Energy Management in the Government Sector –An International Review

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1998

Abstract

The paper reviews existing energy management programs for the government buildings and facilities sector based on a new survey covering 25 countries in Europe, North America, Latin America, and Asia. Governments are often the single largest users of electricity in a country, and the energy savings potential in the government building sector is significant. Government in-house energy management programs can provide an important and highly visible example to other energy users, and by directing its purchasing power governments can become important agents for market transformation.

Of the countries studied, some have very sophisticated in-house energy management programs, but as a rule, comprehensive programs are rare. The paper identifies a host of possible strategies for such programs. These are voluntary or mandatory approaches including: policies for purchasing or leasing of energy-efficient equipment, technology procurement, informational programs, standards, training, energy audits, demonstration projects, common performance or savings targets, and various financing methods. The paper outlines a few key strategies for governments that wish to introduce comprehensive in-house energy management programs: government purchasing, guidelines and recommendations, information and training, and finally, life-cycle cost analyses in combination with budget allocations that need no or little additional funding.

The processes and motives leading to--or not leading to--the creation of comprehensive energy management programs in the government sector are not well understood, and further research should help explain these processes. Suggested areas for further research are the effectiveness of various comprehensive strategies, and energy management activities in the government sector other than buildings.

1. Introduction

Government-related facilities are often the largest energy users in a country and the single most important customers for energy-using products and services. Their energy savings potential is significant due to a relatively old building stock and--compared with private industry--a longer financial horizon for efficiency investments and typically lower requirements for return on investment. The purpose of this paper is to review existing government ”in-house” energy management programs in industrialized and developing countries, based on a new survey conducted by the authors. The main focus is on government buildings and facilities, as distinct from

transportation or industrial types of energy end uses.

We make no attempt at comparing the cost-effectiveness of different national programs and activities, and the scope of this paper does not allow us to present evidence for each country that in-house government energy management would be more cost-effective than, for instance, a laissez-faire approach or decentralized activities. However, mainly based on the US Federal Energy Management Program (FEMP) described in the country-by-country appendix, as well as on general knowledge about the institutional barriers for energy efficiency, it is safe to assume that government in-house energy management is worth pursuing. Improving energy efficiency in government facilities through targeted programs is important because of the scale of the savings potential, unique barriers to involvement by private-sector entities such as Energy Service Companies (ESCOs), and the ability of government programs to provide an important and highly visible example to other energy users. Governments are major purchasers of energy-using equipment, and can thus be a key agent of market transformation if they direct this purchasing power towards efficient products. Moreover, if the purchasing of single agencies and institutions are coordinated, the effect will be greater than if individual agencies act on their own, even if the aggregated volumes would be the same in both cases.

Existing strategies for government-sector energy management differ among countries: some focus on a limited set of actions while others take a comprehensive approach that may include development of software, training programs, demonstration projects, energy audits, savings targets, standards, financing, and innovative procurement strategies. Some programs are "centralized," in that they support energy efficiency across all branches of government, while others are located within one or more agencies. Governments can also implement energy efficiency policies indirectly through publicly-owned companies. These can be housing companies, property management companies, electric utilities, government-owned industries etc. Among the recent trends are innovative efforts to attract private sector financing for energy efficiency investments in government facilities.

2. Methodology

2.1 Countries Surveyed

We designed a survey to help us determine the nature of government in-house energy management activities in various countries located throughout Europe, North America, Asia and Oceania, and Latin America. We received responses from 25 countries (including Hong Kong, although not a country) as listed below:

- **Europe** (Denmark, Czech Republic, Ireland, France, Germany, Netherlands, Sweden, Switzerland)
- **North America** (Canada, United States)
- **Asia and Oceania** (China, Hong Kong, India, Indonesia, Japan, Korea, New Zealand, Philippines, Thailand)
- **Latin America** (Argentina, Brazil, Colombia, Costa Rica, Mexico, Peru)

The survey was distributed to knowledgeable people in the government sectors of the countries, research institutes, non-governmental organizations, and other groups. As only 25 countries responded, the results do not provide a comprehensive global overview. However, we believe that we have covered most of the very active nations.

2.2 Definitions and Scope of Project

This report is limited to accounts of in-house energy management in government buildings and facilities. A strict definition of government in-house energy management was difficult to develop. Taking as a starting point the most extensive program in existence--the US Federal Energy Management Program (FEMP)--we asked if similar programs could not be found elsewhere. However, the fact that public administration and/or programs in various nations are organized differently posed a problem. We chose to define in-house energy management in the government sector broadly, to include government-owned companies, such as housing companies. Electric utilities owned by the government were included only to the extent that these utilities were running programs directed towards the government sector. Although analogous programs are conducted at the state or provincial effort, here we focus strictly on national-level efforts.

3. Energy Efficiency Strategies for the Government Sector

We have found an array of existing approaches for governments to reduce energy use in their own buildings and other facilities (such as public lighting or water-supply systems) including:

- Common performance or savings targets (or for each agency) expressed in terms of normalized energy use or costs combined with baseline measurement and data monitoring to allow for comparisons among agencies and between the government sector and the rest of the economy.
- Voluntary programs like the US Green Lights Program. (The Green Lights Program is open for private and public organizations.)
- Policies that require (or encourage) the purchase or leasing of off-the shelf energy-efficient equipment.
- Technology procurement activities to improve the range of available products on the market.
- Informational programs (including efficiency guidelines for government contractors, and product energy labeling).
- Adoption of efficiency standards for new buildings or equipment.
- Training.
- Energy audits (including the development of specialized software tools).
- Demonstration projects.
- Financing for energy-efficiency projects: either direct funding from current-year budgets or from special ad-hoc allocations; capital financing (bond issues); transfer of funds from operations and maintenance budgets to efficiency investments; revolving funds, where saved funds are reinvested in new efficiency projects; utility incentive payments; or third-party financing through shared energy savings.
- Utility-sponsored programs aimed at public sector customers.

Some of these instruments will be discussed more in the final section of the paper.

4. Findings

4.1 Growing Awareness of Opportunities

Although somewhat paradoxical, there is on the one hand a considerable amount of exciting government in-house energy management work underway in various countries, yet little of the full opportunity has been captured to date.

In some countries we found no noticeable activities at all. This was surprising since the opportunities seem so substantial. In most of the countries studied, there appears to be a growing awareness of the opportunities, since a number of agencies and initiatives are present. However, very few countries have concerted efforts like the US program. (Individual programs are described in the summary table and in the Appendix.) Fig 1 below is an attempt at graphically describing how the different national program relate to each other.

4.2 The Leading Nations: An Active/Coordinated Government Role

In very few countries, in-house energy management activities are the result of government or parliament decisions specifically aimed at a systematic effort to make their governments a leader in energy efficiency. In North America, both *United States* and *Canada* are pursuing a very active policy in this vein. Canada has its Federal Building Initiative and the US has its Federal Energy Management Program (FEMP), and US Presidents Bush and Clinton have issued ”Executive Orders” calling for government energy management activities. One of the primary virtues of these programs is their role as coordinators. FEMP, for instance, helps other agencies identify and systematically pursue energy-efficiency opportunities and is responsible for supporting all agencies with information and education, energy audits, and data monitoring that allows performance comparisons. By centrally coordinating the efforts, the work of each agency or ministry is made visible since it is viewed as part of a larger initiative. In the *Netherlands*, the same role was given jointly to NOVEM and the Government Building Agency, based on the need for a very high government profile following the Dutch Parliament's decision to launch a very ambitious national environmental plan, primarily driven by the concern for global climate change. The government sector part of the *Swiss* E2000 program also appears to be driven by very much the same logic as the programs in the Netherlands and North America. A national environment and efficiency initiative was launched, and the need for the government to act as a leader was recognized. *Denmark* also belong to this group of very active countries, with specific funds, legislation, programs and savings targets for the government sector. The Danish government follow the developments in its own sector closely and publishes a yearly report. The Danish National Energy Agency is reponsbile for coordinating the program, and is continuously producing key figures, to use as benchmarks for the various government institutions. These key figures will also be used to formulate new savings targets and re-formulate existing ones.

4.4 Making Berlin a Showcase

Although *Germany* seems to be lacking a large-scale program for the whole federal sector, the grand showcase efforts involved in moving its capital are worth mentioning. The parliament, the government's offices, and most of the ministries and government agencies have just begun to move from Bonn to Berlin in a process that will last for a about a decade. Germany has decided to show that environmental concern and energy efficiency are a top priority.

4.5 Active Countries – Very Strong Efficiency Activities But the Opportunity of Coordinated Programs Has Yet to Be Captured

If Canada, Netherlands, Switzerland, and US represent countries where the importance of the government sector is recognized and made visible by specific and systematic efforts, *Sweden* represents a case where the foundation is laid and some sort of central program could rather easily be started. Sweden has some very active agencies, but since these activities are not part of a central program a lot of potential impact appears to be lost. Such a central program would not need to provide funding or even technical assistance--this is largely available through the existing national energy efficiency program. But by assisting with data monitoring and common performance targets, and by systematically combining the otherwise fragmented purchasing power of the public sector, the value of each individual agency's effort would likely be enhanced. Moreover, the government as a whole could act as a leader, which is not possible today since the visibility of each agency's effort is so low.

