Energy Performance Standard in Commercial Premises

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Abstract

Service industry made up over 80% of our GDP. Good business packaging and convenient access channels governed how successfulness of a service based business. The need of energy performance standard is prominent as a result of extended operating hours, good air conditioning and lighting of commercial premises. On the other hand, the role of such a standard is always misunderstood. This paper will discuss the need to establish the standard, explain the role of it. It will be followed by a discussion of the new performance approach.

Background

Hong Kong is a service industry based economy. Major service industries in the territories are wholesale, retail, import/export trades, restaurants, hotels, finance, insurance, real estate and business services. These service industries account for over 80% of our GDP at the moment.

The Need of Energy Performance Standard

While the booming of service industries fuelled our economic growth in the past decade, it also increased our use of energy and escalates the pollution problems. The need of pollution control was intensified as a result. It was noticed that "Total End Use" energy experienced a compound growth of 3.2% per annual between the years 1987 to 1997. The electricity consumption grew at a much faster pace of 4.6% per annual. The diminishing of manufacturing industries shifted our energy usage pattern. Service industries were charactierised by the need of good business packaging and access channels. Thus shops with good air-conditioning, lighting and extensive operating hours were the pre-requisite of a successful business. It increases the importance of electricity in our total end use portfolio. The proportion of electricity grew from 36% of our total end use in 1987 to about 42% in 1997. Within the electricity consumption portfolio, commercial sector accounts for about 56% of the total consumption. Compared with only about 43% in 1987, the

commercial sector has become the biggest electricity consumer as a result of the decadent manufacturing sector. Up to this moment let me summarise our present scenario. Our total-end-use energy has a compound growth of 3.2% in the period 1987-1997. Electricity has become more significant within the total-end-use energy portfolio. Commercial sector is the most significant electricity consumer and the consumption share grew from 43% in 1987 to 56% in 1997. It is the fastest growing sector with an annual increase of 7%.

The energy policy of Hong Kong is to ensure that the energy needs of the community for its economic and social development are met reliably, efficiently, safely and at reasonable prices; to minimise the environmental impact of energy production; and to promote the efficient use and conservation of energy. With efforts in the fuel selection and diversification, we are now enjoying secure energy supply at reasonable price. The remaining job to promote the efficient use and conservation of energy not only rely on the efforts of power companies and authorities, but also the awareness and cooperation of consumers. Regular publicity programmes can have no doubt increase consumers' awareness on energy efficiency. However, consumers' cooperation would need much more efforts. In many other countries, either regulatory instrument or financial instrument is engaged as the tool to achieve consumers' cooperation. Some examples are environmental Ordinances, environmental tax, and tradable permits etc.. In both regulatory and financial instrument, there is a need for the authorities to set up standards as a reference to operate the instrument. As the commercial sector is our biggest electricity consumer., energy concerns are very naturally put on commercial buildings. A set of comprehensive building energy codes aiming to promote the energy performance of commercial buildings has been planned since 1994. The set of building energy codes cover the major engineering services within a commercial building. It was found that the major engineering services in a commercial building include air conditioning, lighting, electrical installation and other services. These services contribute to the energy consumption in different extend. It was also found that air conditioning is the most significant electricity consuming service which was followed by office equipment and lighting. Thus the set of building energy code is targeted at lighting, air-conditioning, electrical system, and lifts/escalators.

The Role of Building Energy Codes

These building energy codes set out the minimum energy efficiency requirements of an engineering system in a building. The term "minimum" carries two

