
Asia-Pacific
Economic Cooperation

# Government Sector Energy Management: Best-Practices Inventory and Comparative Analysis to Reduce Government Market Trade Barriers in APEC Economies

**APEC Energy Working Group**

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# Contents

# Chapter 1: Introduction

## 1.1 Why is Government Sector Energy Management Program Important?

There are two motivation of government sector energy management: one is to contribute actually to energy conservation as well as reduce environmental impacts, another is to lead the economy-wide energy conservation activities and demonstrate with smart energy management.

In recent years, due to the shortage of energy, the price of oil is rising all the time, which has formed a kernel obstacle to the rapid economic growth all over the APEC economies. Expanding energy demand for economic development, environmental concern and energy security have become a challenge for many of Asia's political and business leaders. It has been recognized that, for the sake of the growing economy and international concern, the crucial important way to achieve a sustainable energy future is to enhance efficiency and propose rational approaches for energy utilization.

The government sector plays an important role in worldwide economies -- between 10% and 20% of total economic activity. Considered as a whole, government facilities and functions are usually an economy's largest energy user and biggest purchaser of energy consuming equipment. According to the our investigations, the federal government consumed about 1,400,000,000,000,000 BTU (1.4 Quad) of energy at a cost of $9.6 billion in 2001, which is 1.4% of all energy used in the US, and American taxpayers pay $3.9 billion annually just to heat, cool, and power the 500,000 federal buildings and facilities; In Japan, the budget of the National resources and Energy agency(ANRE) in 2001 was 130 billion yen (about $1 billion), and thereinto covering 52 billion yen (about $300 million) for energy conservation and new energy utilization, which account for 40% of the total agency's budget; In Korea, the government spent over $10 billion to procurement for both goods and constructions. So do the other APEC economies.

The government sector's buying power and public leadership can generate broad demand for energy efficiency products and services; create entry markets for domestic suppliers and stimulating competition in providing high-efficiency products and services. By focusing on the measures in government investment, procurement, and operating practices on energy efficiency buildings, products, and services, the public sector can create a strong, sustained, buyer-led shift in the market toward energy efficiency.

Some APEC economies initiated energy management program in government sectors and accrued rich experience from a diverse range and number of programs covering building, which was stressed by speakers from 12 participating economies on APEC sponsored symposium (8/2004) on the "Implementation of Government Energy Management Programs". The best-practices inventory and comparative analysis on

government sector energy management will be valuable reference for all APEC economies.

Because learning from the experience of other economies can be helpful in designing energy-efficiency programs, this project is working to compile a comprehensive inventory of public sector energy management programs that are being carried out around APEC economies. Especially, the results from comparative study on government procurement policy for energy efficiency products and other incentive and/or restrictive policies are helpful to overcome trade barriers for government market.

### 1.2 The Implementation of Government Sector Energy Management

UP to now, some APEC economies initiated energy management program in government sectors and accrued rich experience from a diverse range and number of programs, such as the US, Australia, Japan, Republic of Korea, Mexico, etc. However, most APEC economies are still less active. Therefore, the best-practices inventory and comparative analysis will be a valuable reference for all APEC economies to improve the government sector energy management.

Among the six surveyed economies, the government of the US, Australia, Korea and Japan do well in government energy management, and especially have achieved greatly in both areas of public building and government efficiency procurement. Chinese government started the energy efficiency procurement program from 2003. Hong Kong, China launched some energy efficiency labeling programs.

### 1.3 Methodology and Scope of the Project

How to give an exact definition of a government sector is necessary for the research on government sector energy management. There are two prevalent definitions currently. In one definition, a government sector is understood as a public sector in broad sense, which is the public agency that is publicly financed, such as public administration, healthcare, schools, post office, defense and public service, and so on. In this context, private schools that are mainly public financed, represent a part of the public sector. In another definition, a government sector is understood as a public sector in narrow sense, which is the public sector defined as the central state, regional, and local public administrations.

There are some specific definitions in APEC member economies:

- **The US:** The government sector is defined as executive department, government corporation and independent establishment in the executive branch. (According to *5U.S.C.105*)
- **China**: The government Sector refers to all the departments, agencies of the economy, province and local levels of government, including state-owned enterprises, defense, schools, universities, colleges, hospitals, and other public

services which are supported by public financial.(According to *Government Sector Energy Management Program* enacted by the State Department of China)

- **Korea:** The government sector includes "central government entities", "sub-central government entities" and "other entities" which shall be prescribed by the Presidential Decree. The coverage of a "central government entity" includes coverage of its subordinate units, i.e. its branch offices and subsidiary organizations. (According to *Government Procurement Act (No.4697)*)

In this report, we define government sector in a broad sense, i.e., a government sector is an agency that is publicly financed, such as public administration, healthcare, schools, post office, defense and public service, and so on.

### 1.3.1 Methodology of the Project

During the research on the Government Sector Energy Management, a series of methods are adopted such as “Online survey”, “Desk Research”, “Specialist Interview”, and so on.

1) **Online Survey:** We utilized Online Survey method to analyze the real-time information of several economies. The organizations and website that we have surveyed are shown in Appendix1-1.

2) **Desk Research:** We also collected and analyzed the published information. The published information includes the annual reports of government agencies, energy conservation policies, laws, regulations, procurement specifications, and so on.

3) **Specialist Interview:** We consulted with many specialists in government agencies of several economies on government sector energy management through email, telephone and visit. From several specialist interviews, we got more publications, data, suggestion and other information. Especially, some specialists made some analysis of the work of government sector energy management, which greatly benefit to our research work.

### 1.3.2 The Scope of the Project

“Government Sector Energy Management” is of great extent, this report is just limited to the energy management in public buildings and facilities, in government procurement for energy efficiency products, and in public transport & utilities& infrastructure. In other word, the report is limited to the energy management in the affairs which are publicly financed.

In order to make a comparative analysis of these and find the best-practices inventory, intensive studies are made to six selected APEC economies in the report, that is the US, China, Japan, Australia, Korea, and Hong Kong, China. They are all developed economies except China, and they all have done much work in the government sector

energy management.

In the report, the meaning of "Government Sector Energy Management", the management mechanism, laws & regulations on energy management, political measures, and the financial measures are taken into consideration to each economy, and to the three key areas of energy management, including public buildings, government procurement for energy efficiency products, and public transport & utilities& infrastructure, both the laws & regulations and political measures are analyzed respectively in detail.

## Chapter 2: General Analysis of the Government Energy Management Program in APEC Economies

### 2.1 A Comparative Analysis of the Management Mechanism

A well operational management mechanism is crucial to carry out the government sector energy management program successfully. The report will give the comparative analysis of this from two areas: the first is from the Management Organizations, the other is from the Management Measures.

#### 2.1.1 Management Organizations

The six APEC economies we surveyed (The US, China, Japan, Australia, Korea, and Hong Kong, China) all have established management organizations for the government sector energy management, which are detailed in Appendix 1-2. Based on these surveys, some characteristic of these management organizations of every economies are intensive studied:

1) An organization v.s. several organizations

Some economies have only one organization which is responsible for the government sector energy management, while others have several, which are responsible for the different areas of government sector energy management. Among the six APEC economies, United States, China, Korea and Hong Kong, China only has an organization which is responsible for all the affairs of government sector energy management, while the other two, Japan and Australia, have several organizations.

With detailed information, Japan has two organizations: one is the National resources and Energy agency (ANRE), which is subjected to the National Development and Reform Commission (NDRC) and is responsible for energy conservation management and implementing energy conservation policies; the other is Government Buildings Department, which is subjected to the Government Buildings Department, The Ministry of Land, Infrastructure and Transport(MLIT) and is responsible for promoting energy conservation policies of government infrastructure.

In term of Australia, which has three organizations: one is the Australian Green house Office (AGO), which is subjected to the Department of the Environment and Heritage (DEH) and is responsible for encouraging resource efficiency and greenhouse gas abatement throughout government agencies at all levels; one is the Australian Building Codes Board (ABCB), which is subjected to the Department of Industry, Tourism& Resources (DITR) and is responsible for developing the Building Code of Australia (BCA) and promoting building industry regulatory reform; the other is the Australian Procurement and Construction Council (APCC), which is subjected to the Australian Procurement and Construction Ministerial Council (APCMC) and is responsible for the management of government procurement for energy efficiency constructions and facilities. The three organizations are all responsible for the energy management in government sector and contribute to the energy saving and energy efficiency in government sector.

2) Special organization v.s. Non-special organization

Some economies have special organizations for the government sector energy management program, while others not. Among the six APEC economies surveyed, only the United States has the special organization for the government sector energy management program, which is the department of Federal Energy Management Program (FEMP). The mission of FEMP is to reduce the cost of government by advancing energy efficiency, water conservation and the use of renewable energy. FEMP aims to achieve those goals set forth in law as well as those which are inherent in sound management of federal financial and personnel resources.

While the other five economies do not have the organizations that are special responsible for the energy management in government sector, that is to say, the energy management sector is one of the responsibilities of the organizations.

3) Conclusion

On the whole, no matter there is an organization or several organizations, it based on the practical situations of each economies. It seems they all work well up to now. And the practices also suggest that no matter the organization is special or non-special, which does not affect the effect of energy management in government sector.

But it is important that there must be an organization or several organizations to answer for government sector energy management. It is absolutely that any of the six surveyed APEC economies have set up organizations responsible for the energy management in government sector, and they are coming to some fruition up to now.

2.1.2 Management Measures

Based on the research, we have found an array of principle elements to carry out the government sector energy management, which direct the governments to take right

management measures, include:

- Top Level Commitment

Top Level Commitment to the government sector energy management can greatly show the government's will and confidence to carry out the government sector energy management program. The former president of the US, the Clinton President, gave the commitment as the President Executive Order 13123 to push greening the government through efficiency energy management. The Prime minister of Korea, gave the commitment as the Prime minister's instruction to push the government into energy saving. As to China, Premier Wen Jiabao also made important comments to push the government sector energy management. The practices showed that top level commitment can greatly push the implementation of government sector energy management.

- Setting Savings Targets

The government sector can well manage the energy consumption as well as the greenhouse-gas emissions after setting savings targets. The saving targets are expressed in terms of energy legislation or administrative regulations and it is compulsive as laws. Almost every APEC economy has the energy saving target for the energy conservation programs, so do the six surveyed economies. Among the six APEC economies, the United States even has set the detailed special energy efficiency targets for the government sector, which has done great help to the government sector energy management. The other five economies set the targets served for both the government sector and the rest of the economy. More information is detailed in Table 2-1. The experiences prove that to set savings targets is a well-run measure for the government to manage the government sector energy consumption as well as the greenhouse-gas emissions.

Table 2-1: The Summary Information about Energy Saving Target

| Economy | Formal Expression of Energy Saving Target | Characteristic |
|---|---|---|
| The US | ✧ The percentage of energy-reduction<br>✧ The percentage of renewable energy<br>✧ Energy efficiency of federal buildings | Quantitative |
| China | ✧ The percentage of energy-reduction<br>✧ The percentage of greenhouse-gas reduction | Quantitative |
| Japan | ✧ The percentage of electricity-reduction<br>✧ The rate of growth of energy consumption reduction<br>✧ The percentage of greenhouse-gas reduction | Quantitative |

| | | |
|---|---|---|
| Australia | ✧ The normalized energy intensity<br>✧ The percentage of greenhouse-gas reduction | Quantitative |
| Korea | ✧ Rationalization of energy use<br>✧ Reduction of carbon dioxide emission | Qualitative |
| Hong Kong, China | ✧ Reduction of energy consumption<br>✧ Reduction of carbon dioxide emission | Qualitative |

- Plan and implement project

When the Top Level Commitment and Savings Targets are already ready, the designated energy manager (or committee) should start to plan and implement some projects. The government launched projects in three main areas, as:

- the area of public building,
- the area of government procurement area,
- the area of public transport, utilities, and infrastructure.

