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RESET: WHY BUILDING ENERGY CONTROLS ARE WRONGLY OPERATED.

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ABSTRACT

The objective of the RESET project was to quantify the savings that could be made by resetting the energy related controls of buildings to their original or optimum settings. The method was to identify a range of office buildings and carry out energy and management audits. Advice was given on incorrectly set controls, and estimates were made of the potential savings if the controls were set correctly.

Cost savings of between 10% and 30% were almost always identified and could be made at little or no cost. In spite of these benefits, practically none of the organisations changed their controls. Many organisations showed a defensive attitude and did not welcome the information provided to them.

The study then investigated the reasons for this apparently unreasonable behaviour. The research team, led by ECD Energy and Environment Ltd found that there was strong demotivation for changing from the status quo, and little or no reason for making improvements. The project is currently investigating how to overcome these demotivating elements so that the undoubted savings will be made. The project is being supported by both Government and private sector companies. It shows that understanding the needs and motivations of the building user is essential in order to obtain the expected performance.

1. INTRODUCTION

The RESET project for improving the use of controls started in the spring of 1995. It was based on the hypothesis that the annual £20 billion energy bill for UK buildings could be reduced by between 10 and 20% if building services were better controlled to reduce over-liberal provision, excessive running hours and plant inefficiencies. While some of this improvement might require investment in improved systems, it was estimated that users could save 5% of their energy consumption by making minor alterations to their controls.

It was agreed that work on RESET would proceed in two phases. Phase 1 was to run from the spring of 1995 to autumn 1996, with the aim of quantifying the problems, opportunities and benefits to occupants in the area of improved use of controls.

2. PROJECT OBJECTIVES

At inception, the objectives of the RESET project were set out as follows:

1. To determine why controls become mis-set
2. To establish methods for improving the situation
3. To demonstrate the savings possible when users have clear responsibility for control settings
4. To show what other remedial actions may be beneficial, including training of users and reconfiguring or redesigning controls
5. To provide information for manufacturers so that user control interfaces can be improved
6. To provide early information and feedback to assist in the longer term BRE strategic controls study being carried out by the United Kingdom Building Research Establishment.

3. PLAN OF WORK

The original plan of work allowed for two project phases:

Phase 1

1. Identify a representative selection of buildings
2. Investigate 20 typical buildings, representing a range of sizes and control systems, to establish:
   - the technical adequacy of controls
   - the skills and time required by the users
   - how the controls are being used in practice
   - reasons for any deviations from set points
   - who "owns" controls; responsibility and monitoring system used
3. Identify the scope for controls-related improvements and the associated energy-saving potential
4. Produce a draft action plan making use only of low-cost and management-related measures to improve the energy performance of the building
5. Convert the draft plan to an implementation plan through discussion with building management
6. Attempt to implement the plan in the buildings; record progress by logging energy consumption, progress and problems
7. Exchange information between building management and the RESET team
8. After one year, review results in discussion with building management
9. Report on results

Phase 2

Consolidate results, continue monitoring, extend work to additional measures.

4. WORK COMPLETED

Phase 1 called for between 10 and 50 office buildings to be identified and surveyed with the help of the project sponsors. However, great difficulty was encountered in obtaining access to suitable buildings, and in the event six office buildings were visited and surveyed:-

Building ID	CH	CS	HC	KC	KR	MH
Building Type*	2	3	3	3	3	4

*see below

Table 1. Buildings Surveyed.

After walk-round surveys were carried out, facilities managers in four of the six buildings were presented with summary sheets, recommending actions which could be taken to reduce fuel use and costs. The response to these proposals was disappointing. There was considerable resistance to suggestions for improving control settings. Such resistance was partly active, with objections to change being made on specific grounds, and partly a result of inertia and a general lack of motivation.

At this stage of the work it was possible to draw the following conclusions:-

1. In every building surveyed, though to varying degrees, inefficiencies were apparent due to the mis-set control settings.
2. In every building opportunities were identified to reduce fuel consumption and costs by taking "zero cost", "no regrets" measures (i.e. management actions involving no capital expenditure).
3. In the first four buildings where facilities managers were approached, drawing attention to mis-set controls, there was not incentive enough to address the opportunities.

The difficulty in obtaining buildings to survey as part of the RESET project seems to be part of the same syndrome of resisting an identifiable route to improved efficiency and reduced costs. Organisations are satisfied with existing service provision and charges and lack the motivation to upset the status quo.

