

Performance Contracting for Energy Management

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Abstract: Energy performance contracting is not common in Asia, where fast economic growth in many parts of the region during the last two decades has taken precedence over people's concern for energy saving. Explores how one particular group of facility managers introduced the concept of energy performance contracting in a context where bureaucratic tradition had always rewarded control rather than relationship development. The paper considers the roles and expectations of key players, including the in-house energy savings champion, the energy management contractor / consultant, the facility management team and finally the traditional maintenance staff working on the project. Discusses the issues that nearly derailed the project and how these were eventually overcome. Suggests there is a need for ongoing communication between all partners involved in energy performance contracting, both to overcome barriers to traditional ways of working and also to develop an appreciation for the differing objectives of each partner involved in the contract.

Keywords: Energy performance contracting, change management

1. INTRODUCTION

As cost control becomes increasingly important in Hong Kong's health care sector, hospital administrators, in an attempt to meet Government's stated aim of reducing operating expenditure, are looking for ways to save money. One over-looked area in Hong Kong is energy conservation. Energy costs can constitute 3% to 10% of a hospital's budget, but with energy conservation, that amount can be reduced by a factor of 20% to 40%, (General Accounting Office, 1982). Energy conservation activities were first launched in public hospitals in 1994. The main focus then was on regulating and reducing energy consumption through staff awareness and good practices. For example, a "Good Energy Conservation Practice Guide" was issued to all hospitals during the mid-nineties. Later, in 1998, the Hospital Authority launched a staff awareness campaign on energy conservation. These activities helped to raise overall staff awareness and invited their participation in conserving the use of energy. As a result of these initiatives, an estimated 5% cost reduction accrued.

Currently, the Hospital Authority is progressively implementing energy conservation measures in 14 hospitals with the technical support of the Hong Kong Government's Electrical and Mechanical Services Department (EMSD) (Gilleard and Wan, 2001; Davies and Chan, 2001). The measures include taking down unnecessary lighting, installing timers for lighting and controlling air-conditioning, e.g.

- ☐ Intensive de-lamping of lighting fixtures in common areas and corridors
- ☐ Manually operating the ventilation systems at slow speed
- ☐ Revising the operating schedules of some ventilation systems
- ☐ Shutting off the reheat systems

- ☐ Shutting down 60% of the domestic hot water calorifiers
- ☐ Manually sequencing chiller plant operation

According to the EMSD, these initiatives have contributed an overall savings of around HK\$3.2 million per annum (Capital Works Policy Paper 1999).

However, hospitals interested in significantly lowering energy costs beyond these simple measures usually face serious hurdles (Benda and Lange, 1984; Hermann, 1994). For example, energy efficiency improvement projects are typically expensive, technically complex and may not immediately (or ever) produce savings equal to their installation costs. In addition, many hospital physical plants, particularly air-conditioning equipment, continues to operate at wasteful levels of efficiency. This is often due to an inadequate capital replacement budget. The hospital may also be unwilling to take the risk of engineering, financing, and managing a complex energy conservation program without guaranteed cost savings. Finally, many hospital facilities departments frequently lack technically competent staff to initiate such work.

2. ENERGY PERFORMANCE CONTRACTING

The emergence of energy performance contracting is a response to the failure of traditional energy management techniques to achieve greater levels of energy efficiency (Kozlowski, 1996). This business assumes both the technical and financial risks by investing its own time and money in facility improvements and asking to be paid only out of a share of the resulting savings. Called "shared savings" or "performance contracts", the concept has been widely used in the United States and Europe for over 20 years but it is relatively new in Hong Kong. Energy performance contracting is a means of raising funding

for investment in energy efficiency based on future savings.

There are a number of financing mechanisms that an Energy Management Service Company (EMSC) offer, usually based on the amount of energy saved. Two forms generally apply. These focus on the type of financial arrangement used to share savings:

- ☐ Guaranteed savings agreement. Payments are fixed for the term of the agreement based on an agreed estimate of energy savings. If measured savings are less than the guarantee, the EMSC makes up the short fall to the customer.
- ☐ Shared savings agreement. The EMSC puts up the money for the project and generally owns the equipment. Payments are for a specified percentage of measured energy cost saving and if there are no savings, the customer makes no payment.

Previously, energy performance contracting was not popular in Hong Kong, where the fast economic growth in preceding years outgrew people's concern for energy saving. Energy cost, usually taken for granted as a recurrent cost, typically attracted little attention. Building owners thus had no incentive for an energy conservation programme. The number of EMSC in Hong Kong was small. However, in the late 1990s a pilot scheme to implement a guaranteed savings contract was introduced in the Pamela Youde Nethersole Eastern Hospital (PYNEH). This was a comprehensive energy management scheme, working in partnership with EMSD and an EMSC.

