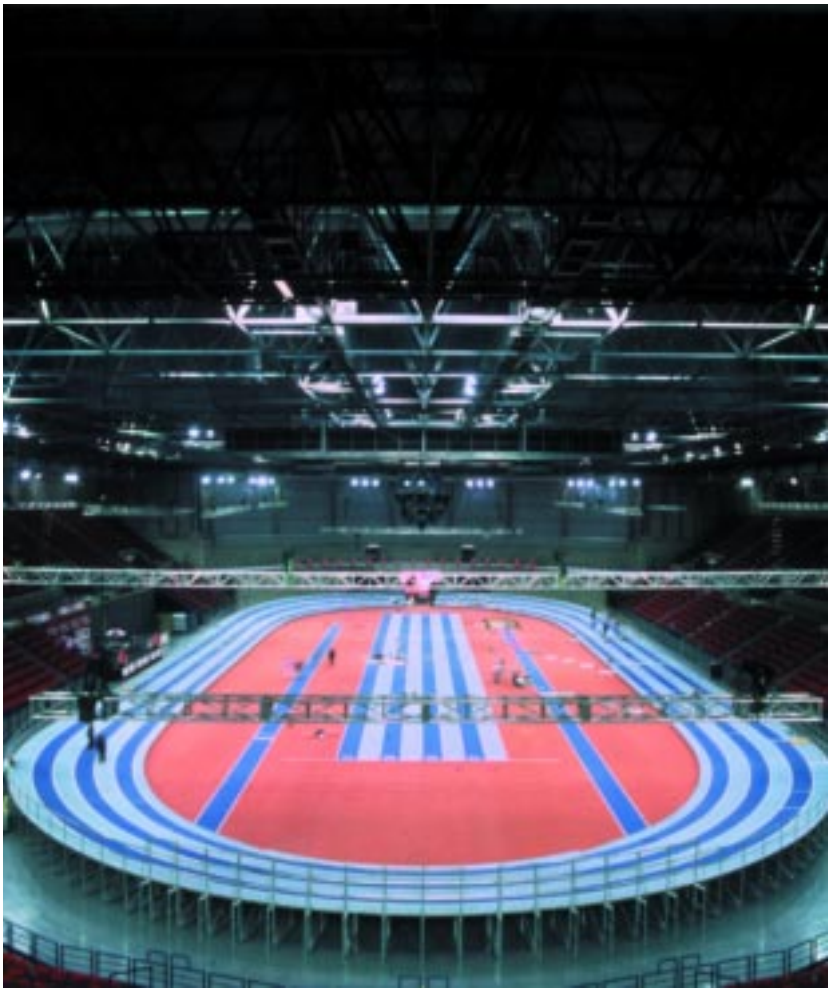
The second page for each centre type gives a table of benchmarks in terms of:

- annual electricity consumption in kWh/m^2
- annual gas consumption in kWh/m^2
- annual energy cost in £/m^2 and total £ for the centre type of the typical size.

(See the box in section 4 for further explanation.)

The table also gives:

- details of how energy consumption and cost can be improved from ***typical*** to ***good practice*** levels by the progressive application of specific types of energy-saving measure
- further adjustments to take account of age, location, exposure, intensity of use, special features such as snack bars; and servicing features including the use of combined heat and power (CHP) systems.



The figure for each feature or factor should be added to or subtracted from the core ***typical*** benchmark, as indicated. This information will give an estate manager or client more detail and permit a closer tailoring of benchmarks to match an individual centre's features and plant.

Once the benchmarks have been tailored to your centre's profile, you can compare them against your actual consumption. Electricity and fossil fuel ('gas' in the tables) should be counted separately as they:

- serve different end uses
- are billed separately
- have very different implications in terms of cost and carbon emissions.

INTRODUCTION

If consumption and/or cost is above the benchmark, then you should review the measures listed in section 3, as it should be possible to improve the control of the plant and systems. If performance is already lower than the benchmark, you still need to keep close management control over the energy use, to ensure that it does not creep up again. Experience shows that, even in the most energy-efficient centres, further reductions in energy consumption are nearly always possible.

Appendix 2 includes a worked example using the look-up tables; and a blank proforma.

Base data

Appendix 3 gives the base data on floor areas and energy use for each of the seven reference types of centre. If the proportions of space taken up by each sports facility differ from the reference centres (see table 8 for the schedule of floor areas), an experienced cost controller or energy management specialist can take account of this and use table 9 to build up a benchmark specific to the mix of facilities at the centre. These data also allow custom benchmarks to be made up for any composition of sports centre (with different floor areas, uses, or mixes of features). Table 9 also gives data to allow accounting in terms of CO_2 emissions.

Energy management specialists can also use table 10 to split the benchmarks according to building services plant end use. This is intended to allow analysis of which systems contribute to different aspects of overall energy performance, using the principles of the Energy Assessment and Reporting Methodology. This is covered in more detail in CIBSE Technical Memorandum 22[1].

A CD-ROM is being prepared to provide further assistance with creating benchmarks specific to your centre, and also to suggest measures to reduce energy consumption.

Further information

Section 5 provides useful contacts, references, technical background and conversion factors.

BENCHMARK DATA

BRECSU is always seeking new and credible energy performance data. If you have any that you consider applicable, particularly for centres that are more energy efficient than the current ***good practice*** benchmarks, please let us know at **brescuenq@bre.co.uk**.

2 ANNUAL ENERGY COSTS

REFERENCE TYPES

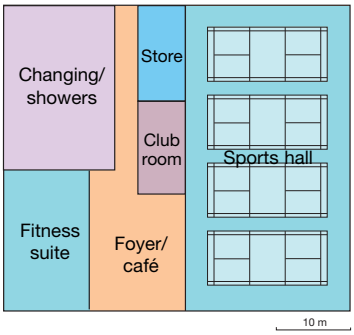
The seven reference types range from a local dry sports centre to a regional leisure centre. All reference types, with the exception of the type 6 sports ground changing facility, include a reception area and a typical number of staff offices.

For each of the reference types, benchmarks are given as annual energy cost per square metre, so they can be used for any size of facility, as long as its mix of activities and features are broadly similar to the reference example. If they are not, use table 9 to build up a benchmark based on the mix of activities at your centre.

Section 4 contains plans of each reference type and more detailed information on the effect of different features.

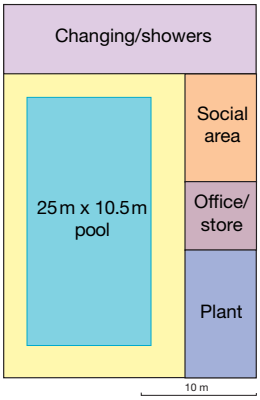
Type 1 – local dry sports centre

The core feature is a sports hall of a size suitable for four badminton courts, which can accommodate five-a-side football, basketball and other sports. The centre has changing rooms, a fitness room and a club/meeting room (in some centres this area is used instead as a crèche, soft play area, snack bar or licensed bar).



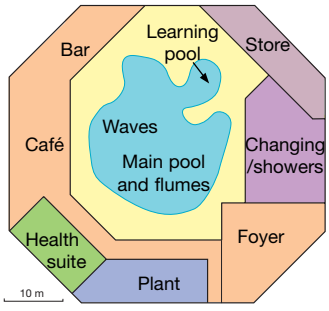
Type 2 – 25 m swimming pool centre

A stand-alone centre arranged round a 25 m five-lane pool. It includes wet changing rooms, and a vending/seating area.



Type 3 – leisure pool centre

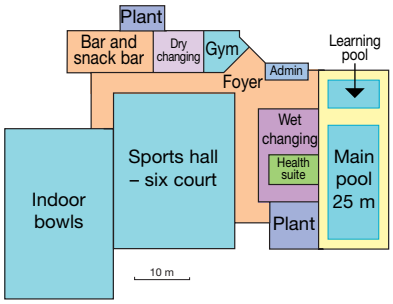
The free-form pool has a wave area, adjoining learning pool, splash pool for the flume run-off, changing area, café and bar.



ANNUAL ENERGY COSTS

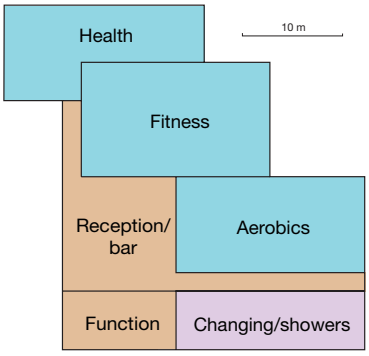
Type 4 – combined centre

This includes a 25 m five-lane pool and a learning pool, plus a six-court sports hall and a six-lane indoor bowls hall. There is a licensed bar and snack bar, fitness room and health suite with jacuzzi, sauna and solarium.



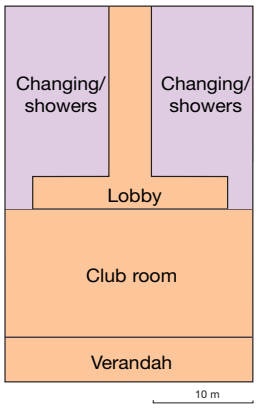
Type 5 – fitness centre

Organised around fitness studios and a suite of exercise rooms with exercise machines, the centre has a sauna, solarium, licensed bar and a snack bar. The tables assume central mechanical ventilation is provided to most areas, which are also cooled by ceiling cassette units.



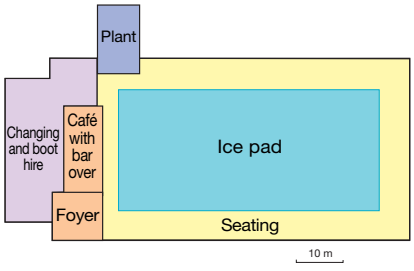
Type 6 – sports ground changing facility

A free-standing changing room/pavilion for team games pitches. The benchmarks assume that energy is needed for lighting, heating, hot water for changing and pitch floodlighting. The floor area basis for the benchmarks is the building floor area only.



