

Best Practices
For Energy Efficiency Incentives and Their Role in Energy Policy:
A Report to The China Sustainable Energy Program¹ for Decisionmakers in
China

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I. Introduction

A. Incentives and Standards

Standards are the foundation on which energy efficiency policy for the building sector is constructed worldwide.² Standards for new buildings are in place in most OECD countries, including all of Europe, Australia, Canada, the U.S., Japan, Korea, and New Zealand; they are also in place or under development in significant non-OECD countries including Singapore, the Philippines, Mexico, Turkey, Algeria, India, Malaysia, Indonesia, and Kazakhstan. Some countries also have developed regional standards that are in effect in some states or provinces and that may be more stringent than the national building standards.

In those few regions where financial incentives have been employed seriously on a long-term basis, the savings from incentives are almost as large as the savings from standards.

Financial incentives work synergistically with standards: the preexistence of standards makes incentive programs easier to design and administer, and the programs themselves contribute to the effectiveness of future standards. Energy codes assist financial incentive programs by providing a base beyond which savings can be calculated, and which minimizes the amount of “free ridership” that will be the result of a financial incentive program. For example, if a standard is relatively stringent, we can be confident that few buildings will go beyond the standard without some additional market intervention.

¹ The Natural Resources Defense Council gratefully acknowledges the China Sustainable Energy Program for its support of the research and drafting of this report.

² *Energy Efficiency Policies and Indicators*, a report by the World Energy Council. World Energy Council, London, UK, October 2001; and *Energy Efficiency: A Worldwide Review, Indicators, Policy, and Evaluation*, World Energy Council and French Environment and Energy Management Agency (ADEME), 2004

Energy codes also provide the test procedures by which buildings can be rated, so that the savings from financial incentive programs can be more easily quantified. With performance-based building codes, financial incentives can be based on percent savings relative to the standard, which is a simple to understand and easy to administer reference.

Financial incentive programs complement standards by effectively testing the feasibility of higher standards levels. If a high market penetration is achieved for a given level of incentivized efficiency across a broad range of building types or cities, this achievement provides evidence that a standard at that level would be economically justified. It also provides assurances that the technologies and design expertise needed to meet the standard are already out there in the marketplace. Energy code upgrades can then achieve the same savings with higher market penetration and with minimal costs to the government.

In the abstract, financial incentives may seem more attractive to policymakers than codes and standards. But when the policymakers see how expensive incentives can be when their goal is near-100% market share, and how difficult it is to fund such programs, then the advantages of codes and standards are clear. The role of incentives is therefore to push efficiency beyond the minimum levels required and to aim at market shares much less than 100%.

B. Types of Financial Incentives

The working hypothesis of this paper initially was based on a clear distinction between government-sponsored financial incentives, such as tax credits or deductions, and more individually-tailored financial incentive programs such as those operated as utility DSM programs. The conceptual model focused on tax incentives as a longer-term, more highly ambitious program in terms of energy efficiency level, while the DSM programs focused on shorter term, easier to achieve, and more widely commercialized technologies.

A second key policy issue is the distinction between cost-based incentives – which had been used in the earliest experiments with financial incentives for efficiency and proved unsuccessful--and performance-based incentives, which are the basis of DSM programs and were assumed to be the preferred basis of government-sponsored tax incentive programs.

While these categories make sense as ideals, the evidence does not support a simple categorization. Many tax incentives and other government-run programs rely on grants or loans or other individually-reviewed applications. They operate in ways that are hard to distinguish from the ways that DSM programs operate.

Furthermore, we found that many programs combine cost-based incentives with performance-based incentives. Under such a hybrid system, the financial incentive might be based on a percentage of the incremental cost of efficiency or on the total cost of an efficient building or product, but would only be available provided that the component or building meets a performance threshold.

Because existing programs often combine the aspects of short-term, managed programs with longer-term, more ambitiously targeted programs, and also often combine cost-based approaches with performance-based qualification, and because most programs have not been evaluated formally, it is impossible to recommend an optimal program design based solely on international comparisons of measured results.

Nevertheless it is possible to infer from those evaluations that have occurred and from comparisons of programs that are widely considered to be effective what the best recommended practices are.

Thus, the recommendations that we make in the next section in summary and in more detail in Section V are not necessarily the basis of the majority of programs operated worldwide. They are, however, at the heart of recommendations of the small number of independent reviews that we have seen. They are consistent with the experience of American DSM programs and of those non-DSM financial incentive programs that have been evaluated, although the subset of programs that *have* been evaluated is small.

C. Recommended Structure of Financial Incentives

Most of the experience worldwide, weighted in terms of dollar volumes of incentive payments, has been managed incentive programs run by utilities (and in some cases, state energy offices) in the United States. Managed incentive programs are discussed in more detail in Section IV. These incentives generally have been tied to energy codes or equipment standards, usually directly, and have been operating in different parts of the country for over 20 years.

The Swedish government has had a long-standing policy of promoting quality housing, which has included energy efficiency as one of the parameters, for a comparably long time. These incentives are government administered and take the form of grants or subsidized loans.

Other policies employed throughout the world, apparently mostly during the last 5 or so years, appear to be cost-based incentives that apply to qualifying equipment, buildings, or processes.

