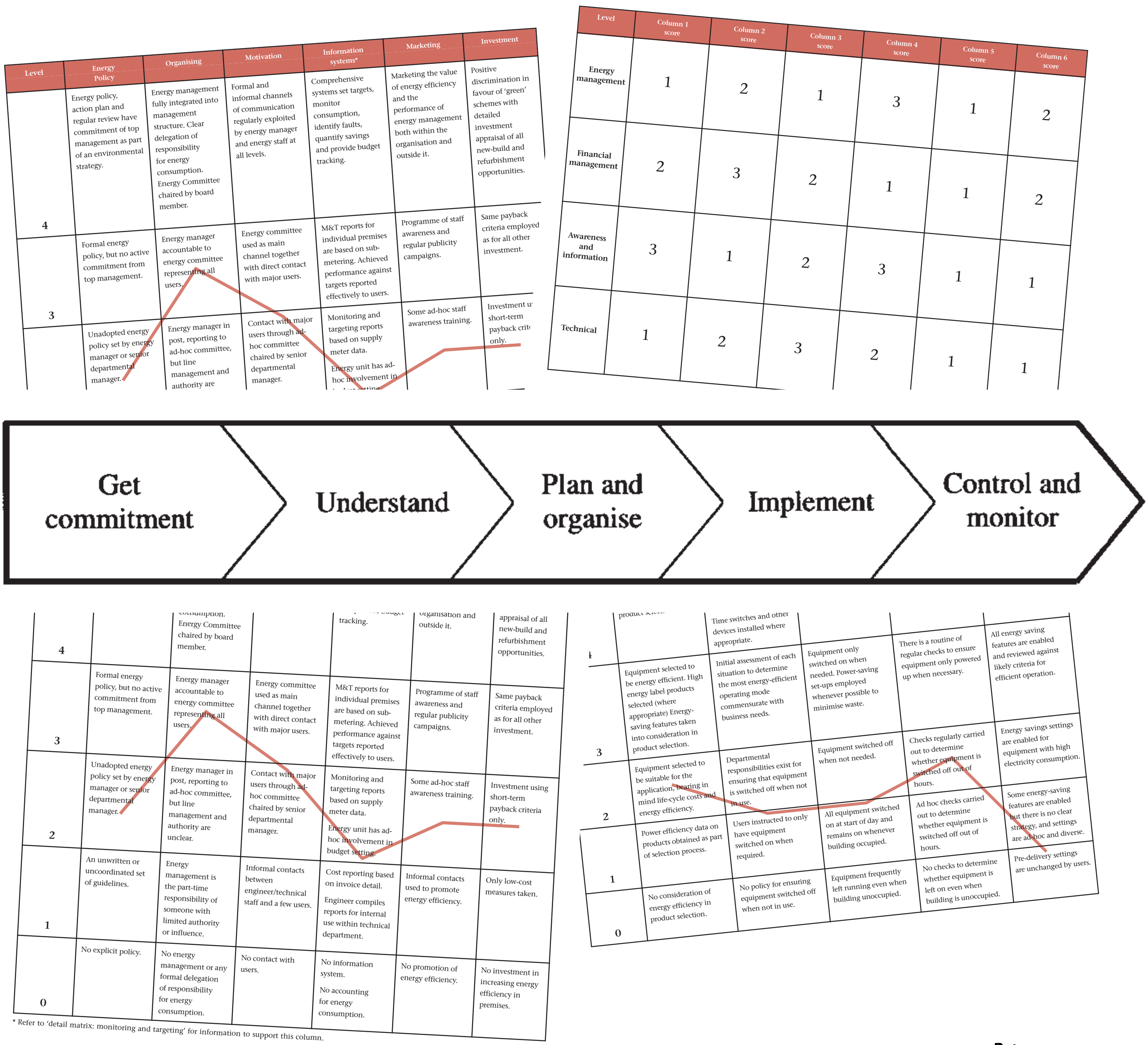
Energy management priorities

– a self-assessment tool



ENERGY EFFICIENCY

BEST PRACTICE PROGRAMME

CONTENTS

1 INTRODUCTION

BACKGROUND

The purpose of this Guide is to provide a set of simple tools to help technical and non-technical staff set priorities for energy management.

All management processes need a structured approach if they are to be implemented successfully, and energy management is no different. One approach is described in Good Practice Guide (GPG) 200 ‘A strategic approach to energy and environmental management’. The Guide uses the five simple steps shown in figure 1 to develop a corporate approach to energy management.

The energy management matrix has been developed to help organisations implement the five-step approach. The matrix is a simple tool which helps an organisation to understand the present status of energy management, set priorities and assess progress.

It has been used successfully in a wide range of public and private sector organisations. The matrix is described in General Information Report (GIR) 13 ‘Reviewing energy management’.

This Guide builds upon the principles of the energy management matrix to provide a set of simple tools to help technical and non-technical staff prioritise energy efficiency activities to maximise the potential impact of their actions.

This is achieved through the use of performance matrices, which allow the user to quickly establish the current position of their organisation with respect to a range of energy management issues and to identify which areas should be improved.

Some of the matrices are very specific in nature and will not be relevant to every building or organisation.

WHO SHOULD USE THIS GUIDE?

This Guide is intended for use by:

- senior managers and directors who control everyday corporate management and its priorities
- energy managers and estates staff with responsibility for energy use
- departmental managers, facilities managers and other staff seeking efficiency improvements
- consultants carrying out energy surveys and assessments.

HOW CAN THIS GUIDE HELP?

Using the matrices described in this publication will help the user to:

- **understand** the current status of energy management in their organisation
- **plan** the priority actions
- **monitor** progress in improving energy management performance.

THE MATRICES IN THIS GUIDE

Top-level matrix

Energy performance

Second-level – organisational matrices

Energy management
Financial management
Awareness and information
Technical

Third-level – detail matrices

Space heating
Lighting
Hot water
Small power equipment
Boilers
Monitoring and targeting
Air-conditioning systems
Building fabric
Building energy management system

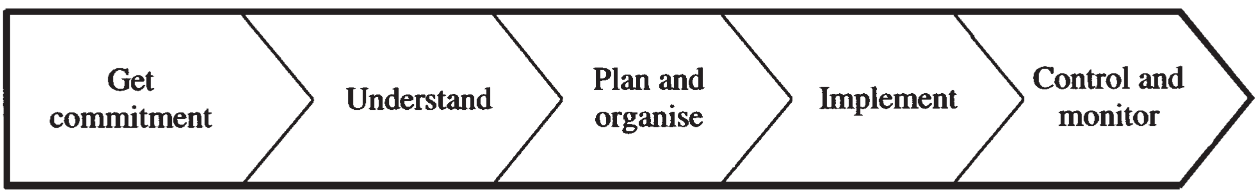


Figure 1 Five-step approach

2 HOW TO USE THIS GUIDE

This Guide contains three levels of matrices. At the top is a summary energy performance matrix that provides a top-level overview of the status of energy management in an organisation.

At the second level are four organisational matrices covering the key areas of energy management, finance, awareness and technical issues. Some of these matrices have already been used successfully by a wide range of public and private sector bodies and are well-established and recognised energy management tools. These four matrices are used to support the overall assessment in the summary energy performance matrix.