The PYNEH opened in 1993 under the management of the Hong Kong Hospital Authority. The hospital is located on the East Side of Hong Kong Island. It serves a population of approximately 600,000. By April 2000, 1,835 beds were commissioned for operation within the hospital. Three thousand hospital staff members are employed at PYNEH. The total hospital floor area is 150,000 square meters on a land site of ten hectares. The mission of the hospital is, *"to excel in the provision of holistic, patient-centred, quality health care through loving, dedicated and cohesive team effort"*. PYNEH acts as a role model in the health care arena following best practices, introducing new technologies and innovative projects in public hospitals of Hong Kong.

Spring 1996, the PYNEH Energy Management Steering Committee decided to proceed with a "performance contracting" arrangement. Under this arrangement, an EMSC would provide the necessary expertise and capital for incorporating energy savings equipment, and the Hospital would repay the capital from the energy cost savings, which were guaranteed by the EMSC within an agreed period. The EMSC would pay the deficit in case the guaranteed amount could not be met. The Hospital and the EMSC also established (i) a method for calculating saved energy, (ii) an implementation schedule for all phases of work, (iii) priorities for the modifications and retrofitting of equipment, and finally (iv) the need to install a Computerised Energy Management System, Table 1.

Table 1. Scope of Work of the Energy Performance Contract

Strategy #1	AHU Ventilation System Modification VFD Installation CO ₂ Sensors Installation Occupancy Sensors Installation Humidity Sensors Installation
Strategy #2	Lighting System Modification Electronic Ballasts & T8 Lamps Installation Reflectors Installation
Strategy #3	Chiller Plant Modification Automation Sequencing Chilled Water Supply Temperature Reset
Strategy #4	BAS Control Strategy Modification AHU Operating Schedule Revision Outdoor Air Damper Control Space Air Temperature Setpoint Reset Supply Air Temperature Setpoint Reset Night Purge Control
Strategy #5	Heating Plant Modification Hot Water Circulating Pumps Scheduling Isolation Valve Installation
Strategy #6	Reset discharge air temp from AHU's

After renegotiation between the PYNEH and the EMSC a final contract sum of ~HK\$27m was agreed. This represented a 30% reduction over the original contract sum. At the time of the original contract it was estimated that measured savings would accrue, i.e.

- ☐ ~500 KVA Electrical Demand (per month),
- ☐ 7,395,811 KWh Electrical Consumption
- ☐ 60,862 CCF Towngas Consumption

This was equal to a utility cost savings of approximately HK\$6m based on 1996 utility rates. In addition, an estimated operational savings of ~HK\$0.45m would also be realized. Thus total cost savings of ~HK\$6.45m was estimated. This figure was equivalent to ~12% of the then current annual hospital energy expenditure, or \$55m.

Prior to implementation of these measures hospital personnel had voiced concern over the potential loss of control of their work environment. To allay these concerns PYNEH contractually established acceptable comfort conditions - temperature parameters, lighting levels and air exchange to assure a quality environment - with the EMSC. For example, space temperature in common areas such as wards, waiting areas, offices and general store areas was to be maintained at 25.5°C (+ 1 - 1°C) in summer, and

20°C (+ 1 - 1°C) in winter. For laboratories and critical areas such as the intensive care unit and operating theatres, the temperature would be required to be maintained at 20°C to 24°C, depending on the areas served.

A project team, chaired by General Manager (Administrative Services) of the hospital with members from EMSC and EMSD, was set up to monitor the progress of the project. To facilitate communication, office space for the EMSC project manager was established at the PYNEH. (The project manager was required to be on site for a minimum of three days per week.) The 15 months between the signing of the agreement and the beginning of the guarantee period were filled with activity. Monthly progress meetings were conducted much in the same way a construction progress meeting is run. A time schedule was established for each component of the work – controls upgrade, lighting retrofit, sensor installation. The project team played a major role during this period, e.g., reviewing shop drawing, inspecting work in progress and helping to establish control strategies for control retrofit.

A tremendous amount of co-ordination was required during this time. PYNEH is a 24-hour 365-day operation. Retrofitting a hospital facility with state-of-the art heating, ventilation, air-conditioning and lighting system is a delicate affair. The project was carried out in and around, a fully active workforce – one subject to constant changes, emergencies, high stress and the usual mundane daily tasks of caring, feeding, testing, moving, admitting and discharging patients. That was not an easy task. (Most of the lighting retrofit work was undertaken at weekends or overnight. Air-conditioning chiller plant replacement was made in the summer.) Finally the retrofit work was accomplished with some delay but fortunately with minimal disruption to the hospital service.