The American DSM programs are all performance-based, rather than cost-based. They have been subject to a great number of formal evaluations, and so a number of other design criteria have been developed to maximize program success.

With the exception of the utility-operated programs in the United States, there appears to have been little or no formal evaluation of the results of programs. Informal critiques of some of the programs suggest that many or even most of them have not been as effective as one might have hoped, particularly in terms of free ridership.

The evaluated programs have developed criteria for program management that both minimize free ridership and ensure that energy savings are real and are reliable.

In summary, analysis of the programs that we have been able to review seems consistent with the hypothesis that they should satisfy at least the following basic design principles:

- The incentive should be based on performance.
 - To the extent possible, the incentive should not be based on cost.
- It is important to make the incentive the right size. Too large an incentive will cause budgetary problems, while too small an incentive will not motivate decisions.
 - An incentive of 30% to 60% of expected incremental cost appears to be about the right size.
 - The energy efficiency threshold for the incentive should be relatively high, particularly for multi-year programs.
- Multi-year programs can achieve higher levels of energy efficiency than managed programs. But they require more careful program design.
 - Managed incentive programs with less ambitious goals can complement long-term incentive programs with more aggressive goals.
- Programs should allow choice among the recipients of the incentives so that many technologies can compete or the incentive can be shared or utilized by many different players in the market.
- The results of the incentive should be evaluated formally.

- Incentives should be designed to be complementary to other public policies;
 - These other policies could be developed in parallel with the incentives.

D. Exploration of Policy Issues

There has not been an extensive discussion in any national community of which the author was able to find documents, much less in the international community, of the policy issues that affect economic incentives. Indeed, the minimal communication suggests a number of different ways of framing the policy issues before they are even answered. These framings are not just theoretical: because one framing will lead to a different type of policy than another, and different financial incentive policies used by different countries reflect this sort of framing. One way of addressing the issue is as follows:

- How do the incentives fit into a broader tax policy? How do they fit into a national strategy of promoting energy efficiency?
- How should the incentives be designed in terms of the stringency of their energy efficiency targets (if indeed they have targets), the level of incentive provided, what that level is linked to (for example, the use of a technology, the meeting of a particular energy efficiency target), or their connection to the cost of the efficiency measure or of the system on which it is being added?
- How well do they work, either as a function of how they are designed or absolutely?

Other framings have guided the discussion in some circumstances. One possible framing asks the questions:

- Who provides the incentive and who can receive it? (For example, is the program a government program open to all or limited by income, a government grant that reviews individual applications, an addition to an existing government or private sector program such as loan qualification?)
- Is there a hard budget limit to the incentives, or are they available to all applicants that qualify?
- Who provides the funding, and how is the revenue raising connected (or not) to other policies?

- How do financial incentives for energy efficiency fit in with the broader fiscal policies of the government with respect to energy supply projects or energy consumption taxes?
- How do they work? (In this framing, the question may well be framed as how does the whole suite of efficiency policies work rather than how does the incremental value of a particular incentive compare with its cost)

An additional question being asked more frequently, particularly among countries that have ratified the Kyoto Protocol, is how tax policies towards energy and towards efficiency fit into the broader context of the cap-and-trade system and Clean Development Mechanism policies that are being brought into effect to comply with the requirements of the Kyoto Protocol.

The diversity of approaches used throughout the world, and the apparent scarcity of comprehensive experience with applying financial incentives for energy efficiency, makes a results-based comparison across countries difficult or impossible to do at this point. Indeed, we will discuss why the policy of tax incentives for energy efficiency, as they would apply to a large country like China, are structurally unlikely to have had formal evaluation results that can be used as a basis for future decisions.

But many of the financial incentives that have been applied over long periods of time by administrators, whether private sector companies or governments, and which therefore have had the time and experience on which to perfect programs through trial and error, offer some consistent directions that should be useful to China in developing and implementing global best practices in the building sector.

Section II discusses the theoretical issues in more detail. It attempts to analyze the basis on which different regions or countries have implemented tax incentives and attempts to reach conclusions about which types of incentives appear to work best. It also discusses how financial incentives can complement standards and what implications this complementarity has for the design of specific financial incentives.

Section III discusses some of the practical experiences with financial incentives in different countries, emphasizing “lessons learned” and policy recommendations that are being made based on the programs.

Section IV discusses the issue of managed incentives that are intended to achieve short-term improvements in efficiency on a large scale relative to long-term incentives whose goal is more advanced levels of efficiency, longer time scales, and lower market penetration, at least initially. It discusses some of the practices that have been developed in the context of managed incentives, which have been evaluated systematically to a

much greater extent than long-term tax-based incentives, and how these lessons can be applied to the design of future incentives.

Section V proposes some design criteria for how financial incentives should be structured for China.

Appendix A provides a more detailed listing of what incentives appear to have been used in what countries.

Appendix B provides a more detailed informal evaluation of the state of Oregon's tax incentive program.

Appendix C provides more detailed discussion of programs in Canada, Korea, Thailand, South Africa, Singapore, Greece, and the UK.

Appendix D presents a policy discussion of the issues for developing well-designed long-term incentives through the tax system, focusing on the bill before the U.S. Congress that resulted from this analysis: S. 680 (Snowe-Feinstein).