We also place *Japan* and *Mexico* in the group of active countries that have yet to capture the opportunities. In the case of Japan, our survey has not revealed how much of the Japanese efforts are part of a comprehensive in-house government energy management program, which *may* be the case. Mexico is also a good example of a country with an outspoken "government as a leader" policy. The country is pursuing codes and standards. Mexico's 100 Buildings pilot program also appears very promising, since it takes a comprehensive approach that includes audits and diagnostics, monitoring, training, and efficient purchasing policies. However, a systematic government energy management program is still not in place.

4.6 Central programs exist, but with a lower level of sophistication

Hong Kong is an example of a country where a foundation is laid and the opportunity for a central program seems to be existing.. *Ireland* is also in a similar position with a high-profile national efficiency program but with no specific government leadership role and a lower level of sophistication than for instance, Sweden and Japan. *New Zealand* has a program aimed at reducing energy use in the government sector, but has only recently (1993) decided to use the program as a model for the rest of the economy. New Zealand's program is moving from mandatory implementation methods to voluntary methods. *France* is a country where the government sector is targeted with a special program, and where there is a Prime Minister Directive calling for efficiency programs in the government sector. However, the government leadership role doesn't seem to be as outspoken as in the above programs..

Indonesia has set a savings target for the government sector and started a program for reaching it, but the program is still in the very early stages of implementation.

Korea is a country where the rapid growth in energy use has made the government recognize its potential role as a leader. However, the program is still vague in its focus.

4.7 Low Level of Sophistication But Increasingly Active Countries

In many of the economies in transition, the opportunities for centralized actions seem to be great. Although these economies are moving rapidly towards a deregulated market economy, many governments have chosen to keep energy and water utilities in the government's control. The *Czech Republic* has an active efficiency policy, but has yet to ask its government sector to act as a leader.

Many of the newly industrialized nations in Asia also have a tradition of strong central government involvement. Relying on this tradition, it appears as if there would be a great opportunity for central government programs. In *Thailand,* various demand-side management programs are now about to be followed by a program for the government sector. *China* has been active in its own industrial sector, but the liberalized economy seem to have caused many of these programs to slow down, or even halt.

Some developing countries also show very promising activities. In *Brazil,* central actions seem to be evolving out of various DSM programs. The *Philippines* is another country where the importance of the government sector is recognized, and where an embryonic program is taking shape. However, the funding level is still relatively low and the situation is similar in Brazil.

4.8 Countries Starting From a Low Level

Argentina, Colombia, Costa Rica, India, and *Peru* are all running energy management programs. However, they start from a low level and comprehensive energy management programs in the government sector are not at all present.

Activity vs. comperehensiveness of studied countries

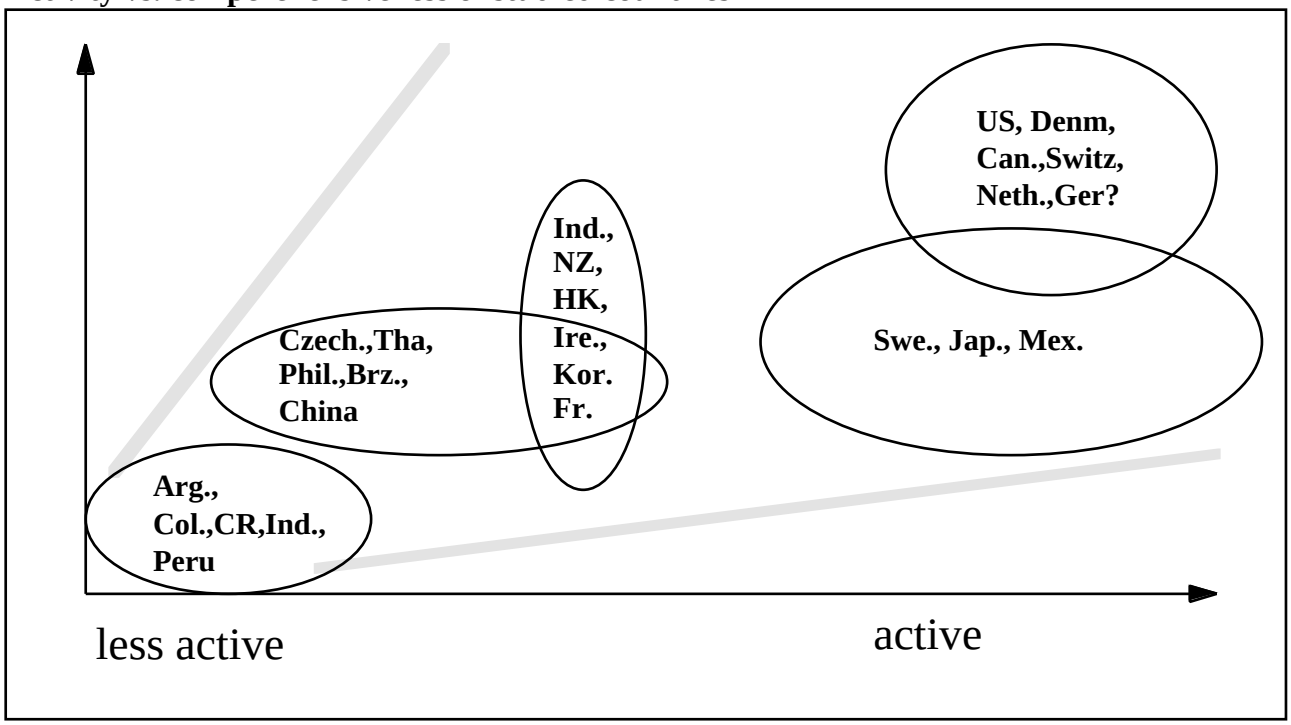

Fig 1. An attempt at graphically make a difference between the comprehensiveness of a national programs and the activity. In some cases, very active nations may have programs that are less comprehensive than those we have identified as more active.

5. Why Do Some Countries Have Active Programs and Others Do Not?

Although it seems natural for governments to start pursuing efficiency in their own premises, the opposite often seems to be the case. One possible explanation is that even if the planning horizons are long and opportunities are great, governments are constantly faced with the lack of funds. It is then often easier to ask--or require--the private and industry sector to implement efficiency. China seems to be a good example of this, investing several billion dollars on industrial efficiency in the last decade. One exception to this tendency to ask the private sector to undertake efficiency investment seems to be efficient public lighting programs in many Latin American countries. In street lighting the payback period is generally so short that retrofit programs have come without a large-scale effort. These street lighting programs could serve as a good model for extending the activities to other sectors.

For some countries where activities have started rather recently, it seems that where efficiency activities in--or aimed at--the private sector have reached a ”critical mass”--i.e., where there is a good energy management infrastructure serving the private sector--as well as competent buyers!-- it could be transferred to the government sector. This seem to be especially true where energy demand is constantly outpacing supply. This combination of ”critical mass” and quickly growing energy demand is found, for instance, in Thailand, where we have identified good examples of government energy efficiency initiatives following the nation's DSM programs. Brazil is another example of a country where the government’s intentions and such a ”critical mass” seem to be giving birth to various activities in the government sector. (However, where this infrastructure is not present, the government sector should help establishing it.)

Yet another explanation of why governments have not pursued efficiency in their own premises may be the fact the trend towards deregulation been very strong in most parts of the world. Even if government in-house energy management is in no way contradictory to deregulating much of the economy, it is likely that ideological resistance to large scale government programs have hampered this development. Moreover, deregulation has posed practical problems in some countries, where the role of the utilities and other organizations such as postal services, railways etc. have become unclear when they were transformed from public-service entities into profit-making companies. This confusion may have been further underlined in cases where ownership of these new companies is split between the private and public sectors.

6. Moving Towards Government Energy Efficiency Programs

Most countries seem to recognize the potential for energy management in the government sector, but one or all of the following three things often seem to be lacking: 1) funding, 2) the necessary infrastructure, and 3) political will and interest. Very sophisticated programs, such as in the Netherlands or the US, require a certain infrastructure in terms of research facilities, energy consultants, skilled personnel, a comprehensive set of standards, etc. However, they also need high-level political support in terms of funding and leadership. Even in very active countries covered by this survey there still seems to be an opportunity to get something started, as outlined below. And

in many cases, the very fact that there is a government sector program could help build energy management infrastructure for the rest of the economy.

Although this study was not a comprehensive one and may have missed some important countries, it is surprising that so few countries currently operate active and comprehensive energy management programs for the government sector. We have identified a clear connection between a high level of energy efficiency activities in the economy as whole and the presence of programs for the government sector. In this respect, one of the most surprising findings is the case of Sweden, where the presence of an active and highly successful energy-efficiency program aimed at the whole economy is not backed by a more comprehensive strategy for the government sector.