Many governments have launched varies of projects, some are proved to be successful, some are under way. While there is broad consensus: A good project with perfect plan and implementation will be the best example and the strongest impetus for the implementation of government sector energy management program.

- Information and Training

Facility managers, energy managers, contractors, and others need to understand the latest information about energy management in order to help the government save energy and money and meet savings goals. So it is important to offer relevant information and trainings to all stakeholders. Generally speaking, the information is always diffused by publications, TV, Radio, and website (www.), and others. Among these, varies kinds of publications and website are two main approaches for information and be adopted by most of APEC governments.

In addition to the procurable information, training is also an important measure adopted by the government to popularize energy management in government sector. With targeted and up-to-date courses, energy managers become more proficient in energy management and learn about alternative forms of financing energy-saving projects. So do the other stakeholders. In addition to training courses, it is also a good idea for the government to sponsor a number of energy and water management conferences hosted by other entities; and, to list a wide variety of training opportunities offered by universities, professional associations, and private organizations. These will both greatly benefit the stakeholders of the government sector energy management program and do great help for the program's popularization.

- Report Progress

Reporting mechanism is adopted by some APEC economies to monitor agencies' compliance with the energy reduction targets. Such as the US, Australia and Japan have established perfect reporting mechanisms and the government is satisfied with the progress monitor for the program. Based on the progress report, the government can adjust the policies, guidelines, emphases as well as budget for the program.

Generally speaking, a special organization is needed to conduct the report mechanism. In the US, the FEMP, which is subjected to the US Department of Energy, is responsible for the report mechanism. Every year, FEMP required the government agencies to report the status of energy consumption and then collected all of these and reported to the Congress and the President. In Japan, the Ministry of Economy, Trade, and Industry (METI) is responsible for it; And in Australia, the Australian Greenhouse Office, which is subjected to the Department of the Environment and Heritage, is responsible for it. The three organizations are all government agencies and have great authority to push the government sector energy management program.

- Reward Leadership

Both immaterial and material awards are adopted to encourage the government agencies to act the energy efficient program. The immaterial awards are implemented in the form of honor certificate, medal, or others. For example, the US federal government has established the Federal Energy and Water Management Awards and the Presidential Awards. Federal Energy and Water Management Awards are established to honor organizations and individuals who have made significant contributions to the efficient use of energy and water resources in the Federal government. There is also Presidential Awards for Leadership in Federal Energy Management. And the Presidential Awards is issued by the president himself.

In addition to the immaterial awards, material awards are also adopted to honor the outstanding organizations and individuals. Based on our research, the existing mode for material awards are:

- Add appropriate government grants: It is usually conducted by the Department of Finance or other government department. The award will come true when the government plan the budget and considered the grant, and the organizations that have made significant contributions to the program is expected to get more grants.
- Grant energy saving performance retention: The award will come true for the implementation of energy saving performance retention system. As regulated in the system, the budget fund is hold almost constant to the agencies, while the fund saving from the energy management can be retained in part by the agency himself. The retention is special for the awarders, the energy service corporations and the purchase scheme for renewable energy.

## 2.2 A Comparative Analysis of the Political Framework for Government Sector Energy Management

In order to promote energy conservation and energy efficiency in the government sector, the economies enacted a variety of laws and regulations to construct the policy framework for energy management. Economies establish their policies, rules and regulations concerning the goals, organization and accountability, management, technical assistance, development and use of energy resources, and so on.

Almost all economies that have implement government sector energy management program have enacted a series of laws & regulations to establish a policy framework for the program. Some economies have particular and comprehensive policy framework for government sector energy management, such as the US It has particularly energy management goals, organization as well as accountability, management, and technical assistance in government sector, which is regulated by *the President Executive Order 13123—Green the Government Through Efficient Energy Management* and other laws and regulations. While other economies, such as China, Japan, and Korea, make the policy framework for energy management in government sector as well as in the economy as a whole. More information about the laws and regulations are detailed in Appendix 1-3.

The practices show that the policy framework is very necessary for the energy management in government sector. So to learn from the experience of other economies, and to start designing or to perfect the policy framework is a key step for you to launch government sector energy management program.

## 2.3 A Comparative Analysis of the Financial Measures

No cost, no benefit. All the governments have to get enough capital to make the government sector energy management program function. There are many categories of funding sources for the program, but the three, Government grants, Retention of cost savings, and Third-party financing, are most available.

### 2.3.1 Government grants

Government grants is the most familiar financial measure for the government sector energy management program and is adopt by almost all economies. Government grants come from government budgeted funds, and are ostensibly the most cost-effective means for funding energy projects, since interest is not owed, administration requirements are less, and all project savings accrue to the host. Such as in the US, the federal government grants 100~200 millions every year for government sector energy management program.

### 2.3.2 Retention of cost savings

Some governments, such as the federal government of the US, hold the constant

budget fund to agencies every year, and permit agencies to retain the fund saving from the energy management in part. The retention is used by agencies for the awarder, the energy service corporations and the purchase scheme for renewable energy.

2.3.3 Third-party financing

There exist two popular and successful approaches to get the third-party finance, including Energy Savings Performance Contracts ( ESPC) and Utility Energy Services Contracts (UESC):

- Energy Savings Performance Contracts ( ESPC)

If you're doing all you can to meet your agency's energy efficiency, water conservation, and renewable energy goals but are frustrated by a lack of funds, then ESPC could be the answer. An ESPC is a contracting vehicle that allows agencies to accomplish energy projects for their facilities without up-front capital costs and without special Congressional appropriations to pay for the improvements.

An ESPC project is a partnership between the customer and an energy services company (ESCO). The ESCO conducts a comprehensive energy audit and identifies improvements that will save energy at the facility. In consultation with the agency customer, the ESCO designs and constructs a project that meets the agency's needs and arranges financing to pay for it. The ESCO guarantees that the improvements will generate savings sufficient to pay for the project over the term of the contract. After the contract ends, all additional cost savings accrue to the agency.

ESPC is widely adopted in the US, Japan, Australia, Korea, and so on. Make the federal government as an example: the US Congress and the President encourage agencies to use ESPCs to finance and implement efficiency improvements and meet their energy goals. Legislation authorizing ESPCs was enacted in 1992, and DOE promulgated regulations for their use in 1995. Super ESPCs were placed to streamline the process in 1998, and ESPCs were reauthorized through 2016 by the Energy Policy Act of 2005. At present, more than 400 ESPC projects have been awarded by 19 different federal agencies in 46 states. $1.9 billion has been invested in the US federal facilities through ESPCs, saving 16 trillion Btu annually, equivalent to the energy used by a city of about 450,000.

- Utility Energy Services Contracts (UESC)

One of the useful ways for government agencies to implement efficiency and renewable energy projects is through partnerships with their franchised or serving utilities. With a UESC, the utility typically arranges financing to cover the capital costs of the project. Then the utility is repaid over the contract term from the cost savings generated by the energy efficiency measures. With this arrangement, agencies can implement energy improvements with no initial capital investment; the net cost to

the government agency is minimal, and the agency saves time and resources by using the one-stop shopping provided by the utility.

Make the federal government as an example: the US agencies often enter into utility energy service contracts (UESCs) to implement energy improvements at their facilities. The Energy Policy Act of 1992 authorizes and encourages Federal agencies to participate in utility energy efficiency programs offered by electric and gas utilities and by other program administrators (e.g., state agencies). These programs range from equipment rebates (i.e., utility incentives) to delivery of a complete turnkey project. At present, more than 45 electric and gas utilities have provided project financing for energy and water efficiency upgrades at Federal facilities, investing more than $600 million through utility energy services contracts since 1995. The Edison Electric Institute has committed to encouraging $2 billion in private investment funding by 2010 for life-cycle, cost-effective Federal facility improvement projects. In fiscal year 2000, $157 million in private-sector investments generated $35 million in savings at Federal facilities. These projects are now paying for themselves from a share of the cost savings resulting from efficiency improvements.

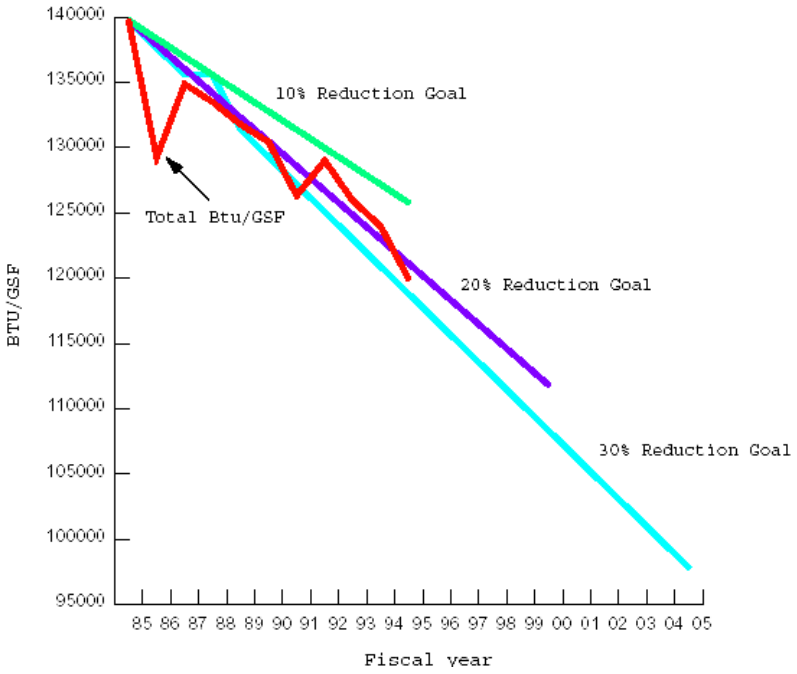
### 2.4 A Best-Practice Example— the US government Energy Management Program

As the economy's single largest energy consumer and energy waster, the US government had paid much closer attention to the government sector energy management from 1970s. In 1973, the US Department of Energy (DOE) sponsored the Federal Energy Management Program (FEMP) and set up the Department of FEMP in order to promote the progress of the economy-wide energy saving activity and help the federal agencies achieving their overall energy saving goals.

FEMP works to reduce the cost and environmental impact of the Federal government by advancing energy efficiency and water conservation, promoting the use of distributed and renewable energy, and improving utility management decisions at Federal sites as shown in following achievements:

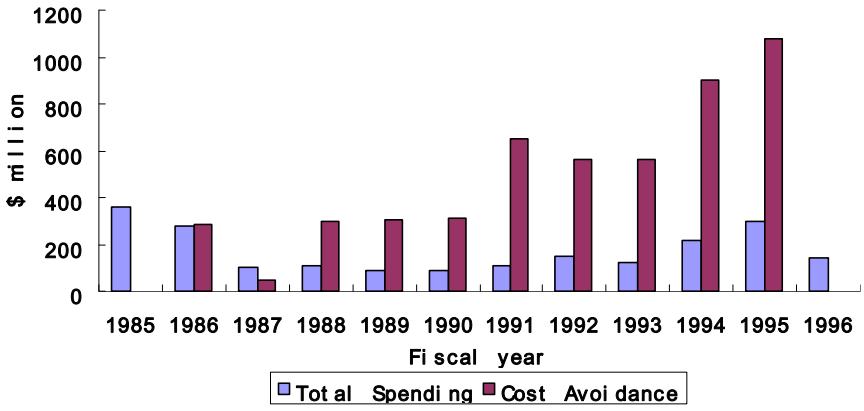
**Achievement 1)** The United States management mechanism works well in government sector energy management. As shown in Fig. 2-1, energy savings of federal government have met or surpassed these targets, when measured in terms of direct energy use.