Type 7 – ice rink

A main hall with 56 x 26 m ice pad and 500-seat limited spectator area, plus boot hire and changing areas with occasional-use showers, a café, licensed bar and video game areas. Storage is included for machines to tend the rink.



ANNUAL ENERGY COSTS

COST BENCHMARKS FOR INITIAL ASSESSMENT

The table below shows annual energy cost benchmarks for the seven reference types. The benchmarks are related to floor area and so apply to any size of centre. However, since the mix of accommodation and use varies, you should check that your centre is reasonably similar to the appropriate reference type.

Appendix 3 gives the floor areas and features included in each of the seven reference types.

You should obtain the energy cost per square metre for your facility. Add electricity, gas and other energy costs over a 12-month period and divide the total by the total floor area (technically the gross internal floor area (GFA)) measured in m^2. Appendix 1 gives an example calculation and a blank proforma. Floor area in m^2 is best obtained from construction records but can also be measured from drawings if necessary. Energy use is affected by many factors apart from the mix of facilities and features.

- **Imposed factors** – in particular weather (dependent on geographical location) and the extent of use of a centre.
- **Building and plant factors** – exposure, standards of fabric insulation and plant efficiency. The age of a facility can give a first indication of these general standards, but alterations and refurbishments must be taken into account. These often have less effect on the total energy cost than expected – while energy efficiency of buildings and equipment get better, more equipment is installed, and it is used more intensively.
- **Standards of controls, settings and management** – for example, with easy-to-use controls and energy-aware management, the standards of lighting, heating, ventilation and pool temperature can be fully maintained with minimum energy use.

The benchmarks assume typical values for the above factors. They assume electricity costs at 5.5p/kWh and gas costs at 1p/kWh. Section 4 shows how more detailed corrections can be made if your centre has different facilities from the reference centre, if your unit costs are different or your heat is supplied from a different fuel.

Although over recent years energy prices have generally decreased, the Climate Change Levy increases most non-domestic energy costs by 10-15%. At the same time Enhanced Capital Allowances (ECAs) will provide beneficial tax incentives for qualifying energy-efficient plant and equipment (see 'Investment measures for existing buildings', section 3, page 13).

Description	Cost (£/m^2) *Good practice*	Cost (£/m^2) *Typical*
1 Local dry sports centre	5.09	9.21
2 25 m swimming pool centre	14.08	26.40
3 Leisure pool centre	14.74	27.40
4 Combined centre	7.91	14.34
5 Fitness centre	8.99	15.16
6 Sports ground changing facility	6.52	11.18
7 Ice rink	10.18	16.20

Note: The cost benchmarks are based on average unit rates (including standing and demand charges, but excluding the Climate Change Levy and VAT) of 5.5p/kWh for electricity and 1p/kWh for gas. Energy prices vary with the size of supply and are changing rapidly – if yours are significantly different you will need to adjust the cost benchmarks.

Benchmarks of total annual energy cost per m^2 of gross internal floor area

3 MEASURES TO SAVE ENERGY

ENERGY MANAGEMENT APPROACH

Making and maintaining the best savings in energy use and cost is generally best achieved as part of a well-organised plan that has good senior management support. Energy Efficiency in Buildings (EEB) 7[2] shows how to set up and organise an energy management programme. Good Practice Case Study (GPCS) 360[3] illustrates how this was achieved at Kirklees Metropolitan Council. Effective management of sports centres is described in Good Practice Guide (GPG) 146[4], and for swimming pools in GPG 219[5].

Where sports facility management services are contracted out, benchmarks from this Guide may help you to set energy efficiency targets. It is also important to agree who will be investing in energy measures (see General Information Leaflet (GIL) 37[6]).

CHECKLIST OF NO-COST/LOW-COST MEASURES FOR EXISTING BUILDINGS

'Good housekeeping' measures – which require little or no capital investment – are discussed in GPG 129[7] for dry sports centres; and GPG 130[8] for swimming pools. The following actions should be checked off.

- Review the standards of lighting, heating, ventilation and other energy-intensive functions required in each area, and how long these services are to be provided. For manually controlled items (eg local lighting, and extract ventilation in many sports halls) you can often change procedures for turning on and off so that the use fits the needs more closely. Sometimes new local switches or occupancy sensors are required. This avoids waste with no reduction in the service provided or the quality of the environment.
- For timed equipment, such as external lighting and most central ventilation plant, the automatic time settings should be at the minimum reasonable, with facilities and procedures for extending the use when needed, and returning to normal settings afterwards – preferably automatically, but otherwise by an agreed and easily implemented management procedure.
- Make sure that all plant is operated and maintained to work effectively (see GPG 137[9]).
- Make sure that small or local requirements, such as cleaning – or ventilation in a single exercise room – do not cause the rest of a large system to be brought into operation or cause inefficient use of central plant.
- Make sure that room air temperatures, and water temperatures in swimming pools, are set appropriately and checked regularly. Guidance on suitable temperatures can be found in GPG 211[10].
- If ventilation plant has high/low or variable settings, check that the plant normally runs at a low setting, and is only turned up when the facility is heavily occupied. Overnight, ventilation plant should normally be off, except for swimming pool ventilation systems, which may need to run at a reduced speed.
- Ensure that energy-saving equipment or features are used as intended, for example pool hall covers should go on as soon as practical after the last bather leaves the water. Any automatic lighting or plant controls should be fully understood and properly commissioned and set up.
- Water costs can be comparable to energy costs – constant effort and monitoring is required to control consumption and reduce waste (see GPG 228[11]).
- Appropriate and effective maintenance is essential, including checking and re-calibrating controls. This needs all maintenance activities to be clearly defined and carefully monitored.

MEASURES TO SAVE ENERGY

INVESTMENT MEASURES FOR EXISTING BUILDINGS

Measures requiring significant expenditure should be reviewed from time to time and implemented if suitably cost-effective. There should a long-term investment plan – otherwise it is easy to waste money by doing things in the wrong order, for example by replacing equipment a year or two before a major refurbishment. An overview of technologies is provided in GPG 144[12]. Training should be given to ensure that the operation of the equipment is understood by the user. Where possible, the training sessions should be recorded on video as a future reminder to operators and to assist new staff. The operation and maintenance manual must also be updated to incorporate the new equipment, operating and maintenance routines and control settings.

From April 2001, investment in many types of energy-efficient plant and equipment may benefit from Enhanced Capital Allowances (ECAs), whereby the whole cost may be offset against tax in the first year rather than being spread over a number of years. Eligible technologies currently include:

- combined heat and power
- lighting systems
- boiler systems
- pipework insulation
- refrigeration
- high-efficiency motors
- variable speed drives.

Details of qualifying technologies, products and systems are shown at **www.eca.gov.uk**.

Lighting

Older lighting systems in sports areas, pools or general areas can be inefficient; or original light levels may have been excessive. High lighting levels may have been provided for television broadcasts, but operation at these levels is very rarely needed. Illumination levels and power requirements can be evaluated and proposals made for replacement with efficient systems. Most lighting should be high-frequency fluorescent tube or compact fluorescent fittings. There are very few uses for which incandescent bulbs are justifiable – low-voltage tungsten halogen can be justified for sparing use to create effect, but never in bulk. High-bay lighting can be metal halide, high-pressure sodium, or often preferably fluorescent (which offers faster switch-on, the opportunity for step control, and less local loss of light if one tube fails). Guidance on energy-efficient lighting is given in GPG 223[13]; with details for sports halls in Sports Council Guidance Note 383[14] and for floodlighting in Sports Council Guidance Note 370[15].

Heating systems

For central systems, high-efficiency (preferably condensing) boilers will provide substantial savings in relation to older and larger plant. Sometimes localised and locally controlled heating can use less energy, particularly where only occasional heat is required. For example, in high-bay sports halls, gas-fired radiant tubes can provide highly efficient ‘on-demand’ heating. General guidance on sports hall heating is given in Sports Council Guidance Note 382[16]. Boiler replacement is addressed in GPCS 74[17] and case studies of condensing boilers are reported in GPCS 43[18].

Heat recovery

Recovering heat from swimming pool exhaust air is generally cost-effective if appropriately designed. Because gas and oil currently cost much less than electricity (at present typically one-fifth), any increase in fan or pump electricity consumption must be kept as low as possible; and the economics of heat pump installations can suffer. Heat recovery and dehumidification are described in GPG 144[12].

MEASURES TO SAVE ENERGY

Combined heat and power

CHP is generally cost-effective in larger swimming pools, which have a suitable year-round heat load for pool heating. CHP units can be a capital purchase as described in GPCS 280[19] or can be funded by the supplier as described in GPCS 281[20]. CHP is eligible for ECAs if installed to prescribed quality standards. In assessing the costs and benefits of CHP, remember to include both routine maintenance and the larger overhauls typically required at intervals of two to five years (depending on the specific plant and its intensity of use). Don't fall into the common trap of thinking that the recovered heat is completely free.

Building fabric

Improving insulation to current Building Regulations, or better, is often cost-effective during alteration or general refurbishment work but is rarely justified in isolation. GPG 144[12] gives a brief review of glazing and other fabric measures. Even new sports buildings are often far from airtight, so checking and sealing can often be justified, particularly where complaints of draughts have resulted in increasing the heat settings and hours of operation.

Ventilation fans

Fans are usually sized for the maximum ventilation requirement although, in practice, this requirement is rare. The energy cost of running them can be surprisingly high for any mechanically ventilated building, and especially for swimming pools. High-efficiency fans and motors, together with sensitive design of ductwork and air-handling units, can reduce power requirements at full load. Appropriately sized, more efficient fans that can take advantage of low-speed operation for most of the time can save well over 50% of the ventilation energy. Swimming pools require less ventilation when:

- pool covers are used
- activity levels are lower
- advanced pool water treatment (for example, ultra-violet systems) produces less smell.

