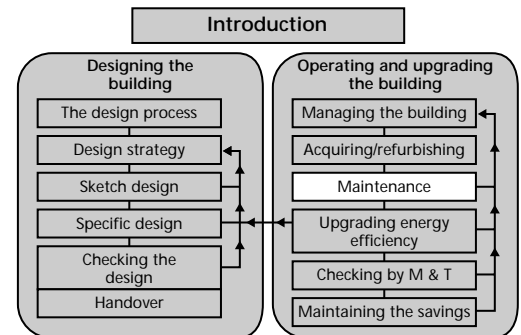


16 Maintaining the building

16.0	General
16.1	Planning maintenance
16.2	Maintenance contracts
16.3	Monitoring maintenance



This section provides an overview of maintenance and its implications for energy management, in line with the principles at the front of this Guide. Section 17 covers more specific maintenance issues that affect energy efficiency. Detailed guidance on maintenance is also available from CIBSE⁽¹⁾, HVCA⁽²⁾, and other sources^(3,4).

16.0 General

Effective maintenance contributes to the realisation of an energy efficient building by ensuring the efficient operation of systems and equipment; it also prolongs the useful life of the plant. Each building is unique and maintenance regimes should be tailored to the particular building.

16.1 Planning maintenance

The overall approach should be set down in a clear concise policy for operation and maintenance.

16.1.1 Maintenance policy

The maintenance policy is the plan to provide and maintain the required environment for the occupants within the constraints of the owner's objectives and legal requirements.

Maintenance and energy policies should be co-ordinated with the support of top management (see section 14). Maintenance work can then include energy efficiency measures and checks, as appropriate.

Maintenance and energy management have the common objectives of:

- ensuring that a building and its services continue to function reliably, efficiently and effectively
- ensuring the health, safety and comfort of occupants
- protecting and enhancing the value of investment in a building and its equipment.

16.1.2 Types of maintenance

Maintenance tasks generally fall into two main categories. These are:

- reactive or breakdown maintenance
- planned preventative maintenance.

Maintenance duties might also include checks on plant operational efficiency and the installation of new services and equipment. Maintenance staff or contractors can maintain and improve energy efficiency by:

- servicing plant and equipment, e.g. boilers^(5,6) to maintain optimum efficiency
- repairing faults that cause direct energy wastage
- identifying and implementing energy efficiency measures.

Most of the recommendations in section 17 are maintenance tasks and can often be funded, sometimes at marginal cost, from maintenance or utilities budgets.

16.1.2.1 Reactive maintenance

Although defects and emergencies are by their nature unplanned, they should not be identified and dealt with in the same way. Faults that result in loss of service tend to be reported promptly, whereas faults that result in energy wastage (but do not cause inconvenience) tend to be ignored. Building users should be encouraged to report all faults, whether or not they result in loss of service. This can help develop staff awareness and positive attitudes to energy efficiency. All reported defects should be assigned a priority and action taken accordingly.

Maintenance problems and energy losses that are not immediately evident can sometimes be detected by careful monitoring of energy use. Some can be identified directly

Table 16.1 Examples of planned maintenance tasks

Time based	Condition based
Annual service of boiler plant, clean adjust/replace items as necessary	Change air filters when pressure drop across filter exceeds given level
Daily/weekly/monthly checks for air, steam or water leaks	Clean gas side of boiler when flue gas temperature exceeds that in clean condition by, say 40°C
Complete daily/weekly/monthly log sheets to monitor plant performance	Grease motor bearings when bearing temperatures or vibration exceeds a certain level
Carry out weekly/monthly test of boiler efficiency	

by suitable BMS software. The use of energy monitoring and targeting systems in diagnosing faults is described in section 20.

Formal records should be kept of all repairs and breakdowns for management review. Monitoring equipment performance will help to identify malfunctions, which can then be rectified by reference to maintenance manuals. The timing and frequency of maintenance procedures is vital to the efficient running of equipment⁽⁷⁾.

16.1.2.2 Planned preventative maintenance

Planned preventative maintenance should reduce the risk of breakdown or loss of performance of an item of equipment. It may be carried out at set intervals ('time based') or when pre-determined conditions occur ('condition based'). Table 16.1 gives some examples of tasks falling into these categories which have energy implications.

The frequency of planned preventative maintenance should be reviewed where monitoring suggests that a change would be worthwhile. An assessment of the likely effect on energy costs should be included as part of any review. The condition based tasks are generally carried out in response to the results of routine checks, measured against target values⁽⁸⁾. Performance monitoring of this type can be assisted by the use of building management systems^(9,10).