II. Theoretical Approaches

In many countries, the energy policy debate is undertaken in a framework based primarily on classical microeconomics. Energy consumption is looked upon as primarily responsive to price signals. A more sophisticated version of this approach looks at price signals both on the supply side and on the demand side and also takes into account externalities.

This approach is common among European countries. This is a significant result because the European Union is moving to establish carbon trading to support its implementation of the Kyoto Protocol. Carbon trading becomes a method for raising the price of energy in proportion to its carbon content and thus encouraging the use of lower carbon alternatives.

But, policy makers in virtually all European countries recognize that reliance on cap and trade alone as a way to meet the ambitious Kyoto target is inadequate. More structured financial incentives are necessary in order to meet the policy goals required by Kyoto. It appears to be in this spirit that many of the newer financial incentives in Europe are being designed. The current approach being used in European countries continues and builds on the directions that were employed in the 1970's and 80's.

All of these fit into the broad paradigm of classical microeconomics. Reducing energy consumption is looked at as an economic problem in which the financial incentives or barriers are analyzed only within the economics paradigm. This will be contrasted to the approach

preferred in this paper, which looks more at the *technologies* for energy efficiency and their *quantitative results in terms of energy consumption* than it does at the economics.

For example, in this context, some of the proposals call for equalizing value added taxes (VAT) between energy efficiency investments and energy consumption. Currently, in some countries, the VAT on fuel or electricity purchases is lower than on building supplies or services, creating an unbalanced playing field between the economics of investment in efficiency relative to energy supply.

This approach is based at least implicitly on the assumption that simply “getting the prices right” will make a major difference in promoting energy efficiency. So, for example, if there are tax breaks for energy supply options, whether at the consumer or producer level, the policy context would suggest that compensating incentives be provided for the energy efficiency side of the equation.

This economic paradigm reflects that there is a governmental interest in promoting energy efficiency at levels beyond those that would be obtained without government intervention. The government – meaning the national government – attempts to set up a selection of policies that create greater investments in energy efficiency than would occur otherwise. These policies include codes, tax incentives, government-administered grants or loans, etc.

In some cases, the policy context is broader than energy. For example, Sweden has a national policy to promote high quality housing for the middle class. Thermal comfort and energy efficiency are components of housing policy rather than separate goals. What literature there is available on financial incentives policies focuses on the economic issues rather than the technology issues. This can be seen from the structure of what information is included in reports and what is not included. There is generally extensive discussion of what the financial incentives are, how they are computed, and how they are administered, but little or no discussion of the energy goals, either in terms of the technologies or insulation levels used to achieve them or in terms of the actual energy results that are expected to be achieved.

This can be seen by the evaluations that are listed in Appendix A; the Appendix and its reference sources are much more concerned with the presence or absence of incentives and their annual budgets than they are with the levels of efficiency being incentivized and what the costs and benefits from a particular technology—or of the whole package—are or should be.

This paper proposes a recommended theoretical structure for financial incentives that can be seen as part of a pyramid for promoting existing, newer, and yet-to-be-developed technologies for energy efficiency on a continuing basis. The base of the pyramid refers to wide market penetration of relatively low-level technologies while the peak of the pyramid refers to the initial commercial introduction of highly advanced technologies.

The basis for this recommendation is the observation that simply getting the prices right for energy doesn't go very far towards solving the problem. Comparisons of prevailing levels of efficiency with available technological options shows that throughout the world, efficiency investments are confronted with a powerful array of market barriers and market failures that generally prevent even technologies with 30% and 50% returns on investments from being used widely.

Besides the problems of conventional market failures, there are additional issues that relate to the concept of market transformation. New technologies are subject to a learning curve in which the initial amounts of production cost the most and increasing cumulative experience with producing the new technology lowers its cost. Economic theory states that the marginal cost of a product subject to a learning curve *should be* the marginal cost of producing the last unit of production that is ever produced, which is the fully mature market cost.³

But this pricing phenomenon seldom if ever happens in energy efficiency markets. The rationale for economic incentives includes the attempt to bring prices down to the level that economic theory suggests they should be at, which will encourage more experience with advanced technologies.

This paradigm is fundamentally different than the economics-based paradigm that tends to assume more perfection in the real marketplace. It suggests a technology-based approach rather than a pricing-based approach.

At the base of this pyramid is the energy code. Energy codes, if properly implemented, can achieve nearly 100% market penetration.

The next level of the pyramid consists of the application of generally available but not widely used energy efficiency technologies that go beyond the code. There are three major methods that have been used in various countries for encouraging this first generation of efficiency products.

The first is informative labeling. Although labels are uncommon on buildings, they are used in most OECD countries and many developing countries for appliances and equipment. Informative labels list the energy consumption of a product, generally on a scale that compares it to other products with similar performance and size features. In some cases, the scale is presented simply as a numerical range; in most cases, such as the European Union, Australia, and New Zealand, the energy ratings are expressed in a quasi-normative fashion as one star, two stars, three stars, etc. or as letter grades, A, B, C, D, E. In Europe, at least, there is evidence that this labeling system has moved the market measurably towards greater energy efficiency over time.