Fig. 2-1: Achievements in Federal Building Energy Intensity




**Achievement: 2)** At the same time, federal energy management efforts in government sector have yielded saving valued significantly above the investment in achieving those savings. As seen in Fig. 2-2, this represents significant progress, the funds invested to date fall far short of the total need of 5 billion USD in investment.

Fig 2-2: The US federal Buildings & Facilities
Energy Management Costs vs. Savings




There are many measures adopted by FEMP to management the energy in federal agencies.

**The first measure** is to enact laws and regulations to establish policy framework for energy management and energy conservation. FEMP works closely with Federal agencies as well as the Office of Management and Budget and the Office of the Federal Environmental Executive to develop, disseminate, and refine policy related to

Federal energy management. FEMP also develops guidance materials to assist Federal agencies in meeting legislative and executive order requirements.

**The second measure** is to set clear and detailed energy efficiency & energy conservation targets to make energy management objective. It is always issued in the form of energy legislation or administrative regulations, such as President Executive Order, Federal Energy Management Improvement Act, Energy Policy Act, and so on.

**The third measure** is to push the government procurement for energy efficiency products. Federal agencies spend approximately $10 billion to $20 billion on energy-consuming products each year, offering literally thousands of opportunities to reduce federal energy use through the purchase of high efficiency equipment. Based on the directive in President Executive Order 13123 and the Energy Policy Act of 2005, it is mandatory for the federal agency to procure either Energy Star products or FEMP-designated products that are in the upper 25 percent of energy efficiency.

**The fourth measure** is to launch the information programs to make it informed. Perhaps the best-known voluntary program in the US is Energy Star. Energy Star includes labeling of energy efficiency products as well as energy efficiency homes. In addition to the Energy Star labeling, LEED Green Building Rating System is also widely adopted in energy efficiency buildings in the US. What's more, the list of energy efficiency products is offered by FEMP and is free for all purchasers.

**The fifth measure** is to offer energy education and technical assistance to make it easy. FEMP provides unbiased, expert technical assistance to help Federal energy managers identify, design, and implement new construction and facility improvement projects. These projects can incorporate energy efficiency, renewable energy, distributed energy technologies, sustainable design practices, state-of-the art lighting, and water-saving technologies.

**The sixth measure** is energy statistic reporting mechanism to make it reported. To monitor agencies' compliance with the energy reduction targets, all agencies are required as stated to measure and audit their own energy consumption, and submit it as annual Federal energy report to FEMP. Then another annual report built on each agency's annual Federal energy reports are due to be submitted to the President on Jan. 1$^{st}$ of each year. What's more, in order to help implementing the Energy Statistic Reporting Mechanism, Office of Management and Budget (OMB) in the White House is in charge of the supervision to it. OMB is entitled to decline the finance budget to the agencies if they are not submitted the reports faithfully on time.

**The seventh measure** is awarding mechanism to make it awarded. The federal government adopts the both immaterial and material awarding mechanism. The immaterial awards include Federal Energy and Water Management Awards sponsored by the Federal Interagency Energy Policy Committee, the Presidential Awards, and so on. It is great incentive to be active in the energy efficient program for the federal

agencies.

**The eighth measure** is financial mechanism to make it fund. Although the improvement in operations and maintenance save money over time, federal appropriations do not provide enough funds to meet this target. The introduction of ESPCs and UESCs allows federal agencies to address government energy waste without paying the cost up-front.

## Chapter 3: Public Building

### 3.1 Introduction

Why do the economies implement energy management in public buildings? It seems that there exists great energy saving potential in public building energy management for the governments of all economies.

Based on our research, the main motivation is founded:

1) As the largest single "landlord" whom owns millions of public buildings, and has the responsibility of amount of energy consumption, the first important motivation is to tap the enormous energy saving potential in public buildings. For example, the US federal government oversees about 500,000 federal buildings and totally about 8% energy is used to all buildings. Highly efficient buildings can typically use 20-50% less energy than average ones, the life-cycle savings of energy efficiency construction are enormous, and the potential gap can not be ignored.

2) The second important motivation is to promote energy efficiency as a whole. It is a reality that some buildings are built and operate very efficiently, while others are built and operate inefficiently. So how to help the bad one to win the good performance and promote the good one to win the better performance is a very significant work for governments.

3) The third important motivation is to lead by an example. Government buildings are models for the citizenry they serve. This influence is most prominent through demonstrating energy efficiency construction features and concepts but also through educating managers, designers, and other people in energy efficiency principles and practices. Government sector energy management in public buildings works effectively to enhance the public energy efficiency sense, advance the energy efficiency activities, and reach energy consumption reduction in all buildings.

Through the government energy management in public buildings, it will work effectively to demonstrate energy efficiency construction features and concepts, educating managers, designers, and other people in energy efficiency principles and practices, and enhance the public energy efficiency sense as well as advance the energy efficiency activities. The program of energy management in public building

will at last reach energy consumption reduction in all buildings.

Energy management in public buildings is an emphasis on government sector energy management program including in both existing building and new construction:

### 3.2 Energy Management in Existing Buildings

The energy management in existing building should including following operations & maintenance:

- Building system commissioning
- Metering/monitoring, benchmarking
- Facility manager training & certification
- Incentives and recognition
- Employee education
- Energy management system

### 3.3 Energy Management in New Construction

#### 3.3.1 Establishing and Tracking Efficiency Goals

It is important to establish sustainability and energy use targets at the project's outset. Energy efficiency targets should be set for the whole building level as well as for individual systems. Goals and targets should have “teeth” in that they should be measurable and verifiable. For example, the US government set the targets as:

- For new federal government buildings, they are required to be 30% more energy efficiency than the code requirements for all other buildings (Energy Policy Act of 2005, Sec. 104).
- Encourage agencies to strive to meet the LEED Green Building Criteria

As for China, the Ministry of Construction declared the savings targets as:

- 50% reduction in 2010, and
- 60% reduction in 2020.

#### 3.3.2 Building Design

- Sustainable design

Government agencies are required to implement certain aspects of sustainable building design and operation, including energy and water efficiency; use of recycled content, bio-based, or other environmentally preferable building products; waste recycling, including construction and demolition debris; and use of environmental management systems to continually improve operational performance of government facilities.

Government-wide policies emphasizing the energy and water efficiency aspects of sustainable building design and operation are highlighted. Make the US federal requirements as example, many policies are established for the requirement of

sustainable design, as:

- **Code of Federal Regulations:** *"Energy Conservation Voluntary Performance Standards for New Buildings; Mandatory for Federal Buildings"* (10 CFR 435) establishes performance standards to be used in the design of new federal commercial and multifamily high-rise buildings; "*Federal Energy Management and Planning Programs"* (10 CFR 436) establishes procedures for determining the life-cycle cost-effectiveness of energy conservation measures and for setting priorities for energy conservation measures in retrofits of existing federal buildings.
- **Legislative Acts:** The Energy Policy Act (EPAct) of 1992. EPAct, orders federal agencies to reduce their energy consumption per square foot of building, install energy and water conservation features, track energy and water consumption, and institute systems to facilitate the funding of energy efficiency improvements.
- **Executive Orders:** Executive Order 13123—Greening the Government Through Efficient Energy Management requires the federal agencies to apply sustainable design principles. Executive Order (E.O.) 13123 provided the first federal requirement for general sustainable design principles as applied to the siting, design, and construction of new facilities.

In addition to the policies & regulations, Sustainable design can also be enhanced by the adoption of market-leading design, construction and operations rating standards, such as Leadership in Energy and Environmental Design (LEED™), popular in the US, Canada, and India; Canada's Building Environmental Performance Assessment Criteria; Hong Kong, China Building Environmental Assessment Method (HK-BEAM); and Australia's Green Star.

- Design assistance

Design assistance is another effective avenue that public sector energy management programs can offer to help lower the cost and information barrier to energy efficiency new construction in their governments. The US Federal Energy Management Program (FEMP) has long maintained a design assistance component in the portfolio of energy management services it offers, using technical experts from the US Department of Energy's laboratories. Each year it issues a "call" for requests for design assistance to the US government agencies. Because of limited resources, FEMP offers assistance to roughly a third of the requested projects. Selection is based on financial and technical merit, strategic value, implementation plan, and agency support and cost sharing. FEMP also has training seminars on specific technologies and strategies. Training requires more preparation to establish, but is more easily replicable than direct technical assistance.

- Life-cycle analysis

A life-cycle cost (LCC) approach, or at bare minimum a simple payback threshold, that explicitly permits increased first cost investment for future operational cost savings, is highlighted by the US government, Japan government, Australian government, Chinese government, and others. LCC helps facility managers make sound decisions, allows for rational trade-offs between initial investments in energy-saving features and future savings of energy costs and related operating expenses (e.g., maintenance), subject to discounting to reflect the time value of money.

There are many existing software, training, publications, and guidance on how to apply LCC to evaluate the cost-effectiveness of energy and water investments, such as FEMP's BLCC software, which is used as a standardized life-cycle costing tool; "2-hour televised workshop" and "two-day classroom workshops" offered by FEMP.

3.3.3 Standards & codes

Based on the research, there are two kinds of existing codes: mandatory minimum standards and the voluntary standards. Practices showed that a mandatory approach may result in un-ambitious targets, while a voluntary program may not provide enough motivation. It is often optimal to have a "push-pull" approach, which incorporates reasonable minimum mandatory standards, with incentives for increasing levels of voluntary efficiency targets. The successful approaches in economies are researched and some conclusions are gained as below:

- Building Code of the US：Adopt the LEED Green Building voluntary standards for new constructions.
  - LEED was built upon valued industry reference standards, such as those developed by the American Society for Heating, Refrigerating, and Air-Conditioning Engineers, the Sheet Metal and Air Conditioning Contractors' National Association, and the US Environmental Protection Agency.
  - LEED has four ranks, in turn as: Certified, Silver, Gold, and Platinum. The Platinum rank is the best.

- Building Code of Australia：Place both mandatory minimum standards and the voluntary standards, include:
  - Minimum energy performance standards for houses
  - Minimum energy performance standards for residential buildings other than homes
  - Minimum energy performance standards for office, retail, carparks, etc
  - Nationwide House Energy Rating Scheme (NatHERS): that can be used to give houses an energy efficiency rating from 0 to 5 stars. A 0-Star rating indicates that the house is inefficient and will be uncomfortable without a lot

of heating in winter and a lot of cooling in summer. A 5-Star rating indicates that the house has achieved a high level of energy efficiency, and will require minimum levels of heating and cooling to be comfortable in winter and summer.

- Building Code of Japan: implement mandated energy conservation building Criteria and Regulations, showed as below. At the same time, Japan also adopted the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) standard to provide enough efficiency motivation.
  - Prevention of Heat Loss through the Outer Walls, Windows, etc, of Building;
  - Efficient Use of Energy by Air Conditioning Equipment;
  - Efficient Use of Energy by Mechanical Ventilation Equipment Other Than Air Conditioning Equipment;
  - Efficient Use of Energy by Lighting Equipment;
  - Efficient Use of Energy by Hot Water Supply Equipment;
  - Efficient Use of Energy by Lifting Equipment.