COMBINED HEAT AND POWER – TECHNICAL ISSUES

CHP plant generates electricity on-site, often using a gas-engined generator. It saves energy and money by making available (as hot water) the engine's exhaust heat, which would normally be wasted. It therefore substantially reduces a centre's electricity requirement from the mains, but increases gas use marginally because the CHP produces hot water with less efficiency than a boiler. To check performance it is necessary to know the gas consumed by the CHP and the electricity it produces – these should be metered and recorded separately from other services. The sizing of CHP plant requires careful consideration of the heat and electrical load profiles and operating hours for the centre. As CHP plant needs to operate for long hours to be cost-effective, it should not be oversized. A CD-ROM guide[21] is planned to be available from the EEBPp to calculate sizing.

In these cases, reducing fan speeds (to levels still sufficient to avoid condensation) can save large amounts of electrical and heating energy. Ventilation measures are discussed in GPG 144[12], together with pool treatment in Sports Council Guidance Note 387[22].

Pool covers

Pool covers reduce heat losses from pool water, and avoid the need for ventilation at night. This further reduces heating and electrical costs in a well-designed, controlled and managed system. GPCS 76[23] describes case studies of alternative types of covers.

NEW BUILDINGS AND REFURBISHMENTS

New buildings and refurbishment offer crucial opportunities to make sports facilities energy efficient, often at little or no extra cost for the project, although the budget may need to be spent differently. The following principles have been identified.

MEASURES TO SAVE ENERGY

Principles	Examples
A good brief should include qualitative and, if possible, quantitative criteria and benchmarks. It should also be effectively managed throughout the process; with regular reviews of requirements as the design develops, including standards, proposed solutions, room data sheets, and the implications for centre management.	Ensure these design principles are applied. Set benchmarks for Watts per m^2 of lighting, fans and pool pumping power. Consider energy efficiency when purchasing all equipment.
Prevention is better than cure. Use building form, orientation, shelter and fabric to reduce loads. Reduce building volume and use 'passive' measures where possible, ie natural daylighting, natural ventilation, shading, shelter, and heat storage in the building fabric. Straightforward 'fit and forget' measures are normally preferable (see GPG 211[10]).	Make use of daylight (see General Information Report (GIR) 35[24]). Make sure buildings are designed, specified and constructed to be airtight – sports centre construction often is not.
Choose appropriate standards. Do not over-specify. Consider mixed-mode strategies that combine natural ventilation with mechanical ventilation and cooling. Comfort standards are not absolute. Closely controlled conditions are not always necessary; sometimes people may prefer less precise conditions with more opportunities for individual control.	Hot water requirements for changing rooms and showers are often massively overestimated, leading to plant that is expensive to buy and inefficient to run. Avoid over-specifying lighting standards.
Service the loads effectively. Consider the simplest and most intrinsically efficient means of doing the job over the whole operational range. Don't necessarily design only for the worst case. Don't assume that all the plant will need to operate simultaneously – consider probabilities and solutions that can be adapted to meet changing loads and requirements.	Choose condensing boilers and high-efficiency lighting. Consider efficient fans and motors and multi-speed operation for ventilation, with variable speed control for the larger and more complex systems.
Don't be too clever for the people who operate the building. Do not add complications unless the essential systems are already efficient. Consider the commissioning, operational and maintenance implications of each new piece of equipment.	The support required by building management systems, CHP and/or heat recovery have proved too onerous for some managements, particularly in the smaller sports centres.
Consider energy recovery and alternative energy sources. These will be most practicable and cost-effective if buildings and systems are already efficient.	Heat recovery is generally cost-effective for swimming pool ventilation; but take care to minimise the additional electricity consumption (eg added fan power) required for some heat recovery systems. Consider CHP systems in the larger buildings with swimming pools.
Control systems effectively. Not just in the engineering sense but to be 'understandable' and usable by occupants, with good feedback to management.	Centre staff often operate systems more effectively with simple local controls than more complex central ones, which often prove hard to set and to understand.
Ensure that initial commissioning by the contractor results in all systems and their controls operating effectively with reasonable initial settings.	Surprisingly often equipment is incorrectly installed, eg fans obstructed or installed the 'wrong way round'. More often still, automatic controls for plant or lighting are not fully working and cannot be used.
Bring building and plant managers up to speed on building operation, and ensure plant operation settings are recorded in straightforward language.	An initial 'sea trial' period and six-monthly review of time schedules and automatic control settings will help ensure the centre is run as intended.

4 ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

WHERE THE ENERGY GOES

Knowing what your centre's energy is used for (eg space heating, pool heating or lighting) helps you to understand which systems use most energy and to set priorities for technical or management attention.

The first step is to know what facilities your centre supports. The graph below shows the floor areas of the seven reference types, and the wide range of activities encompassed. Percentage and absolute areas are given in table 8 in appendix 3 (page 36).

The energy use for each zone is tabled in appendix 3. Swimming pools dominate the energy use where present. For example, lighting costs around £2.50/m^2, and this is one-third of the total for a dry sports hall, but only one-tenth of that for a swimming pool centre because of the very high energy use of swimming pools for heating, ventilation and pumping. Table 9 in appendix 3 shows the energy costs attributable to each system for the seven reference types.

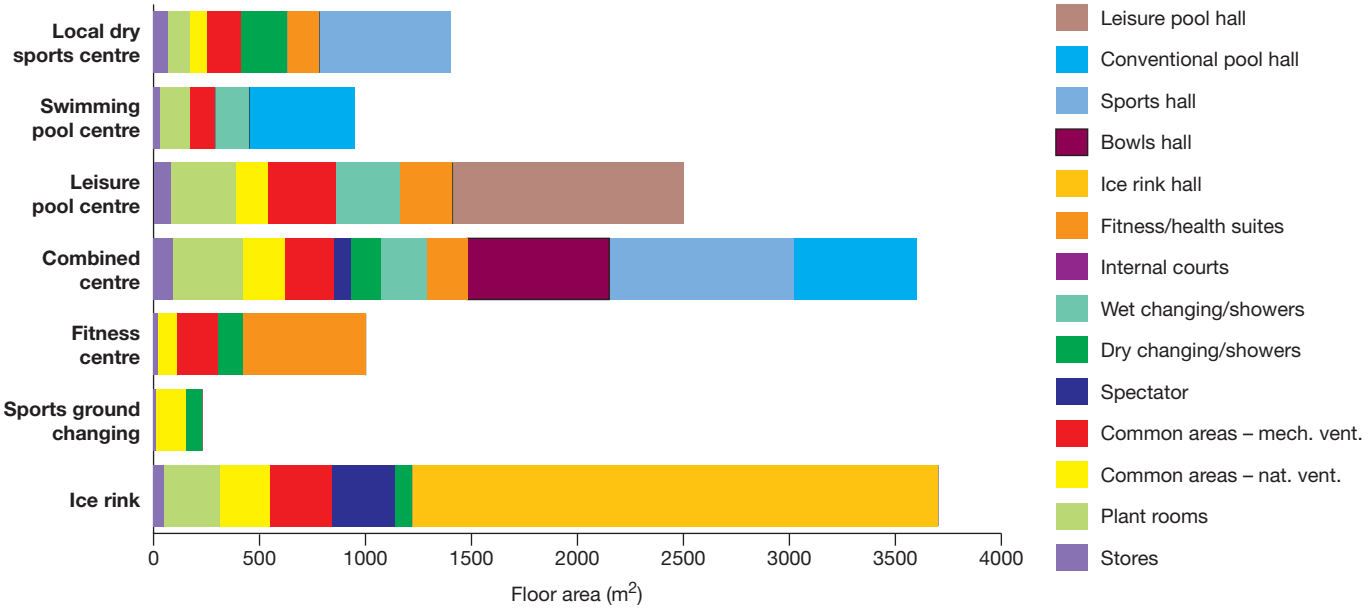
LOOKING AT YOUR FACILITY USING DETAILED BENCHMARKS

The look-up tables for each reference centre (pages 19-31) provide detailed benchmarks for each type of facility. Using these tables you can:

- allow for having different features and usage
- look at the effect of improvements to fabric and services.

Appendix 2 gives a worked example of their use and a blank proforma.

These tables apply to any size of centre but assume a typical mix of areas. If none of the reference types has a mix of areas matching your facility, data in appendix 3 also allow you to calculate a benchmark for the appropriate mix of accommodation. However, this should generally not be necessary because of the range of reference types. Remember that if your centre is larger or smaller than a reference type, but has the same proportions of areas, then you can still use the benchmarks as they are given in units per m^2 of floor area.



Composition of the reference types

ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

USING THE LOOKUP TABLES

The first two rows in each table give the ***typical*** and ***good practice*** benchmark values for energy and cost, per m^2 of floor area. Subsequent rows show the effect of various changes – those that reduce energy use and costs are indicated by a negative change to the typical benchmark.

Comparisons on the basis of cost are given priority as it is more likely that cost information will be available to the sports centre manager. However, it does depend on energy unit costs being the same as the 'cost factors' given in section 5. If your costs differ from these, the benchmarking exercise should be carried out in terms of electricity and heating fuel energy separately and then converted to cost.

The four columns in the tables show the following.

- Energy use in kWh/m^2 of floor area, for electricity and heating fuel separately. The heating fuel benchmark applies to gas and oil. Solid fuel systems – rarely found in sports centres – may use more energy owing to their more limited controllability.
- Energy costs per m^2 based on unit costs for electricity and gas given in section 5. If your average unit costs are significantly different, you will need to adjust this benchmark by multiplying the kWh/m^2 benchmark annual electrical energy consumption by your average unit rate for electricity, the same for heating fuel, and adding them up. If your heating fuel is other than gas, use the fuel conversion factors given in section 5.
- A total cost in £ per year is given for each reference centre. This helps to identify the magnitude of features and measures for each of the reference buildings. This figure should only be used if your centre is of similar size to the 'example dimensions' given for each type, your energy unit costs are the same as the 'cost factors' given in section 5 and your heating fuel is gas.

The example in appendix 2 shows how the annual energy cost per m^2 of your centre is compared to a customised benchmark which takes account of the effects of features such as location, and age of the centre.

Note: The CO_2 emissions benchmarks in table 9 use CO_2 emission factors for electricity and gas derived from data for services sector buildings in the Digest of UK Energy Statistics 1999. If you use oil or solid fuel, the benchmark CO_2 emission and actual CO_2 emission should be recalculated from the energy benchmarks using the appropriate emission factors, given in section 5.

ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

TYPE 1 – LOCAL DRY SPORTS CENTRE

Facilities

- Four-court badminton hall for a range of sports
- Equipment store
- Changing
- Fitness studio without equipment
- Members/club room (could be crèche or bar)
- Management office and reception

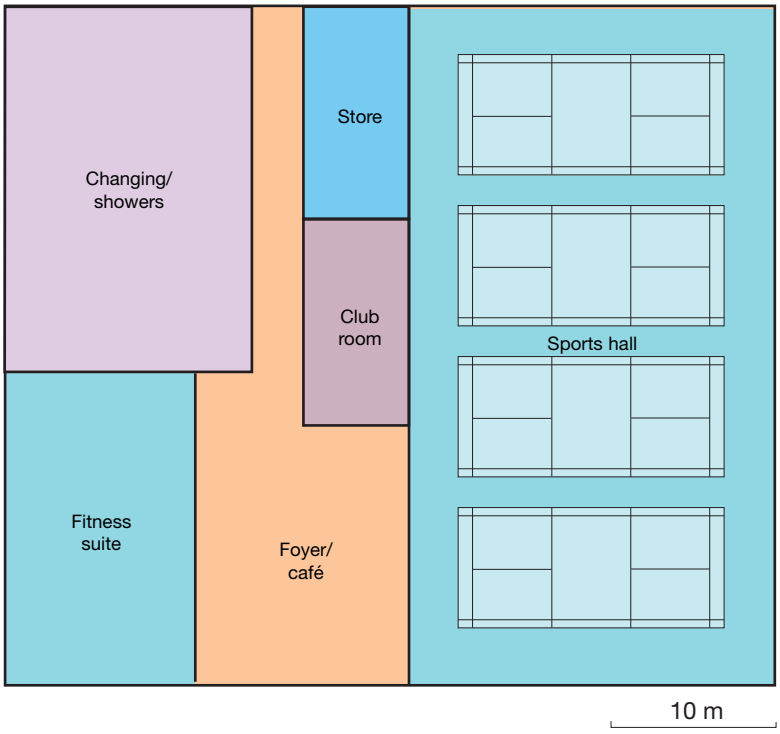
Example dimensions

- Total floor area – 1400 m² (gross internal)
- Sports hall – 620 m²

Building and services

Example for ***typical*** benchmark (see table for ***good practice***):

- steel frame, brick and metal cladding
- fluorescent tube lighting in sports hall – no daylight
- warm air heating of sports hall
- ancillary areas heated by radiator system.



ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

	Annual energy use and cost			
	Electricity use (kWh/m²)	Heating fuel use (kWh/m²)	Cost per m² (£/m²)*	Example cost (£)*†
Benchmarks				
Typical	105	343	9.21	12 890
Good practice (includes items marked in red below)	64	158	5.09	7130
Effect on benchmarks of changes relative to ***typical***	Add to or subtract from ***typical***			
Building and services changes				
Building fabric improved with high insulation levels and detailing to avoid air leakage	0	-36	-0.36	-500
Heating and ventilation systems improved with radiant gas tube heating or minimal ducting, and appropriate ventilation	-19	-111	-2.16	-3020
Lighting improved with high-frequency fluorescent, stepped lighting levels and presence detection	-15	0	-0.83	-1160
Operation and scheduling of heating, ventilation and lighting, with switching for use only	-7	-38	-0.77	-1080
Features				
Central ventilation plant with an extensive central ventilation (and heating) system serving the whole centre	+34	+72	+2.59	+3630
Exercise machines included (20 stations)	+15	0	+0.83	+1160
Older property with poor standards of insulation and airtightness or extensive single glazing, and older-style lights	+37	+107	+3.11	+4350
Location and level of use				
High usage – more than 100 customers per m² per year (140 000 customers per year for the four-court 1400 m² centre	+13	+30	+1.00	+1400
Light use – less than 40 customers per m² per year (56 000 customers per year for the four-court 1400 m² centre)	-10	-20	-0.76	-1060
Location in Scotland	+7	+50	+0.87	+1220
Southern location – Thames valley, Avon valley or further south	0	-38	-0.38	-530
Exposed location – unprotected hillside or seafront site	+8	+25	+0.72	+1010

Table 1 Benchmarks for local dry sports centre

* Assumes electricity and gas at the unit costs in section 5

† Based on a centre with the example dimensions on the page opposite

ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

TYPE 2 – 25 M SWIMMING POOL CENTRE

Facilities

- Five-lane 25 m pool
- Changing including for groups of up to 25 people
- Seating/viewing area with vending
- Snack bar as optional feature

Building and services

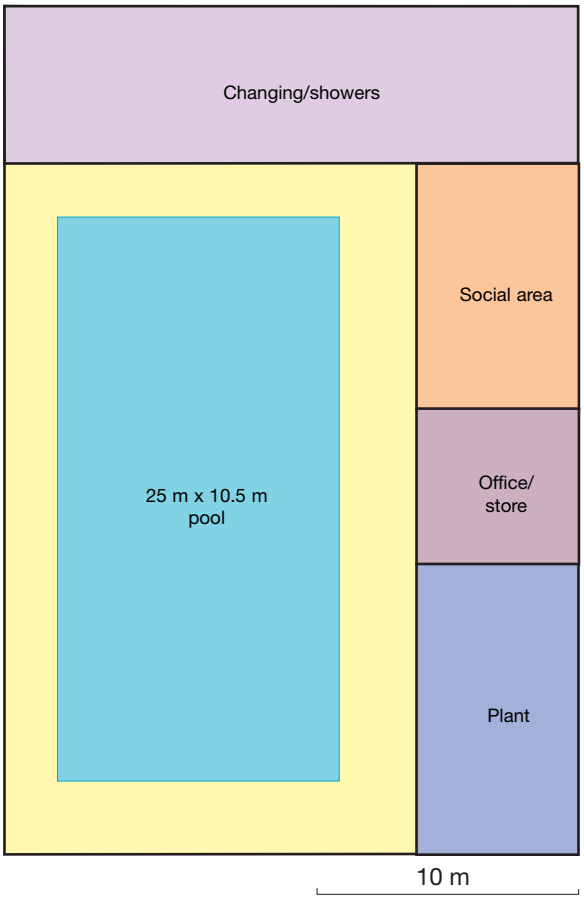
Example for ***typical*** benchmark (see table for enhancements to bring up to ***good practice***):

- discharge lighting in pool hall, fluorescent tube lighting elsewhere
- pool hall ventilation system without heat recovery or dehumidification, provides constant ventilation rate
- ancillary areas heated by radiator system.

Example dimensions

- Total floor area – 950 m^2 (gross internal)
- Pool surface area – 300 m^2 (can be split between two pools, eg a main pool and a learning pool)
- Pool hall floor area* – 500 m^2 plus 160 m^2 changing
- Other seating, viewing, entrance, store, plant – 290 m^2

*Note that pool hall floor area is its total floor area including the pool surface area.



ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

	Annual energy use and cost			
	Electricity use (kWh/m²)	Heating fuel use (kWh/m²)	Cost per m² (£/m²)*	Example cost (£)*†
Benchmarks				
Typical	237	1336	26.40	25 080
Good practice (includes items marked in red below)	152	573	14.08	13 370
Effect on benchmarks of changes relative to ***typical***	Add to or subtract from ***typical***			
Building and services changes				
Building fabric improved with high insulation levels and detailing to avoid air leakage	0	-51	-0.51	-480
Ventilation systems improved with reduced fan power out of hours, include heat recovery or dessicant dehumidification	-25	-481	-6.19	-5880
Pool water pumps and treatment improved energy efficiency with minimised pump rates and multi-speed demand-controlled pumps	-29	0	-1.60	-1520
Pool cover installed and used regularly with reduced night ventilation	-8	-145	-1.89	-1800
Lighting improved standards – metal halide lighting in pool hall with daylight and presence detection. High-efficiency fluorescents or compact fluorescents in ancillary areas	-16	0	-0.88	-840
Operation and scheduling improved for ancillary heating and lighting, with switching for use only	-7	-86	-1.25	-1190
Features				
Combined heat and power installed sized for summer heat load	-97	+91	-4.43	-4210
Pool temperature increased by 2°C to 32°C	0	+133	+1.33	+1260
Snack bar serving 200 hot meals per day	+39	0	+2.15	+2040
Older centre (usually pre-1980) with poor standards of insulation and airtightness or extensive single glazing, and older-style lighting	+80	+147	+5.87	+5580
Location and level of use				
High usage – more than 150 customers per m² per year (143 000 customers per year for the 25 m pool with 950 m² floor area)	+29	+115	+2.75	+2610
Light use – less than 90 customers per m² per year (85 000 customers per year for the 25 m pool with 950 m² floor area)	-23	-76	-2.05	-1950
Location in Scotland	+16	+191	+2.76	+2620
Southern location – Thames valley, Avon valley or further south	0	-143	-1.43	-1360
Exposed location – unprotected hillside or seafront site	+19	+95	+2.02	+1920

Table 2 Benchmarks for local 25 m swimming pool centre

* Assumes electricity and gas at the unit costs in section 5

† Based on a centre with the example dimensions on the page opposite

ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

TYPE 3 – LEISURE POOL CENTRE

Facilities

- Free-form pool measuring 30 m
- Wave pool area within main pool
- Learning pool adjoining
- Flume and splash pool
- Café and bar face onto pool area
- Changing for individuals and groups

Building and services

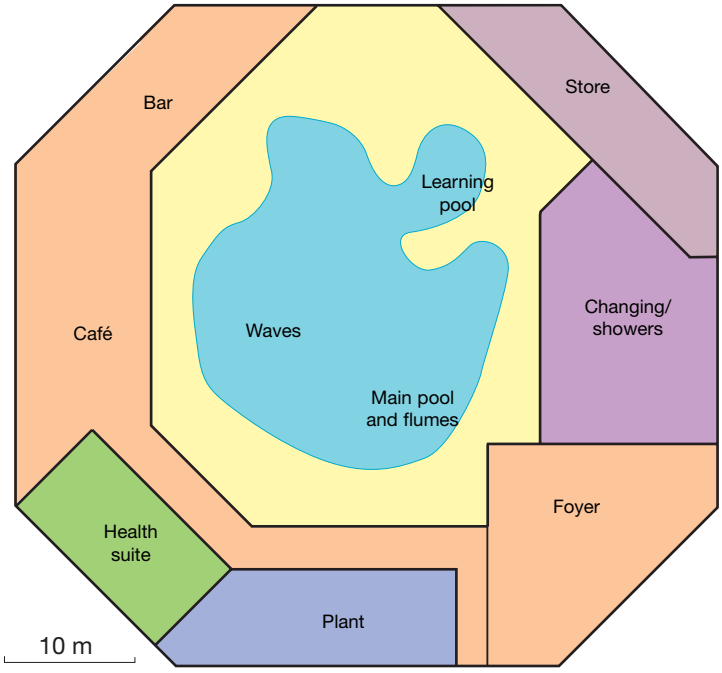
Example for ***typical*** benchmark (see table for ***good practice***):

- metal halide lighting in pool hall
- older style fluorescent (T10) lighting in ancillary areas
- pool hall ventilation system without heat recovery or dehumidification, provides constant ventilation rate.