Finally, a set of third-level, more detailed matrices is provided, each covering different service functions – space heating, lighting, etc. These can be used to support other matrices, particularly the technical matrix, and will be particularly useful in identifying specific opportunities for improvement.

Figure 2 indicates how the matrices can be used to set priorities for energy management.

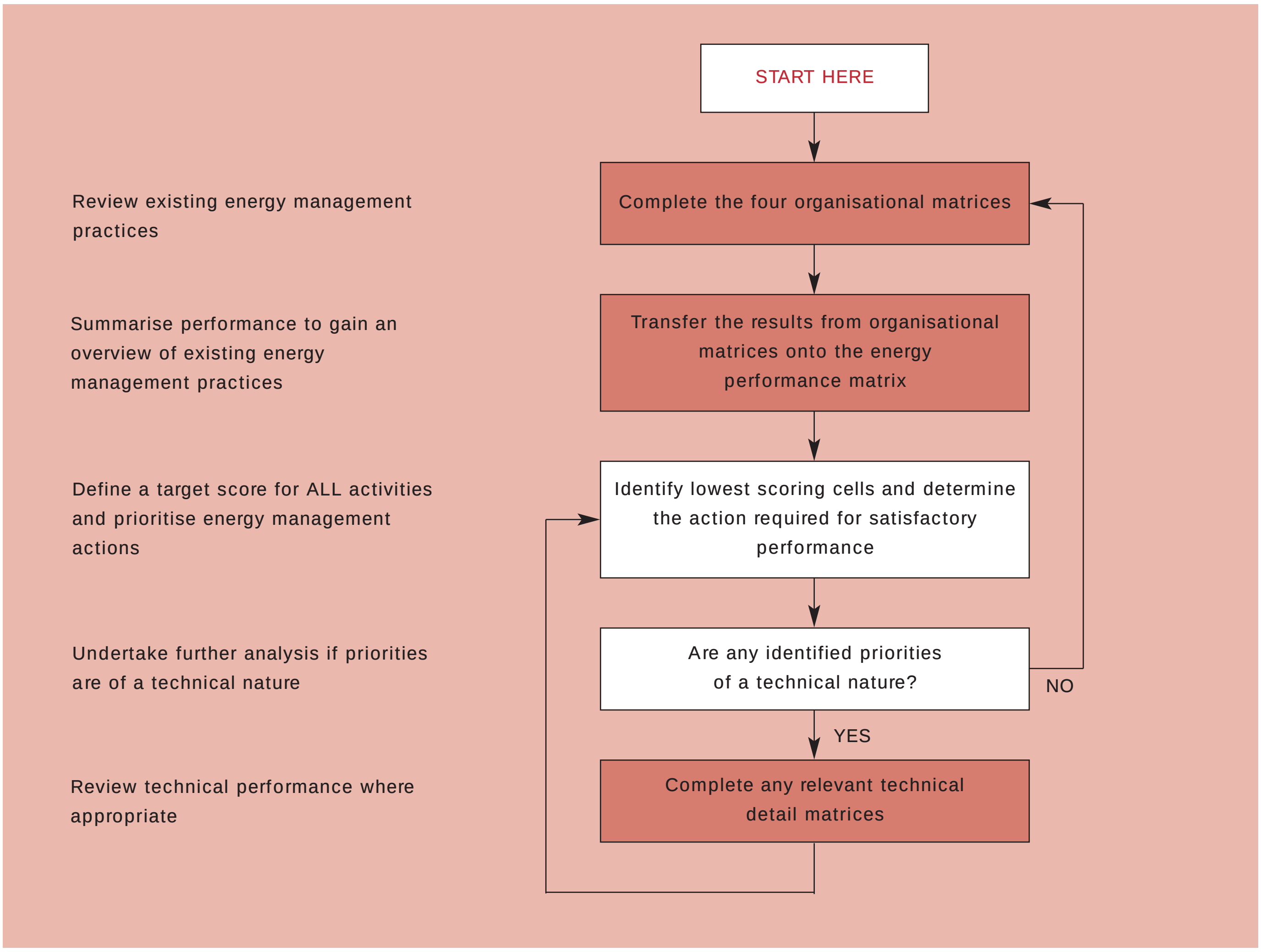


Figure 2 Flowchart

3 HOW TO USE THE MATRICES

Each matrix has up to six columns, each of which covers a discrete topic related to energy management performance. The ascending rows, from levels 0-4, represent increasingly sophisticated handling of these topics. In general terms, the levels can be interpreted as follows.

Level 0 applies to sites where energy management is virtually non-existent. There is no energy policy, no formal delegation of energy management responsibilities, and there is no programme for promoting energy awareness within the organisation. Any equipment is unlikely to be energy efficient or to include any energy-efficient features.

Level 1 generally indicates that, although there is no specific energy policy, some energy management activities are in place, albeit in a rudimentary or informal fashion. Reporting procedures and awareness matters are undertaken on an ad hoc basis. Some plant and equipment will include energy-efficient features.

Level 2 suggests that the importance of energy management is recognised at a senior management level, but there is little active support for energy management activities. Energy staff are likely to be based in a technical department, and the effectiveness of energy management is restricted to the interests of a limited number of employees. The majority of plant and equipment will be energy efficient.

Level 3 indicates that energy management is treated seriously at a senior level, and is incorporated within formal management structures. Consumption is likely to be assigned to cost centre budgets, and there will be an agreed system for reporting energy consumption, promoting energy efficiency and investing in energy efficiency. Plant and equipment selection will be based on energy efficiency.

Level 4 is indicative of clear delegation of responsibility for energy consumption throughout the organisation. Energy efficiency is regularly promoted both formally and informally. A comprehensive monitoring system is in place, and performance is closely monitored against targets. Plant and equipment will be selected for energy efficiency and its operation will be closely monitored.

As a guide to the impact of energy efficiency, each level typically represents a change in consumption of 8-10%, or 30-40% overall. Levels 3 and 4 will generally represent realistic levels of best practice. Level 3 is likely to be appropriate for smaller organisations, where level 4 would not be viable. Larger organisations may find it appropriate to operate at level 4.

COMPLETING THE MATRICES

Follow these steps to complete the matrices and get an overview of energy management in your organisation.

- Make several photocopies of the organisational matrices.
- Consider each column, one at a time. On one photocopy, mark the place in each column which best describes where you are currently located. Place your mark in the appropriate cell, or between cells if you think this is more accurate.
- Join your marks across the column to produce a graph line. The profile will give an indication of how balanced energy management is in your organisation. Don't worry if a profile is uneven. This is the case in most organisations. The peaks indicate where your current effort is most sophisticated, the troughs where you are least advanced.
- On other photocopies, get other people involved with the services you offer to complete the process, marking it up in the same way. Other people you could ask are your line manager, staff that directly report to you, and managers and staff from other departments. It is important to get as wide a spread of people as possible, as this gives you an idea as to how energy management is perceived throughout the organisation.
- Transfer the results to one photocopy, making clear the origin of each point – yourself, your line manager, your staff, other staff and managers.

HOW TO USE THE MATRICES

- Try to draw a composite line from the results. It is likely that different groups will produce significantly different results. By discussing the results with each group you may be able to reach an agreed profile. Do not worry if you can't. The fact that you are discussing the results with each group will help you understand the barriers and obstacles to effective energy management in your organisation, and will help you understand the appropriate actions to improve the situation.