- Building Code of Hong Kong, China: stipulate the minimum energy efficiency requirements for individual components and sub-systems of an installation, showed as below. At the same time, Building Environmental Assessment Method (HK-BEAM) is widely adopted in Hong Kong, China, which made the voluntary initiative to measure, improve and label the environmental performance of buildings.

  - Code of Practice for Energy Efficiency of Lighting Installations, 1998 edition,
  - Code of Practice for Energy Efficiency of Air Conditioning Installations, 1998 edition
  - Code of Practice for Energy Efficiency of Electrical Installations, 1998 edition,
  - Code of Practice for Energy Efficiency of Lift and Escalator Installations, 2000 edition.
  - Performance-based Building Energy Code, 2003 edition.

3.3.4 Building certification

In order to measure, improve and label the energy efficiency performance of buildings, many economies launched building certification. Building certification highlights energy efficiency and favorable energy management, which made efficiency building appreciable and greatly enhanced energy management in buildings too. There are many building certification for new buildings, the several most well known are Leadership in Energy and Environmental Design (LEED™), which is popular in the US, Canada, and India; Canada's Building Environmental Performance Assessment Criteria; Hong Kong, China Building Environmental Assessment Method (HK-BEAM); and Australia's Green Star. They also present the opportunity for goal-setting and public recognition as well as, more generally, a form of reporting to

the public about successes by the public sector. Several federal agencies of the US have adopted these standards as goals for their new construction.

## Chapter 4: Government Procurement

### 4.1 Introduction

Government procurement for energy efficiency products is a good operating practice by government which has great influence to the broader society in both tangible and symbolic ways. A striking example was the 1993 Executive Order in the US, directing all federal agencies to purchase only energy efficiency computers and office equipment that qualified for the Energy Star® label. Even though federal sales amounted to a mere 2-3% of the market, this policy caused an immediate jump in manufacturer participation in the Energy Star program, with most types of office equipment quickly achieving Energy Star penetration rates of 90% or more (Jeffry Harries, etc.)

To use the power of government purchasing is a simple and low-cost measure. Relatively little funding is needed to use the leverage of government purchasing as a powerful tool for market transformation. By setting up the procurement specifications and listing the energy efficiency products for government purchasers, the collective purchasing power of the government could help create markets for efficiency products for the rest of the society. In most economies, government procurement for energy efficiency products is regulated by law. And there are three main existing modes for the government to push energy efficiency procurement:

--Push energy efficiency procurement directly
--Advocate efficiency procurement as well as ecological procurement
--Push efficiency procurement by green procurement

### 4.2 Push energy efficiency procurement directly

Among the six surveyed economies, United States and Korea have very successful practices of government efficiency procurement. The successful model adopted by the governments for government procurement for efficient products are detailed below:

--Enact laws & regulations to make government efficiency procurement policy
--Adopt procurement criteria
--Launch the information program
--Offer technical assistance

#### 1) Enact laws & regulations to make government efficiency procurement policy

Generally speaking, there are two types of policies up to now, one is for **mandatory procurement**, and the other is for **preferential procurement**. The mandatory procurement policy has the mandatory regulation from which the government agencies are mandatory to procurement for energy efficiency. Such as the US federal

government adopted the mandatory procurement and detailed the mandatory regulation of government procurement for efficiency products by a series of laws & regulations, such as *President Executive Order 13123*, *Energy Policy Act of 2005*. Based on these, the federal purchasers are mandatory to Purchase ENERGY STAR labeled products or purchase products that are in the upper 25th percent of energy efficiency as designated by the Federal Energy Management Program (FEMP). They are also required to buy products with 1-watt or other low levels of standby as determined by USDOE/FEMP too. The Korea government also adopted mandatory Policy: Based on the Prime Ministers Instruction '*Propulsion guide of Government Agency energy saving*', all of the government agencies must use the high efficiency equipments & supplies compulsorily.

Different from mandatory procurement, the preferential procurement is just to encourage or require the government purchasers to make the preferential decision for high efficiency products. It is not mandatory. As of December 2004, The Chinese government had issued a policy document on "*Implementation of Government Energy Efficiency Procurement*" by the Ministry of Finance and the National Development and Reform Commission (NDRC), calling for a staged, 3-year program to establish energy efficiency purchasing practices at all levels of government in China. It stipulates that government organs at all levels, public sector non-profits units and organizations, when using fiscal resources for procurement, should preferentially procure energy efficient products and gradually eliminate low-efficiency products. The Korea government also adopted preferential policy to procurement for high efficiency products: Based on the Public Procurement Service's instruction '*Purchase & operation standard of the energy-consuming product*', the high efficiency products shall be purchased preferably by government.

In despite of mandatory procurement policy or preferential procurement policy, they all should reach the same point: To make the government procurement for energy procurement policy.

2) Adopt procurement criteria

Governments implement energy efficiency procurement according to some procurement criteria, which detailed the performance of energy efficiency products. Some economies' criteria for government procurement are shown as below. Government Procurement Criteria is the most critical prerequisite for an energy efficiency purchasing program to differentiate among different models of a given product type. It also works to make government procurement more transparent and more standardized.

Table 4-1

| Economies | Government Procurement Criteria |
|---|---|
| United States | ✧ ENERGY STAR labeled<br>✧ FEMP designation |

| | |
|---|---|
| China | ✧ China Standard Certification Center (CSC) labeled |
| Japan | ✧ Top Runner Standard |
| Australia | ✧ 4-star or better based on Australian "Energy Star" standard |
| Korea | ✧ Energy Efficiency Standard<br>✧ e-Standby labeled<br>✧ High-efficiency Appliance Certification |

3) Offer technical assistance

- Procurement guidelines

Procurement guidelines are disseminated by governments to prospective buyers. The simplest guidelines can be done at minimum including a list of the covered products and their efficiency criteria. It has been successfully practiced by Chinese government. In 2004, the first *Energy Conservation Product Procurement List* is offered by CSC, which includes 9 energy & water efficiency products. About a year later, the list was modified, and 11 more products are added.

However, it may be effective to present more, both for credibility and to increase compliance with the recommendations. Make the US as an example, FEMP produces a series of one-sheet (double-sided) guides, each devoted to one of the products. Along with providing the complying efficiency thresholds, FEMP's "Product Efficiency Recommendations" are also distributed as a loose-leaf binder, which include material about government policies on energy-using products, case studies, life-cycle cost analysis guidance, "Where to Find" guidance, "Buyer Tips" guidance, and other sources of information on efficient products. The initial binders, covering just a dozen products, were published in early 1997. Update packages, with new and amended recommendations, were distributed to subscribers, who numbered almost 4,000 by 2003, twice annually. Over 50 products are covered. In 2004, FEMP switched to a CD-ROM format for distributing this material. The information is also disseminated through website simultaneous through publications.

- Training

Training is offered to energy management practitioners to help them become proficient in the knowledge and skills required to procure energy efficiency equipment. There are multiform trainings, such as person-to-person interactions, trainings by dint of internet and other electronic media, and so on.

Among these ways, person-to-person interactions are probably the most valuable, which allows for interaction with the instructor to work through the "how to" of executing involved tasks and hands-on practice with the relevant software, energy-using equipment, or diagnostic instruments is no doubt included; while the internet and other electronic media allow for inexpensive accessibility to wide-ranging audiences, and allow people to participate at their own desks, avoiding the time and cost of travel. Up to now, FEMP has done successful practice of on-site

trainings. FEMP's on-site trainings cover specifics on how to meet the Federal Acquisition Requirement and the Executive Order 13123 directive, and the practice showed that most of purchased are benefited from these for purchase ENERGY STAR® products and FEMP designated products (products in the top 25th percentile of energy efficiency).

4.3 Advocate efficiency procurement as well as ecological procurement

Among the APEC economies, Australian government is a good example who pushes efficiency procurement as well as ecological procurement. As to Australia, although there is plenty of energy, and energy production is much more than energy supply, the energy construction and energy consumption are not reasonable. The statistical evidence showed that for about 80% electricity are produced by burning coal, which brings 38% $CO_2$ of total emissions of the economy. What's more, Australia ranks No.1 on $CO_2$ emission per human. So it is important for the Australian government to pay high attention to the green gas emission as well as enhance energy efficiency of end-energy consumption products.

As to the government procurement, the Australian government considers about both energy efficiency and ecological. The Australian government has already enacted purchasing policies to mandate the energy efficiency procurement, the main requirements of which include:

--All new office equipment should have Energy Star power saving options.
--All goods covered by the Appliance Star labeling scheme should be rated 4-star or better.
--All purchased office equipment must meet the US Environment Protection Agency "Energy Star" minimum energy performance standard.

At the same time, the government also advocates green procurement and encourages agencies to achieve this by looking at the environmental impacts of one or more of the following aspects of the product's life cycle such as:

| | |
|---|---|
| --Source of raw materials | --Potential for reuse and recycling |
| --Production & manufacturing | --Operation |
| --Packaging | --Maintenance, and/or |
| --Distribution | --Disposal of the product |

The government also launched the "Greening of Government Program" and "ECO-Buy Program" to advocate green procurement.

- Greening of Government Program

The program aims to cut power consumption, produce less heat and reduce the green gas emissions by purchasing and using the energy efficiency and environment-friendly products covers a range of key goods and services procured by the Australian government. These goods and services include:

--Building management services
--Cleaning services
--Dishwashers
--Fax machines
--Miscellaneous office equipment
--Office equipment consumables
--Packaging
--Paper and cardboard
--Personal computers and monitors
--Printers, photocopiers and multi-function devices
--Printing services
--Recycled products
--Refrigerators
--Task lighting/desk lamps
--Waste management services

- ECO-Buy Program

ECO-Buy is endorsed by Minister Thwaites. ECO-Buy works with local government and business to motivate purchasing of green products, ie products that are less damaging to our environment and human health, as well as to increase awareness of the range and quality of green products.

The main services offered by the program include:

--Offer an ideal way for local governments to demonstrate to their communities that they are taking positive steps to create a more sustainable future by choosing to buy products that are less damaging to our environment and human health.

--Offer green procurement tools to make it easier: such as EPEAT, which is an environmental procurement tool designed to help institutional purchasers in the public and private sectors evaluate, compare and select desktop computers, notebook computers and monitors based on their environmental attributes.

--Draft out and publish Eco-Guides for purchasers.

--Produce the Great Report Cavort annually which details local government members' green purchasing achievements and provides detailed information on members' expenditure on green products.

--Set up Eco-buy website

In order to push efficiency procurement as well as ecological procurement better, the Australian government, both the Commonwealth government and the State/Territory Governments, have already made effective channel for complaint/appeal by potential suppliers. There is no special Commonwealth-wide system for dealing with procurement complaints or providing remedies for complainants. However, two general avenues of complaint are available. One is Purchasing Advisory and Complaints Service (PACS), the other is Australian and New Zealand Government Procurement Agreement. As to the State/Territory Governments, State/Territory procurement agencies, relevant State/Territory Government Minister, and State/Territory Ombudsman are all have responsibility to deal with complaints about government procurement.

4.4 Push efficiency procurement by green procurement

Be different from the two models above, some governments advocate green

procurement instead of efficiency procurement, and push efficiency procurement by green procurement. The Japanese government procurement is a good example. The procurement model adopted by the Japanese governments is detailed below:

-- Enact Laws & Regulations to Regulate Green Purchasing
-- Establish Green Purchasing Network (GPN)
-- Launch the purchasing program
-- Establish the System of Complaint Review Procedures for Government Procurement

1) Enact Laws & Regulations to Regulate Green Purchasing

In 1995, the government adopted the first "*Action Plan for Greening of Government Operations*". This action plan set objectives and indicates the methods to achieve a greening of public procurement by the year 2000. Green purchasing is very often seen as a first step to change general consumer behaviour. Activities focus on office material and electronics, as well as vehicles. Then *the Guideline of Measures to Prevent Global Warming* is also enacted to promote the government as well as the economy to take actions to prevent global warming.