³ Richard Duke and Daniel Kammen, "The Economics of Energy Market Transformation Programs," *The Energy Journal*, 20 (4) 15-64.

The second approach to incentives is normative labeling: a label that is given only for products that perform well. The U.S. EnergyStar® label is perhaps the best-known example of such a normative label. The EnergyStar® program for new homes established a relatively ambitious target for energy efficiency in the late 1990's and achieved a market share that doubled every year through 2003; in 2004, over 130,000 homes were labeled with the EnergyStar® marker, representing almost 10% of the new construction market in the United States. Some 70% of these homes achieved the efficiency level without any outside subsidy.

The ability to label buildings depends on the development of test protocols for measuring energy efficiency in buildings. The European Union has recently passed a law that requires that all buildings (including existing buildings) be rated for energy consumption by 2006. But the EU has yet to develop a rating test protocol.

Russia has adopted a national energy code that requires all new buildings to contain a permanent record of their projected energy consumption and demands that measurements of actual energy consumption be added over time. The test protocol is a part of the energy code. A similar feature is found in the energy code of Kazakhstan.

The United States has developed, through an NGO process, a system of technical standards for ratings and quality assurance standards for organizations and people who can perform these ratings for homes. The system is used nearly universally for homes that are seeking EnergyStar® certification, but it is not widely used outside of the new home construction market. The rating system is also used to qualify in some cases for financial incentives paid by utilities or state energy offices.

For commercial buildings,⁴ the author is unaware of anywhere in the world that has developed a labeling protocol that is usable and that is used. The closest approach to this would appear to be the energy calculation protocols employed by California's Title 24 building standards for commercial buildings. These are used in some 50% of the energy code compliance documents submitted by building designers, but are only used in the context of code compliance and are not available after the energy inspections have been completed (although they could become available).

California's Governor has recently issued an Executive Order requesting that all commercial buildings be "benchmarked" for energy consumption in the near future.

An example of a normative rating system for buildings that goes beyond just energy efficiency is the U.S. Green Buildings Council's LEED™ system.

A more effective but also more expensive approach is to provide financial incentives for buildings that go beyond minimum code levels. In the United States, these are primarily

⁴ "Commercial buildings," are what is referred to as "public buildings" in China.

provided by utilities or by state energy agencies that are funded through surcharges on the sales of electricity or natural gas. In Sweden, the government provides, or used to provide, grants and subsidized loans for homes that went beyond that country's already stringent energy efficiency standards.

Financial incentives for energy efficiency in new buildings can be provided in the form of technology-based incentives or whole building performance-based incentives. Examples of technology-based incentives include rebates for efficient lamps or luminaires or for variable speed motors or particular types of fenestration.

The whole building approach looks at the performance of the building as a whole, or of one of the three major energy using systems (envelope, HVAC, and lighting) as a whole. The incentives tend to be based on percent savings compared to minimum compliance with the energy code. For example, in California, commercial building new construction programs that were based on the whole building achieved 22% savings compared to the California stringent energy code. These programs affected 13% of new construction in 2003. The residential new homes program in California is based exclusively on percent savings beyond the building code, with tiered incentives for 15% and 20% savings.

The preceding details on the design of California's utility-administered incentives program is important as a means of introducing the concept of long-term incentives. The savings from the utility-administered programs in the U.S. typically are on the order of 20%-30%. Anecdotal information suggests that the financial incentives in Europe have similar order of magnitude of savings.

How do we get higher levels of savings? Managers of the utility programs have said consistently that their programs are most effective at inducing buildings whose design and/or construction are nearly complete to substitute more efficient equipment or products at the final stage of design.

More comprehensive, systems-based approaches have been less effective in the utility-run incentive system because they require interventions early in the design process. The incentives cannot be promised at this early stage due to regulatory limits on utility budgeting: so designers and owners are loath to put much money or effort into designing around the availability of an incentive that in fact may be withdrawn by the time the building is actually constructed and able to take advantage of it.

The solution to this problem is to develop long-term incentives that are available for a set period of time – for example, 5 or 6 years – and whose qualification criteria and financial amount of incentive cannot be changed. Designers and owners can plan on designing buildings to qualify for this long-term incentive.

As far as this author has been able to determine, long-term incentives have not been employed systematically on a nationwide level anywhere. But conceptually similar programs have been used with great success in the United States and in Sweden.

These programs have been referred to as “market transformation” and they involve setting a target specification that will establish eligibility for financial incentives. This is actually a weaker policy prescription than the one recommended here, in that the only thing that is fixed is the qualification level, while the actual incentives may come and go or may change in value over the years.