PRIORITISING ACTIONS

Having established an overview of the existing energy management practices within your organisation, you will now need to target a number of activities for follow-up action.

For matrices at the second level (ie energy management, financial management, awareness and information and technical matrices), the aim should be to have a balanced profile, and to then move up the matrices in a balanced way. Decide which columns contain issues that are most important in your situation. Choose two columns where you would most like to see an improvement, ideally making sure that your matrices become more balanced. Often these will be the columns in which your score is lowest, but not always so. There may be obstacles which seem insuperable, in which case it is better to concentrate on areas where there is a good chance of success. Then decide on what actions are needed to make the improvements you have identified. Discuss these with your manager, and use them as the basis for developing a costed action plan. The aim should be to move up through these levels toward current best practice and, in so doing, develop or maintain a balance across the columns. For example, it is not so effective having high levels of investment without adequate reporting on achieved performance (and vice versa). Without reporting there is a reduced justification for future investment (and without investment there will be little to report on).

> Once a priority has been set. there is often a temptation to concentrate on that activity until it meets the level 4 requirement of the matrix. This should be avoided. A deviation of plus or minus one level about the mean is acceptable. Any results significantly above the mean are unlikely to contribute to the current energy efficiency status.

For the third-level matrices, attention should be focused on the columns with the poorer performance. The aim should be to improve the performance of these columns as much as possible within working constraints (eg budgetary, staff resources, etc). Once again, the aim is not necessarily to meet the level 4 requirement. There is no specific need for the matrices to be balanced.

4 THE PURPOSE OF EACH MATRIX

FURTHER READING

Energy management

GIR 12
GIR 13
GPG 75
GPG 119
GPG 165
GPG 167
GPG 186
GPG 200

Awareness

GPG 84
GPG 172

See page 10 for publication titles and the back cover for contact details.

TOP LEVEL – ENERGY PERFORMANCE MATRIX

This is a grid that summarises the results from four second-level 'organisational matrices' described below. It contains full details of existing organisational energy management practice on a single grid.

Its main advantage over the four separate organisational matrices is that it can easily be referred to in order to broadly identify any energy management activities that merit priority attention. If completed regularly it has a useful secondary purpose as a record document providing a 'snapshot' of energy management practice at various stages in an organisation's development.

SECOND LEVEL – ORGANISATIONAL MATRICES

These four matrices provide assessments aligned to an organisation's achievements under the heading of 'energy management', 'financial management', 'awareness and information', and 'technical' activities. Underpinning some of these matrices are a number of third-level detail matrices that focus on specific areas of activity which can be used as appropriate.

Energy management matrix

This matrix is used to assess the level of strategic energy management activities that have an impact on the entire organisation, and the columns should be assessed accordingly. It has been used successfully by a wide range of public and private sector bodies and is a well-established and recognised energy management tool.

Assessments are made on a range of management issues. The presence of an energy policy is assessed, along with the level of commitment provided by senior management. Other columns are used to assess the extent to which energy management responsibilities have been assigned throughout the organisation and how staff are motivated to manage energy. Energy management reporting systems are also analysed, along with investment criteria for energy efficiency and energy management promotional activities.

Financial management matrix

This matrix assesses the level of financial commitment the organisation has to energy efficiency.

The assessment addresses the organisation's procedures for developing plans for investment in energy efficiency and undertaking financial appraisals. Attitudes towards investing capital and resources in energy efficiency are compared with criteria for investment in core business activities. Information and reporting procedures are also assessed.

Awareness and information matrix

This matrix assesses the role of energy awareness and training activities, and the use of information to continually improve energy performance. Procedures for reviewing energy performance, reporting performance and for keeping abreast of market developments are assessed.

Technical matrix

This matrix assesses the energy management attributes of technical plant and equipment and how these are being operated and maintained. Consideration is also given to the way in which records, describing the intended operation of the equipment and how it should be operated and maintained, are kept. There are a large number of detail matrices that provide further assistance in assessing the energy performance of technical equipment.

THE PURPOSE OF EACH MATRIX

THIRD LEVEL – DETAILED MATRICES

These matrices provide underpinning evidence for the four organisational matrices, particularly on technical matters. They should be used as appropriate to support and guide planning for investment in energy-saving opportunities. It is not as important to maintain a level profile in these matrices, as energy savings can be more substantial if improving a single aspect to a higher level.

Space heating

This matrix can be used to assess the technical capabilities of the overall heating system and its control. A further assessment takes account of circuit operating temperatures and the levels of space heating achieved. The operation of the heating system is also considered.

Lighting

This matrix provides a mechanism for measuring the suitability of selected lamp types, associated control gear and diffusers for general applications. The switching arrangements are assessed, along with their operation in practice. The replacement strategy is also considered.

Hot water

This matrix assesses the relative performance of the systems for providing domestic hot water. It is assumed that where there is a high demand for hot water, this is generated at a central point and stored. Where the demand for water is low or intermittent, it is assumed that water is heated at the point of use.

Small power equipment

This matrix is to be used when assessing the selection and operation of portable power consuming equipment, including PCs, photocopiers and other office equipment.

Boilers

This matrix can be used to assess the energy performance of boilers, the way they are connected, and the way they operate together. Consideration is given to the way they operate at different times of the year, and the pumping regimes that have been adopted.

Monitoring and targeting

This matrix assesses the way in which data is gathered and analysed in order to improve energy performance. Data, sources and administrative procedures are assessed, together with the information that is disseminated. An assessment is also made on procedures for auditing this information.

Air-conditioning systems

This matrix can be used to assess the appropriateness of the selection and design of air-conditioning controls. An assessment is also made of the controls, with particular regard to simultaneous operation of heating and cooling plant in a single system.The performance of fans and cooling systems is also analysed.

Building fabric

This matrix should be used to assess the energy performance of windows, floors, doors and roof insulation. Factors which affect the thermal performance of each element are considered, along with draughtstripping of windows and doors.

Building energy management system

This matrix allows an assessment to be made of the performance of the building energy management system (BEMS), and reviews and audits its operation. Hardware and software performance are also assessed, including general operation of controls, reporting, and sensor calibration.

FURTHER READING

Space heating and hot water
FEB 21
GPG 182
GPG 188

Lighting
FEB 12
GPG 160
GPG 199
GPG 272

Small power
GPG 118
GPG 276

Boilers
GIL 1

Monitoring and targeting
FEB 7
GPG 31

Air-conditioning
GPG 71
GPG 118
GPG 257

Building fabric
GPG 227a

Controls
FEB 10
GIR 40

See page 10 for publication titles and the back cover for contact details.

FURTHER READING

ENERGY EFFICIENCY BEST PRACTICE PROGRAMME PUBLICATIONS

The following Best Practice programme documents are available from the BRECSU Enquiries Bureau. Contact details are given on the back cover.