6.1 Much is Not Understood Yet

We have identified some rather obvious connections between the awareness of the importance of energy efficiency coupled with active programs, and the presence of government in-house energy management. However, more knowledge about these links would be needed in order to give more specific recommendations. In order to gain this knowledge, more countries also need to be surveyed. Other information needs include:

- We need a better understanding of the process that has lead to the formation of government sector programs. For instance, were the decisions to start a comprehensive program the result of a careful analysis that identified a large savings opportunity, or simply the result of very active politicians who understood the importance of good leadership? Or were some programs launched as the result of a growing "critical mass" of people active in other programs pressing the government to "practice what it preaches."
- It would also be useful to know about efforts to create a government-sector efficiency program that did *not* succeed, and to understand the reasons why.
- Another question of interest is whether individual agencies generally view a lead agency as a valuable resource or as an infringement on their own domain.
- Below, we argue the case that any government could get started at a low level. However, we know little of in what order various measures could be taken, and for what sort of condition a certain measure would be useful.
- A further area of study might be international cooperation to share ideas, results, or perhaps even resources (e.g., energy auditing software or training materials) across international boundaries. Some experience exists, for instance through the European Union’s So-called Phare multi-country programs.
- Finally, it would be interesting to study government activities beyond the buildings and facilities sector. Transportation is a very energy-intensive area in most economies, and would be of special interest in developing countries where most of the public transport infrastructure is managed by central, local or regional governments. If industrialized countries, municipal programs for the transportation sector would be interesting to study.

6.2 ...But we Know Enough to Get Started Now

We have shown that there is a connection between a nation’s level of ”energy efficiency infrastructure” and the presence of energy management programs. The interesting cases appear to be

those countries where this infrastructure is present, yet where there are no comprehensive energy management program for the government sector.

In countries where this infrastructure is poor, and/or where available government funding is very scarce, there are still some "low-effort" opportunities that would be likely to pay off well if recognized and utilized. Such possible programs would include rather simple measures. These decisions could include the following components:

- Life-cycle cost analyses and transfer of funds. A central decision for the government to apply life-cycle cost analyses for investments would help identify the best opportunities for energy-efficiency investments and provide an unambiguous means for measuring progress. If these efforts are combined with measures that allow the transfer of funds from energy and maintenance budgets to efficiency investments, the problems with capital shortage can be relieved. Life-cycle cost analyses could also be coupled with a deliberate decision to extend the acceptable pay-back period for efficiency investments (cf. the Dutch decision to allow very long-pay periods for efficiency investments).
- Third-party financing. Energy-Service Companies (ESCOs) and Energy-Service Performance Contracting (ESPC) offer another way to overcome budget constraints (and other constraints such as low availability of trained staff, etc.). By using public buildings as a first market for these services, the public sector can be a competent and important agent in creating a sustainable market for ESCOs for the whole economy.
- Government purchasing. Another simple and low-cost measure is to use the power of government purchasing. Relatively little funding is needed to use the leverage of government purchasing as a powerful tool for market transformation. By setting up energy efficiency targets for specific products it buys, the collective purchasing power of the government could help create markets for efficient products for the rest of the society.
- Guidelines and recommendations. If available and applicable, professional organizations' guidelines and recommendations could be mandatory or at least actively promoted within the government sector. Examples of this are the voluntary American Society of Heating, Ventilating, and Air-Conditioning Engineers (ASHRAE) building standards which are mandatory for new federal construction in the US and the German government that requires the Swiss SIA 340/4 recommendations to be implemented for the new and refurbished government quarters in Berlin.
- Information and training. Information and training are relatively low-cost measures, but appear to be less efficient if they are not combined with other measures.

Finally, in developing countries and economies in transition, government in-house energy management appear to be an interesting target for international development programs. Development agencies and other international funding vehicles are already supporting pilot programs aiming at supporting an institutional infrastructure that also would help cut the cost of government administration and help train government officials in efficient resource management. Examples of this are, for instance, the European Union's Phare, Thermie, and Tacis programs that have been or are active in Eastern Europe and in Asia.

Government sector leadership seems to be at least as relevant in developing as in developed countries--in the former it may be the government sector which is the most stable (if not necessarily the fastest growing) and has the best-established links to supply chains, the most attention of manufacturers, importers, vendors, etc. If the government sector were to begin pointing the way to efficient purchasing practices, and chronically revenue-short public sectors (this applies to both

developed and developing countries) it makes policy sense to think beyond a first-cost minimization to a life-cycle criterion. However, significant obstacles still exist before large-scale energy-efficiency loans can be developed and replicated by the multi-lateral agencies. [Philips]

7. Conclusions

Although the processes and motives leading to--or not leading to--the creation of comprehensive energy management programs in the government sector are not well understood, and the cost effectiveness of various approaches needs to be investigated further, this lack of information does not seem to be a motive for a ”no-action” strategy. We have showed that there are several major gains to be made for a nation by activating the government sector to move towards increased energy efficiency. Even in nations with very limited financial and personal resources, there are measures that could be taken which appears to pay off well.

SUMMARY TABLE--Varying levels of ”in-house” government energy management efforts

	Country	Non-financial measures							Financial measures					Other	
	Years state starting of program	Savings targets + monitoring	purchasing leasing policies	Technology Procurement	Information Voluntary guidelines	Standards tougher than rest of nation	Training Audits	Demo Projects	Current yr/or spec funding	revolv, funds O&M-to-eff investm.	capital finan cing	Long Payback allowed	3rd party finance	Volun-tary prgs	Utility prgs for publ
Comprehensive, all-agency programs gov’t leadership policy	USA 1985 (in operation)	Monit. base: ‘85 10% 1995 20% 2000 30% 2005	Top 25% Femp pub-lishes best products	Techn Pr (US DoD and EPA)	Information Guidelines	ASHRAE + Special stds	Tr/Aud	Adv tech demos	Curr yr +spec fund				priv financ ESCOs ESPC	Voluntary programs	utility prgs avail.
	Canada 1994 (decision)	Monit. 90-2005 20% Ggas emiss. cut			info/guidel Standard con tracts		Train-ing	Demos	Curr yr			8 yrs	Private finance ESCOs	Vol prgs	utility prgs avail.
	Denmark 1993	Monit. base ´93 20% Ggas red in 2005			info/guidel	special legislation require actions	training	demos etc	spec funds 8-12MUS$						utility prgs available
	Switzerland 1990	stab. fossile at 1990 lvls, electr. 2000			info/guidel	SIA 340/4	Tra/Aud	Demos	Special credits & allocationss			15 yrs/ 25 yrs external costs inc.			
	Netherlands 1990	Monit 17% 89-2000		Techn Pr	info/guidel	No special stds	Training Audits		Special funds+ curr yr			18 yrs!			utility prgs avail.
Gov’t a leader/advanced prgs/single agency(-ies)	Germany		purch pol		info/ guidelines	SIA 340/4 Target levels			Funds available			not to exceed bldg life			
Very active national prgs. Good infra-structure	Sweden		Individual agencies	Technology procurement	info/guidel market support activities	No special stds	training+ auditing ind. agencies	demos	curent yr + seed money			yes, but not de-fined	ESCOs 3rd party financing	vol prgs	utilities may but few do
but no comprehensive programs for the gov’t sector. (Many in this group have embryon-ical gov’t energy mgmnt activities	Japan	96-2000 3.1%/yr CO2 red	procurem policies		Info guidelines labelling	No special stds	Training Audits		Special budget appropr	Capital budget provisions	Also: Tax incentives			Vol prgs	Sun-shine prg
	Mexico	Monit.	purchasing policy				audits								
Central prgs, but a lower level of sophisticiation and/or less visibility	Indonesia	93-99 15% red			info. guidel labelling		tr/Aud		Curr yr		bonds		3rd party	vol prgs	
	New Zealand 1993				info/guidel									vol prg	
	Hong Kong	metering			inform guidelines		Training Audits	demos						vol progr	
	Ireland				info		Tr/aud	demos	curr yr sep fund						
	Korea		initial efforts		Information guidel/labels		training audits		curr yr	revolving funds	bonds		3rd party		utility progs
	France	Mon, 4% ‘96-2000			info	No special stds	Tr/Aud		Current yr fund	Not permitted					

	Country	Non-financial measures							Financial measures					Other	
		Savings targets + monitoring	purchasing leasing policies	Technology Procurement	Information Voluntary guidelines	Standards tougher than rest of nat	Training Audits	Demo Projects	Current yr/or spec funding	revolv, funds O&M Æ eff investm.	capital finan cing	Long Payback allowed	3r d party financ	Volun-tary prgs	Utility prgs for publ
Low efforts in the gov't sector, but increasingly active countries Sufficient infrastructure still lacking?	Czech Republ.														
	Thailand	some mo-nitoring			info guidelines						nat'l fund		nat'l fund		
	Philippines	10% '93			info guidelines		Training Audits	regional pilot							
	Brazil				information guidelines		audits	large demo					ESCOs		Utility programs
	China														
Countries with limited activites	Argentina					soc housing.									
	Colombia														
	Costa Rica				info		audits								util prg
	India														
	Peru	monitoring			information guidelines		audits								