Example dimensions

- Total floor area – 2500 m² (gross internal)
- Pool surface area – 540 m²
- Pool hall floor area* – 1090 m² plus 300 m² changing
- Other: bar and snack bar, health suite, office, store, plant – 1110 m²

*Note that pool hall floor area is its total floor area including the pool surface area.



ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

	Annual energy use and cost			
	Electricity use (kWh/m²)	Heating fuel use (kWh/m²)	Cost per m² (£/m²)*	Example cost (£)*†
Benchmarks				
Typical	258	1321	27.40	68 500
Good practice (includes items marked in red below)	164	573	14.74	36 840
Effect on benchmarks of changes relative to ***typical***	Add to or subtract from ***typical***			
Building and services changes				
Building fabric improved with high insulation levels and detailing to avoid air leakage	0	-54	-0.54	-1350
Ventilation systems improved with reduced fan power out of hours, include heat recovery or dessicant dehumidification	-23	-469	-5.96	-14 900
Pool water pumps and treatment improved energy efficiency with minimised pump rates and multi-speed demand-controlled pumps	-26	0	-1.43	-3580
Pool cover installed and used regularly	-6	-140	-1.73	-4330
Lighting improved standards – metal halide lighting in pool hall with daylight and presence detection. High-efficiency fluorescents or compact fluorescents in ancillary areas	-16	0	-0.88	-2200
Operation and scheduling improved for water features and ancillary areas, with switching for use only	-23	-85	-2.12	-5300
Features				
Combined heat and power installed, sized for summer heat load	-97	+90	-4.44	-11 100
Pool temperature increased by 2°C to 32°C	0	+111	+1.11	+2780
Snack bar serving increase from 200 to 400 hot meals per day	+14	0	+0.77	+1930
Older centre (usually pre-1980) with poor standards of insulation and airtightness or extensive single glazing, and older-style lighting	+37	+145	+3.49	+8730
Location and level of use				
High usage – more than 150 customers per m^2 per year (375 000 customers per year for the 2500 m^2 leisure pool centre)	+32	+114	+2.88	+7200
Light use – less than 90 customers per m^2 per year (225 000 customers per year for the 2500 m^2 leisure pool centre)	-25	-76	-2.15	-5380
Location in Scotland	+17	+189	+2.82	+7050
Southern location – Thames valley, Avon valley or further south	0	-142	-1.42	-3550
Exposed location – unprotected hillside or seafront site	+21	+95	+2.11	+5280

Table 3 Benchmarks for leisure pool centre

* Assumes electricity and gas at the unit costs in section 5

† Based on a centre with the example dimensions on the page opposite

ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

TYPE 4 – COMBINED CENTRE

Facilities

- 25 m five-lane swimming pool and 11 m teaching pool
- Six-badminton-court sports hall
- Fitness room with 20 stations
- Health suite with sauna, solarium and jacuzzi
- Licensed bar and snack bar
- Indoor six-lane bowls hall

Building and services

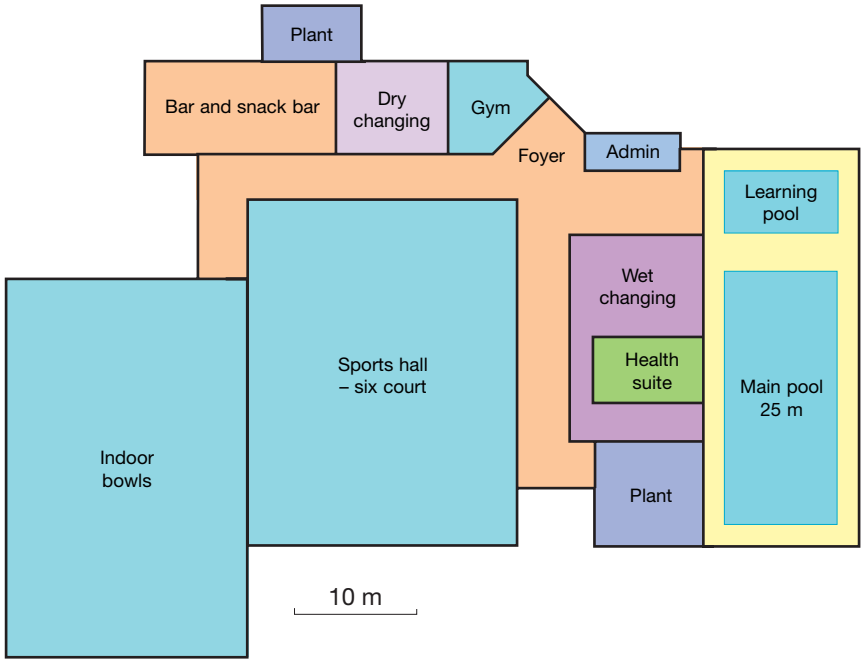
Example for ***typical*** benchmark (see table for ***good practice***):

- metal halide lighting in pool hall
- pool hall ventilation system without heat recovery or dehumidification, provides constant ventilation rate
- fluorescent tube lighting in sports hall – no daylight
- warm air heating of sports hall and ancillary areas
- older style fluorescent (T10) lighting in ancillary areas.

Example dimensions

- Total floor area – 3600 m² (gross internal)
- Pool surface area – 330 m²
- Pool hall floor area* – 580 m² plus 220 m² changing
- Sports hall – 870 m²; bowls hall – 670 m²
- Other: fitness gym, health suite, bar and snack bar, dry changing, office, store, plant – 1260 m²

*Note that pool hall floor area is its total floor area including the pool surface area.



ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

	Annual energy use and cost			
	Electricity use (kWh/m²)	Heating fuel use (kWh/m²)	Cost per m² (£/m²)*	Example cost (£)*†
Benchmarks				
Typical	152	598	14.34	51 620
Good practice (includes items marked in red below)	96	264	7.91	28 480
Effect on benchmarks of changes relative to ***typical***	Add to or subtract from ***typical***			
Building and services changes				
Building fabric improved with high insulation levels and detailing to avoid air leakage	0	-39	-0.39	-1400
Ventilation systems improved – pool hall with reduced ventilation out of hours, heat recovery or dessicant dehumidification. Sports hall radiant gas tube heating or minimal ducting, and appropriate hall ventilation rate	-12	-193	-2.59	-9320
Pool water pumps and treatment improved energy efficiency with minimised pump rates and multi-speed demand-controlled pumps	-14	0	-0.77	-2770
Pool cover installed and used regularly	-3	-46	-0.63	-2270
Lighting improved standards – metal halide lighting in pool hall with daylight and presence detection. Sports hall high-frequency compact fluorescent or high-pressure sodium with stepped lighting levels and presence detection	-15	0	-0.83	-2990
Operation and scheduling improved with separate schedules for pool hall, sports hall, bowls and fitness facilities, and optimal use of ventilation and lighting controls	-12	-56	-1.22	-4390
Features				
Combined heat and power installed, sized for summer heat load	-42	+36	-1.95	-7020
Pool temperature increased by 2ºC to 32ºC	0	+41	+0.41	+1480
Older centre (usually pre-1980) with poor standards of insulation and airtightness or extensive single glazing, and older-style lighting	+36	+103	+3.01	+10 840
Location and level of use				
High usage – more than 150 customers per m^2 per year (525 000 customers per year for the 3500 m^2 combined centre)	+19	+52	+1.54	+5540
Light use – less than 50 customers per m^2 per year (175 000 customers per year for the 3500 m^2 combined centre)	-15	-34	-1.16	-4180
Location in Scotland	+10	+86	+1.41	+5080
Southern location – Thames valley, Avon valley or further south	0	-65	-0.65	-2340
Exposed location – unprotected hillside or seafront site	+12	+43	+1.11	+4000

Table 4 Benchmarks for combined centre

* Assumes electricity and gas at the unit costs in section 5

† Based on a centre with the example dimensions on the page opposite

ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

TYPE 5 – FITNESS CENTRE

Facilities

- Fitness studio with 40 exercise stations
- General purpose exercise studios; two dedicated system studios
- Health suite with six-person sauna, solarium for four persons
- Licensed bar and café/restaurant