In 2000, *The Law on Promoting Green Purchasing* was passed and went into effect the following year. The law superseded the purchasing directives of both *the Action Plan for Greening Government Operations* and *the Guideline of Measures to Prevent Global Warming*, and aims at establishing a society that will exert less burden on the environment, and a society that can enjoy sustainable growth.

The three pieces of laws form the policy framework for government green purchasing and greatly help for the implementation of green purchasing.

2) Establish Green Purchasing Network (GPN)

In 1996, the Green Purchasing Network (GPN) was established to promote green purchasing among consumers, companies and governmental organizations in Japan. It currently has 2350 members, including 350 local authorities, 1640 private companies, consumer groups, environmental NGOs, and co-operative associations. The GPN has two responsibilities for green purchasing, one is to promote the ideas and practices of green purchasing and draw up purchasing guidelines for each type of product; the other is to publish environmental data books on various products, hold seminars and study meetings, and awards commendations to organizations that have shown remarkable performance in implementing green purchasing.

3) Launch the purchasing program

Japan ministries and governmental institutions are required by law to implement green procurement and encourage purchasing of energy efficiency and eco-friendly products. Examples of actions specified in the program are included as:

--Purchasing eco-labeled products
--Purchasing top runner products
--Purchasing energy star office equipment

4) Establish the System of Complaint Review Procedures for Government Procurement

The Japanese government has a system for reviewing complaints regarding government procurement. This system will receives and processes specific complaints concerning government procurement of goods and services (including construction services), to ensure greater transparency, fairness, and competitiveness in the government procurement system, under the principle of non-discrimination of foreign and domestic sources.

5) Establish Government Procurement Reporting Mechanism

Every the annual report for government procurement is issued by Cabinet Secretariat, which have four main contents:

--Review the Policy and Achievements of government procurement;
--list each award in order by the procuring Ministries and Agencies;
--show data and analysis on overall trends in Japan's government procurements;
--make the results of a survey of domestic and foreign suppliers about procurement procedures.

## Chapter 5: Public Transport, Utilities, and Infrastructure

### 5.1 Introduction

In every economy there is a great energy gap to improve energy efficiency in government facilities, operations such as roads and transit, water and wastewater, and other public services and infrastructure. They are all valuable thing for government, and their benefits include lower government energy bills, reduced greenhouse gas emissions, less demand on electric utility systems, and reduced dependence on imported oil. Such as the federal government energy management in fleet activities and Australian government energy management in street lighting are both good practices.

### 5.2 A good example of energy management in public transport

The government of the US has achieved energy management in fleet activities:

In 1992, Federal fleet activities are shaped by the requirements of EPAct (section 303) that 75% of a Federal fleets new LDV acquisitions in a metropolitan area must run on alternative fuels. Then in 2000, Executive Order (E.O.) 13149 *Greening the Government through Federal Fleet and Transportation Efficiency* was enacted to direct Federal agencies to take a leadership role in the reduction of vehicular

petroleum consumption. E.O. 13149 goes a step further by establishing a petroleum reduction goal of 20% by 2005 for Federal agencies compared to their fiscal year 1999 usage. The two laws form the policy framework for the US government energy management in fleet activities.

Following E.O. 13149, the US Department of Energy (DOE) issued guidance on complying with the requirements of Executive Order 13149. This guidance detailed preparing compliance strategies, designating responsible senior-level officials, and reporting compliance data. The guidance greatly pushed the implement of E.O. 13149.

An online reporting system which is based on Federal Automotive Statistical Tool (FAST) is also unveiled by government for energy management to collect and compile information on petroleum consumption, alternative fuel consumption in alternative fuel vehicles (AFVs), conventional and AFV acquisitions and inventory, fuel efficiency of vehicle acquisitions, and vehicle operational data. And federal agencies are required to annually report compliance with EPAct and E.O. 13149 requirements of their fleet vehicles through DOE's Federal Automotive Statistical Tool (FAST) no later than November 1 after the end of each fiscal year.

5.3 A good example of energy management in public utilities

The Australian government has achieved energy management in street lighting:

Australian government is generally responsible for installing, maintaining and operating street lighting. But road and street lighting is the largest single expenditure item for many local councils. As a result, it is important to keep up-to-date with developments in lamp and light fitting technology and standards. This will help the governments to ensure that they can provide the best street lighting service to road users in your community, while minimizing associated costs, reducing the energy use and greenhouse emissions associated with your street lighting.

1) Set out Street Lighting Standards

Performance and installation requirements for street lighting are specified in standards AS/NZ 1158, which are set out in a number of sections covering the following topics:

--Category V lighting. Category V lighting is applicable to roads where the visual requirements of motorists are dominant, such as arterial roads and freeways. The Standard identifies five sub categories with different illumination requirements.
--Category P lighting. Category P deals with lighting for areas intended primarily for pedestrian use or for mixed pedestrian, vehicle and bicycle use. The Standard provides specifications for 5 lighting sub categories, according to the degree of pedestrian, vehicle or cyclist activity, the risk of crime and the need to enhance the prestige of the locality. Category P supersedes former

categories ‘B’ and ‘C’ and lighting of the type categorized as “Minor Road Lighting” in earlier versions of the Standard.

--Computer aided lighting design. The majority of street lighting design work is now undertaken using computer-aided procedures. The standard outlines guidelines and principles for this process.

--Supplementary lighting requirements at pedestrian crossings.

2) Energy-Saving Actions for the Street Lighting

The launched actions include:

--Replacing inefficient lamps. More efficient lamps allow you to save energy while maintaining or improving light levels. If you decide to replace your lamps you will often need to change the control gear as well.

--Reducing the number of lamps operating. Reduce lamp numbers and maintain lighting levels by using more efficient lamp types.

--Reducing operating hours. Use daylight sensors or time clocks to ensure that lamps only operate when required.

--Replacing inefficient switching equipment. Replace outdated cadmium sulphide light photo sensors with electronic sensors.

--Changing type of energy used. Consider use of solar energy. This can be an attractive option in some specialist applications.

--Improving maintenance practices. Lamps fail at fairly predictable intervals, so planned; mass-replacement of lamps is a good option and can be less expensive than spot replacement. Lenses should be kept free from dirt to ensure that light output is not reduced.

--Improving data management. Energy management and other asset management tasks will be simplified if records of lamp and luminaries types are kept up to date. Commercial software is available to assist in data management. It's also important to know how much you are paying to run your street lights, and how the energy costs are calculated.

3) Technologies used in street lighting applications

Some technologies are used in street lighting applications to achieve energy efficiency, such as HID lamps, LED lamps, compact fluorescent lamps, and others.

## Chapter 6: Findings from the Comparative Analysis

### 6.1 The Value of Government Sector Energy Management

There are many ways to justify the value of improved energy efficiency within government’s own buildings and operations, any one of these may be sufficient justification by itself for a strong program on government sector energy efficiency. Based on the comparative analysis and research on the six surveyed APEC economies, a further recognition are acquired as:

1) Leadership by Example

Government sector energy management starts from the top and leads an example for other consumers. If the public sector leads, the architects, engineers, manufacturers – and ultimately the public – will follow.

2) Saving Energy and Money

Saving energy in the government sector helps avoid harmful air and water pollutants and greenhouse gas emissions – often at a *negative* cost per ton of pollutant or $CO_2$ avoided. By definition, energy-saving measures that are cost-effective produce enough value in saved energy to more than pay for any added first costs.

To save energy is to save money. Government sector energy management also does great help to lower government operating costs. For example: in 2004, the annual energy cost of federal government in the US was 11,258 million; cumulative costs savings over the 1985–2004 periods were $7,535 billion due to energy productivity improvements made since 1985. Therefore, as the biggest energy user and with 10-20% large fraction of GDP, it is significant for the government to develop the "untapped savings potential" in government sector and save money from energy management. At the same time, energy cost savings permit government agencies to devote more of their budget to fulfilling their primary mission.

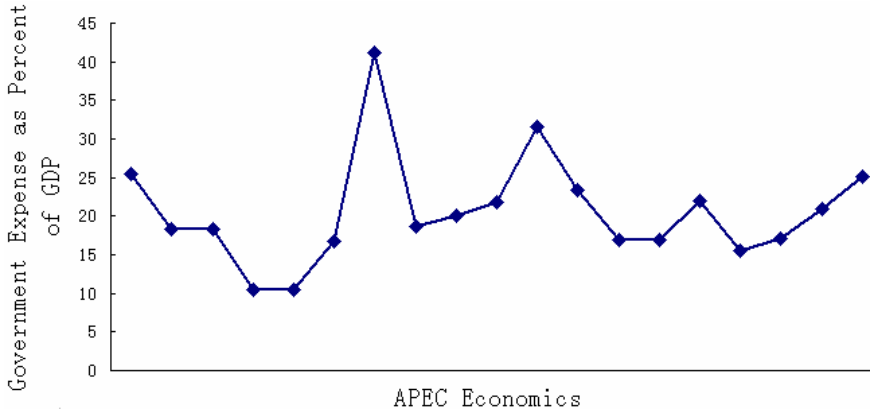
3) Slower energy demand growth

Facing high pressure in energy supply, government sector energy management can effectively free capital and electricity capacity for economic growth, ease dependence on imported oil and gas, improve electricity system reliability by lowering demand at peak times, reduce pollution and greenhouse gases, as well as preserve scarce public and private capital for investments in other infrastructure needed for economic growth.

4) Economic Significance

Government sector energy management also has great economic significance. From Fig 6-1, we can see how important the government sector is within the total economy: The average share of Gross Domestic Product (GDP) represented by government expenditures at all levels was almost about 20% as of 2004. For example: the US federal government expenditure shared 20.9% of GDP in 2004. Although the US federal government represents only 20~25% of total public sector economic activity, the federal government is also the world's largest buyer of most energy-related products and services, spending more than $10 billion/year on energy-using equipment and making federal policies on energy efficiency purchasing an important force in the market.

Fig 6-1: Government Share of Economy in 2004

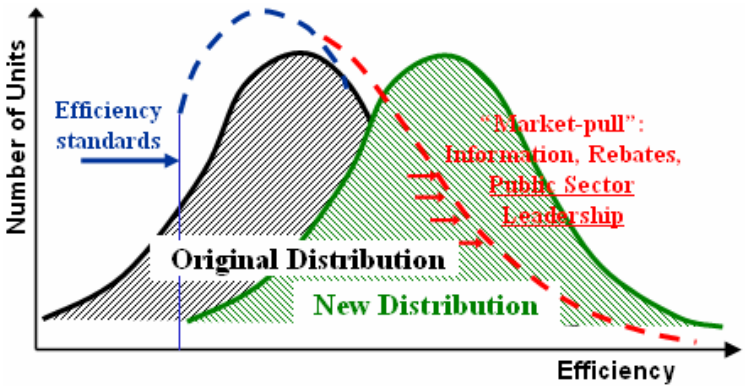



Source: World Bank

5) Do help to transform the market

Because governments have a significant market share, their purchasing power, if directed towards energy efficiency technologies, could create increased demand for these products, and enable the technology manufacturers to move towards mass production of their products. For some technologies the higher capital costs of energy efficiency products, in comparison to higher energy consuming products, is a major barrier to their more widespread deployment. Mass production would lead to reduced manufacturing costs and reduced product prices, and would improve prospects of more widespread deployment of the technologies. At present, the purchasing power for energy efficiency products is widely harnessed to transform energy efficiency product market by most developed economies such as the US, Korea, Japan and Austrian. In addition to government procurement for energy efficiency products, the market-oriented strategies adopted by Government leadership such as adopting efficiency standards to cut off low end, successful RD&D to raise high end, information programs, also does great help to transform the market. The government sector's help to market transformation is showed as Fig 6-2:

Fig 6-2: Government Sector Helps Transform the Market



6) “ Demand-pull” for new technology

In addition to the government procurement for energy efficiency products, there is a trend of implementing technology procurement. Technology procurement initiatives, maybe technology demonstrations at first, can pull new (more stringent) performance levels of products and services.