5. RESULTS

The figures on the following pages summarise the results from the surveyed offices by comparison with Energy Consumption Guide 19[1](ECON 19). This document is the result of a survey of buildings carried out by BRECSU, and provides benchmark performance of Typical offices as well as examples of Good Practice offices. It distinguishes between four office types:-

Type 1: Naturally ventilated, narrow plan

Type 2: Mechanically ventilated, narrow or medium depth

Type 3: Typical air conditioned
Type 4: Air conditioned prestige/head office, with longer operating hours and generally with catering and central computer facilities

Figure 1 shows carbon dioxide emissions from the buildings, giving the breakdown between electricity and gas consumption, showing how the building performs by comparison with typical and good practice buildings of the same office building type from ECON 19. Energy consumption data from four other Type 4 buildings, which were surveyed in a parallel project, have also been included.

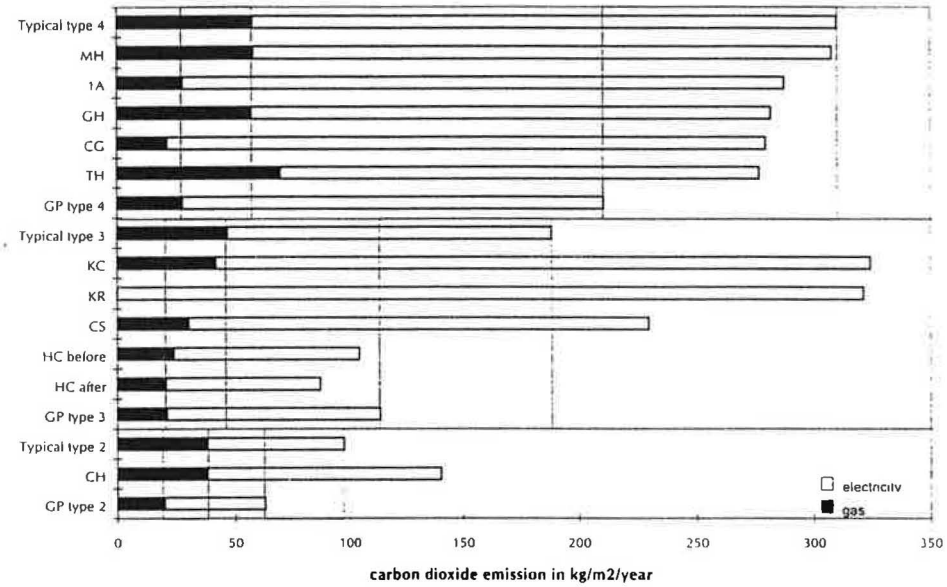

Figure 1. Carbon dioxide emissions compared to ECON 19 Typical and Good Practice benchmarks.

6. THE NEED FOR MOTIVATION

The first phase of the project showed that the initial estimate of 10% savings was conservative, with typical savings of 15-20% being identified. Moreover these savings could be achieved with little or no extra costs, and were technically very easy to implement. Yet they were not acted on, and follow-up discussions were mostly marked by a lack of concern, defensiveness or even hostility to suggestions of change.

It became clear that it is not enough simply to point out mis-set controls. There must also be someone in the management process who is motivated and pushes for energy savings.

The results were therefore re-analysed, using a subjective assessment of the motivation of the management team for energy saving, based on the comments of the assessor at the survey and plotted against the achievement of building performance compared with a Good Practice benchmark.

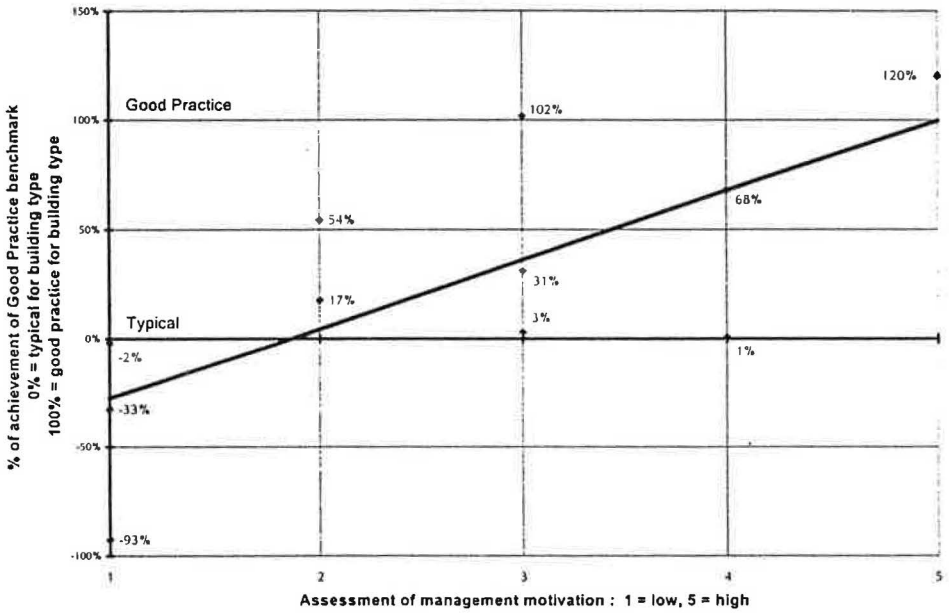

Figure 2. Building energy consumption and management motivation.