3. BENCHMARKING THE BASELINE YEAR

One of the toughest problems to be overcome was establishing a mutually agreeable base year of energy consumption to be used for calculating energy savings. Climatic variations, number of hospital beds, range of clinical and non-clinical activities would impact energy consumption, hence agreeing on the base line was to prove problematic. For example, between 1995-6 and 1998-9:

- ☐ The number of hospital beds increased from 1463 to 1835.
- ☐ Eleven new hospital wards were opened.
- ☐ Two thousand eight hundred additional items of medical equipment were acquired.
- ☐ A pneumatic tube system was introduced.
- ☐ In patient foodservices were improved with the introduction of a "chill cook system".

Unfortunately the original baseline conditions were not well documented. It therefore became very difficult, if not potentially impossible, to mutually agree baseline adjustments. These negotiations had the potential to unravel the original agreement. However, both the Hospital and EMSC had too much at stake to

let this problem stand in the way of successfully implementing their agreement. This period may be characterized as both a stressful yet productive time.

Since operating conditions were unequal between the baseline (1996) and first tracking period (2000) energy saving adjustments were necessary. The Hospital therefore agreed to undertake energy usage site measurements and log all new medical and office equipment. Adjustments were then made to the base period to reflect anticipated energy usage patterns with respect to the increased demand. Based on the above process, the energy savings measurement and verification for the period of April 1999 to March 2000 may be summarised, Table 2.

Table 2. Energy Saving Measurements

	Estimate (\$M)	Remarks
A. Base Year 95/96 (9/95 to 8/96), excluding Multi-centre Block	\$44.5m	Charges at 99/00 utility rates (kWh and kVA)
B. Guaranteed savings under Performance Contract (PC)	\$6m	Revised figure excludes Towngas saving (\$470,000) and operational saving (\$453,333) Charges at 99/0 utility rates (kWh and kVA)
C. Total load growth (95/96 to 99/00)	\$3.5m	
D. Target electricity charge under PC	\$42m	D = A – B + C
E. Hospital's electricity charge for PC areas (99/00)	\$44.3m	
F. Shortfall for the first year guarantee saving (99/00)	\$2.3m	F = E - D
G. Pre-guarantee saving (Jan 98 to Mar 99, 15 months)	\$1.65m	Revised based on actual progress of energy retrofit works as agreed with EMSC
H. Shortfall to be borne by EMSC	\$0.65m	H = F - G

4. DISCUSSION

After the first full year in the guarantee period, electricity payment for 1999/2000 was \$44.3m, an increase of \$2.3m over projections. EMSD, the EMSC and the Hospital agreed that pre-guarantee energy savings was about \$1.65 million. In other words, EMSC had to pay \$0.65 million to the Hospital for the net shortfall. However, it should be emphasized that performance contracts are not without risks. For example, many labour under the misconception that performance contracting is simply about implementing

technical solutions. Unfortunately performance contracting lives or dies not on the technical excellence of the solution, but on the sense of a shared partnership. The success of the contract depends on how effectively the contract team and the client's staff work together. Consequently, discontinuity and change of key players may significantly reduce performance levels. This was clearly demonstrated with the project under review where early movement of key personnel disrupted effective management of the contract. This in turn led to a loss of critical knowledge and a breakdown in the initial project team. Only later when sufficient buy-in from all parties was established based on sharing of a common goal with a high degree of dependency is it possible to create a strong desire for mutual cooperation, i.e., "I cannot succeed if you don't."

Change is very difficult, especially initiating an alliance contract which involves three parties, the Hospital, EMSC and EMSD. Alliance management is a very new and difficult concept for the traditional manager to grasp. The problem is that each party sets itself up as a guardian of the right way of working – its way. The key concept is to let go of the operational activity and to begin building an alliance relationship. Implementing an energy program requires changes in past practices. It is not unusual to find resistance to these changes. Planning is also a primary mechanism for creating a common set of goals. It is a dynamic process that involves all parties who will be working together. Operation and maintenance (O&M) personnel should be active participants in the effort from the beginning and should receive a steady flow of information as the project moves forward. Even when the process becomes a matter of issuing requests for qualifications and contract writing, the O&M should be kept informed of progress. They have a direct personal interest, because when the project actually "happens", it will happen to them and their attitude will have a major impact on results – good or bad. Yet in this project, EMSD had not been actively involved prior to signing the original energy performance contract. This may explain why there was an initial difficulty in establishing a commitment from EMSD to the partnership relationship.