6.2 Key Opportunities to Getting the Program Started

There are some suggestions for governments to get start government sector energy management program

1) Set up policy framework

The government should provide the policy framework for a successful government sector energy management at first. A series of laws and regulations should be enacted, as the six surveyed governments have done, and the saving goals, manager, accountability, technical assistance as well as business opportunities should be regulated, from which collaboration between the Government and the community should lead to energy efficiency and the creation of jobs necessary for development. It is important to set overall policy framework for government sector energy management to Asia-Pacific economies, particularly for economies with rapidly growing domestic energy demand or energy import dependent economies.

2) Set up organizational framework

It is not enough to only have policy framework, the organizational framework which is responsible for the implementation of government sector energy management is also very necessary. The practice suggests that no matter there is an organization or several organizations, no matter the organization is special or non-special, which does not affect the effect of energy management in government sector. But it is important that there must be an organization or several organizations to answer to government sector energy management. You can make the best decision to set up the organizational framework based on the economy’s actual conditions.

3) Start with the easiest targets

Make an evaluation to your economy and find out the predominance in energy conservation, then choice the easiest targets for government sector energy management to start the program. Such as Office equipment purchasing & power management, building lighting, street lights, operations & maintenance are appropriate areas to start the program.

4) Plan and implement government efficiency procurement project

Maybe government procurement for energy efficiency products is the most simple and

low-cost project among the existing project s, while it is the most useful and resentful project for almost all economies. With the government purchasing power, the government can act leverage to market transformation as well as stimulate the public conservation mind.

In order to push government agencies for energy efficiency products, mandatory or preferential purchasing policies are needed. To setting up the procurement specifications and listing the energy efficiency products for government purchasers are both good idea validated by the successful government sector energy management programs, and it is very important to link the purchasing policies to energy efficiency certification & labeling programs.

5) Make the best of information and training resources

The government should inform the government sector energy management to both government and public. Publications and network resources should be widely used. In addition to the information program, training program is also necessary.

6) Identify funding needs and sources

Once you make the decision to launch the government sector energy management program, you should find the fund dollars to make projects happen. Government grants or loans, retention of cost savings, and third-party financing are three broad categories of funding sources.

6.3 The Suggestion for Energy Management in Public Buildings

It is recognized by all that energy management in public building is very significant and important, but how to launch the energy management program in public buildings?

1) The first step: It is necessary to enact building codes for energy conservation to make it policy;

2) The second step: The energy efficiency of main building appliance and equipments (such as envelope of buildings, air-condition, lightings, lifting, and so on) should be high regarded.

3) The third step: Energy Audit is absolutely required to ensure the implementation of building codes. The government must have special organization to carry out energy audits, and manage the detailed information of energy conservation in all public buildings. In addition to these, useful advice to improve energy efficiency can be provided based on energy audits.

4) The forth step: In addition to the political measures above, information and education are also necessary measures to make the program easily. Publications,

website, training courses are all good choices.

5) The fifth step: To make a consideration of making a good use of ESCOs for financing. It is proved that in addition to the economic benefits realized by ESCO customers through energy and maintenance cost savings, new jobs have been created at the same time, not only within the ESCOs, but though the use of contractors and through the many firms involved directly and indirectly in supporting energy efficiency projects. Historically, the energy service industry is relatively young. Most of the US ESCOs place the industry's origins in the late 1970s and early 1980s when energy prices rose dramatically following the 1973 Arab oil embargo and the Iranian Revolution in 1979. These events created the opportunity to make a business out of reducing customers' growing energy costs. The future for ESCOs and for their customers is bright as there is an increasingly global need to implement energy efficiency projects on a widespread basis.

6) At last: if you can, you will consider the advanced measures, such as building certification & labeling, green lease, and others for your program. But the important point is the measures must be adopted according to the actual state of the economies.

6.4 The Suggestion for Government Procurement for Energy Efficiency Products

There are three existing channel for implementation of government efficiency: the first one is to push government procurement for efficient products directly; the second one is to push efficiency procurement as well as ecological procurement; the last one is to push efficiency procurement by green procurement. The practices show that they all work well in different economies.

No matter what you choose, one of the three channels or others, the suggestions will be helpful for you to start government procurement for energy efficiency products

1) It is necessary to enact laws & regulations to make government efficiency procurement policy

2) It is a good idea to develop an authority list of energy efficiency products to make the efficiency decisions easily

3) It is a good help for government efficiency procurement to launch the information program, such as product efficiency information or efficiency label.

4) To establish the system of Complaint Review Procedures for Government Procurement and Government Procurement Reporting Mechanism can work well to audit the implementation of government efficiency procurement.

5) Various popularizing measures should be well utilized, such as publications, website, trainings, and so on, to wide the effect of efficiency procurement

# Chapter 7: International Harmonization

## 7.1 Introduction

APEC economies represent a large share of global manufacturing capacity and demand for energy-using products. There are very large potential benefits from government procurement harmonization in energy efficiency appliances and office equipments. The main benefits include:

- Share effort, costs, & lessons learned
- Increased availability and reduced manufacture, purchase and running costs
- Aggregate buyer demand – create a large "virtual buyer" for efficient products
- Market certainty to manufacturers
- Competitive prices to government buyers
- Economies of scale (manufacturing & distribution)
- Entry market for new technologies & improved products

In the aggregate, government procurement harmonization will reach a result of overcome trade barriers for government market, reduction of consumption/sustainable consumption, as well as EE market transformation to benefit all consumers.

## 7.2 Procurement Criteria Comparison

Every economy has policies to promote the government procurement for energy efficiency products. But these procurement activities are shown in different ways. Some economies have straightforward policies. And in some economies such as Japan, government procurement for energy efficiency products is enclosed into the Green Purchasing.

In China, Implementation of Government Procurement for Energy efficiency Products was co-published by National Development and Reform Commission (NDRC) and Ministry Of Finance People's Republic of China (MOF) in 2004. This implementation suggestion put the energy efficiency products in preferable station in the government procurement. If the product has the similar quality and price, the high energy efficiency product has higher priority in procurement. Attached to the suggestion, an energy efficiency products list is published. This suggestion is implemented firstly in top central government and provincial level agencies and organizations in 2005. Then it spread to municipal and some other second-class central government organizations in 2006. Only CSC labeled products could be list in the government procurement products catalogue. In 2007, it spread to every government agencies all around the economy. It encourages the government agencies to implement the suggestion in advance. This implementation suggestion made a rapid progress to promote the government procurement for energy efficiency products. In August 2007, the Chinese State Council issued a directive of promoting government procurement for energy efficiency products, which made the government procurement for energy efficiency products be mandatory. This directive will promote the government procurement for

energy efficiency products strongly.

In Japan, the government procurement for energy efficiency products is embedded in the Green Purchasing framework. In 2001, the Law concerning the Promotion of Public Green Procurement (Green Procurement Law) came into force. As far as energy efficiency criteria are concerned, the Green Procurement Law incorporates the standards developed in the Top Runner Program. There are currently 12 product groups included in both the Top Runner Program and the Green Procurement Law.

In Korea, according to The Instruction of Public Procurement Service No. 1346, products with the 1st efficiency grade of Energy Efficiency Labels & Standards Program, all certificated High-efficiency Appliances Certification Program, and all registered Energy Saving Products, especially products with standby power below 1W of e-Standby Program should be procured as a top priority in government purchases. The purchasing for energy efficiency products is preferable.

Most of economies have offered an authority list of efficiency products for the government purchasers, such as China, Japan, Korea, and so on. The lists are all based on specific certifications or labeling programs, and so on. So, in some sense, the government procurement harmonization is to harmonize the criteria of the energy efficiency products. The table below has detailed the criteria of the energy efficiency products for the government procurement of China, Japan and Korea.

Table 7-1: Summary of government procurement criteria

| | China | Japan | Korea |
|---|---|---|---|
| The Criteria | - CSC Label | - Top Runner Standard | - e-Standby Label (for office equipments and home appliances)<br>- Energy Efficiency Label and Standard |

Up to now, Japan has requirements for 29 products, Korea requires energy efficiency government purchasing for 28 products, and China's government procurement policy, to be applied to cover 18 products. Products covered by energy efficiency testing & labeling in these 3 economies. 38 products are required for government purchasing in at least one economy, and 13 products are required in all the 3 economies. According to a product survey among APEC economics conducted by CSC, the lighting, office equipments and home appliances are the most common products purchased by the governments. So the harmonization of government procurement for energy efficiency products could consider these products firstly.

In this report, the initial analysis is focused on two products: Computer and TV-set.

7.2.1 Computer

Computers are required for government efficiency procurement and they are widely used in government sector in all the 3 economies. Every economy has specific requirements for Products Coverage, the Critical Technical Components and Values, Test Procedures, Operating Modes Tested, and Labeling process. The initial comparison for computer's procurement criteria is done among the 3 economies as below:

- Products Coverage

Chinese CSC label, Japanese and Korean e-Standby label of computer all have the same coverage including personal computers, laptop computers, workstations, network computer desktops and computer-based point-of-sale retail terminals. Almost all computers sold commercially or for household use in the market except servers are included.

- Test Conditions and Instruments

There is a little difference among the 3 economies: Both Japan and Korea do not have clear requirements for "Relative humidity" and "Atmospheric Pressure", while China does; And the requirements for "Ambient temperature", "Voltage of AC power supply" and "Frequency" are all different for each other among the 3 economies though they all regulated these when test. More information is showed in Table 7-3.

Table 7-2: Comparison of Test Condition and Instruments

| Items | China (CSC Label) | Japan ("Top Runner" Standard) | Korea (e-Standby Label) |
|---|---|---|---|
| Ambient temperature | (15-25)ºC | (16-32)ºC | (18-26) ºC |
| Relative humidity | 45%-75% | NA | NA |
| Atmospheric pressure | (86-106) kPa | NA | NA |
| Voltage of AC power supply | (220±5)V | (100±10)V | (220±5)V |
| Frequency | (50±0.5)Hz | The rated frequency | (60±3)Hz |

- Standby Modes Tested

Generally the same 2 modes (off mode and sleep mode) are tested required by the three criteria and the test methods are almost the same. The criteria of China and Korea have the test processes for testing power consumption in off mode, testing power consumption in sleep mode, and testing the default time from on mode to sleep mode. Japanese criteria do not have the requirement to measure the default time to sleep mode for lack of the component in Top Runner Standard. So China and Korea

are more consistent while Japan differs, and a common test method or test criterion is foremost needed for the procurement harmonization.

- Critical Technical Components and Values

Both China and Korea has the same key technical components, that are “Power consumption in off mode”, “Power consumption in sleep mode”, and “Default Time to Sleep Mode”. Japan has the only one component that is “Standard Energy Consumption Efficiency”. It seems the criterion of Japan is absolutely different from the criteria of China and Korea, but in fact, the technical component of “Standard Energy Consumption Efficiency” established taking power consumption of both off mode and sleep mode into consideration. So there is much common ground on the critical technical components among the 3 economies.