Building performance was rated on a scale of 0-100%. A rating of 0% represents a building with an energy consumption equal to a "Typical" base building of the corresponding type in ECON 19. A rating of 100% represents a building with an energy consumption equal to a "Good Practice" benchmark building in ECON 19. Figure 2 shows the results of this performance versus motivation analysis, and the trend line shows a correlation of energy performance with motivation. The diagram shows that to achieve good energy performance we need to obtain high motivation.

There are several notes of caution which should be sounded about this result. It has been noted elsewhere that it can be deceptive to look at total energy consumption in buildings and take this as a measure of building performance. Nevertheless, there is a clear trend that highly motivated management achieves or exceeds Good Practice performance benchmarks. The next phase of the work therefore investigated the reason for motivation and the pathways available to achieve actions.

7. MOTIVATING FACTORS

A large number of factors are involved in the decisions and pressures to reduce energy consumption. There are four main types of organisation or person involved - the Tenant, which includes the Managing Director, Finance Director and Facilities Manager; the Landlord; the Building Operator and Services Manager; and the Maintenance and Controls Contractors.

Each of these groups has pressures that they can bring on others. However, analysis showed that there were very few motivations for reducing energy consumption, while there were a large number of reasons for not taking action.

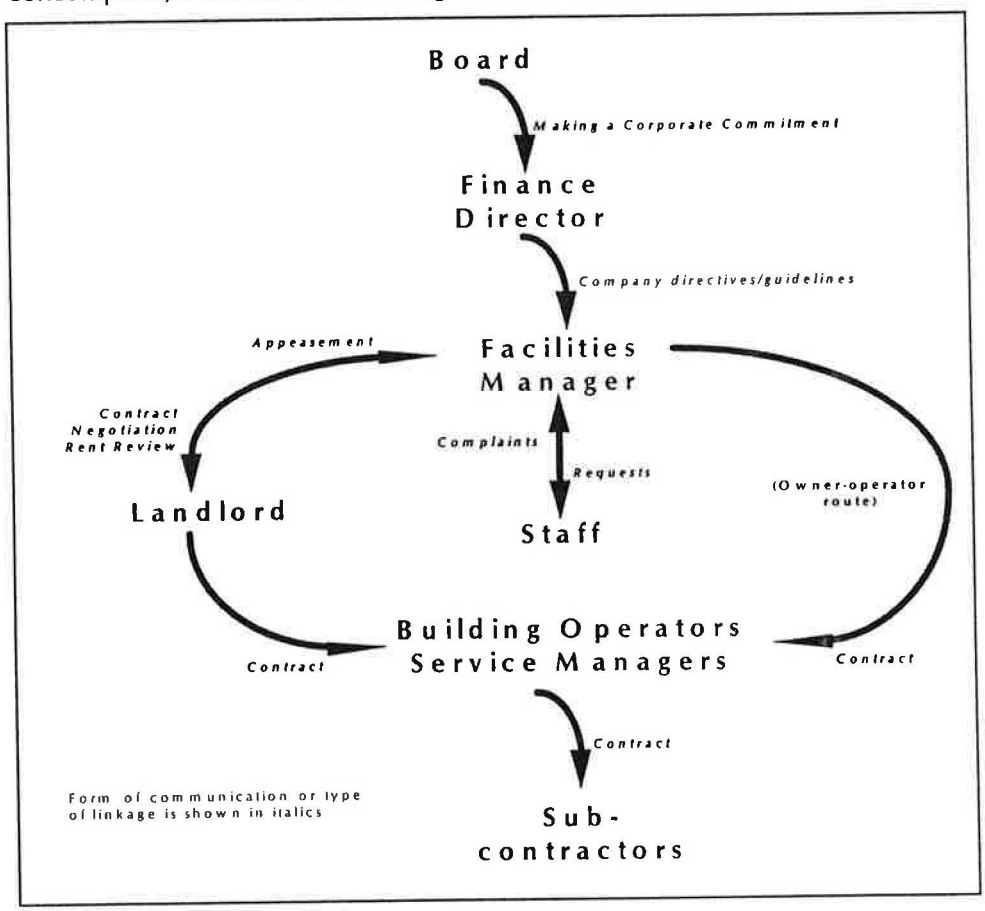

Figure 3. Actors and links

The next diagram, Figure 4, shows that there are only 3 *original* motivations:

1. Tenant's desire to save money
2. Facilities Manager's and Landlord's desire to demonstrate "best-in-class" attitude
3. Contractors professional pride.