Establishing alliances also takes considerable work and time. It is also complex. Various cultures within the relationship, different chemistries and even different languages between different service providers, have to come together over time. The need for stability is important. The team not only has to be able to build and sustain personal working relationships, but it also has to develop an organisational memory. If the relationships and individuals involved in managing a partnership change constantly, the ability to bring past discussions and commitments to bear on a current decision is at risk. However, since signing the initial performance contract all EMSC directors and engineers who were part of the original negotiating team to the agreement either resigned or were transferred within the company. Naturally, this hindered the establishment of trust and teamwork during the implementation process. Team members were constantly busy "getting-to-know-each

other", thus reducing operational efficiency during the energy improvement works.

A good alliance relationship is not managed by the contract, but by a strategic framework embracing total quality management. The legal contract should be viewed as the starting point and perceived as the minimal objective for the alliance leaving room for future innovations that could far exceed what is noted in the initial contract. Often in alliance relationships, you can only see the present and not the future. Anticipating that changes are inevitable in the hospital business, staff at the PYNEH deliberated over the agreement for a long time. The final contract outlined well-defined goals, expectation, compensation and measurement process. The contract also left room for flexibility to accommodate new and inevitable challenges.

The binding force in energy management and performance contracting is communications, i.e. an ability to communicate energy needs and opportunities and to elicit the support needed to make the human dimension a strong core of the energy programme. This requires ongoing attention to the communications function by each partner, both internally and externally between all partners. Communication is one aspect of a performance contract that costs little and gains much. One of the greatest ironies in energy management is that planned communication can be the most cost-effective tool in energy management, yet it is often relegated to an incidental, haphazard activity with the result that communication strategies are too often insufficient or misplaced.

An alliance relationship brings substantial change to any organisation. This needs to be communicated and managed aggressively. Communicating intentions to all interested parties is vital. A critical first step with O&M staff is to affirm the good things they have been doing. O&M staff must understand the "why" as well as the "what" of their role in energy efficiency, or the effort will fail. Care must also be exercised to assure O&M personnel that the new energy effort is not a criticism of their past efforts. Nor should it be viewed as a job threat. Performance contracting provides an opportunity to free up time for in-house O&M staff, releasing them to deal with preventive maintenance activities in hospital wards and offices. And will, in fact, enhance their work. Hospital staff need to know how they fit into the efficiency plan and how they, in turn, will benefit. Without that understanding and the commitment to help, O&M staff and hospital staff can defeat the most sophisticated control system or elaborate management plan.

In the PYNEH case it started off with inherent tension in the relationship between EMSC and EMSD. Some of O&M staff continued to hold on to cumbersome bureaucratic structures and processes. They used traditional tactics of "transactional style of relationship" in dealing with EMSC. They believed it was better to keep an arm's length relationship, in which the rules of the game should be well specified and the failure to deliver on commitments by either party resolved through litigation. Relationship conflict can be the most contentious, unclear and the most difficult to diagnose.

During the transition phase it became evident that a major transformation in the leadership and management style within the EMSD occurred, which was a critical success factor in our project. Top management compatibility was the key starting point. EMSD top management faced the challenging issue that Hospital Authority might dispense with their E&M service by year 2000. An attitudinal paradigm shift occurred whereby the O&M managers moved from controlling activities to mutually establishing and co-managing new processes. They also exhibited a willingness to let go of what they had done historically. New roles were established for O&M staff to allow the alliance partner to take on a meaningful role within the new structure. For the alliance relationship to be successful there had to be the ability to view the alliance as an extension of hospital services and not as maintaining the traditional client/vendor mindset.

5. CONCLUSION

Performance Contracting is a new business approach in energy management in Hong Kong. The concept is sound, but trust is a decisive factor in determining success. Putting the "manage" into energy management requires effective leadership. Hence the real difference between an effective energy programme, and one that is not, is the attention paid to the human dimension.

Performance Contracting projects thrive in an environment of change. In the implementation of performance contracting in health services, the role of the project leader may be characterized as "change master", with all of the pressures and responsibilities that the term and the concept imply, (Wilson and Wilson, 1999). The project leader is the catalyst for implementing change, and as such he or she is a target for all resistance that often accompanies change. The case study challenges professionals to seek out opportunities by envisaging change. It is insufficient today to be merely technically competent. Nor is a willingness to work long hard hours the only challenge that they will face. In order to survive,

'people' skills are essential, with the manager well able to persuade, motivate and inspire colleagues.

For years, bureaucratic tradition has rewarded professionals for acting as though they were always in control – even when confronted with events clearly beyond their grasp. However, in times of great change successful workplaces fuse intelligence and imagination. Today's energy performance leaders need interpersonal skills, e.g., facilitation and development of teams; performance coaching of individuals and teams; an ability to foster accountability and creativity; and skills at creating effective coalitions.

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