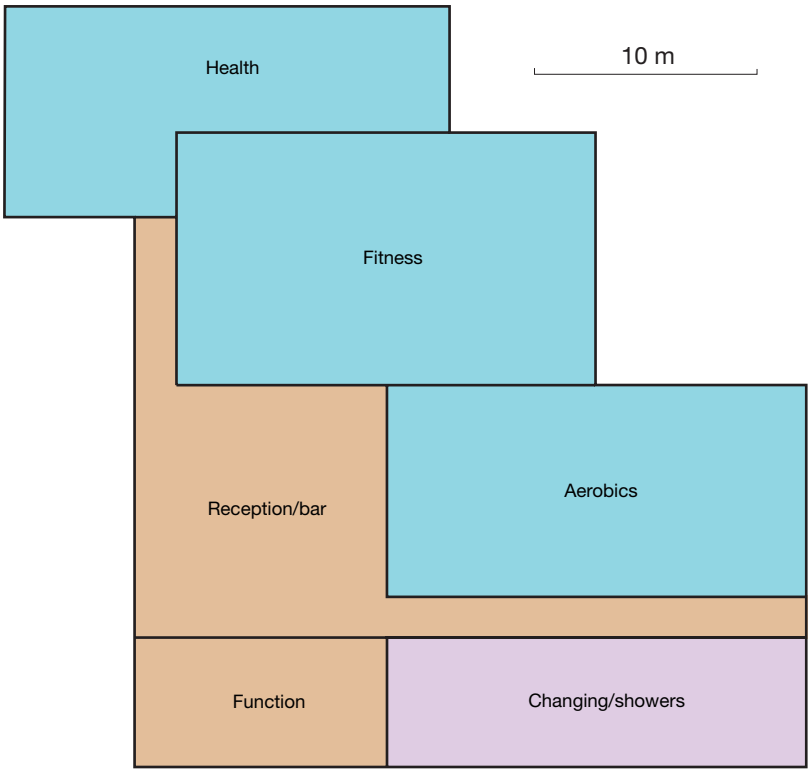
Example dimensions

- Total floor area – 1000 m² (gross internal)
- Exercise and health rooms – 580 m²
- Changing and showers – 120 m²
- Store – 20 m²
- Bar, social and common areas – 280 m²

Building and services

Example for ***typical*** benchmark (see table for ***good practice***):

- older-style fluorescent (T10) lighting throughout, also with PAR tungsten effect lighting in studios
- constant high ventilation of studios and with common areas on same system
- cooling units operating most of the year – opposing fresh air heating in winter.



ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

	Annual energy use and cost			
	Electricity use (kWh/m²)	Heating fuel use (kWh/m²)	Cost per m² (£/m²)*	Example cost (£)*†
Benchmarks				
Typical	194	449	15.16	15 160
Good practice (includes items marked in red below)	127	201	8.99	8990
Effect on benchmarks of changes relative to ***typical***	Add to or subtract from ***typical***			
Building and services changes				
Building fabric improved with high insulation levels and detailing to avoid air leakage	0	-43	-0.43	-430
Ventilation, heating and cooling systems improved – appropriate ventilation rate provided only where required. Heating and cooling use same controllers. Common/social areas only cooled where required	-20	-81	-1.91	-1910
Lighting improved standards – high-efficiency T8 reflectors or compact fluorescents with daylight and presence detection. Appropriate halide effect lighting	-19	0	-1.05	-1050
Operation and scheduling improved with separate schedules for exercise rooms, health and social facilities, and optimal use of ventilation and lighting controls	-28	-124	-2.78	-2780
Features				
Avoiding air-conditioning – with cooling equipment limited to the main exercise studio; use of opening windows and natural ventilation	-40	-10	-2.30	-2300
Older centre (usually pre-1980) with poor standards of insulation and airtightness or extensive single glazing, and older-style lighting	+26	+42	+1.85	+1850
Location and level of use				
High usage – more than 200 customers per m² per year (200 000 customers per year for the 1000 m² fitness centre	+24	+39	+1.71	+1710
Light use – less than 80 customers per m² per year (80 000 customers per year for the 1000 m² fitness centre)	-19	-26	-1.32	-1320
Location in Scotland	+13	+65	+1.36	+1360
Southern location – Thames valley, Avon valley or further south	0	-49	-0.49	-490
Exposed location – unprotected hillside or seafront site	+16	+33	+1.21	+1210

Table 5 Benchmarks for fitness centre

* Assumes electricity and gas at the unit costs in section 5

† Based on a centre with the example dimensions on the page opposite

ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

TYPE 6 – SPORTS GROUND CHANGING FACILITY

Facilities

- Floodlit* football pitch, with unlit sports and practice pitches
- Changing/shower building for 50 changing uses per day
- Drinks vending in social area

*If you do not have a floodlit pitch this can be allowed for using the information in table 6.

Indicative benchmarks for sports ground changing facilities are shown in table 6, based on system assessments rather than monitoring of a range of buildings, as suitable data sources were not available.

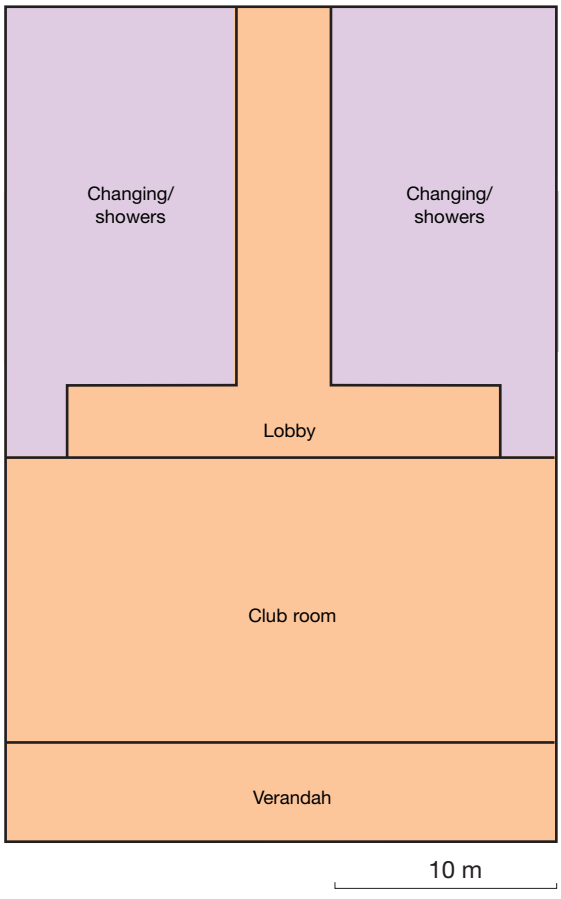
Building and services

Example for ***typical*** benchmark (see table for ***good practice***):

- tungsten halogen floodlighting
- constant background heating
- large, poorly insulated hot water system running
- older-style T10 fluorescent lamps with inaccessible switching.

Example dimensions

- Total building floor area – 230 m² (gross internal)
- Changing and showers – 80 m²
- Club room, common areas and store – 150 m²
- Floodlit pitch – 5000 m²



ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

	Annual energy use and cost			
	Electricity use (kWh/m²)	Heating fuel use (kWh/m²)	Cost per m² (£/m²)*	Example cost (£)*†
Benchmarks				
Typical	164	216	11.18	2570
Good practice (includes items marked in red below)	93	141	6.52	1510
Effect on benchmarks of changes relative to ***typical***	Add to or subtract from ***typical***			
Building and services changes				
Building fabric improved with high insulation levels and consideration for intermittent use	0	-28	-0.28	-60
Hot water system appropriately sized, insulated and controlled	0	-32	-0.32	-70
Lighting improved – internal and external with high-efficiency metal halide to appropriate lighting level; for football 50 lux practice up to 180 lux for club play; and switching to allow different levels to be selected	-68	0	-3.74	-860
Heating and ventilation upgrade, operation and scheduling improved	-3	-15	-0.32	-70
Features				
Extended floodlit area – for each 1000 m² of floodlit pitch	+25	0	+1.38	+320
No floodlighting	-127	0	-6.99	-1610
Level of use				
High usage – more than 0.33 changing uses per m² per day (75 changing uses per day for the 230 m² changing facility)	+19	+21	+1.27	+290
Light usage – less than 0.11 changing uses per m² per day (25 changing uses per day for the 230 m² changing facility)	-15	-14	-0.99	-230

Table 6 Benchmarks for sports ground changing facility

* Assumes electricity and gas at the unit costs in section 5

† Based on a centre with the example dimensions on the page opposite

ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

TYPE 7 – ICE RINK

Facilities

- 56 m x 26 m ice pad
- 500 spectator seats
- Ground floor café, vending and first floor balcony bar
- Boot hire and change area

Indicative benchmarks for ice rinks are shown in table 7, based on system assessments rather than monitoring of a range of buildings, as suitable data sources were not available.

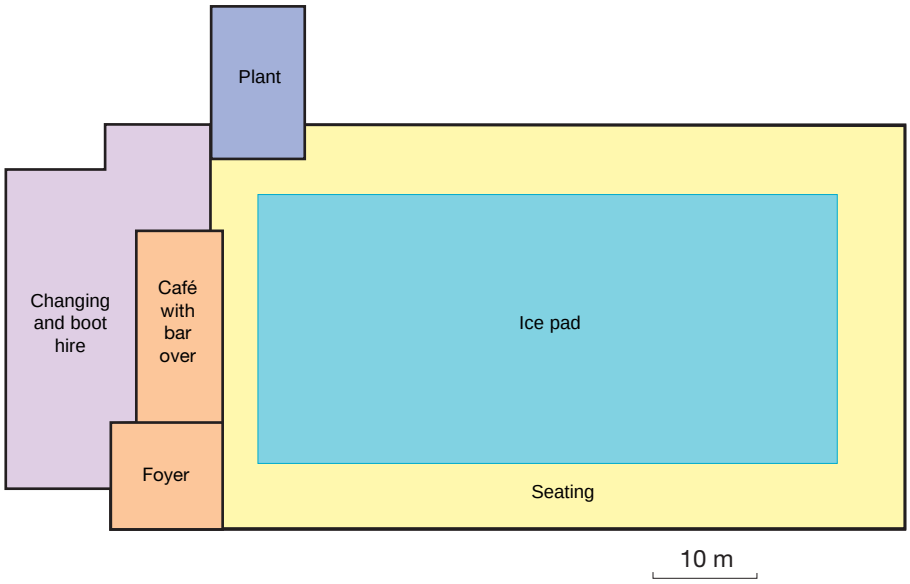
Building and services

Example for ***typical*** benchmark (see table for ***good practice***):

- fluorescent tube lighting in ice hall – no daylight
- ancillary areas heated by radiator system
- hot water for ice conditioning.