Energy management

GIR 12	Aspects of energy management
GIR 13	Reviewing energy management
GPG 75	Financial aspects of energy management in buildings – a summary
GPG 119	Organising energy management – a corporate approach
GPG 165	Financial aspects of energy management in buildings
GPG 167	Organisation aspects of energy management – a self-assessment manual for managers
GPG 186	Developing an effective energy policy
GPG 200	A strategic approach to energy and environmental management

Awareness

GPG 84	Managing and motivating staff to save energy
GPG 172	Marketing energy efficiency – raising staff awareness

Space heating and hot water

FEB 21	Simple measurements for energy and water efficiency in buildings
GPG 182	Heating system option appraisal – a manager's guide
GPG 188	Maintaining the efficient operation of heating and hot water – a manager's guide

Lighting

FEB 12	Energy management and good lighting practices
GPG 160	Electric lighting controls
GPG 199	Energy efficient lighting – a guide for installers
GPG 272	Lighting for people, energy efficiency and architecture

Small power

GPG 118	Managing energy use. Minimising running costs of office equipment and related air conditioning
GPG 276	Managing for a better environment. Minimising the running costs and impact of office equipment

Boilers

GIL 1	The success of condensing boilers in non-domestic buildings

Monitoring and targeting

FEB 7	Degree days
GPG 31	Computer aided monitoring and targeting for industry

Air-conditioning

GPG 71	Selecting air conditioning systems
GPG 118	Managing energy use. Minimising running costs of office equipment and related air conditioning
GPG 257	Energy efficient mechanical ventilation systems

Building fabric

GPG 227a	Selecting energy-efficient windows

Controls

FEB 10	Controls and energy savings
GIR 40	Heating systems and their control

TOP-LEVEL MATRIX – ENERGY PERFORMANCE
(using results from the four 'organisational matrices')

Date .... Completed by ....

Level	Column 1 score	Column 2 score	Column 3 score	Column 4 score	Column 5 score	Column 6 score
Energy management						
Financial management						
Awareness and information						
Technical						

This page forms part of Good Practice Guide 306, 'Energy management priorities – a self-assessment tool', produced by BRECSU as part of the Government's Energy Efficiency Best Practice programme. For further information on buildings-related topics contact: Enquiries Bureau, BRECSU, BRE, Garston, Watford WD25 9XX. Tel 01923 664258. Fax 01923 664787. E-mail brecsuenq@bre.co.uk. Or call the Environment and Energy Helpline on 0800 585794.

SECOND-LEVEL MATRIX – ENERGY MANAGEMENT

Level	Energy policy	Organising	Motivation	Information systems*	Marketing	Investment
4	Energy policy, action plan and regular review have commitment of top management as part of an environmental strategy.	Energy management fully integrated into management structure. Clear delegation of responsibility for energy consumption. Energy Committee chaired by board member.	Formal and informal channels of communication regularly exploited by energy manager and energy staff at all levels.	Comprehensive systems set targets, monitor consumption, identify faults, quantify savings and provide budget tracking.	Marketing the value of energy efficiency and the performance of energy management both within the organisation and outside it.	Positive discrimination in favour of 'green' schemes with detailed investment appraisal of all new-build and refurbishment opportunities.
3	Formal energy policy, but no active commitment from top management.	Energy manager accountable to energy committee representing all users.	Energy committee used as main channel together with direct contact with major users.	M&T reports for individual premises are based on sub-metering. Achieved performance against targets reported effectively to users.	Programme of staff awareness and regular publicity campaigns.	Same payback criteria employed as for all other investment.
2	Unadopted energy policy set by energy manager or senior departmental manager.	Energy manager in post, reporting to ad hoc committee, but line management and authority are unclear.	Contact with major users through ad hoc committee chaired by senior departmental manager.	Monitoring and targeting reports based on supply meter data. Energy unit has ad hoc involvement in budget setting.	Some ad hoc staff awareness training.	Investment using short-term payback criteria only.
1	An unwritten or uncoordinated set of guidelines.	Energy management is the part-time responsibility of someone with limited authority or influence.	Informal contacts between engineer/technical staff and a few users.	Cost reporting based on invoice detail. Engineer compiles reports for internal use within technical department.	Informal contacts used to promote energy efficiency.	Only low-cost measures taken.
0	No explicit policy.	No energy management or any formal delegation of responsibility for energy consumption.	No contact with users.	No information system. No accounting for energy consumption.	No promotion of energy efficiency.	No investment in increasing energy efficiency in premises.

* Refer to third-level matrix: 'monitoring and targeting' for information to support this column.

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SECOND-LEVEL MATRIX – FINANCIAL MANAGEMENT

Level	Identifying opportunities	Exploiting opportunities	Management information	Appraisal methods	Human resources	Project funding
4	Detailed energy surveys are regularly updated. Lists of high- and low-cost opportunities already costed and ready to proceed immediately.	Formal requirement to identify the most energy-efficient option in all new- build, refurbishment and plant replacement projects. Decisions made on the basis of life cycle costs.	Full management information system enabling identification of past savings and further opportunities for investment meeting organisation's financial parameters.	Full discounting methods using internal rate of return and ranking priority projects as part of an ongoing investment strategy.	Board take a proactive approach to a long-term investment programme as part of a detailed environmental strategy in full support of the energy management team.	Projects compete equally for funding with other core business investment opportunities. Full account taken of benefits which do not have direct cost benefit, eg marketing opportunities, environmental factors.
3	Energy surveys conducted by experienced staff or consultants for buildings likely to yield largest savings.	Energy staff are required to comment on all new-build, refurbishment and plant replacement projects. Energy efficiency options often approved but no account is taken of life cycle costs.	Promising proposals are presented to decision-makers but insufficient information (eg sensitivity or risk analysis) results in delays or rejections.	Discounting methods using the organisation's specified discount rates.	Energy manager working well with accounts/finance department to present well-argued cases to decision makers.	Projects compete for capital funding along with other business opportunities, but have to meet more stringent requirements for return on investment.
2	Regular energy monitoring/analysis identifies possible areas for saving.	Energy staff are notified of all project proposals with obvious energy implications. Proposals for energy savings are vulnerable when capital costs are reduced.	Adequate management information available, but not in the correct format or easily accessed in support of energy-saving proposals.	Undiscounted appraisal methods – eg gross return on capital.	Occasional proposals to decision makers by energy managers with limited success and only marginal interest from decision makers.	Energy projects not formally considered for funding from capital budget, except when very short-term returns are evident.
1	Informal ad hoc energy walkabouts conducted by staff with checklists to identify energy-saving measures.	Energy staff use informal contacts to identify projects where energy efficiency can be improved at marginal cost.	Insufficient information to demonstrate whether previous investment in energy efficiency has been worthwhile.	Simple payback criteria are applied. No account taken of lifetime of the investment.	Responsibility unclear and those involved lack time, expertise and resources to identify projects and prepare proposals.	Funding only available from revenue on low-risk projects with paybacks of less than one year.
0	No mechanism or resources to identify energy-saving opportunities.	Energy efficiency not considered in new-build, refurbishment or plant replacement decisions.	Little or no information available to develop a case for funding.	No method used irrespective of the attractiveness of a project.	No-one in organisation promoting investment in energy efficiency.	No funding available for energy projects. No funding in the past.