The financial incentive may include a rebate or payment for products that meet the specification. In some cases, the structure of the incentive is a bulk purchase. Examples of successful market transformation programs are:

- In 1992, a consortium of U.S. utilities offered a \$30,000,000 competition for marketing a refrigerator that saved 30% of energy use and eliminated the worst ozone depleting chemicals. No such product existed at the time anywhere in the world. By 1995, all manufacturers had agreed to produce all refrigerators at this level of efficiency. This agreement is embodied in a Department of Energy standard supported by manufacturers as well as environmental advocates, utilities, and states that was adopted in 1997 and went into effect in 2001.
- In the late 1980s, EPA introduced an EnergyStar® recognition program for computers that would power down the screen and hard drive during periods of non-use, adapting the technologies used for extending battery life in laptops to a desktop machine. The federal government reinforced this spec in the marketplace by bulk purchases. By the late 1990s, almost all computers offered this effective energy saving feature.
- In the early 1990s, California utilities offered incentives for commercial lighting equipment and designs that saved 20% of energy use. In 1997, the lighting industry supported a proposal that the California Energy Commission later adopted requiring a 20% reduction in lighting energy in all buildings through the state’s energy code, (Title 24) effective in 1999.
- A U.S. national program to develop clothes washers with more than a 50% reduction in energy use was initiated by the Consortium for Energy Efficiency in the early 1990s. By 2000, newly designed compliant products were offered under the brand names of 5 major U.S. companies, as well as a number of smaller and foreign-based brands. Total market share was approximately 10%, enough for manufacturers to agree to a standard that requires all products to meet this level by the year 2007. By 2005, the new efficiency targets for incentive programs are 40%, 60%, and 75% higher than the initial 1990’s target.

- Research at a national laboratory demonstrated in the early 1980s how to make a fluorescent lamp ballast that cut lighting energy 20% while improving lighting quality. The product was introduced commercially in the 1980s but languished at 1-2% market share or less. After 1990, utilities began incentivizing this product, especially in California, and EPA promoted it through its EnergyStar® programs. By 1999, market share had increased to 50% nationwide and about 90% in California. Industry agreed in 1999 to a mandatory near-total phaseout of the older, less efficient product between 2005 and 2010.
- In the early 1990's, the Swedish organization, NUTEK established a competition for a refrigerator that would use dramatically less energy than current products on the market. This induced very substantial and widespread gains in efficiency. Super efficient refrigerators have become so successful in Europe following this program that new rating categories of A+ and A++ needed to be established to differentiate the most efficient European refrigerators. NUTEK has a number of other market transformation successes; three of which have received formal evaluations.
- In the late 1980's, the Pacific Northwest established an incentive program to encourage the development of manufactured homes using 50% less energy than the then current normal practice. As a result of several years of incentives, 70% of the product in the Northwest met the target level. Even after the incentives were discontinued, the market share of efficient manufactured homes remained at 50%.

These results are very encouraging. They show that relatively modestly scaled programs without large budgets succeeded in making products available in the market at much higher efficiencies than were there previously and that came to represent 50% or even 100% of the market within 10 years of the program. This suggests that the potential for long-term incentives in new buildings is very high, despite the lack of practical experience with them.

If the point of long-term incentives is to provide assurances of future content of the incentive program, then *it is essential that the design of the program be well thought out*. The requirement for stability makes it difficult to correct errors in program design without creating ill will or financial losses from people who tried in good faith to meet the specification as it was published. It suggests strongly that such long-term incentives be developed based on existing programs that have gone through cycles of feedback and improvement.

This philosophy was used in the development of proposed American legislation currently being debated in the U.S. Congress, Senate Bill 680.

III. National and Regional Examples

A. National Examples

Earlier and current programs in Europe appear to conceptualize the energy problem as developing market incentives for known efficiency technologies or measures whose costs would be bought down by a subsidy or grant, or in some cases a loan.

For example, as early as the 1970's, Sweden was providing subsidies "covering part of the cost of approved retrofit measures, selected on the basis of economic effectiveness."⁵ This program involved grants, suggesting some individual plan review of applications for the grant, as opposed to a more organized by rigid process. Reviews of this program, which was focused on housing, raised some questions about free ridership. It is not clear from this discussion whether the subsidies were based on the amount of efficiency installed (energy savings or number of square meters of insulation) or whether they are based on the cost of the installation. The value of the incentives was about 25% of the value of the house, but this included the housing subsidy as well as the energy efficiency incentive.

The Swedish financial incentive program appeared to be managed comprehensively in terms of codes, incentives, research and development, and links to non-energy housing issues. Thus, the question of providing a funding source for the program never seems to have arisen. The energy efficiency aspect of housing was simply considered part of the nation's housing program.

In the UK, the government has established a carbon trust that encourages businesses to invest in energy efficiency. The approach is to provide subsidized consulting services with the goal of identifying cost-effective carbon mitigation investment opportunities, and then providing direct subsidies to encourage the host industries to carry out the identified program.

While the specifics of this approach do not apply to buildings, the general principle could be applied anywhere. Following this principle, it is the national government that is the primary entity in developing and implementing financial incentives. The government collects money through the carbon emission charges and uses it to provide subsidies for energy efficiency opportunities. This model will be discussed in more detail later; but it is essentially identical to the system used in many U.S. states by which utilities or state energy offices collect money from a "wires charge" on electricity sales and then use the revenue to finance energy efficiency programs.

⁵ Lee Shipper, Stephen Meyers, Henry Kelly, "Coming in From the Cold: Energy-Wise Housing in Sweden," Seven Lochs Press, Cabin John, MD.