Example dimensions

- Total floor area – 3700 m^2 (gross internal)
- Ice hall – 2480 m^2 including 1460 m^2 ice pad
- Other: hire/change, café and balcony bar, and plant – 1220 m^2



ASSESSING YOUR CENTRE USING DETAILED BENCHMARKS

	Annual energy use and cost			
	Electricity use (kWh/m²)	Heating fuel use (kWh/m²)	Cost per m² (£/m²)*	Example cost (£)*†
Benchmarks				
Typical	255	217	16.20	59 940
Good practice (includes items marked in red below)	167	100	10.18	37 660
Effect on benchmarks of changes relative to ***typical***	Add to or subtract from ***typical***			
Building and services changes				
Building fabric improved with high insulation levels and detailing to avoid air leakage	0	-14	-0.14	-520
Heating and ventilation systems designed to provide appropriate temperatures, and appropriate ventilation	-21	-48	-1.64	-6070
Lighting improved with high-efficiency compact fluorescent or high-pressure sodium with stepped lighting levels and presence detection	-18	0	-0.99	-3660
Operation and scheduling of heating, ventilation and lighting, with switching for use only	-49	-55	-3.25	-12 030
Features				
Older property with poor standards of insulation and airtightness or extensive single glazing, and older-style lights	+38	+35	+2.44	+9030
Location and level of use				
High usage – more than 200 customers per m^2 per year (740 000 customers per year for the 3700 m^2 ice rink centre)	+32	+19	+1.93	+7140
Light use – less than 90 customers per m^2 per year (333 000 customers per year for the 3700 m^2 ice rink centre)	-25	-13	-1.52	-5620
Location in Scotland	+17	+32	+1.25	+4630
Southern location – Thames valley, Avon valley or further south	0	-24	-0.24	-890
Exposed location – unprotected hillside or seafront site	+21	+16	+1.32	+4880

Table 7 Benchmarks for ice rink

* Assumes electricity and gas at the unit costs in section 5

† Based on a centre with the example dimensions on the page opposite

5 FURTHER INFORMATION

FUEL CONVERSION FACTORS

Fuel	kWh conversion (multiply by)
Electricity in kWh units	1
Natural gas in kWh units	1
Natural gas in Therms	29.3
Fuel oils (litres)	11.3
Gas oil (litres)	10.6
Liquefied petroleum gas (LPG)/propane (tonnes)	13 780
Coal (kg)	8.9

COST FACTORS

Unit costs of energy assumed in tables (excluding VAT):

- electricity – 5.5 p/kWh
- gas – 1.0 p/kWh.

ENVIRONMENTAL FACTORS – CO_2 EMISSIONS

Each kWh of energy delivered to a building incurs atmospheric emissions of the major greenhouse gas CO_2 from the extraction, processing and delivery of each fuel and its consumption on site.

For the purpose of comparability with other statistics, CO_2 emissions in table 9 of this Guide are quoted as kg of carbon per kWh of delivered fuel (kgC/kWh). Conversion from CO_2 to carbon is the ratio of their respective molecular weights (44:12).

Quoted conversion factors vary according to the assumptions made. The table below shows the conversions used here, in carbon and CO_2 per kWh of delivered fuel.

The conversion factor for electricity varies with the primary fuel mix used to generate it. In the UK, it is falling owing to rising efficiency of generation and a move from coal to gas and some renewables.

Fuel	kgC/kWh	$kgCO_2$/kWh
Gas	0.052	0.19
Oil	0.069	0.25
Coal	0.081	0.30
Electricity average	0.127	0.46

Derived from data for services sector buildings in the Digest of UK Energy Statistics 1999

USEFUL CONTACTS

Design Advice

The Design Advice service is a government-sponsored initiative that offers design teams and their clients independent and objective advice on all aspects of energy-efficient and environmentally conscious design. Subject to a simple eligibility criterion, a one-day consultation is available, and is paid for by a cash-back scheme. It will be undertaken by a consultant registered with the service, who will provide a brief written report detailing design recommendations.
Tel 0800 585794
Internet **www.designadvice.co.uk**

Environment and Energy Helpline

The Environment and Energy Helpline provides free information and advice to businesses on all energy efficiency and environmental issues. Smaller companies may be eligible for a counselling visit.
Tel 0800 585794

Sport England

16 Upper Woburn Place, London WC1H 0QP
Tel 020 7273 1500. Fax 020 7383 5740

Sports Council for Wales

Sophia Gardens, Cardiff CF11 9SW
Tel 029 2030 0500. Fax 029 2030 0600

Sport Scotland

Caledonia House, South Gyle, Edinburgh EH12 9DQ
Tel 0131 317 7200. Fax 0131 317 7202

Sports Council for Northern Ireland

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Appendices

APPENDIX 1
ENERGY COST – INITIAL ASSESSMENT EXAMPLE AND PROFORMA

INITIAL ASSESSMENT EXAMPLE

SPORTS FACILITY ENERGY COST – INITIAL ASSESSMENT FORM

Premises name and date	Example pool 08/02/2001			
a Type of facility	Leisure pool centre			*Choose nearest type from section 2*
b Total floor area (m^2)	2200			
c Annual energy cost – electricity and gas (excl VAT)	£62 700			
d Actual energy cost per m^2 (£/m^2)	28.5			
	Good practice	***Typical***		
e Benchmark annual energy cost per m^2 (£/m^2)	14.74	27.4		*From the table in section 2*
f Comment on actual compared with benchmark	Our cost is higher than ***typical*** and merits urgent attention			

BLANK PROFORMA

SPORTS FACILITY ENERGY COST – INITIAL ASSESSMENT FORM

Premises name and date				
a Type of facility				*Choose nearest type from section 2*
b Total floor area (m^2)				
c Annual energy cost – electricity and gas (excl VAT)				
d Actual energy cost per m^2 (£/m^2)				
	Good practice	***Typical***		
e Benchmark annual energy cost per m^2 (£/m^2)				*From the table in section 2*
f Comment on actual compared with benchmark				

APPENDIX 2
LOOK-UP TABLES – EXAMPLE OF USE AND PROFORMA

An example that illustrates how different measures and features can be allowed for when using the look-up table benchmarks is given below. A blank proforma is also provided.

EXAMPLE OF USE OF LOOK-UP TABLE BENCHMARKS FROM SECTION 4

EXAMPLE: ASSESSMENT OF TOTAL ANNUAL ENERGY COST PER m^2			Notes
Centre name	West Northwood Centre		
Date of assessment	February 2001		
Centre type	Type 3 leisure pool		*See descriptions in sections 2 and 4*
Appropriate benchmark table	Table 3		
***Typical* benchmark cost**	27.40	£/m^2	*From table 3*
Features of your centre	**Effect**		
1 Pool water pumps upgraded	-1.43	£/m^2	*From table 3*
2 Snack bar serving 100 meals	+0.38	£/m^2	*Pro-rated from table 3*
3 Located in Scotland	+2.82	£/m^2	*From table 3*
4		£/m^2	
5		£/m^2	
6		£/m^2	
Total of 'effects'	+1.77	£/m^2	*Sum effects 1 to 6 (subtract negative ones)*
Customised *typical* benchmark	29.17	£/m^2	*Add total effect to **typical** (subtract if negative)*
***Good practice* benchmark**	14.74	£/m^2	*Directly from table 3*
Annual energy cost of your centre	28.5	£/m^2	*From appendix 1*
Assessment	Just lower than customised ***typical***		

BLANK PROFORMA – USE OF LOOK-UP TABLE BENCHMARKS FROM SECTION 4

EXAMPLE: ASSESSMENT OF TOTAL ANNUAL ENERGY COST PER m^2			Notes
Centre name			
Date of assessment			
Centre type			*See descriptions in sections 1 and 7*
Appropriate benchmark table			*Select one from tables 1 to 7*
***Typical* benchmark cost**		£/m^2	*From appropriate benchmark table*
Features of your centre	**Effect**		
1		£/m^2	*From appropriate benchmark table*
2		£/m^2	*From appropriate benchmark table*
3		£/m^2	*From appropriate benchmark table*
4		£/m^2	
5		£/m^2	
6		£/m^2	
Total of 'effects'		£/m^2	*Sum effects 1 to 6 (subtract negative ones)*
Customised *typical* benchmark		£/m^2	*Add total effect to **typical** (subtract if negative)*
***Good practice* benchmark**		£/m^2	*Directly from appropriate benchmark table*
Annual energy cost of your centre		£/m^2	*From appendix 1*
Assessment			

APPENDIX 3 BASE DATA

SCHEDULE OF ACCOMMODATION

This table shows the composition of the reference types in terms of gross floor area (GFA) of the centre. A chart of these floor areas is shown on page 16.