The values of the technical components differ somewhat between China and Korea, as below. It seems the Korean criterion has more specific requirements than Chinese criterion. Japanese Top Runner Standard also has absolutely different requirements for the technical component of “Standard Energy Consumption Efficiency”. So how to harmonize the values of the technical components will be the first gap for criteria harmonization.

Table 7-3: Comparison of technical components and values between China and Korea

| Items | China<br>(CSC Label) | Korea<br>(e-Standby Label) |
|---|---|---|
| Power consumption in off mode | ≤3W | ≤20W(Laptop Personal Computers)<br>≤3W(Desk top Personal Computers)<br>≤5W(Integrated Computer System) |
| Power consumption in sleep mode | ≤10W | ≤10W (Laptop Personal Computers & nameplate output power of power supply≤400W)<br>≤10% of nameplate output power (Laptop Personal Computers & nameplate output power of power supply>400W)<br>≤10W (Desk top Personal Computers & nameplate output power of power supply≤400W)<br>≤10% of nameplate output power (Desk top Personal Computers & nameplate output power of power supply>400W)<br>≤15W(Integrated Computer System) |
| Default Time to Sleep Mode | ≤30min | ≤30min |

- Labeling process

The Labeling process is similar among the 3 economies. China & Korea add factory inspection and random testing after computers are certified.

7.2.2 TV-set

- Products Coverage

Chinese CSC label, Japanese and Korean e-Standby label of TV-set all have the same coverage. The TV-sets including those having a cathode-ray tube (CRT), liquid crystal display (LCD), plasma display, or other display device and designed to receive and display a television signal broadcast by antenna, satellite, or cable.

- Test Conditions and Instruments

There is a little difference among the 3 economies, showed as Table 7-5: Both Japan and Korea do not have clear requirement for "Relative humidity" and "Atmospheric Pressure", while China do; And the requirements for "Ambient temperature", "Voltage of AC power supply" and "Frequency" are all different for each other among the 3 economies though they all regulated these when test.

Table 7-4: Comparison of Test Conditions and Instruments

| Items | China (CSC Label) | Japan ("Top Runner" Standard) | Korea (e-Standby Label) |
|---|---|---|---|
| Ambient temperature | 22±4ºC | (16-32)ºC | (18-26) ºC |
| Relative humidity | 45%-75% | NA | NA |
| Atmospheric pressure | (86-106) kPa | NA | NA |
| Voltage of AC power supply | (220±10)Vrms | (100±5)Vrms<br>(200±10)Vrms | (220±5)V |
| Frequency | (50±3)Hz | (50±3)Hz<br>(60±3)Hz | (60±3)Hz |

- Standby Mode Tested

The Chinese test method of TV-set is similar with Korea's, while is much different to Japan. The Japanese test method include the measures of power consumption in standby mode, operational power consumption, and reduced power consumption by energy-saving function, then to calculate the Standard energy consumption efficiency based on a formula.

- Critical Technical Components and Values

All the 3 economies paid attention to the power consumption in standby mode. But with a general speaking, China is consistent with Korea, while Japan differs. Both China and Korea has the same key technical component, which is "Power

consumption in standby mode", while the value of it seems to be slightly different, showed in Table 7-4. In fact, the value of *the Power consumption in standby mode* in Korea's criteria will take effect up to FY 2007; the actual value is just 3W, the same as Chinese.

The criterion of Japan also has only a technical component as "Standard Energy Consumption Efficiency", which is established taking both operational power consumption and standby power consumption into consideration. So the value of it is incontrovertible different from the above two.

Table 7-5: Comparison of technical component and values

| Items | China (CSC Label) | Japan ("Top Runner" Standard) | Korea (e-Standby Label) |
|---|---|---|---|
| Power consumption in standby mode | ≤3W | Required as "Standard energy consumption efficiency" | ≤1.0W |

- Labeling process

The Labeling process is similar among the 3 economies. China & Korea add factory inspection and random testing after TV-set are certified.

## 7.3 International Harmonization Roadmap

Based on the comparative analysis, differences in computer & TV-set government procurement criteria among the 3 economies are modest, so it will be a good start toward harmonizing government procurement in the near future. Government procurement criteria harmonization can be performed in the three areas step by step:

- Test procedure harmonization
- Energy efficiency criteria harmonization
- Labeling Process harmonization

1) Test procedure harmonization

To harmonize test procedure is the first step to get to harmonize government procurement internationally. It needs to consult with stakeholders, mainly with manufacturers, industries, and test labs. A suit of common test procedure, which includes the same testing condition, testing instruments and testing methods, should be developed. There are a lot of international standards defining test procedures for some products developed by some organizations like the IEC and ISO. When developing a harmonized test procedure for government procurement, to adopt these international standards is very helpful.

2) Energy efficiency criteria harmonization

Start technical reviews for the energy efficiency criteria, and consult with stakeholders

for Consensus Building. The conceivable stakeholders include the national standardization committee, government department, industries, experts, manufacturers, suppliers, and other interest groups. The main targets of these activities include:

- To harmonize the product coverage: The harmonized criteria should adapt the same products. The existing energy efficiency criteria of the three economies adapt the same computers and TV-sets, so it is a good start for harmonization, and no work is needed if none new types are added.
- To harmonize the critical technical components & values: The harmonized criteria should adopt the same harmonize the critical technical components & values. There are many bases for the harmonization of computer & TV-set criteria among the three economies. As the comparative analysis above, China and Korea have almost the same critical technical components & values, while Japan a little differ.

3) Labeling process harmonization

Once test procedure and Energy efficiency criteria are got harmonized, we can think about to harmonize labeling process because these 3 elements consist of a whole harmonized labeling program. Most of government procurement schemes take energy efficiency labeling programs as reference, like China, Japan and Korea's government procurement scheme are based on their energy efficiency labeling programs. Most economics have their own labeling programs. Some regional energy efficiency labeling program likes the Efficient Light Initiative (ELI) has making some progress in the harmonization of labeling program. The Energy Star labeling program also spread widely in the last several years. It has provided a possible framework for continued collaboration.

# Chapter 8: International collaboration

## 8.1 Introduction

The objective of the comparative analysis is to identify the opportunities for future international collaboration and analyze the potential benefits. It is suggested in this report that the future promising international collaboration should include following activities: collaborated procurement, collaboration in public building energy management, international leadership and information sharing & collaboration.

## 8.2 Collaborated procurement

There exists a good example of collaborated procurement in the US, federal agencies are finding that they can save 10%-50% each time they specify and buy an energy efficiency product in the course of normal daily operations. It is estimated that this adds up to a savings potential of more than US$ 1 billion/year, if the federal criteria for energy efficiency purchasing are adopted by all public agencies (including state and local governments, schools, hospitals, and universities). The corresponding reduction in greenhouse gas emissions would be equivalent to about 4 million tons of carbon/year. Therefore, it is important to build procurement criteria for members of APEC economies.

The collaboration of procurement should include the harmonization of procurement criteria and policy.

- ✧ Hharmonization of procurement criteria;
  1) Test procedure harmonization
  2) Energy efficiency criteria harmonization
  3) Labeling Process harmonization

- ✧ Harmonization of procurement policy;
  1) Target and motivation
  2) SWOT (Strength, Weakness, Opportunity, Threats) analysis
  3) Initiation, including who, how start the program based on what law or rule.

The collaborated procurement can select an integrated mode among three main existing modes for the government to push energy efficiency procurement: 1. Push energy efficiency procurement directly; 2. Advocate efficiency procurement as well as ecological procurement; 3. Push efficiency procurement by green procurement.

The collaborated government procurement include following activities:

- ✧ Enact government international procurement policy, including mandatory and preferential policy;
- ✧ Adopt international procurement criteria, APEC member economies can adopt some regional energy efficiency labeling programs, such as the Efficient Light Initiative (ELI) labeling program, and widely used labeling programs, such as the Energy Star labeling program.
- ✧ Push efficiency procurement by green procurement, including establish green purchasing network, establish the system of review procedures and establish the **international trading system** for government procurement.

8.3 Collaboration in public building energy management

As mentioned in previous section, the motivation of energy management collaboration in public building is to tap the enormous energy saving potential, promote energy efficiency as a whole and lead by an example. Government sector energy management in public buildings works effectively to enhance the public energy efficiency sense, advance the energy efficiency activities, and reach energy consumption reduction in all buildings.

For existing public building, the cooperation in energy efficiency (EE) should be focused on following fields: Building system commissioning, metering/monitoring, benchmarking, facility manager training & certification, incentives and recognition, employee education and energy management system. To date, an international standard on energy management system is under discussion, and may be developed in near future. APEC economies should follow up its progress and take it as the common

criteria to energy saving in government sector.

For new public building, firstly, the collaborated economies should establish and track common efficiency goals, e.g., for new government buildings, they are required to be 30% more energy efficiency than the code requirements for all other buildings. The LEED Green Building Criteria is a good example for collaborated economies. Secondly, the building design should consider sustainable design, design assistance, life-cycle analysis. Thirdly, the common standards and codes, including mandatory minimum standards and the voluntary standards should be established. Finally, in order to measure, improve and label the energy efficiency performance of buildings, economies should launch efficient building certification. Building certification highlights energy efficiency and favorable energy management, which made efficiency building appreciable and greatly enhanced energy management in buildings too.

Lack of energy efficiency policies is the main obstacle for scaling up EE building in developing economies. This barrier is identified by most experts during the project investigation phase as the main reason why EE Building is not common in the studies economies. Governments, especially in developing economies, often have limited capacity in designing and implementing EE policies and programs. Designing and implementing effective policies requires resources and that have generally been undersupplied, even in more developed economies. Therefore international standards remain voluntary can be share between developed and developing economies.

For international cooperation of EE building, quantitative management tools and indicators for energy performance have not become part of management norms and business culture. In practice, CDM (Clean Development Mechanism) projects employing good energy management practices have help to change corporate culture toward energy uses. For example, ITC Sonar project utilizes several management measures to establish EE as a corporate culture. For example, real- time display and daily reminder of energy consumption data (using per square meter energy consumption as an indicator) with comparison information with other ITC hotels have become goal, reassurance of performance, and competition in the daily routine among entire hotel staff. Translation of staff's energy saving efforts into management norms, such as incorporating energy saving credits into performance evaluation that links to salary, and CER (certified emission reduction) benefit sharing with the energy management team, has created a proactive and healthy energy saving culture in the business. In addition, CDM as a financing mechanism could reduce the barrier of high initial investment costs. Therefore, it is suggested that the international collaborated economies should coordinate to build CDM capacity for developing CDM project in public building.

8.4 International Leadership

- Necessity

As mentioned in previous section, in every economy, government sector buying power and active, visible leadership offer a powerful non-regulatory means to stimulate demand for energy efficiency products and services. With the globalization of economy, it is feasible and realizable to build international market between bi-lateral and multi-lateral government. International leadership also becomes more and more important. The joint government sectors of bi-lateral and multi-lateral have larger buying power and strong leadership. The international leadership can also influence the domestic market in each member of collaboration.
There are important opportunities for international leadership to improve energy efficiency in government facilities, operations, and public infrastructure and services. Its benefits include lower government energy bills, reduced greenhouse gas emissions, less demand on electric utility systems, and reduced dependence on imported oil.

Equally important, by establishing a reliable international entry market for more efficient products and services, government can encourage individual domestic suppliers to introduce more energy efficiency products at competitive prices. In other words, the individual government's own energy efficiency initiatives can leverage other actions by both buyers and suppliers throughout the economy – as well as helping public agencies themselves save money and energy, and avoid pollution.