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SECOND-LEVEL MATRIX – AWARENESS AND INFORMATION

Level	Energy management responsibilities	Energy efficiency awareness	Reporting procedures	Review of energy performance	Ongoing training	Market awareness
4	Lists of responsibilities and their assignment exist and are comprehensive and regularly reviewed. All staff have responsibilities.	Energy efficiency performance regularly presented to all staff. Full use made of publicity. Advantage taken of all available dissemination routes for promoting new measures for saving energy.	Comprehensive reporting of current status compared with best practice, on regular basis and geared at a variety of audiences. Full support to public statements.	Energy and water efficiency regularly reviewed. Performance compared against internal and external references or benchmarks. Ideas actively sought.	Continuous professional development properly resourced for technical and premises staff. Active technical library. All staff have ready access to domestic and non-domestic energy efficiency information.	Keep abreast of technological developments by ongoing monitoring of trade journals, literature and other sources on issues affecting energy efficiency.
3	Lists of responsibilities and their assignment exist for key energy staff and all departments.	Energy efficiency status presented to all staff at least annually. Occasional but widespread use of publicity to promote energy-saving measures.	Current status reports issued annually to shareholders and staff. Impartial reporting of performance to staff and departments on a regular basis.	Frequent energy efficiency reviews using monitored consumption and cost data. Analysis is regular, wide-ranging but ritualistic.	Continuous professional development for technical and premises staff. All staff are aware of and have access to an energy efficiency library.	Regular studies carried out on trade journals, literature and other sources to assess current developments impacting on energy efficiency.
2	Some staff and departments have written responsibilities.	Energy performance presented to staff on a regular basis. Occasional use of publicity for promoting energy-saving measures.	Occasional issue of energy efficiency status reports. Concentrates on good news.	Occasional technical energy efficiency reviews. Regular cost checks with exception reporting. Analysis of limited scope.	Technical and premises staff development mainly via professional and technical journals. Occasional initiatives to train staff in energy efficiency.	Trade journals, literature and other sources scanned on an ad hoc basis for information on the latest developments relating to energy efficiency.
1	Unwritten set of responsibility assignments.	Energy performance occasionally reported and known to very few staff. Energy-saving measures are rarely promoted.	Reports only issued if prompted by a business need. Most reports will contain only good news.	Energy review activity based on revenue costs. Limited exception reporting only.	Energy efficiency awareness generally low. A few staff have knowledge of energy efficiency techniques and facts. Little, if any, training in energy efficiency for staff.	Trade journals, literature and other sources studied for energy implications when a purchase is imminent.
0	No evidence of assignment of energy efficiency tasks and duties.	No staff have explicit responsibilities or duties.	No reporting.	No monitoring activity to underpin review processes.	Little, if any, knowledge of energy efficiency amongst staff. No attempt made to inform staff of techniques and benefits of energy efficiency.	Energy efficiency not a consideration when keeping up to date on products or technology.

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SECOND-LEVEL MATRIX – TECHNICAL

Level	Existing plant and equipment*	Plant and equipment replacement	Maintenance procedures	Operational knowledge	Documentation and record keeping	Operational methods
4	The majority of existing equipment (fixed plant and portable appliances) incorporates best practice energy-efficient features, is correctly commissioned for energy efficiency and well maintained.	Equipment is selected to be the most appropriate to the application. Life cycle costs and energy efficiency are taken into account. Energy saving is a major consideration in product selection.	Maintenance is based on needs, with formal condition appraisal methods being performed for all equipment and fabric elements affecting energy efficiency. Results acted upon where necessary.	All staff understand how their roles impact on energy efficiency and take positive steps to minimise energy use. Staff receive targeted training in energy efficiency.	Fully detailed descriptions of system concepts, plant control and operation. Detailed schedules of all plant, instrumentation and controls.	Operation methods and settings for energy efficiency defined and implemented. Full utilisation of feedback from monitoring.
3	Equipment and plant is appropriately selected, energy efficient, commissioned for low energy consumption and well maintained.	Equipment is selected to be appropriate to the application with energy-saving features taken into consideration. Life cycle costs and energy efficiency are evaluated.	Condition surveys carried out regularly on equipment and fabric elements affecting energy efficiency. Action undertaken for most defects identified.	Staff are aware of how they affect energy use and take all good housekeeping measures to save energy. Further training received on a regular basis.	Detailed descriptions of plant control and operation, and outline system concepts. Reasonably detailed schedules of all plant instrumentation and controls.	Delivered conditions and operating methods for energy efficiency defined and implemented. Informal use of information from monitoring.
2	Most equipment is not specifically energy efficient, but either was commissioned or is being regularly maintained for low energy consumption.	Equipment selected to be fit for purpose, bearing in mind likely life cycle costs and energy efficiency factors.	Condition surveys carried out regularly on all equipment and fabric elements affecting energy efficiency. Remedial work constrained by budgets.	Most good housekeeping practices are adhered to in an attempt to reduce energy usage. Occasional energy efficiency training received.	Basic descriptions of plant control and operation. Basic plant instrumentation and control schedules for most control systems.	Targets set against realistic budgets, and maintained through financial procedures.
1	Equipment is not energy efficient, but has been commissioned for economy and undergoes periodic maintenance.	Power efficiency data on products obtained as part of selection process.	Condition surveys and occasional activity, often prompted by plant failure or safety considerations. Remedial work only carried out on major defects.	Energy-saving techniques are only adopted where they can be easily accommodated within traditional working practices.	Minimal, or poor plant control and operation. Plant instrumentation and control schedules for only some of the plant and control systems.	Targets set by default through budget setting procedures.
0	Energy performance has not been considered during the procurement, commissioning or maintenance of existing plant and equipment.	No consideration of energy efficiency in product selection.	No regular surveys or maintenance carried out.	No consideration is given to energy efficiency during working operations.	None available.	No targets set.

* Where necessary, refer to further detail technical matrices for information to support this column.

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THIRD-LEVEL MATRIX – SPACE HEATING