Premises type	1 Local dry sports		2 Swimming pool		3 Leisure pool		4 Combined		5 Fitness		6 Sports ground		7 Ice rink	
Schedule of GFA	%	m^2	%	m^2	%	m^2	%	m^2	%	m^2	%	m^2	%	m^2
Leisure pool hall	0	0	0	0	44	1090	0	0	0	0	0	0	0	0
Conventional pool hall	0	0	53	500	0	0	16	580	0	0	0	0	0	0
Sports hall	44	620	0	0	0	0	24	870	0	0	0	0	0	0
Bowls hall	0	0	0	0	0	0	19	670	0	0	0	0	0	0
Ice rink hall	0	0	0	0	0	0	0	0	0	0	0	0	67	2480
Fitness/health suites	11	150	0	0	10	250	5	190	58	580	0	0	0	0
Internal courts	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wet changing/showers	0	0	17	160	12	300	6	220	0	0	0	0	0	0
Dry changing/showers	16	220	0	0	0	0	4	140	12	120	35	80	2	80
Spectator	0	0	0	0	0	0	2	80	0	0	0	0	8	300
Common areas (mech vent)	11	160	13	120	13	320	6	230	19	190	0	0	8	290
Common areas (nat vent)	6	80	0	0	6	150	6	200	9	90	61	140	6	240
Plant rooms	7	100	15	140	12	310	9	330	0	0	0	0	7	260
Stores	5	70	3	30	3	80	3	90	2	20	4	10	1	50
Total gross internal	**100**	**1400**	**100**	**950**	**100**	**2500**	**100**	**3600**	**100**	**1000**	**100**	**230**	**100**	**3700**
Pool surface/ice pad area % of GFA and m^2			32	300	22	540	9	330					39	1460
Pool surface/ice pad % of pool hall/rink			60		50		57						59	
Features														
Car park, area (m^2)	1300		1000		1800		1700		0		0		1800	
Floodlit courts/pitch, area (m^2)	0		0		0		0		0		5000		0	
Snack bar, hot meals/day	0		0		200		200		50		0		200	
Sauna/steam room, size (person)	0		0		5		8		0		0		0	
Solarium, no of sunbeds	0		0		2		2		2		0		0	
Exercise machines	0		0		12		12		50		0		0	
Wave machine	0		0		1		0		0		0		0	
Flumes	0		0		3		0		0		0		0	
Spa pool/jacuzzi (no of persons)	0		0		4		4		0		0		0	

Table 8 Schedule of floor areas for the reference types

Note: Discrepancies in totals are due to rounding

BASE DATA

Benchmarks related to pool/ice pad area

For centres with swimming pools or ice rinks, the schedule of floor area can also be used to find the benchmark of the centre in relation to pool/ice pad surface area using the percentage of pool surface area or ice pad area quoted in table 8.

As an example for a 25 m swimming pool centre:

- good practice energy cost from the table in section 2 is £14.08 per m^2 of total floor area
- the pool surface area from table 8 is 32% of the GFA of the building; so good practice energy cost per m^2 of pool surface area is:

$$\frac{14.08}{32} \times 100 = 44$$

ie £44.00 per m^2 of pool surface area.

A similar calculation can be carried out to relate the benchmarks to pool hall area, or ice rink area.

ENERGY USE FOR EACH ACTIVITY ZONE AND FEATURE

Floor areas in these tables relate to the floor area of the zone and not of the entire building. The energy use of features is expressed as kWh per year per unit of size as specified in the left hand column, at ***good practice*** (GP) and ***typical*** (Typ) levels (see table 9).

Notes

- By combining zone areas with zone energy use per area the benchmarks for the reference centres can be built up, except the sports ground changing building, which cannot be produced in this way because it includes pitch floodlighting in addition to the building area.
- These data are expressed in a consistent format, but the number of significant figures should not be taken to indicate high levels of accuracy.

Zone	Electricity (kWh/m^2)		Heating fuel (kWh/m^2)		Cost (£/m^2)		kgC/m^2		Example	Cost (£/year)	
	GP	*Typ*	*GP*	*Typ*	*GP*	*Typ*	*GP*	*Typ*	Area (m^2)	*GP*	*Typ*
Leisure pool hall	208.1	318.4	999.6	2325.6	21.4	40.8	77.9	160.4	580	12 435	23 647
Conventional pool hall	208.1	318.4	824.9	1936.7	19.7	36.9	68.8	140.3	580	11 422	21 391
Sports hall	39.4	69.0	102.6	224.3	3.2	6.0	10.3	20.3	870	2779	5254
Bowls hall	31.8	51.9	67.6	130.5	2.4	4.2	7.5	13.3	670	1626	2786
Ice rink hall	204.8	307.7	73.8	158.8	12.0	18.5	29.5	46.8	2500	30 005	46 286
Fitness/health suites	78.4	130.0	209.3	482.3	6.4	12.0	20.7	41.3	160	1025	1916
Internal courts	52.4	86.2	86.3	190.5	3.7	6.6	11.0	20.7	600	2247	3987
Wet changing and showers	93.4	167.1	529.7	1267.0	10.4	21.9	39.2	86.6	220	2296	4809
Dry changing and showers	92.4	149.6	299.4	676.0	8.1	15.0	27.1	53.8	140	1131	2098
Spectator	62.3	102.4	168.4	354.8	5.1	9.2	16.5	31.2	80	409	734
Common areas (mech vent)	74.1	117.7	168.4	354.8	5.8	10.0	18.0	33.2	230	1325	2305
Common areas (nat vent)	52.7	80.9	109.5	185.3	4.0	6.3	12.3	19.7	200	798	1261
Plant rooms	74.1	117.7	168.4	354.8	5.8	10.0	18.0	33.2	160	921	1604
Stores	52.7	80.9	109.5	185.3	4.0	6.3	12.3	19.7	90	359	567

Feature and unit of size	Electricity (kWh/unit)		Heating fuel (kWh/unit)		Cost (£/unit)		kgC/unit		Example	Cost (£/year)	
	GP	*Typ*	*GP*	*Typ*	*GP*	*Typ*	*GP*	*Typ*	Size (units)	*GP*	*Typ*
Car park, area (m^2)	4.6	6.6	0.0	0.0	0.3	0.4	0.6	0.8	1700	427	614
Floodlit courts/pitch, are (m^2)	3.3	5.8	0.0	0.0	0.2	0.3	0.4	0.7	5000	903	1606
Snack bar, hot meals/day	109.5	182.5	0.0	0.0	6.0	10.0	13.7	22.9	200	1205	2008
Sauna/steam room, size (persons)	1168.0	1752.0	0.0	0.0	64.2	96.4	146.5	219.8	8	514	771
Solarium, no of sunbeds	2628.0	3942.0	0.0	0.0	144.5	216.8	329.7	494.5	2	289	434
Exercise machines	788.4	1051.2	0.0	0.0	43.4	57.8	98.9	131.9	12	520	694
Wave machine	13 140.0	17 520.0	0.0	0.0	722.7	963.6	1648.5	2198.0	1	723	964
Flumes	3504.0	6570.0	0.0	0.0	192.7	361.4	439.6	824.2	2	385	723
Spa pool/jacuzzi, no of persons	876.0	1752.0	0.0	0.0	48.2	96.4	109.9	219.8	4	193	385

Table 9 Energy used by activity zone (related to zone area or number of items, not total building area)

BASE DATA

ENERGY USED BY THE BUILDING SERVICES SYSTEMS

Floor areas in these tables relate to the floor area of the zone and not of the entire building. The energy use of features is not included in these tables, because it has been listed in table 9.

Zone	*TYPICAL*								
	Local electricity use by system (kWh/m²)					Local heating fuel use by system (kWh/m²)			
	Lighting	Ventilation	Pumps	Other	Total	Fabric	Ventilation	Pool/other	Total
Leisure pool hall	49.9	104.6	148.9	15.0	318.4	361.1	866.9	1097.6	2325.6
Conventional pool hall	49.9	104.6	148.9	15.0	318.4	294.6	707.2	934.9	1936.7
Sports hall	42.9	9.1	7.0	10.0	69.0	107.1	83.4	33.9	224.3
Bowls hall	42.9	1.8	4.7	2.5	51.9	107.1	16.7	6.8	130.5
Ice rink hall	49.9	49.3	8.5	200.0	307.7	0	83.4	75.4	158.8
Fitness/health suites	61.3	49.0	9.7	10.0	130.0	170.6	294.8	16.9	482.3
Internal courts	60.0	9.1	7.0	10.0	86.2	107.1	83.4	0	190.5
Wet changing and showers	46.0	97.9	13.1	10.0	167.1	284.3	982.7	0	1267.0
Dry changing and showers	46.0	84.0	9.7	10.0	149.6	170.6	505.4	0	676.0
Spectator	46.0	36.7	9.7	10.0	102.4	170.6	184.3	0	354.8
Common areas (mech vent)	61.3	36.7	9.7	10.0	117.7	170.6	184.3	0	354.8
Common areas (nat vent)	61.3	2.9	9.7	7.0	80.9	170.6	14.7	0	185.3
Plant rooms	61.3	36.7	9.7	10.0	117.7	170.6	184.3	0	354.8
Stores	61.3	2.9	9.7	7.0	80.9	170.6	14.7	0	185.3

Table 10 Energy used by building services systems – typical benchmark level

Zone	*GOOD PRACTICE*								
	Local electricity use by system (kWh/m²)					Local heating fuel use by system (kWh/m²)			
	Lighting	Ventilation	Pumps	Other	Total	Fabric	Ventilation	Pool/other	Total
Leisure pool hall	26.3	65.0	106.8	10.0	208.1	273.5	248.5	477.6	999.6
Conventional pool hall	26.3	65.0	106.8	10.0	208.1	221.7	201.5	401.7	824.9
Sports hall	26.0	4.3	4.1	5.0	39.4	61.0	25.3	16.3	102.6
Bowls hall	26.0	0.6	3.3	2.0	31.8	61.0	3.4	3.3	67.6
Ice rink hall	26.3	23.3	5.3	150.0	204.8	0	28.2	45.6	73.8
Fitness/health suites	41.4	25.9	6.1	5.0	78.4	102.9	98.2	8.1	209.3
Internal courts	39.0	4.3	4.1	5.0	52.4	61.0	25.3	0	86.3
Wet changing and showers	29.6	51.7	7.1	5.0	93.4	182.1	347.6	0	529.7
Dry changing and showers	29.6	51.7	6.1	5.0	92.4	102.9	196.4	0	299.4
Spectator	29.6	21.6	6.1	5.0	62.3	102.9	65.5	0	168.4
Common areas (mech vent)	41.4	21.6	6.1	5.0	74.1	102.9	65.5	0	168.4
Common areas (nat vent)	41.4	2.2	6.1	3.0	52.7	102.9	6.5	0	109.5
Plant rooms	41.4	21.6	6.1	5.0	74.1	102.9	65.5	0	168.4
Stores	41.4	2.2	6.1	3.0	52.7	102.9	6.5	0	109.5

Table 11 Energy used by building services systems – good practice benchmark level

Note: In the above tables, discrepancies in totals are due to rounding

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This Guide is based on material drafted by Target Energy Services Ltd and William Bordass Associates under contract to BRECSU for the Energy Efficiency Best Practice programme