- Collaboration mode

1. Bi-lateral collaboration;

The leadership is established between two economies. This bi-lateral relationship of government sectors is easy to maintain in general. The leadership will take effect on those enterprises and organizations set in both economies.
There are two situations of this collaboration. One kind of collaboration is that the situation of the two economies is similar in the resource and developing degree, therefore, method can be used as reference each other. Another kind of collaboration is established between a developing economy and a developed economy. The developed economy can help the developing economy according to their experience.

2. Regional collaboration

The trading relationship among neighbouring economies is stronger than other economies in general. It lays a basis for establish regional collaboration. The cost of the trading and investment in neighbouring economies is lower than in different continents. The carriage cost is related to the distance obviously. However, it is no the unique cost even the main cost. Other factors are also important, e.g., culture difference can influence confidence and communication. Therefore, the economies

in same region would like to collaboration other than outer collaboration. The governments should reduce the trading cost to encourage the further collaboration in same region.

3. Multi-lateral collaboration;

Multi-lateral relationship is established among multiple economies based on MOU in general. Compare with bi-lateral leadership, it is hard to establish a multi-lateral but with the effect is stronger. The leadership can take effect on those multi-national large organizations. The collaboration mode includes policy specialization and regular communication.

## 8.5 Information sharing and collaboration

In order to achieve energy conservation target, there should be an information sharing platform for each member of APEC economies. Each member can share the experience, propose new suggestion and methodologies.

✧ International research institute establish

An international research institute should be established so that the international project and collaboration can be developed by joint research base.
Each government in collaboration should support the research institute to advocate international science plan and engineering plan. The research institute should coordinate and support the international cooperation of science and engineering plan. The research institute should enhance the contact among international governments and organizations and sponsor series of high level practical international conference in order to utilize the advanced international technology.

✧ International management system

There should be an energy management system among each member of APEC economies. Based on this management system, each economy should share and collaborate on following aspects: Energy saving target setting; Energy saving methodology adopting; Energy saving support system establishing; energy conservation effect comparison among economies.

✧ Best practice methodologies development

Energy efficiency methodologies should be developed for international collaboration. There exist many methodologies in energy related field. But few can be applied into international government collaboration directly. Therefore, the research work on new or existed methodologies should be developed for demonstrating the leadership of international collaboration. The research will improve the quality of international project, reduce the development lifetime and increase the efficiency.

**Appendix 1: Information resource list**

Appendix 1-1: A List of Surveyed Organizations and Website

| Economy | Organization | Website |
|---|---|---|
| The United States | Federal Energy Management Program (FEMP) | http://www.eere.energy.gov/ |
| | State Energy Office (SEO) | http://www.eere.energy.gov/state_energy_program/ http://www.naseo.org/sep/default.htm |
| | National Association of State Energy Officials (NASEO) | http://www.naseo.org/ |
| China | National Development and Reform Commission (NDRC) | http://hzs.ndrc.gov.cn/ |
| Japan | The Ministry of Economy, Trade and Industry (METI) | http://www.meti.go.jp/ |
| | The National resources and Energy agency(ANRE) | http://www.enecho.meti.go.jp/ |
| | The Government Buildings Department of the Ministry of Land, Infrastructure and Transport (MLIT) | http://www.mlit.go.jp/ |
| Australia | The Australian Greenhouse Office | http://www.greenhouse.gov.au/ |
| | The Australian Building Codes Board (ABCB) | http://www.abcb.gov.au/ |
| | The Australian Procurement and Construction Council (APCC) | http://www.apcc.gov.au/ |
| Korea | Korea Energy Management Corporation (KEMCO) | http://www.kemco.or.kr/ |
| | Ministry of Commerce, Industry and Energy (MOCIE) | http://english.mocie.go.kr/ |
| Hong Kong, China | Energy Efficiency Office, Electrical and Mechanical Services Department (EMSD) | http://www.emsd.gov.hk |

Appendix 1-2: A List of Management Organizations

| Economy | Administration Section | Executive Department | Responsibility for Government Sector Energy Management |
|---|---|---|---|
| The United States | Department of Energy (DOE) | Federal Energy Management Program (FEMP) | Energy management in government sector all over the economy |
| | | State Energy Offices (SEO) | Planning and implementing state level energy efficiency programs |
| China | National Development and Reform Commission (NDRC) | Department of Resources and Environment Protection | Energy management in government sector all over the economy |
| Japan | The Ministry of Economy, Trade and Industry (METI) | The National Resources and Energy agency (ANRE) | Energy conservation management and implementing energy conservation policies |
| | The Ministry of Land, Infrastructure and Transport(MLIT) | The Government Buildings Department | Promoting energy conservation policies of government infrastructure |
| Australia | Department of the Environment and Heritage (DEH) | The Australian Green -house Office (AGO) | Encouragement of resource efficiency and greenhouse gas abatement throughout government agencies at all levels |
| | Department of Industry, Tourism& Resources (DITR) | The Australian Building Codes Board (ABCB) | To develop the Building Code of Australia (BCA) and to promote building industry regulatory reform |
| | The Australian Procurement and Construction Ministerial Council (APCMC) | The Australian Procurement and Construction Council (APCC) | To manage the government procurement for energy efficiency constructions and facilities |

| | | | |
|---|---|---|---|
| Korea | Ministry of Trade, Industry and Energy (MOTIE) | Korea Energy Management Corporation (KEMCO) | Implementation of the energy efficiency and conservation programs, and makes effort to provide service |
| Hong Kong, China | Electrical & Mechanical Services Department (EMSD) | the Energy Efficiency Office(EEO) | Development, implementation and promotion of programs to improve energy efficiency and to conserve energy, to encourage the wider adoption of renewable energy, as well as the monitoring of the technical performance of the electricity supply companies. |

Appendix 1-3: A List of Laws and Regulations

| | Economy | Year | Title of Law or Regulation | Focus |
|---|---|---|---|---|
| 1 | The United States | 1978 | The National Energy Conservation Policy Act | Energy conservation |
| 2 | | 1992 | The Energy Policy Act | Comprehensive regulatory framework on promotion of energy efficiency |
| 3 | | 1994 | The President Executive Order 12902 — Energy Efficiency and Water Conservation at Federal Facilities | Comprehensive regulatory frame -work on promotion of energy efficiency and water conservation |
| 4 | | 1999 | The President Executive Order 13123—Green the Government Through Efficient Energy Management | The goals, organization and accountability, management, technical assistance |
| 5 | | 2001 | Executive Order 13221 | Requires federal agencies to buy products with 1-watt or other low levels of standby as determined by USDOE/FEMP. |
| 6 | | 2002 | The Energy Conservation Performance Standard | Energy conservation in new federal commercial and multifamily high-rise buildings |
| 7 | | 2002 | The Federal Energy Management and Planning Programs | Energy conservation in retrofits of existing federal buildings |
| 8 | | 2005 | The Energy Policy Act | promotion of energy efficiency |
| 9 | | 2005 | Circular of the Office of Management and Budget | Encourages federal agencies to incorporate ENERGY STAR |
| 10 | China | 1997 | Energy Conservation Law | providing an important mandate for energy-efficiency activities |
| 11 | | 2002 | Government Procurement | procedures to purchases |

| | | | | |
|---|---|---|---|---|
| | | | Law | by various levels of public body |
| 12 | | 2004 | China Medium and Long Term Energy Conservation Plan | Energy conservation implementing plan |
| 13 | | 2004 | Implementation of Government Energy Efficiency Procurement | Establishing energy efficiency purchasing practices at all levels of government in China |
| 14 | | 2005 | Design Standards for Energy efficient of Public Construction (DSEEPC) | New standards, including design, materials, heating and air conditioning and ventilation. |
| 15 | | 2005 | Regulation on Energy-Efficiency Labeling Administration | A list of products used for energy efficiency labeling management |
| 16 | | 2006 | Notice of the Strengthening of Resource Conservation in Governmental Agencies | A target of 20% reduction of energy consumption (from 2005 to 2010) in governmental agencies |
| 17 | Japan | 1979 | Energy Conservation Law | Energy conservation |
| 18 | | 1993 | Law for Energy Conservation and Recycling Support | Promote the rationalization of the use of energy and natural resources |
| 19 | | 1995 | Action Plan for Greening of Government Operations | Achieve a greening of public procurement |
| 20 | | 1996 | The Green Purchasing Network | Promote green purchasing |
| 21 | | 2000 | Law on Promoting Green Purchasing | Promote the procurement of such goods at the offices of the government and other public entities |
| 22 | | 2000 | Top Runner program | Set high standard targets for products promoting green purchasing |
| 23 | | 2004 | Basic Policy on Promoting Green Purchasing | Set selection criteria including energy efficiency |
| 24 | | 2005 | Standards for the | Promote the Government |

| | | | | |
|---|---|---|---|---|
| | | | Environmental Preservation Performance of Government Building facilities | Buildings Green Program |
| 25 | Australia | 1990 | the Renewable Energy Authority Act | Provide energy efficiency |
| 26 | | 1990 | the waste management law | Promote the federal government to procure solely products causing little impact on the environment and waste |
| 27 | | 1990 | the Building Code of Australia | Minimize energy requirements of new buildings and major refurbishment including houses, residential buildings, office, retail, car parks, etc |
| 28 | | 1993 | the procurement law | Provide the energy efficiency and induce the GHG emission |
| 29 | | 1994 | National House Energy Rating Scheme | Improve the energy efficiency of the residential , commercial and public sector |
| 30 | | 1995 | the Sustainable Energy Development Act | Provide energy efficiency |
| 31 | | 1997 | Commonwealth Procurement Guidelines | Provide the means to efficiently and effectively deliver the Government's programs |
| 32 | | 2003 | Set Energy Intensity Targets | Normalized energy consumption |
| 33 | | 2006 | the new Building Code of Australia | Made detailed submissions concerning 5 Star energy efficiency regulations |
| 34 | Korea | 1979 | Rational Energy Utilization Act | Promotion of energy conservation and energy efficiency |
| 35 | | 1980 | Enforcement Ordinance for the Rational Energy Utilization Act | Prescribe matters entrusted by the Rational Energy Utilization Act |

| | | | | |
|---|---|---|---|---|
| | | | | and matters necessary for the enforcement thereof |
| 36 | | 1999 | Enforcement Regulation for the Rational Energy Utilization Act | prescribe the matters entrusted by the Rational Energy Utilization Act and the Enforcement Ordinance for the Act and necessary matters with regard to the enforcement thereof |
| 37 | | 2002 | Rational Energy Utilization Act | The recent amendment of 1979 Act, to increase rational and efficient use of energy, and reduce environmental damages |
| 38 | | 2002 | Enforcement Ordinance for the Rational Energy Utilization Act | The recent amendment of 1980 Act |
| 39 | | 2003 | Propulsion guide of Government Agency energy saving | Mandate all of the Government Agency to use the high efficiency equipments & supplies compulsorily |
| 40 | | 2003 | Purchase & operation standard of the energy-consuming product | Give priority to the high efficiency products for purchaser |
| 41 | | 2005 | Prime Ministers' Instruction 2005-5 | Mandate all of the Government building to energy efficiency buildings and preferential purchase for Energy efficiency appliances |
| 42 | Hong Kong, China | 1998 | Building Energy Codes | Code of Practice for Energy Efficiency of Lighting Installations, of Air Conditioning Installations, of Electrical Installations and of Lift and Escalator Installations |
| 43 | | 2003 | Prescriptive Codes for Building Energy Codes (Revised) | |
| 44 | | 2003 | Performance-based Building Energy Code | A building's total energy consumption |

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