The UK recently instituted or plans to institute a number of tax incentives as part of its program for meeting Kyoto Protocol commitments that are similar in structure. The first UK incentive was to provide immediate depreciation for 100% of the value of investments in qualifying energy efficient equipment. This amounts to a subsidy through the tax system of about 22.5%. It is not clear from the write-ups how demanding the energy targets are or how they were established⁶. However, the subsidy is based on the cost of the equipment rather than its performance (although merely qualifying for the incentive requires that the performance exceed a minimum threshold.)

The UK is also developing additional incentives. However, there does not appear to be an overarching principle or plan behind them, nor does there appear to be a solid analytical basis; instead the programs appear to be *ad hoc* experimentation.

One program coordinated with an efficiency program of British Gas gives a £100 council tax rebate to people who buy a £175 insulation package. Another experimental program provides council tax credits for three different levels of household energy efficiency. These tax credits range from £25 to £100. It is not clear what criteria were used to develop these packages. Also, the Prime Minister is introducing a proposal under which homeowners will get tax cuts of up to about £300 for making their houses "green" and energy efficient, with the incentive based on the energy ratings in the homebuyers' information packs, which everyone selling a house will be legally required to have from 2007 pursuant to an EU directive. More details on the UK programs are provided in Appendix C.

This pattern of hybrid cost-based and performance-based incentives appears to be a common program design. For example, in Japan the New Energy and Industrial Technology Development Organization (NEDO) provides subsidies for energy efficiency investments. It appears that these investments have to meet technical specifications concerning efficiency or energy savings, but the subsidy appears to be cost-based.

Previously, Japan also provided loans to support energy efficiency investments. But with the current interest rate for 10-year loans in Japan hovering around 1.5% annually, it is hard to see how subsidized loans would have much impact.

Another Japanese initiative enacted in 1993 provided a tax rebate and accelerated depreciation of 7% of the purchase price of defined energy efficiency equipment. As a result, investments in energy efficiency appear to go up significantly; however, the energy savings impact apparently was not tabulated.

It is not clear whether any of the Japanese programs provided significant amounts of energy efficiency gains; however, it did at least induce by ¥500 billion per year in

⁶ http://www.worldenergy.org/wec-geis/publications/reports/eepi/a1_incentives/ukdata.asp
<http://www.nec.gov.sg/incentive/home.shtm>

1993 compared to 1990; however, these investments fell back to previous levels by 1999.⁷

The energy incentive program in Thailand provides loans and financial assistance for qualifying energy efficiency products. These programs appear aimed more at the industrial sector than at the building sector. After an initial period of enthusiasm, this program appears to be relatively underutilized; however it is ongoing and steps are being taken by the government to increase its use. Anecdotal evidence suggests that active promotion of the program and bureaucratic streamlining will be necessary for it to gain prominence as a significant source of energy savings.

The Korean Government provides a 10% income tax credit for energy efficiency investments. The 10% applies to the full cost of the equipment. The replacement or installation of the facilities and equipment listed below qualified for the income tax credit: (a) replacement of old industrial kilns, (b) installation of energy-saving facilities, (c) alternative fuel-using facilities, (d) other facilities which are assessed as being able to bring forth more than 10% of energy-saving effects.

The level of incentive was not determined by specific and in-depth research. Apparently, Government officials looked at international experience but had no theoretical framework for good program design. The Koreans did not conduct an evaluation of the tax incentive program.⁸

France has energy efficiency incentives in the form of loan guarantees for businesses that are installing energy efficient equipment or for manufacturers of energy efficient equipment. Again, virtually no information is available on the size or effectiveness of these programs.

Canada has one major program at the Provincial level in British Columbia(BC). This program is similar to several of the state level programs in the U.S. (see discussion below). The program that exempts the sale of Energy Star products plus some oil furnaces from the BC social services tax (PST), which is essentially a sales tax. The PST rate is 7%. The program is scheduled to operate from February 16, 2005 to April 1, 2007.

The technologies that qualify for the exemption were chosen by the Federal Government. The tax rate was chosen by the Province and equals the full sales tax available within the Province's control. Since the tax savings are issued at the point of purchase by the retailer, as a non-collection, the program is very easy to implement.

The savings are applied to the full purchase price and may represent a large fraction of the *incremental* cost between standard and high efficiency units. One thing that makes the program unique, and exemplary of a good practice, is the coordinated

⁷ *Energy Efficiency Policies and Indicators*, a report by the World Energy Council. World Energy Council, London, UK, October 2001.

⁸ For more details and sources, see Appendix C.

effort between the Provincial and Federal governments. This is the first such program in Canada. There will be an annual impact evaluation of this program that will calculate energy savings but will not address free riders. (There is an unexpressed assumption that there will be significant free-ridership.)

Some of the earlier approaches in the 1970's worked more simply. In the late 1970's, the U.S. offered tax incentives for energy efficiency and for solar energy in the 1970's and early 80's that were based on a percentage (15% at the federal level, often supplemented by even larger percentages at the state level) of the cost of qualifying purchases regardless of their performance. Even today a nearly identical approach was proposed as part of a major energy bill (H.R. 6) that was considered but not adopted by the U.S. Congress in 2004.

These incentives were costly and either ineffectual or only minimally effective.