16.2 Maintenance contracts

There is a growing reliance on contractors for the maintenance of building services plant. External contractors require tight specifications with performance targets to maintain energy efficiency. BSRIA⁽¹¹⁾ provides advice on all aspects that the client should consider when obtaining contract maintenance. It covers concepts, conditions, specifications, tender procedures, and the monitoring and control of the ongoing contract. Maintenance contracts frequently lack a clear explanation of operational responsibilities and standards. The result is that plant is often run liberally to avoid complaints, but energy efficiency suffers badly.

16.2.1 Performance specification

A brief from the client to the maintenance manager is required whether maintenance is carried out in-house or by

Table 16.2 Advantages and disadvantages of contract and direct labour

Contract	Direct labour
More competitive price	More difficult to assess costs
More flexible workforce with wide skills	Fixed workforce and fixed skills
May not be able to respond to all emergencies	Always available to respond to emergencies
Contract needs to be monitored	In-house supervision required
Specialist training and tools included	Need to provide specialist tools and training

external contractors. This should include budgets, levels of service, responsibilities, reporting procedures and policies such as energy, and health and safety. CIBSE Technical Memoranda TM17⁽¹⁾ provides a detailed checklist of issues that should be included.

Many contracts now include performance standards for particular items of equipment, e.g. a boiler must operate above a certain efficiency. This approach places a greater responsibility on the contractor to ensure that plant is maintained to a high level in order to achieve the required performance. This can be an effective way of building energy efficiency into the maintenance contract. However, requirements for efficient operation of the system as a whole are seldom included.

16.2.2 Use of maintenance contractors

Some of the advantages and disadvantages of using maintenance contractors are shown in Table 16.2.

An important issue in any maintenance contract is identifying those actions which should be undertaken by suitably qualified specialists as indicated in the manufacturer's documentation. The in-house capabilities can then be assessed to see if specialist contractors are required. Further guidance on the use of contractors is contained in CIBSE Technical Memoranda TM17⁽¹⁾.

16.3 Monitoring maintenance

While responsibility for maintenance should rest with those carrying it out, the client must institute some form of monitoring to ensure value for money and to identify any changes in the policy that need to be made. In particular, it is important to obtain feedback on whether the contractor is adhering to the maintenance policy and to determine the effectiveness of that policy in ensuring the energy efficiency of the plant.

16.3.1.1 Maintenance records

Maintenance records are a vital part of maintenance management and therefore have an important role in energy management. There are two broad categories of records:

- Installation records: include operating and maintenance (O&M) manuals⁽¹²⁾, plant details, design performance data, maintenance

Table 16.3 Approximate costs for maintaining mechanical and electrical services

Building type	Cost (£/m ²)
Hospitals	12–14
Hotels	8–10
Offices, light industrial, university	6–9
Leisure	4–6
Major retail	3–5
Schools, residential homes	2–4

Note: based on BSRIA research 1991

instructions, commissioning data, record drawings and control set points. Documents should be updated when any modifications are made.

- Service records: include log sheets, job records, work orders, inspection and test results and service performance data. Periodic checks on performance of plant and equipment in service can indicate when action should be taken before serious energy wastage occurs. Details should be kept of the time and nature of corrective action. Other adjustments of plant or control settings should also be recorded for future reference.

The schedule of installed assets, the planned maintenance programme and the service history are often combined in a computer based information system. This greatly simplifies the task of extracting and analysing information. Full details of test results or data logged during maintenance work (meter readings, flow and return temperatures, boiler flue-gas temperatures, etc.) is more commonly kept in its original form on log sheets. Traditional log sheets can still be a useful source of information for energy management.

A BMS can help to collect this information and prepare inspection and maintenance routines for maintenance staff. A BMS can handle a greater volume of data in less time, and assists in monitoring complete systems, rather than individual assets, highlighting anomalies that would otherwise go unnoticed.

16.3.2 Checking maintenance standards

Building operators should monitor both technical and financial indicators to ensure that maintenance is effective⁽¹⁾.

Breakdown frequency provides a retrospective benchmark. A minimum period of data collection is necessary to provide a useful comparison. Judgements have to be made by the building owner over time, related to the expected life of the plant. Energy management through monitoring and targeting can also provide valuable information to assess the effectiveness of maintenance. Lack of maintenance or incorrect plant settings will increase energy consumption when compared with target figures.

As a rule of thumb, based on research by BSRIA⁽¹³⁾ and data from Williams⁽¹⁴⁾, the annual spend on building services maintenance should be about the same as that for energy. If the figures differ widely, something may be wrong,

especially if the energy spend is high and the maintenance spend low.

Table 16.3 provides a guide to the costs of maintaining mechanical and electrical services for various types of buildings. Cost indices, such as those provided by Building Maintenance Information (a division of the Royal Institution of Chartered Surveyors' Business Services) can be used to obtain current values.

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