Level	Time control	Boiler output controls	Heat emitters	Operation of heating systems	Heating levels and balance	Zoning
4	Space heating is controlled by a sophisticated system such as a BEMS, programmed for weekends and holidays, and with self-learning optimum start and stop functions.	Effective automatic control of boiler standing losses. Only those boilers whose output is required are hot, all others cold or cooling. Boilers and manifolds are well insulated.	Radiators have thermostatic valves, fan convectors have individual controls and different areas of the building each have internal temperature sensors or thermostats.	Rigorous checking of controls function, settings, and system balance carried out once per year. Documented procedures and comprehensive records of results.	Temperatures are even throughout the building – within the range 18°C to 20°C during the periods of occupancy, and reducing to lower temperatures outside those periods.	Objective zoning for occupancy, solar gain, equipment gain, emitters, structure, etc, where appropriate. Adequate means for controlling temperature in each zone.
3	An optimum start controller varies the start time of the heating according to outside temperatures, and an optimum stop does the equivalent at the end of the day.	Effective manual isolation of boilers to reduce standing losses when full output is not required. Boiler and manifolds are well insulated.	Radiators and fan convectors have individually operated controls. The temperature of radiator circuits is hotter in mid-winter and cooler in autumn and spring.	Full checking of controls function, controls settings, and system balance carried out once per year. Documented procedures exist for each check. Some results on record.	Temperatures are even throughout the building, but in some parts they occasionally rise over 20°C during spring or autumn. 20°C is maintained only during the hours of occupancy.	Extensive zoning, approximately reflecting occupancy time and temperature requirements. Temperature controls exist for each zone.
2	There is an optimum start controller fitted to the heating system. Holiday periods can be programmed in advance.	All boilers become hot only when boiler output is required. Boilers are cold at all other times (eg overnight).	Radiators and fan convectors have individually operated controls but water temperature to the radiators is the same all year round.	Informal checking of controls function and system balance carried out once per year. Schedule of checks exists but no proof of occupancy.	Temperatures above 20°C during spring and autumn, and the building is warm for more than an hour before or after the occupied periods.	Limited zoning, perhaps led by building expansion, but zones approximately reflect the need for separate occupancy times and temperatures.
1	The heating system has a simple timer that can be easily set. Timer settings are adjusted manually to suit seasonal heating requirements.	All boilers remain hot during pre-heat and building occupation hours during summer and winter.	Radiators and heat emitters have basic controls, and there is only one internal temperature sensor to control them.	Annual functional checks carried out although these are not well documented.	Temperatures vary and they are frequently above 20°C for long periods – including outside periods of occupancy.	Limited zoning or inappropriate zoning of circuits.
0	The timer is in a poor state of repair and cannot be easily adjusted. The controller may not recognise days of the week.	All boilers remain hot regardless of whether or not there is a demand for heating.	Radiators and heat emitters have no controls and get hot together. Radiator temperatures appear to be the same all year round.	Maintenance is on breakdown basis and controls are checked only when things go wrong.	For much of the building temperatures are frequently too hot, particularly in spring and autumn.	No zoning where zoning desirable, or inappropriate zoning.

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THIRD-LEVEL MATRIX – LIGHTING

Level	Strip lights	Small lights	Switching equipment	Replacement policy	Lighting diffusers and shades	Operation in use
4	A high proportion of strip lights are 26 mm diameter high-efficiency (T8) tubes with high-frequency ballasts*.	A high proportion of small lights are compact fluorescents. Tungsten bulbs (GLS) are only installed in areas that are used very infrequently.	Lights are switched in separate banks whose locations correspond to activity and available daylight. Switches are clearly labelled to show which lamps they operate.	Light fittings, including diffusers, reflectors and ballasts, are updated on a planned basis. Specular reflectors** are widely used.	Diffusers and shades are selected for their high utilisation factor and are cleaned on a scheduled basis.	Lights operate only as required. Where daylight is available, light output is adjusted to the minimum required. There is a routine for regular checking of artificial lighting usage.
3	A high proportion (>75%) of strip lights are 26 mm diameter high-efficiency (T8) tubes.	Most are compact fluorescent with tungsten bulbs (GLS) in remainder.	Lights are switched in separate rows with switches located near the lights they operate. Switches are clearly labelled.	Light fittings, including diffusers, reflectors and ballasts are periodically upgraded when opportunities allow.	Diffusers and shades are selected for their high utilisation factor and are cleaned occasionally.	Lighting levels and hours of operation are well controlled. Checks are undertaken periodically on an ad hoc basis. Cleaners light their current working area only.
2	Most strip lights are 26 mm diameter (T8) tubes.	Approximately half are compact fluorescent, with the remainder tungsten bulbs (GLS).	Lights are switched in rows and switches are in the same space as the lights they operate. But rows do not necessarily correspond with daylight, nor are switches labelled.	Light fittings, including diffusers, reflectors and ballasts are upgraded on an ad hoc basis.	Diffusers and shades are of high utilisation factor, but are not regularly maintained.	Lighting levels are partially controlled. Lights are switched on only when they are required, and switched off at the end of the occupation period. No routine for checking usage.
1	Strip lights are predominantly (>75%) 38 mm diameter (T12) tubes.	A few are compact fluorescent with the remainder tungsten.	Lights have the potential to be switched on in banks, but in practice all go on together.	Lamps and ballasts are sometimes upgraded to high-efficiency types when they are replaced.	Diffusers and shades are of fair translucency but are rarely cleaned.	Lighting levels are partially controlled. All lights are switched on at the beginning of the day and typically operate continuously whenever the building is occupied, whether required or not.
0	Strip lights are all 38 mm diameter (T12) tubes.	Traditional tungsten filament general lighting system (GLS) lamps are installed more or less throughout.	Lights are switched from central locations and all go on together.	Lamps are replaced upon failure with 'like-for-like' lamp types.	Diffusers and shades are not selected for translucency/light transmitting properties. There is no programme for cleaning.	Lighting levels are uncontrolled. Lighting is frequently left on 24 hours per day whether the building is occupied or not.

* Ballast – apparatus to start a discharge lamp and control the current through it.
** Specular reflectors – mirror-like reflections of a light source.

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THIRD-LEVEL MATRIX – HOT WATER

Level	Type of installation (low water use applications)	Timer/programmer settings	Calorifier* installation (high water use applications)	Pipework insulation	Actual water temperature at taps
4	Instantaneous local point of use water heaters or water heaters with localised storage and time controls.	Two or more visual and functional checks made each year against a formal document and results recorded. No pump or heating fuel used when building is unoccupied.	The calorifier/hot water boiler is correctly sized, appropriately located, designed to eliminate stratification**, and insulated to its optimum thickness based on best practice calculations.	All pipework is well insulated, and both insulation and any finishes (eg reflective coatings or waterproof finishes) are in prime condition. Flanges, valves and other fittings are insulated.	Water circulation temperatures are hot throughout (ie >50°C) and where there is risk of scalding, outlets are fitted with blenders to mix with cold water for comfort.
3	Instantaneous local point of use water heaters or water heaters with localised storage without time controls.	Annual visual checks made using formal procedures and results recorded. No pump power or heating fuel used when building is unoccupied.	The calorifier/hot water boiler is correctly sized, and insulated to an economic thickness calculated using local criteria. Calorifier appropriately located to meet demand for hot water.	All pipework in both unheated and heated spaces is well insulated and insulation feels cool to the touch. Flanges, valves and other fittings are insulated.	Water circulation temperatures are hot throughout (ie >50°C) and some automatic blenders are fitted to mix with cold water for comfort.
2	Hot water is provided from dedicated central plant with seven-day timer/programmer that allows heating and hot water services to operate independently.	Times of availability closely matched to demand. Regular checks on time switch settings.	The calorifier/hot water boiler is well insulated with insulation known to be more than 50 mm thick.	All pipework in both unheated and heated spaces is well insulated and insulation feels cool to the touch.	Water circulation temperatures are hot throughout (ie >50°C) Water temperature at the taps is hand hot and cold water has to be added regularly for comfort.
1	Hot water is provided from central plant, with timer/programmer serving both heating system and hot water.	Times of availability not specifically checked.	The calorifier/hot water boiler is insulated with 25-50 mm insulation.	Pipework in unheated spaces is well insulated and cool to the touch.	Water temperature at the taps is variable, and is often less than 50°C or greater than 60°C.
0	The only controls are on/off and the primary circuit thermostat.	Times of availability not specifically checked. Strong possibility of availability when building unoccupied.	The calorifier/hot water boiler is incompletely insulated and is subject to significant heat loss.	Pipework generally is not insulated or the insulation is thin, damaged or in poor condition.	Water temperature at the taps is regularly below 50°C or greater than 60°C.