In the case of the solar industry, the tax incentive did not lead to lower market prices for the solar equipment. On the contrary, the net price after tax incentive remained the same while the cost of the available equipment went up. The industry developed a reputation for unreliability, partly as a result of the cost basis of the tax credits. And the cost-based structure led to problems of contractors "gaming" the system—charging higher prices to allow their customers to qualify for larger tax credits rather than reducing prices to attract more business.⁹ This led to a boom and bust cycle for the solar industry, and left it in a weaker position with lower market share in 1990 than it had had before the incentives in 1975.

The insulation tax incentives were less perverse but equally ineffectual. The most rigorous evaluation study of this program, performed by the Oak Ridge National Laboratory, concluded that, statistically, the incentive appeared to induce more energy efficiency investments than would have occurred without it, but the difference did not achieve statistical significance.

⁹ The solar tax credit provided households that installed a solar hot water system with a credit worth 40% of the cost of the system up to a limit of \$4,000. There were no performance requirements attached to qualification: the system did not even have to work. The immediate effect of this credit was that it allowed contractors and manufacturers to increase the price of their systems. Indeed, a \$10,000 system could be marketed as providing the maximum allowable tax incentive of \$4,000. The following story illustrates how this structure for the incentive led to high prices and unintended consequences. A contractor that formally had offered a solar water heating system for \$3,000 would instead charge \$10,000, but offer a week-long first class trip to a beach resort. The trip was worth \$3,000. Thus, the consumer would pay \$10,000 to the contractor, receive a solar system worth \$3,000, and also \$3,000 worth of benefits (the vacation), and a \$4,000 tax credit. The net cost to the consumer is the original \$3,000. But the government ended up paying \$4,000 in order to reduce the net price to the consumer by only \$1,000. The contractor made the rest of the money. While this story is not documented in the literature, observers of the solar industry believe that it is not atypical of the types of unethical or ineffective uses of the tax credit. It is clear to see that it would be in the interest of the contractor to try to get away with this technique, and that there are not any market forces that would discourage such behavior. It is also evident that an industry that develops based on financial tax code related transactions rather than the actual performance of the system at saving energy will not survive the termination of the tax incentive. This was the case.

Other U.S. studies reached similar conclusions:¹⁰ a household survey conducted in 1983 found that 88% of the households qualifying for the credit said they would have made the improvement even without it; conversely, 85% of households claim they had installed energy efficiency measures that year but did not claim a tax credit. While such surveys often provide unreliable results – for example, evaluation of refrigerator rebates showed that similarly high percentages of consumers claim they would have bought the more efficient product without the rebate, and manufacturers claim that they would have produced the product without the rebate, notwithstanding the fact that were rebates were not available, the efficient products were not available – they do corroborate the statistical findings of negligible impact.

Some of the more recent studies show a significant correlation between the existence of tax incentives and consumers' propensity to invest in efficiency.¹¹ But they did not examine whether energy savings were realized, only whether investments were made. This is a problem, because a consumer who buys insulation but leaves it uninstalled in his garage has made an investment but has not saved energy. Similarly, investments may be made in efficiency measures that were poorly chosen or poorly installed, resulting in little energy savings.

The United States also enacted a 10% cost-based tax credit for business purchase of energy efficiency measures. The measures had to be covered on an eligibility list. It appears, however, that its eligibility was established by the general description of the product rather than specific performance parameters. Again, follow up surveys suggest that the credit did not make much of a difference; that most of the measures were likely to have been installed without the credit.¹²

The lesson learned from this experience is clear: if the incentive is to spend money on efficiency, consumers may spend the money; but they will not necessarily achieve the intended efficiencies. In contrast, in evaluated DSM programs, when the incentive is to save a measured amount of energy, consumers achieve the energy savings. Or at least if they fail to do so, the utility does not spend its budgeted amount for the incentives.

These negative experiences were not entirely a waste, however. While no further economic incentives have been established at the federal level, states and utilities began developing incentives based on the experiences of the 1970's programs. In addition, in the last several years, states have begun to experiment with tax incentives for energy

¹⁰ Patrick Quinland, Howard Geller, Steve Nadel, "Tax Incentives for Innovative Energy Efficient Technologies (Updated Version)," ACEEE Report E013, October 2001.

¹¹ K. Gillingham, R. Newell, and K. Palmer, "Retrospective Examination of Demand-Side Energy Efficiency Policies," Resources for the Future Discussion Paper 04-19 rev, 2004, reviews the primary analyses of the tax incentives.

¹² Ibid.

efficiency. Some of these programs also drew on the lessons of the national programs and consequently are better designed.

A review of these programs in 2002 by the American Council for Energy Efficient Economy (ACEEE) led the authors to establish several principles for the design of tax incentive programs – principles that generally parallel those recommended in this report. And the results of national and state experiences have been incorporated into the language of legislation currently being debated in the U.S. Congress, such as S.680.¹³

Other than the U.S. national tax incentives of the late 70's and early 80's, there appears to have been no formal evaluation of financial incentive programs. One of the reasons for this may be that so many of the programs are recent.