A. APPENDIX
Country-by-country results of the survey

A1. Europe

A 1.1 Czech Republic
The Czech Energy Efficiency Program, managed by the Czech Energy Agency, also covers the government sector. Funding for the whole program is about USD 7,7 million/year (CZK 200 M). Government buildings are not treated differently than other sectors of the economy, and there are no target levels or systematic data gathering for the government sector. Building standards are mandatory for the whole economy, but there are no special requirements for the government building sector beyond those standards. The legal system does not allow the transfer of funds between O&M budgets and investments for improving energy efficiency. [Procházka 1997]

A 1.2 Denmark
The Danish National Energy Plan outlines actions and responsibilities for various parts of the Danish society. The overall aim is to reduce green house gas emissions by 20 percent by 2005 (1988 base year). The parliament has introduced special legislation that requires the government to be very active. From 1993, which is the base year, to 1997, six percent savings had been achieved. An annual funding level of 8-12 M US$ (60-110 M DKK) is used for information and guidelines, training, demonstration programs. There is a detailed monitoring and statistics program, which aims at verifying savings, but more importantly, it will provide feedback to serve as the basis for developing new savings targets which are more realistic. [Morsing 1997]

A 1.3 France
The French program for energy efficiency in the government sector is managed by ADEME, the French Environment and Energy Management Agency. The program aims at reducing government energy use by 4% between 1996 and 2000. Annual funding was $1.8 million (FF 10 million) in 1996, but this sum is predicted to be cut back in 1997/98 because of general budget restrictions. The program is based on a Prime Minister Directive. No special standards exists for government buildings, but the program sets out guidelines for existing buildings that are combined with information, energy audits, monitoring and training programs. Efficiency investments are funded through annual budgets and it is not possible to make transfer O&M budgets to efficiency investments. [Angioletti 1997]

A 1.4 Germany
Moving a country's capital provides a good opportunity for making energy efficiency a good showcase project, and this is exactly what Germany is doing as it sets out on the giant decade-long task to move its capital from Bonn to Berlin. The new and refurbished

buildings of the government and parliamentary quarters around Spreebogen in Berlin must follow very strict energy requirements. These include general recommendations to minimize energy use and use renewable energy whenever, but there are also specific target levels for heating, cooling and ventilation. The federal government also has made clear to contractors, architects, etc., involved in building the new government quarters that it expects to see these levels surpassed. The document also calls for mandatory implementation of the building recommendations from the Swiss (sic!) Association of Engineers and Architects (SIA 340/4) as well as for the mandatory implementation other recommendations. The standards and target values are typically tougher than those applied in the private sector.

No specific budget allocations have been made for the energy-related investments, but the very large budget allocations made for moving the whole capital are also expected to cover any additional cost associated with implementing these standards and target values. However, the pay-back for energy efficiency related investments may not exceed the useful life of the buildings. [Roth 1997, Anforderungen...]

A 1.5 Ireland

The Irish National Energy Efficiency Program is managed by the Irish Energy Centre, a joint initiative between various national ministries and bodies, and Forbairt, a state sponsored organization charged with the task of developing indigenous industry and those bodies that utilize natural resources. The program totally manages approximately. USD13 million (IEP21 million) over a five-year period, of which a certain percentage is allocated towards a program for energy management in the government sector. There are three separate programs for the defense, public buildings, and educational sectors. The program assists individual government departments in devising and implementing energy efficiency programs in their own building stock by up to 10% of investments. [Sproule 1997]

A 1.6 The Netherlands

The Netherlands has what is perhaps the most active and comprehensive energy management program for government facilities in Europe. When the Netherlands was planning for its far-reaching, all-sector National Environmental Plan in 1989, the need for the government to act as an example was recognized. In 1991 the EEG program (Energy Efficiency Programme for Government Buildings) was started, and in 1992 the Ministry of Transport and Public Works formally committed itself to the energy savings target specified in the EEG program. In 1994, the Ministry of Finance joined the program, and by 1995 all Dutch ministries had joined.

EEG is scheduled to run until the year 2000. The program aims at reducing energy consumption in government facilities by 17% by year 2000 (with 1989 as the base-line). As a first step towards this target, the increase in energy use in Dutch government buildings leveled out, on average, in 1993 and has since then started to decline. The program’s total funding from all ministries is NLG 200 million over the ten-year period

of the program (approx. USD110 million). The program covers a total building floor space area of approximately 5 million m^2.

The program is managed by NOVEM, The Dutch Agency for Energy and the Environment together with the Dutch Government Building Agency. A number of tools are used for implementing the program. Mandatory efficiency standards are applied, but the same standards are applied for the private sector as well. The government has also decided that efficiency investments be viewed on a life-cycle cost basis, and a payback of up to 18 years (!) is allowed for such investments. The lead agencies work very actively with energy audits, monitoring of buildings, data reporting systems, and education. Education is an especially important feature of the program, since it is estimated that 11 of the 17 percent energy savings target can be attributed to behavioral and energy management practice changes. In the various buildings and/or organizations, energy coordinators are appointed. They are given extra education and are united in a national network.

A sophisticated reporting system has been set up for the program. Data from each individual building are fed into a database allowing for various comparisons, for instance by region or by agency or building type. [Veelders 1997, NOVEM]

A 1.7 Sweden

Sweden has a very active national energy efficiency program aimed at transforming the market towards higher efficiency. The main vehicle of the program is technology procurement where private and public sector buyers team up to form buyer purchasing power in order to get better and more efficient products out on the market. The technology procurement program is supported by demonstration and information activities. The Swedish Efficiency program is managed by the Swedish National Energy Administration, EM (until 31 dec. 1997 a part of NUTEK, the National Board for Technical and Industrial Development).

There is no government in-house energy management program, and the government has not set up target values or recommendations for energy management in their own facilities. Although most of the major government agencies and government-owned companies have been involved in the efficiency program, involvement has been on the discretion of each single agency and on the same conditions as for private companies. Examples of government agencies or companies involved are the Government Building Agency (now split into three organizations, see below), the Swedish State Railways (*Statens Järnvägar*), the National Airport Authority (*Luftfartsverket*), The Swedish Armed Forces, and various regional county councils and hospital authorities. Several municipal utilities have taken part in the efficiency program.

The former National Building Agency was split up into two government-owned companies and one agency. The former building agency was already quite active in implementing energy efficiency. This tradition is honored by its successors. *Vasakronan* is the offspring that manages the building stock that is possible to rent on the commercial

market (offices, etc.). Yet, it has a very active energy management policy, and has, for instance, been a very active buyer in several of NUTEK's technology procurement projects. The second offspring, *Akademiska hus*, manages all university facilities in Sweden, and since their tenants are institutions, Akademiska hus is able to make decisions based on long-term, lowest life-cycle cost. Finally, *Statens Fastighetsverk (State Building Agency)*, manages the parliament and similar buildings. The State Building Agency in also active in several of NUTEK's technology procurement and demonstration projects, and is currently developing an energy and environmental management manual for all its facilities.

The active involvement of several of these agencies and companies in the national efficiency program should form a logical basis for more systematic and high-profile efforts in the Swedish Government sector. [Bångens 1997, Nilsson 1997, Wallin 1997, NUTEK 1997]

A 1.8 Switzerland

Switzerland has an ambitious national energy program called Energy 2000. The program covers all sectors of the Swiss society and aims at both increasing the use of renewable energy and reducing energy demand by implementing energy efficiency. The goal is to stabilize national use of fossil fuels at 1990 levels and electricity to level off by 2000. In-house federal energy management takes place within the framework of Energy 2000. The three main actors are the Office for Federal Buildings (AFB), the Swiss Federal Railways (SBB), and the Swiss Postal, Telephone and Telegraph Authority (PTT). The efforts are aimed at both transportation and buildings. Quite naturally, AFB focus on buildings, while both PTT and, in particular, SBB by their very nature divide their focus between large building stocks and the very large energy use related to their fleets of cars, trucks, trains and locomotives.

Important strategies are seminars and courses for employees in order to change attitudes and habits, the consequent implementation of the recommendations from the Swiss Association of Engineers and Architects (SIA 340/4) which also covers energy efficiency, energy audits and retrofits, and demonstration projects. In 1995, AFB had 225 projects running while SBB had 221 as of mid 1996. (No information available for PTT). AFB has received a special credit of Swiss Francs 175 million, and SBB has allocated SFR 120 million in its budget, both sums to be used over the time of the E2000 program. The agencies are allowed up to 25 years payback and to incorporate external costs in assessing the profitability of investments.

Each of the three agencies must report their progress to the government, but in many cases there is a lack of base-line data. Between 1990 and 1995 gross electricity consumption for the agencies fell by 5.5%, but the program evaluators have so far not been able to say how much this is attributed to the recession. In the case of SBB, it is clear that reduced freight volumes influenced electric energy total.

It is estimated that the program within the three agencies will create 735 new jobs per annum between 1995 and year 2000. [Aebischer, E2000 Jahresbericht, Brandes]

A 2. North America

A 2.1 USA

This section concerns only Federal energy management at the national level in the US, although many of the 50 states have energy management programs for state government facilities as do many state universities. (Note: all material in this section from USDOE [1995] unless otherwise noted.)