* Calorifier – a heat exchanger, usually with storage capacity, used to generate hot water.
** Stratification – the process whereby hot water rises to the top of a storage, and the temperature steadily decreases towards the bottom.

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THIRD-LEVEL MATRIX – SMALL POWER EQUIPMENT

Level	Purchasing policy	Operational policy	Operational compliance	Audit	Energy-saving features
4	Equipment selected to be the most appropriate to the application, bearing in mind life cycle costs and energy efficiency. Energy-saving features a major consideration in product selection.	Initial assessment and regular re-assessment of each situation to determine the most energy-efficient operating mode commensurate with business needs. Time switches and other devices installed where appropriate.	Regular checking of time switches and automatic controls to ensure equipment powered down to lowest consumption mode whenever possible.	Documented routine of regular checks to ensure equipment only powered up when necessary.	All energy-saving features (eg automatically reverting to standby after pre-determined time) are enabled and optimised.
3	Equipment selected to be energy efficient. High-energy-label products selected (where appropriate) Energy-saving features taken into consideration in product selection.	Initial assessment of each situation to determine the most energy-efficient operating mode commensurate with business needs.	Equipment only switched on when needed. Power-saving set-ups employed whenever possible to minimise waste.	There is a routine of regular checks to ensure equipment only powered up when necessary.	All energy-saving features are enabled and reviewed against likely criteria for efficient operation.
2	Equipment selected to be suitable for the application, bearing in mind life cycle costs and energy efficiency.	Departmental responsibilities exist for ensuring that equipment is switched off when not in use.	Equipment switched off when not needed.	Checks regularly carried out to determine whether equipment is switched off out of hours.	Energy savings settings are enabled for equipment with high electricity consumption.
1	Power efficiency data on products obtained as part of selection process.	Users instructed to only have equipment switched on when required.	All equipment switched on at start of day and remains on whenever building occupied.	Ad hoc checks carried out to determine whether equipment is switched off out of hours.	Some energy-saving features are enabled but there is no clear strategy, and settings are ad hoc and diverse.
0	No consideration of energy efficiency in product selection.	No policy for ensuring equipment switched off when not in use.	Equipment frequently left running even when building unoccupied.	No checks to determine whether equipment is left on even when building is unoccupied.	Pre-delivery settings are unchanged by users.

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THIRD-LEVEL MATRIX – BOILERS

Level	Boiler selection	Multiple boilers	High/low fire boilers	Pumps
4	Very low standing loss boilers – typically less than 0.5% of rated output. Condensing boilers chosen for low-temperature applications.	Score '4' if requirements of '3' are satisfied and formal documentation exists on design intent and control settings.	High fire correctly integrated into burner sequence control, and operation well documented.	Variable speed controlled from representative load, reducing pump differential pressure with demand. Records kept of pump control and operation.
3	Low standing loss boilers with losses down to 0.75% of rated output, common primary pump. Condensing or high-efficiency boilers for low-temperature applications.	Heat losses from idle boilers are automatically minimised by reducing or restricting the water flow through boilers that are not firing.	High fire correctly integrated into sequence control.	Variable speed controlled from representative load, reducing pump differential pressure with demand.
2	High standing loss boilers with losses in the range of 2% to 5% of rated output, fully isolated and cold when off line.	Boiler operation dictated by automatic sequence controls. Redundant capacity capable of manual isolation.	Sequence control achieved by boiler thermostats. High fire control typically set at lower temperature than low fire by margin of at least 6°C to ensure most efficient boiler acts as lead.	Variable speed pumps controlled at constant pump differential pressure. Records kept of pump control and operation.
1	High standing loss boilers with losses greater than 5% of rated output, isolated and cold when off line.	Winter/summer conditions can be manually altered – eg by allowing a dedicated boiler to heat the primary DHW* circuit during summer.	Sequence control achieved by boiler thermostats, although margin may be less than 6°C, and relative efficiency of boilers has not been considered.	Variable speed pumps controlled at constant pump differential pressure.
0	High standing loss boilers greater than 7% of rated output, not isolated when off line.	Operation of multiple boilers does not change with changes in demand – warm return water is circulated through idle boilers, and flow rates are constant.	Inadequate control procedures for burner sequencing (eg high fire control setting set at higher, or same, temperature as low fire).	Constant speed pumps.

* DHW – Domestic hot water.

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THIRD-LEVEL MATRIX – MONITORING AND TARGETING

Level	Operational requirements	Data sources	Administration	Analysis	Outputs	External audit
4	All data obtained up to date and competently analysed with minimum delay. Management and operational efficiency information provided in timely manner and appropriate detail.	Details of premises and occupancy database updated regularly. Consumption data routinely obtained. Internal and external temperatures logged as required to establish changes between shifts or other working practices.	All meter readings taken in accordance with a written plan, temperature and other recorded data collated and combined with relevant trading and business data recording.	Energy usage analysis made with respect to fuel costs, building usage and other relevant parameters. Accuracy of energy targeting and normalisation formally assessed against business needs.	Reports prepared and provided to managers in a concise form allowing both technical and financial data to be effectively utilised. Data normalised for ease of comparison. Impact of any uncertainties defined.	Premises database checked annually for accuracy. Instrumentation calibration verified. Market fuel prices checked. Reports analysed for significant trends and anomalies.
3	All data obtained up to date and analysed so as to provide management information in adequate detail.	Premises inventory and occupancy database updated regularly. All data sources calibrated. Internal and external temperatures logged regularly and energy usage recorded on a shift by shift basis.	All meter readings taken regularly, temperature and other recorder data collated and combined with relevant trading and business data recording.	Energy usage analysis undertaken with respect to fuel costs, business usage and other parameters, including prevailing weather. Comparisons possible with previous periods.	Reports prepared and provided to managers in a concise form allowing both technical and financial data to be effectively utilised, with deviations from budget and comparisons with previous period.	Premises database checked annually for accuracy. Instrumentation calibration verified. Market fuel prices checked.
2	Provision of budgetary figures based on usage in corresponding periods adjusted for changes in base data (eg weather corrected).	Most data sources calibrated. Internal and external temperatures logged routinely and energy usage recorded on a routine basis.	All meter readings taken frequently, temperature and other recorded data collated and combined with relevant trading and business data recording.	Energy usage analysis with respect to fuel costs, building usage and other parameters undertaken as required.	Reports prepared and provided to managers incorporating both technical and financial data together with deviations from budget and comparisons with previous period.	Premises database checked annually for accuracy. Ad hoc cursory check on reports and comparison with previous year.
1	Provision of budgetary figures based on usage in corresponding periods.	Records kept of consumption based on bills from suppliers.	Occasional meter readings taken, temperature and other recorded data collated and combined with relevant trading and business data recording.	Energy usage analysis with respect to fuel costs, building usage and other parameters undertaken occasionally in response to adverse trends.	Reports prepared and provided to managers incorporating both technical and financial data for the period.	Ad hoc checks on premises database. Ad hoc cursory check on reports and comparison with previous year.
0	No information of energy efficiency or consumption available.	No measurements taken and no records kept.	Information not collected.	No energy analysis prepared.	No management reports prepared.	No auditing function.