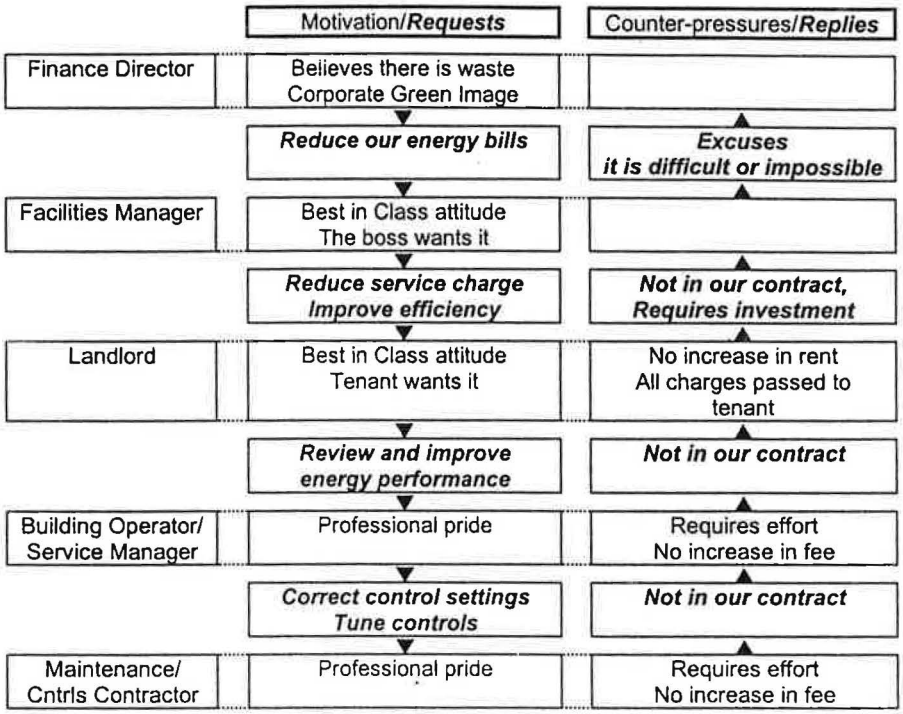

Figure 4. Motivations and counter pressures for energy savings.

Out of these the only strong motivation can be the tenants desire to save money. This however must be achieved without loss of comfort.

8. DIRECTIONS FOR IMPROVEMENT

There is now a need to improve motivation and to promote action. There are several things that need to happen, starting with a motivated tenant:-

- Finance Directors must demand improved performance from their facilities managers. To do so, they must be aware of the possible savings to be made. To set realistic targets, they must have access to easy-to-use benchmark performance standards.
- Facilities Managers as tenant representatives, must be able to put pressure on landlords where they control operation and management of the services. They can use two routes: the legal contract and informal negotiation. There is nothing in most contracts which refers to energy consumption so the only time that changes can be made is during rent review or when negotiating new leases. When these opportunities arise, tenants should have standard clauses which require landlords to charge no more for energy than good practice benchmarks for the energy

component of the service charge. This gives landlords a strong incentive to improve mis-set controls. But in the short term the most fruitful area, for improvement is informal negotiation. Successful managers are those who have consistently pushed the landlord to make improvements. The landlord's desire to satisfy and appease the tenant, should not be underestimated. Again, the benchmark performance standard for a particular building type is the key to setting achievable targets.

- The landlord must in turn obtain better performance from the service operators. This is generally an easier task, because of the threat that unless performance improves, the landlord will terminate the agreement in favour of new services operators.

9. CONCLUSIONS

- The work so far has shown that there are typically 15% savings to be made in energy consumption, by re-setting controls.
- There are pressures for controls to remain mis-set and it is clear that, without motivation, they will not be re-set.
- The major motivation is the desire of Finance Directors to save money. Other motivations are the desires on the part of Facilities Managers and Landlords to do a good job.
- There are both contractual and informal links that can be used to translate motivation into savings. Some of these links need to be improved.
- The next phase of the work will concentrate on developing case studies which verify how these links are improved in practice, and how successful managers and landlords achieve improved performance.

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11. REFERENCES

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