The Federal Government is the largest energy consumer in the United States, although its pattern of consumption is widely dispersed throughout the world (mostly due to Defense Department facilities located overseas). In fiscal year (FY) 1995, the Government reported direct energy use of 1.1 quadrillion British Thermal Units (quads), equivalent to 1.6 quads of primary energy. (1 quad = 10e15 Btu = 1,055 e9 GJ = 25.2 MTOe.) This represents approximately 2 percent of the total 90 quads used in the United States. Government energy use in 1994 was distributed as follows: 32% buildings and facilities, 60% vehicles and equipment, and 8% energy-intensive operations. Due to the relatively high reliance on electricity, buildings represented 44% of the Federal energy bill in 1995.

The Federal Government provides energy to approximately 500000 buildings comprising about 300 million square meters (3,1 billion square feet) of floor area. Approximately 77 percent of the Government-owned floor area is used for housing, office, storage, and service purposes, with the remaining 23 percent devoted to hospital, school, prison, research and development, industrial, and other uses.

The mission of the Federal Energy Management Program (FEMP) is to reduce the cost of government by advancing energy efficiency, water conservation and the use of renewable energy. FEMP's aim is not only to achieve those goals set forth in law and several Executive Orders, but also those which are inherent in sound management of Federal financial and personnel resources.

Although headquartered at the US Department of Energy, the Federal Energy Management Program serves all Federal agencies. FEMP provides technical assistance for project identification, alternative methods of financing projects, technical support and training necessary to successfully implement projects, and transfer of knowledge about successful projects to encourage others to take similar actions. FEMP relies heavily on the DOE National Laboratories to provide technical support. A long-term benefit of these activities is building an infrastructure in Federal agencies that institutionalizes energy efficiency as a good business practice.

With an annual budget that has ranged from USD5 to USD15 million in recent years (not including funds for in-house energy management in DOE's own buildings), FEMP does not aim to provide direct financing for energy savings measures. However, while some

agencies have line-item budgets for energy-efficiency improvements, others do not. For a period of two years, a special capital-grant program--the Federal Energy-Efficiency Fund--was available to finance selected efficiency projects at small agencies without their own in-house energy management budgets. The USD6 million program (which leveraged an additional USD2,5 million in agency and non-Federal funding) eventually fell victim to DOE budget cuts.

As shown in Figure 2, funding for Federal energy management activities has been highly erratic, ranging from about USD50 million per year to nearly USD300 million per year (in 1996 dollars) through the 1985-1995 period. FY 1996 showed a reduction on the order of 50% from 1995. The great majority of this funding was in the budgets of individual Departments and agencies; funding for the DOE In-House Energy Management program itself has ranged as high as USD20 million in recent years, but was eliminated in the 1996 budget. Utility funding via demand-side management programs is also not included in the figure, but was approximately USD7 million for Federal projects in FY 94 .

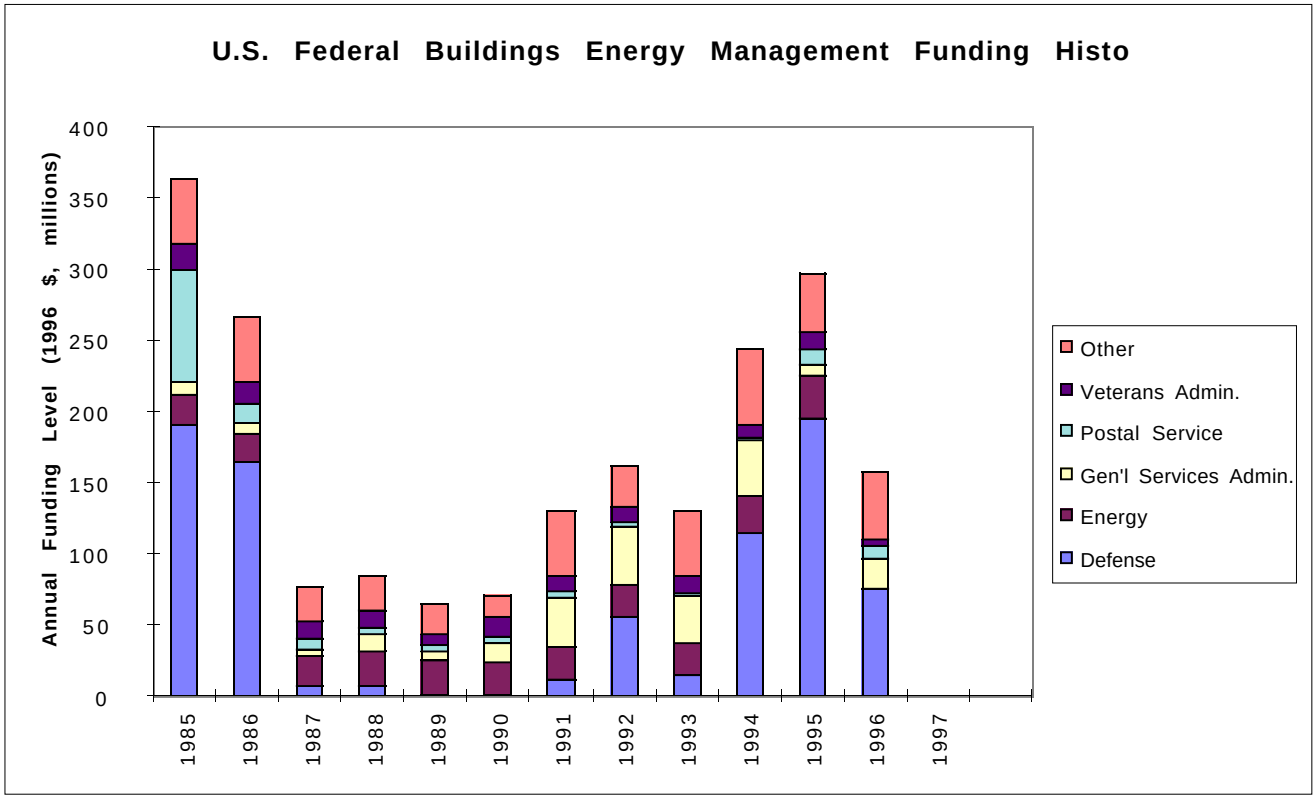

Figure 2. Federal buildings energy management funding history. Expenditures do not include energy savings performance contracts and utility demand-side management incentives. (DOE 1995)

Federal building energy performance standards address new Federal buildings, whereas the programs discussed above address existing buildings. The Energy Conservation Standards in New Buildings Act of 1976 and Executive Order 12759 require each agency to follow prescribed energy performance standards.

The Department of Housing and Urban Development's (HUD) public housing program provides housing for about one million families, and pays over USD1 billion in annual energy bills. These housing units are owned and operated by local housing authorities, but the annual operating costs, including energy, are subsidized by HUD. The program includes an array of energy efficiency activities, including a wide range of retrofits to heating systems and building envelopes conducted for more than a decade. Financing mechanisms, which originally forbade local housing authorities from retaining energy cost savings achieved through retrofits, now allow local authorities to retain some of these savings. This has proven critical in the development of investment opportunities for Energy Service Companies. [Mills et al 1987]

Another program supporting energy efficiency in Federal buildings is the Institutional Conservation Program (ICP), which provides matching grants for energy efficiency retrofits in public and private schools and hospitals. Between 1979 and 1994, participants included 15 600 schools, 5 500 hospitals, and 5 000 colleges. Funding in fiscal year 94 was USD9 million.

A 2.1.1 Targets and Progress To Date

Section 543 of the National Energy Conservation Policy Act, as amended by the Energy Policy Act of 1992, requires each agency to achieve: a 10 percent reduction in energy consumption in its Federal buildings by fiscal year (FY) 1995, when measured against a FY 1985 baseline on a site Btu-per-gross-square-foot basis, and a 20 percent reduction in Btu per gross square foot by FY 2000. Furthermore, Executive Order 12902 requires agencies to achieve a 30 percent reduction by FY 2005. As shown in Figure 3, energy savings have met or surpassed these targets, when measured in terms of direct energy use. However, due to electrification trends in both existing and new buildings, energy use in Federal facilities has remained roughly constant when measured in primary energy.

The Government's total site energy consumption in FY 1994 decreased 16.9 percent from 1 445 trillion Btu in FY 1985 base year to 1 200 trillion Btu, a reduction of 245 trillion Btu. (This reduction could satisfy the energy needs of over one million US households for one year.) Contributing to this decrease was an 18,2 percent decrease in buildings and facilities energy (85,8 trillion Btu) and a 22,7 percent decrease in vehicle and equipment fuels. Certain "energy-intensive" facilities are exempted from FEMP savings goals (this concerns primarily specialized end-uses that are critical to the execution of agency missions, e.g. radar systems for air traffic control), representing 7,8 percent of total government energy use.

In real inflation-corrected 1987 dollars, energy costs for government buildings and facilities decreased by nearly 30% from USD4.2 billion in FY 85 to USD3.0 billion in FY 94. The reduction is due to the combined effect of a 7% reduction in floorspace, a 12% reduction in real energy prices, and a 11% reduction in energy use per square foot between 1994 and 1985 (USDOE 1995). Due to the gradual shift towards electricity, primary energy use per square foot remained about constant over this period while

absolute primary energy consumption declined by about 7% due to the reduction in total floor area.