implications. First, it implies the positioning of the code that the standards are not difficult to comply. The standards are basic design requirements to ensure minimum energy wastage. It is not and should not be state of the art design or any sophisticated system arrangement that can cut the energy bill significantly. It is also not a gauge to measure how efficient the design is. It is the passing grade for energy efficiency and conservation. The second implication of the term "minimum" arises as a misconception of the standard. During the codes' implementation in the past few years, people always concern how much energy can be saved by complying with the codes or the payback period thereafter. People's mindset is trained to think in the cost-benefit model when dealing with energy efficiency matters – no matter what. The building energy codes in fact should be considered as a fixed border that demarcates the inefficient design from the efficient design. Unlike the guaranteed-saving retrofit such as electronics ballasts, saving can be achieved only when the original design falls into the inefficient category and the design is modified to comply with the code. The codes will not affect the design and generate savings if it is already an efficient design. Therefore, there is no general saving figure or payback period. The emphasis of these codes is the prevention of wastage rather than how much can be saved or how long does it need to payback. They should be differentiated from other energy efficiency improvement initiatives such as retrofitting electronic ballasts in which calculate of the payback period justifies the retrofit.

New Approach

The existing building energy codes are prescriptive in nature. Each code includes bundles of requirements guiding the designer to minimise wastage. Designers implement the prescribed requirements, one by one, in their design drawings and specifications. Compliance is then guaranteed. The advantages of these prescriptive codes are their simplicity nature and minimal efforts to comply with the requirements. These advantages are prominent for both the designers and the enforcing authorities. However, the downside is the limitations on innovative designs that may surpass the code's standard. Furthermore, given the speed of technological advancement, it is not possible to prescribe requirements of all system configurations and equipment options in a single code of practice. The code created a boundary on designers' options to seek for better performance designs as a benefit of technological advancement. New equipment are not encouraged merely because the codes do not prescribe them.

To enhance the building energy codes, the Hong Kong SAR Government is

commissioning a consultancy study to develop a performance based building energy code. The consultancy is targeted to commence by the end of this year. In parallel with prescribing requirements of system and components, the performance base approach specifies the target performance parameters as the main control characteristic. The way to achieve the performance target remains the designer's considerations. As a result, the designer has great flexibility in choosing the system configuration as well as equipment options. Less efficient system can be used, provided its deficiency in energy performance is to be compensated by other more efficient system and the final performance target is met. A preliminary planning is to set the performance target in terms of the total energy budget of the building. In simple terms, the performance target indicates how much energy is consumed by the whole building in a specific time frame. In this approach, simulations are run on the energy consumption of the building within the specific time frame under some prescribed assumptions. The energy consumption is compared with the simulated result of a "reference building" or a "prototype building". The reference building is a hypothetical building with similar building characteristics as the proposed design and with the engineering system complying with the prescriptive requirements. A comparison on the energy consumption of the two simulations determines the codes compliance. Since the engineering systems of the reference building are complied with prescriptive requirements, surpassing the performance of the reference building is equivalent to prescriptive codes compliance.

The performance approach will act as an alternative path in addition to the existing prescriptive approach. Both prescriptive energy code and the performance base energy code will coexist to allow choices for designers. Typical design can follow the prescriptive approach for simplicity and minimal efforts requirement, while sophisticated or ambitious design can choose the performance path for extended design flexibility. However, this design flexibility requires designers to carry out at least two simulations, one for the proposed design and the other for the reference buildings. There will be substantial engineering works for the simulation and iteration process that will be a new challenge to our engineering professionals.

The performance approach is not new in energy efficiency standards. Similar standard such as the ASHRAE Standard 90.1 "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings" is a typical prescriptive and performance based building energy code. It has been adopted as the model building energy code of many countries including Canada and some of the states in the USA. The performance based building energy code we are going to develop will also make

reference to this known standard. The new code will interface with the existing building energy code and will be formulated for local conditions and construction practice.

Concurrently, the Government is developing energy consumption indicators and benchmarks for commercial premises and Government buildings. Extensive survey and computer modelling will be used. Deliverables will be available in 2002.

Conclusion

As a summary, the need for a energy performance standard in commercial premises is prominent. The standard demarcates efficiency and inefficiency. They are not guaranteed-saving retrofit options in which financial viability is to be justified by the savings or the payback period. The trend of the standard development will be a parallel coexistence of prescriptive base and performance base. On the other hand, a number of new initiatives are under development. It is hoped that these initiative can make our energy consumption more efficient.