THIRD-LEVEL MATRIX – AIR-CONDITIONING SYSTEMS

Level	System selection	System design	System control	Fan power	Cooling systems
4	Appropriate system selected with delivered air volumes to match the need at all times. Includes energy-saving features such as heat recovery or controlled partial recirculation based on air quality.	System design well matched to user needs and building type. Temperature and humidity requirements achieved with minimum energy consumption.	Wide deadband for control limits on setpoints for temperature and humidity (where appropriate). Occupancy-based control, likely to be via BEMS with extensive operator facilities.	High-efficiency fans selected, and system designed for low pressure loss along ductwork. Control by variable speed drive. Power consumed less than 1 W for each 1/s of air delivered.	Most efficient means selected for providing cooling. Chillers have variable speed compressors. Flow rates and/or temperature of cooling medium is variable depending on demand.
3	Appropriate system selected with carefully delivered air volumes to match the need. Energy-saving features such as run-around coils for heat recovery.	Good system design with all expected energy efficiency measures, such as free cooling control and night purge during summer. Temperature and humidity requirements achieved with reasonable energy consumption.	Automatically controlled but variable conditions for common supply ducts. Modern electronic or electro-mechanical controls. Communication between controllers.	Good fan selection, combined with good ductwork design. Likely to include either VSD or high-efficiency motor.	Efficient means provided for cooling, eg good use made of evaporative cooling*. Chillers selected and sequenced to be able to match demand across load range.
2	Air-conditioning necessary but inappropriate system(s) and/or features selected. Effects are excessive air change rates and unnecessary cooling or humidity control.	Designed to reasonable standard but lacks consideration for energy efficiency other than limited measures, eg free cooling control.	Fixed common supply duct conditions are chosen to limit the duty on terminal units** but do not optimise energy performance. Modern electronic or electro-mechanical controls with time programming.	Reasonable fan selection and ductwork design, although energy efficiency was not a prominent factor during selection.	Cooling provided using efficient chillers. Outputs specifically chosen to minimise energy consumption, particular over the full range of operating loads. Fixed delivery temperature.
1	Air-conditioning only necessary for parts of building, yet other areas are air-conditioned.	Poorly designed – oversized plant, lack of expected energy efficiency measures. Reasonable functional control of plant. Lack of expected energy efficiency features, such as free cooling control.	Unnecessarily close control of heating and cooling (to within 2-3°C, 10% RH***). Stand-alone time control without convenient means for omitting operation during holiday periods.	Either oversized fans or poor ductwork design.	Reasonable chiller performance, but poor performance characteristics at low operating loads. Fixed delivery temperature, lower than strictly required.
0	Air-conditioning not necessary, yet air-conditioning presence is significant.	Very poor design – likely to be oversized for application, etc. No energy-saving features.	Close control of heating and cooling in space and within supply ducts (to within less than 1°C, 5% RH) where not appropriate. Poor time control of plant.	Oversized, poorly selected fans, poor ductwork design.	Poor chiller performance, providing a constant temperature output, at a much lower level than necessary to match loads.

* Evaporative cooling – cooling effect achieved by the evaporation of water.
** Terminal units – components of air-conditioning systems that are close to the point of delivery.
*** RH – relative humidity.

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THIRD-LEVEL MATRIX – BUILDING FABRIC

Level	Windows	External doors	Pitched roof insulation	Natural ventilation
4	All windows are double glazed, and draughtstripped. Window catches hold them tightly shut.	All external doors are draughtstripped and have self-closing devices. Draught lobbies are provided for frequently operated doors.	Roof insulation is at least 150 mm thick and continuous over whole roof area.	Users have control over ventilation, providing adequate ventilation during occupancy. Much reduced overnight and weekend ventilation serving only to prevent condensation.
3	All windows are double glazed, and draughtstripped.	Most external doors are well-fitting draughtstripped and have self-closing devices. Door locks hold them tightly closed.	Roof insulation is at least 100 mm thick and continuous over whole roof area.	Reasonable degree of user control over natural ventilation. Adequate ventilation during occupancy, with significantly reduced air changes outside of working hours.
2	Windows generally are single glazed and draughtstripped. Window catches hold them tightly shut.	External doors are well-fitting and generally draughtstripped.	Roof insulation is 150 mm to 100 mm thick generally, but there are visible gaps in the insulation.	Some degree of user control over ventilation rates during occupancy, although excessive during winter and inadequate during summer.
1	Windows are single glazed but fit well with minimal draughts.	External doors fit well.	Parts of the roof are insulated.	Higher than necessary rates of ventilation during occupied periods, with minimal reduction outside of occupancy.
0	Windows are single glazed and poorly fitting with gaps visible around the edges.	External doors are poorly fitting and gaps are visible around the edges.	There is no roof insulation installed.	Unnecessarily high air change rates with no variation between air change rates inside and outside of occupancy.

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THIRD-LEVEL MATRIX – BUILDING ENERGY MANAGEMENT SYSTEM

Level	Operation of BEMS	System accuracy	Response to alarms	Optimising operating efficiency	Reporting	External aids
4	BEMS installed correctly and regularly checked to ensure that it is operated in the most effective and efficient manner at all times to take into account variations in ambient conditions, occupancy and workload.	All sensors regularly checked and accurately calibrated. All externally owned meters verified to be within calibration.	Out of limit alarms flagged immediately for sensors which affect energy efficiency. Maintenance status report generated on a planned basis to reflect known needs.	Ensure that desired temperature profiles are maintained in accordance with space occupancy and shift patterns.	Concise management reports prepared to show deviation from optimum in both technical and financial terms, analysed to highlight peak/worst hour performance.	Portable monitors and recorders regularly used in both occupied and unoccupied areas to verify that temperature profile is maintained.
3	BEMS installed correctly and operated in an effective and efficient manner at all times to take into account variations in ambient conditions, and occupancy.	All sensors regularly checked and carefully calibrated.	Operation critically reviewed on a regular basis. Maintenance status report generated regularly.	Ensure that desired temperature profiles are maintained in accordance with shift patterns.	Concise management reports prepared to show deviation from optimum in both technical and financial terms.	Portable monitors and recorders used on a seasonal basis in both occupied and unoccupied areas.
2	BEMS operated in the most effective and efficient manner at all times to take into account variations in ambient conditions.	All sensors checked seasonally and calibrated annually.	Occasional review of operation. Maintenance status report generated occasionally.	Periodic review of temperature profiles.	Summary report of BEMS data.	Ad hoc use of thermometers and monitoring equipment in both occupied and unoccupied areas.
1	Temperature controlled by local space thermostats.	Ad hoc checking of sensors.	Ad hoc checks on space temperatures undertaken.	Ensure heating is turned off at weekends and in the summer.	Weekly report by maintenance department of daily space temperatures.	Ad hoc hand checking of radiator temperatures.
0	No BEMS. Temperature controlled using integral plant controls (eg boiler thermostat).	No procedure for sensor checking, setting or calibration.	No ability to measure or check operating efficiency.	None – heating may even be allowed to remain on for seven days/week.	No measurements taken and no reports prepared.	No auditing or monitoring.

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General Information: describes concepts and approaches yet to be fully established as good practice.

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Introduction to Energy Efficiency: helps new energy managers understand the use and costs of heating, lighting, etc.