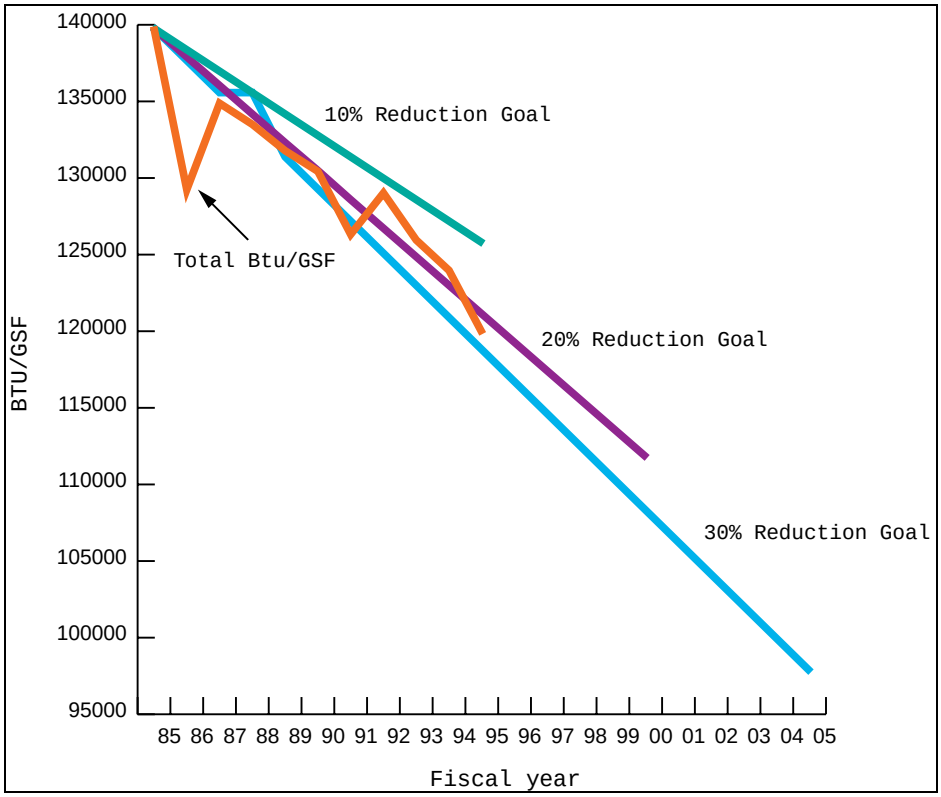

Figure 3. Increasingly stringent savings goals, and actual progress (site energy).

One of the most successful individual agencies has been the U.S. Department of Energy. [Greenberg et al. 1997]. The DOE is the largest government energy consumer in the civilian (non-military) sector. DOE's In-house Energy Management (IHEM) Program was established in 1975 to implement energy efficiency improvements at DOE sites, including power marketing administrations, national laboratories, weapons production facilities, and nuclear reactor facilities, comprising over 14 000 buildings and 11 million square meters of floor area. Energy expenditures at the 62 eligible sites were about USD295 million in 1993, 64% of which was for buildings. Between 1977 and 1993, USD41 million was invested in studies and USD264 million in retrofit projects, with an average payback time of 2 to 3 years. DOE has cost-effectively reduced its energy consumption in buildings by 43% since 1975, and has also reduced its consumption by nearly 21% since 1985, already surpassing the fiscal year 2000 requirement of the Energy Policy Act of 1992.

As seen in Figure 4, national Federal energy management efforts across all agencies have yielded savings valued significantly above the investment in achieving those savings. While this represents significant progress, the funds invested to date fall far short of the total need of ~USD5 billion in investment (60 years of spending at average spending levels over the past decade).

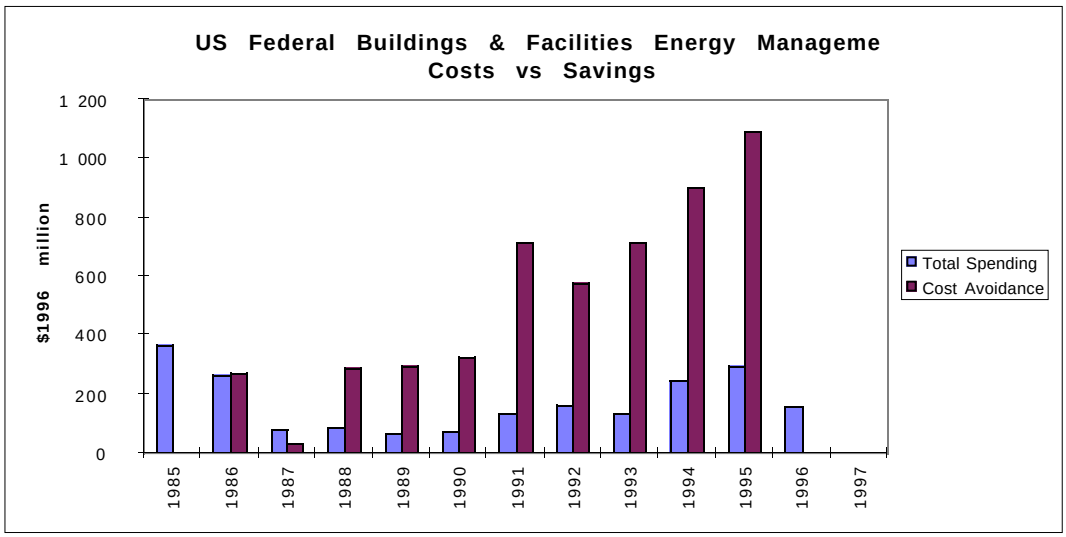

Figure 4. Government buildings energy efficiency investments versus savings achieved.

A 2.1.2 Third-Party Financing and Energy Performance Contracting

Recently, FEMP has turned to third-party financing to help close the gap between investment opportunities and government funds available through the budget process. This generally takes the form of shared-savings contracts (known as Energy Savings Performance Contracts or ESPCs), whereby an Energy Services contractor provides both capital and technical expertise to provide a complete, "packaged" energy management project, including operation and maintenance in some cases. These Energy Service companies may be unregulated subsidiaries of utility companies, or independent firms. The contractor is repaid from a share of the energy cost savings, i.e., based on actual performance. As of late 1995, 19 ESPC contracts had been awarded with a total third-party investment of USD40 million.

FEMP's role is to streamline contracting, pre-qualify ESPC contractors, and assist with measuring and verifying actual energy savings. This helps reduce the risk, complexity, administrative costs, and delay in otherwise implementing ESPCs one project at a time. [Greenberg et al. 1996]

FEMP also uses a second, related mechanism to obtain project financing and technical support. This involves the inclusion of energy management and ESPCs among the services that are available to any Federal agency under an "area-wide contract" for the bulk purchase of electricity (or natural gas) from a utility.

A 2.1.3 Federal Procurement Challenge

The Energy Efficiency and Resource Conservation Challenge is a voluntary, government-wide commitment that uses the buying power of the Federal government to support and expand markets for today's best-practice energy-efficient, renewable, and water conserving products, create new entry markets for advanced, energy-saving technologies and products, and lower the costs of efficient products for all consumers by providing a large, reliable market. The program is designed to save taxpayers money by reducing

operating costs for Federal agencies, reducing greenhouse gas emissions due to Federal energy use, and provide a model for other levels of government, corporate, and institutional purchasers. FEMP provides Challenge participants with a variety of tools and technical support to assist them in achieving Challenge goals. FEMP publishes Product Energy Efficiency Recommendations which identify energy efficiency criteria for "best-practice" products as defined by the Energy Policy Act of 1992 an Executive Order signed in 1994 (see discussion above). The Executive Order established a threshold for all Federal agencies to buy energy-related products that are among the best 25% of all similar products, in terms of energy efficiency. Products that meet this performance level are identified with an "EE" symbol to make it easy for procurement officials to locate them, both through published catalogs and the newer, electronic systems for on-line purchasing. Recently, a number of state and local governments have also become active in directing their buying-power toward energy- efficient products. [US DOE 1995 and 1996, FEMP Web Site] The Environmental Protection Agency (EPA) and DOE agreed to join forces in March 1997, extending the FEMP Procurement Challenge to other levels of government, linking it with purchase of Energy Star products, and to the retailer and volume-purchasing programs of DOE/OBTS. New title will be "Energy Star Procurement Challenge”.

A 2.2 Canada

Federal government departments, Crown corporations and agencies manage more than 50 000 buildings across Canada. The annual energy bill for these buildings is about USD800 million. Since the 1970s, the federal government has supported and encouraged more efficient energy use in its facilities.

As part of its continued commitment to energy efficiency and to reduce greenhouse gas emissions, Canada has adopted a new more vigorous approach to improving performance in this area. In November 1994, members of the federal cabinet stated their support for the Federal Buildings Initiative (FBI) and the retrofitting all federal facilities.

The Federal Buildings Initiative (FBI) is a program developed by Natural Resources Canada to help federal government departments and agencies improve the energy efficiency of federal facilities. Thus, the FBI helps federal bodies contribute to the federal government's goal of reducing greenhouse gas emissions from its operations. The goal is to reduce emissions by at least 20 percent by the year 2005 relative to 1990. The FBI is an element of the government plan for Emission Reductions from Federal Operations which was submitted to the Voluntary Challenge and Registry Program.

The FBI was specifically designed to help the federal government overcome barriers to the implementation of energy-efficiency in their facilities. These barriers included the lack of available capital, poor information on energy-efficient technologies, limited expertise within the public sectors to carry out this type of work, contracting and other administrative constraints.

FBI employs an innovative contractual arrangement involving a prequalified energy management firm. Through this arrangement, commonly referred to as energy performance contracting, the full cost of energy-efficiency improvements are financed with the resulting energy savings.

The FBI also provides departments and agencies with a comprehensive package of products and support services to help them implement projects. FBI has developed model contracts and bid packages; list of qualified bidders for federal projects; and delivers awareness and training seminars and workshops in all regions of the country so that federal facility managers can learn about implementing energy-efficiency projects.

A 2.2.1 Progress To Date
All federal custodian departments have agreed to develop long-term energy management plans for their facilities. All departments had energy-efficiency projects at the preliminary, tendering or implementation phase. The FBI is presently tracking more than 100 projects involving more than 3000 buildings.

Energy management firms has invested some USD200 million in federal energy-efficiency projects. Projects to date in federal facilities will yield annual savings of approximately USD25 million.

The FBI is being replicated at other levels of government, as well as in the commercial and institutional sectors. At the provincial level, New Brunswick has committed to implement a program modeled after the FBI. Other provinces are evaluating the FBI for possible
implementation. The Federation of Canadian Municipalities and the Canadian Association of Municipal Administrators are working to replicate the FBI in the municipal sector. Twenty-one cities, including seven capital cities, have joined the FBI Replication Program. [Natural Resources Canada, 1996, Treasury Board of Canada, 1992].

A 3 Asia and Oceania

A 3.1 China

China is the largest energy consumer in Asia, and is uniquely committed to energy conservation as an integral part of its overall energy strategy. Besides creating new organizational capability for energy management and developing energy-efficient technologies, China has spent over USD20 billion on industrial energy conservation projects since 1981. Counting only projects that received state assistance, these investments resulted in avoided energy consumption equivalent to more than 50 million tons of coal per year, or about 4% of current consumption [Sinton 1996]. However, there currently is no directed program for energy efficiency specifically in the government sector, and attention to energy efficiency in this sector has lagged behind investment in the industrial sector which accounts for two-thirds of energy end-use [Dadi].

Because of economic system reforms and decentralization of planning and budgetary authority, the policies and programs developed in the 1980s are no longer as effective as they once were. The central government is still key to developing and implementing new market-oriented tools to promote energy efficiency, particularly energy-efficiency standards. However, local administrations and enterprises, particularly in the relatively wealthy and energy-poor coastal provinces, will increasingly lead in creating and funding energy-efficiency programs, including programs for the government sector.

A 3.2 India

India is the third largest energy consumer in Asia. The Indian government is aware of the need to reduce energy use and has tended to focus its conservation efforts in the industrial and buildings sectors. The country's 9th five-year plan calls for a reduction of the equivalent of 5,000 MW of electricity by 2002 for all sectors. (In the last five year plan, similar goals were established but it was difficult to ascertain the level of savings.) [Sethi] However, it does not appear that conservation programs specific to the Federal sector are currently a high priority, as there are no legislative requirements that require government agencies to implement energy efficiency programs. (Voluntary equipment standards and existing building standards, to the effect they are followed, impact government energy use, but there is little quantification of the extent to which these standards are followed.) It is important to note, however, that an institutional infrastructure supported by annual appropriations does exist that could allow the federal sector to ramp up its efforts, should this area become a higher priority. [Asthana].

A 3.3 Indonesia

Indonesia is one of the fastest growing economies in Asia, with energy exports (oil and liquified natural gas) playing an important role in foreign exchange earnings. This rapid development has led to strong growth in energy demand. In an effort to reduce future growth in energy demand, the Indonesian government in its sixth long term development plan, has set a target of reducing national energy consumption by 15% by the end of 1999.

To accomplish this goal, the government is establishing a variety of programs including information campaigns, training, audits and other technical assistance which will be financed through bonds, third-party financing and other incentives. The government has also established a state-owned energy service company (PT. KONEBA) which will support energy efficiency efforts in federal and non-federal buildings. [Hutapea, 1996, 1997]

A 3.4 Japan

Overall, the Japanese government has set a goal to reduce the rate of growth of energy consumption between now and the year 2000 from 3.1% annually to 1% annually in order to meet its CO_2 emissions reductions targets. The legal framework for this is Japan's

energy conservation law and its energy conservation assistance law, which provide an estimated 22 billion yen (~USD170 million) of funding annually for energy conservation.

In regard to the federal sector, efforts are focused on audits, procurement, and efficiency labeling. In addition, mandatory equipment and building standards also apply to federal buildings. The Japanese government appears to have a wide array of funding instruments that it is making available for federal efficiency efforts including annual budget appropriations, capital budget provisions, the "new sunshine" utility program, and other tax-related investment incentives for equipment. No data is currently available on the extent of energy savings achieved for the federal sector [Natori].

A 3.5 Hong Kong

While not large in regional terms, Hong Kong has made some initial strides in tackling the issue of federal energy use. The lead agency for Hong Kong's efforts has been the Energy Efficiency Office, Electrical and Mechanical Services Department. Recent estimates suggest that Hong Kong's voluntary programs in the federal sector have resulted in an electricity savings of 1% of total public buildings' consumption (52 TJ), suggesting that significant additional potential is achievable [Lee]. The department's programs have focused on the development of guidelines and implementation of audits, facility metering, and is now beginning to demonstrate selected new technologies. Efficiency standards for buildings and equipment are under consideration, but have not yet been implemented.

A 3.6 Korea

Korea has a coordinated national program for promoting federal energy efficiency led by the Ministry of Trade, Industry, and Energy's Energy Conservation Policy Division. Current efforts are voluntary by participating agencies and no specific conservation targets have been set, although buildings and equipment are subject to energy standards. Existing programs rely on information campaigns and labels, the use of guidelines for federal facilities in addition to selected training and auditing. In addition, there are efforts by federal facilities to establish procurement of more efficient products. While no direct allocation of funds are made on an annual basis, a variety of financial mechanisms exist including bonds, third-party financing, retention of cost savings, and special utility programs, that can help finance particular retrofits [Park and Shim].

A 3.7 New Zealand

New Zealand has an established national program directed toward promoting federal energy efficiency that is carried out primarily by the Energy Efficiency and Conservation Authority (EECA). The government currently spends about USD15 per year on energy. Case studies indicate that savings potential of 10% are still achievable in public sector facilities, but no specific targets have been set for reductions. Before 1993 federal energy efficiency legislation required government agencies to implement efficiency programs, but this approach will be supplemented by voluntary programs starting in 1997-1998. The

key program that was instituted in 1993 was the Government Energy Efficiency Leadership program, relies on the voluntary agreement (a memorandum of understanding) with various government department managers to reduce their energy use by capturing all existing cost-effective savings. Department managers, with the assistance of EECA and departmental energy managers, develop specific energy management plans which they then implement. In addition, the EECA has developed a focused set of tools for this program including: the development of informational materials (brochures, case studies), informational seminars and training of building energy managers. No specific savings are reported as a result of the program [Brander].

A 3.8 Philippines

While few programs have been developed in the past specific toward federal energy efficiency, the Philippines has recently established a USD100,000 annual budget within the country's Energy Utilization Management Bureau (EUMB) of the Department of Energy for a program aimed at reducing federal energy use by 10% compared to 1993 levels [Elauria, 1996]. The program is a component of a national information campaign on electricity conservation. In addition to informational materials (leaflets, posters, etc.), other efforts include conservation guidelines, audits, training of building managers, and demonstration of new technologies (e.g. fluorescent fixtures). Some equipment (window air conditioners) and new buildings are also subject to mandatory efficiency standards.

There is also a particular program for government buildings. This will be pilot test in the National Capital Region and will involve enforcement of building efficiency standards and on-the-job training of local building officials of energy auditing and advisory services for government buildings. [Anunciacion, Arias 1997b]

A 3.9 Thailand

Thailand has become increasingly active in the field of energy conservation. In 1992, the Thai government adopted the Energy Conservation Promotion Act which established a national energy conservation fund (now over USD60 million), provided financial incentives for energy efficiency and renewables, developed mandatory efficiency standards for equipment, and included requirements for mandatory energy conservation measures in large facilities (both manufacturing and commercial establishments) [NEPO, 1994]. Large Federal facilities (greater than 1 MW of installed electrical capacity) were one of the targets of compulsory energy conservation measures, which require large facilities to appoint an energy manager, assess efficiency opportunities, and undertake a savings program using best available technologies. Various funding instruments have been established (efficiency loan fund) to facilitate implementation. The level of savings in federal facilities achieved from the program have not been measured [NEPO].

A 4 Central And South America

A 4.1 Argentina

Argentina has no overall national program for energy efficiency in the government buildings sector, but there is an active program for improving efficiency of street lighting. For new construction of social housing, there are insulation requirements for the building envelope.

In 1996, the Ministry of Economics required all government facilities, including universities, to submit a report on their energy performance. According to a contact at the University of Buenos Aires Engineering School, they were able to submit a reasonable report on the basis of a previous electricity usage audit. However, with little time allowed for these reports, most agencies were probably able to submit, at best, only raw information on energy consumption and costs. In some cases, other universities have conducted energy audits or demonstrations of lighting controls and other measures, on a somewhat ad-hoc basis. There is no record of successful, large-scale implementation on the campus. [Dutt].

A 4.2 Brazil

A national energy efficiency program, PROCEL, was established in 1985. The program is managed by the national electric utility, Eletrobras (Centrais Eletricas Brasileiras). PROCEL funded a recent study of savings potential in the government sector, which estimated that retrofitting 5 000 major government buildings in Brazil could save around 1 000 GWh/yr out of total electricity use of 7 100 GWh/year (4% of national electricity use), with an investment of around USD150 million.

Within the government sector, retrofit investments have been targeted to public buildings and street lighting. PROCEL is working with the local distribution utility in Brasilia, CEB, to stimulate retrofits of major Ministry buildings and other government facilities. CEB has started a serious DSM program due to overloaded distribution grid and rapid demand growth in Brasilia. PROCEL is providing USD100 000/year in core grants, plus leveraging of USD1,25 million in low-interest loans, to retrofit 16 major ministry buildings in Brasilia. This project is to be implemented in 1997, using third-party Energy Service Companies (ESCOs). A pilot project in the Federal Ministry of Mines and Energy building reduced lighting electricity use by 60% (mainly from delamping), and is saving an estimated 700 MWh/year.

There is a low-interest loan fund used within the electricity sector, known as the RGR, which is starting to be tapped by PROCEL for major energy efficiency projects, including retrofit of public buildings. Third-party financing for retrofits is planned at the state level, but beyond a few projects has not yet occurred a significant scale. However, there is interest in third-party financing among banks and a growing number of ESCOs.

A few state governments, including Sao Paulo and Bahia, have established energy efficiency programs for public buildings, although to date these programs have involved mainly audits and technical studies rather than actual retrofits. In addition to CEB in Brasilia, distribution utilities in two other states are starting projects to retrofit state-owned public buildings. One component of a recent energy efficiency loan request

from PROCEL and Eletrobras to the World Bank includes a proposed USD6,9 million project to retrofit 28 public office buildings and 12 public hospitals in Salvador, Bahia, by underwriting a loan from Eletrobras to the State of Bahia. The estimated energy savings is 1,.6 GWh/yr.

A government directive calls for the creation of energy management committees in government enterprises. A number of major state-owned companies including Petrobras (petroleum production and refining), CVRD (mining and other activities), and TELESP (telecommunications) have active energy efficiency programs.

From 1986 to 1993, PROCEL reported total spending for energy efficiency amounted to USD24 million (not including customers' costs) and reported annual savings of 1 200 GWh overall, including 100 GWh for street lighting and 40 GWh for public buildings. The street lighting program has replaced over 300 000 incandescent lamps with mercury-vapor or sodium lighting. Significantly higher savings in public buildings are targeted for future years (300 GWh in 1997; 700 GWh in 1998). [Aguiar, Geller, Lomardo, Mascarenhas, Procel 1996 and undated, Scarpa].

A 4.3 Colombia

Two agencies are working jointly on a national program for energy efficiency: the Unidad de Planeación Minero Energética (UPME) and the Institute de Ciencias Nucleares y Energias Alternativas (INEA). The budget for this program in 1997 is about USD 1.5 million, plus additional utility-funded activities. Energy conservation legislation has been submitted to Parliament for consideration, and a request for loan funding from the International Development Bank is pending.

Within the public sector, one of the major programs underway involves Efficient Public (outdoor) lighting. Beginning in 1995, the government launched a program to replace all 1.2 million mercury lamps with high-pressure sodium lamps, over a 3-year period. One motivation for this program was the history of operating deficits for public lighting systems, due in part to high electricity operating costs. Between April 1995 and June 1996, 140 000 lamps were replaced. Loans are available from a government-sponsored fund (FEN) provided that the new luminaires meet energy efficiency standards set by the INEA. At the same time, the responsibility for public lighting is to be switched from the utilities to each municipal government, beginning in 1997.

Another program is establishing energy management guidelines for intermediate-size cities (up to 400 000 inhabitants), including both local government facilities and other sectors within the cities. A pilot project was carried out in 1996 in the City of Villavicercio, beginning with a survey of energy-saving opportunities in each sector (residential, commercial, industry, and government). Initial funding from the local utility will provide USD300 000 to replace mercury-vapor street lights and install CFLs; repayment of the initial investment (from savings, presumably) will go into a revolving fund for other efficiency investments.

The Public Lighting program has targeted annual savings of 366 GWh, and (night-time) demand reduction from 205 MW to 122 MW. To date, the replacements of about 10% of existing mercury lights are credited with annual savings of 14 GWh and 6,5 MW of generating capacity. Aside from public lighting, no data were available on savings in the government sector. [Arias 1997a, Boletin URE, Cadena, National Plan for Energy Efficiency (Colombia), Rodriguez]

A 4.4 Costa Rica

The national utility company, CNFL (Compania Nacional de Fuerza y Luz, SA) participates in a national energy efficiency program, which includes the government sector (about 3,4% of total electricity sales). The program, established by legislation, includes equipment labeling and standards, energy-savings targets, energy audits and technical assistance, time of use and utility-dispatched peak load reduction, customer information through seminars and bill enclosures, and demonstration projects. [Mora]

A 4.5 Mexico

The government agency charged with energy efficiency programs is CONAE (Comision Nacional Para el Ahorro de Energia). Although responsibility for operation of public buildings is dispersed throughout the various Ministries and agencies, CONAE began a program in June 1996 to focus these agencies' attention on energy use, costs, and savings potential in their own facilities. With a limited budget of about USD180,000/year, the "100 Buildings" program is conducting energy audits and estimating savings potential for a representative group of public buildings, in the hope of stimulating further actions, including demonstration retrofits. [de Buen, Bauer] Technical assistance from Texas A&M University and Lawrence Berkeley National Laboratory will include training in energy monitoring and diagnostics to accompany the audits. Another planned strategy is to change purchasing policies to favor selection of energy-efficient equipment. Purchases by Federal agencies are seen as a potential market-leading activity, especially for lighting products.

A parallel effort supports efficiency programs at the municipal level, with Federal participation planned by CONAE along with the State Infrastructure Bank, the Trust Fund for Electricity Savings, and electric utility district offices. Major electricity-using systems under municipal control include outdoor lighting, water supply and wastewater treatment, and public transport. CONAE provided printed materials and a software package for municipal use, and has conducted four training workshops and assisted with energy audits.

The Trust Fund for Electricity Savings (FIDE) was established in 1989 and is administered by the national electric utility (CFE). FIDE provides grants and loans for energy efficiency projects in both the public and private sectors; the fund receives annual revenues from CFE and its suppliers, as well as a contribution from the Electrical Workers Union. One recent FIDE project, called ILUMEX, targeted significant distribution of compact fluorescent lamps in Guadalajara and Monterrey.

The University Energy Program (PUE) has conducted an energy audit throughout the 800 buildings of the public Universidad Nacional Autonoma de Mexico (UNAM). This has resulted in significant energy savings (8-10 %) through low-capital operation and maintenance measures. In a pilot project at one campus, PUE evaluated lighting costs and savings for 28 buildings. The resulting retrofit program, with funding from FIDE, achieved lighting energy savings of 40% (Bauer, 1997).

Efficiency standards for new buildings are also in preparation, and equipment efficiency standards are being considered - all of which would presumably apply to the public as well as private sector.

Results to Date
Although both the Federal 100 Buildings program and the municipal energy efficiency program are at an early stage, some interim results were provided in a recent CONAE briefing. [Cardona] Since June 1996, 106 Federal buildings (1.3 million sq. meters) have been enrolled in the program, with 58 energy audits completed. A sample of thirty audits (representing about one-third of total floorspace) showed potential energy savings of 22% (3.5 GWh/year), with a two-year payback, for a one-time investment of 3.1 million pesos. No results from the municipal government or UNAM programs (beyond the pilot project mentioned above) were available for this study.

A 4.6 Peru
The government agency charged with energy efficiency is the Programa de Ahorro de Energia (PAE). An energy efficiency campaign, begun in 1995, targets electricity savings primarily in the residential and industrial sectors, beginning with low-cost O&M or household behavioral measures, followed by investments in retrofit measures. Funding was USD5 million in 1995 and USD2 million in 1996, with a savings target of 5% of national electricity consumption. As of 1996, this program has helped reduce average monthly household electricity use by 27 kWh (or 320 kWh/year), saving USD 50 million nationally and avoiding the release of 250 000 tonnes of CO_2 (Romani, 1997).

In the public buildings sector, an energy-saving campaign initially targeted 20 public buildings,in a two-stage process. The first stage consists of operational changes (no capital investment), with the resultant energy cost savings to be reinvested in energy-saving capital improvements.

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