But, another explanation looks more at the difference between the political process for establishing national level tax incentives compared to the process used for establishing incentives with a particular administrative agency, such as a utility or energy office. The difference is that the tax incentive programs are one-time programs that are authorized legislatively. Politicians enact these programs to respond to policy needs or political pressures. It is not in their interest to have the programs evaluated, both because the adverse consequences to a politician of a report showing that his or her program failed would be much greater than the positive consequences of a study showing that the incentives have succeeded, and because the politician's time horizon is shorter than the 5 or 7 years that it would take to complete and publish an evaluation study. It is simply not in the politician's interest, given the fact that no program is certain of success, to allow, much less fund, an evaluation effort.

This problem is exacerbated by personal and cultural influences. Losing face is a major social taboo. No one wants to lose face and, as significant, no one wants someone else to loss face. The loss of face issue presents a significant programmatic issue throughout the Southeast Asian region including in China. The best solution might be for programs to be designed with culturally acceptable ways of accurately assessing program results. Also, with a number of different programs, it would not be expected that all of them would succeed.

In contrast, administrators of state energy programs face budgetary pressures every year in getting their budgets reapproved, and may face competitive pressures from other agencies that wish to operate the program instead. Or, they may be regulated utilities whose revenue base and profitability would be increased (or diminished) to the extent that they demonstrate success (or failure) at achieving public policy objectives. In such a case, there are parties that benefit from accurate evaluations: parties that stand to win if the evaluations show programs are successful, and other parties that stand to win if

¹³ <http://thomas.loc.gov/>; then click on “search by bill number” and type in S680.

the programs are shown to be failures. Thus, the political environment for evaluation is much better, and many more such evaluations have been done.

B. U.S. State Level Examples

The most comprehensive evaluation of state tax credits that we were able to find was an ACEEE study published in 2002.¹⁴ The ACEEE study noted some 8 states that have or have had tax incentives for energy efficiency in buildings and in equipment used in buildings. In addition, three of these states had energy efficiency or alternative fuel incentives for motor vehicles.

Most of these programs were enacted in response to political opportunity rather than as part of comprehensive energy plans in which the tax system was chosen for specific reasons as the means for providing the incentive, as opposed to other potential mechanisms (such as utility programs). (In contrast, the use of the tax system as the basis for the long-term incentives in the U.S. proposed legislation S. 680 was a conscious choice in which the tax code was found to be the best policy mechanism for making long-term financial commitments.)

Given the unplanned or opportunistic nature of many of these incentives, the issues of the details of program design did not appear to be handled on a comprehensive basis. Nevertheless, the fundamental design concepts of the programs appear to be reasonably good, and the report finds encouraging if not formally evaluated signs of success from many of these programs. Several of the state programs are structured around providing a sales tax waiver for products that met an advanced level of energy efficiency specification. Typically, this level was the Energy Star® level.

Sales tax exemptions for equipment meeting efficiency specifications is a combination of a performance-based incentives and a cost-based incentive. The incentive is performance-based because the primary qualification criterion is energy performance. But it cost-based because a more expensive product gets more of an incentive than a less expensive product even if the levels of energy efficiency are no different.

Several U.S. states have adopted similar programs: tax relief for products that meet a certain threshold. More than one state has provided sales tax exemptions for products meeting threshold levels that typically are set equal to the U.S. EnergyStar® level.

The EnergyStar® level typically represents the top 5%-25% percentile of the market in terms of energy efficiency, so the target is relatively ambitious. The sales tax

¹⁴ Elizabeth Brown, Patrick Quinland, Harvey M. Sachs, Daniel William, "Tax Credits for Energy Efficiency in Green Buildings: Opportunities for State Action," ACEEE Report No. E021, March 2002.

in most states is in the neighborhood of 6% to 8%, so this amounts to a 6%-8% subsidy of the entire cost of a device that is more energy efficient. Note that this subsidy is entirely unrelated to the incremental cost of the energy efficiency measure. If the energy efficient device has other consumer features that cause it to command a much higher purchase price (for example, dishwashers), then the subsidy for the expensive device is much larger than for the cheaper one. In some cases, this is directionally good energy policy because the most expensive dishwashers that meet EnergyStar® tend to exceed it by a considerable degree whereas the cheaper ones tend to meet it minimally. But this is accidental: for products like air conditioners, purchasing a larger (and even oversized) air conditioner results in a larger subsidy than purchasing a correctly-sized and thus more energy conserving model.

In addition, Arizona offered a combined performance-based and cost-based incentive for new homes that meet an advanced level of energy efficiency of 50% savings compared to the 1995 Model Energy Code. This incentive is small, averaging around \$200 compared to the purchase price of a new home, which is probably on the order for \$200,000. Hawaii also offered a combined system of a 20% cost-based incentive for heat pump water heaters, but the specification that it be a heat pump is essentially a performance-based specification.

New York and Oregon offer incentives for “green buildings” for commercial buildings that are certified for environmental performance including energy efficiency. New York developed its own criteria, but Oregon provided the incentives based on a non-profit organization’s objective rating scale: the U.S. Green Buildings Council’s “LEED™” rating. The New York green buildings proposal, as well as those of other states that have not yet adopted green buildings incentives, has a fixed budget available for complying projects. Each project must make an individual application to the administrator of the program and when the budget is exhausted, the incentive is no longer available.

This structure differs fundamentally from all of the other state tax incentives and from those proposed at the national level in the U.S. In all other cases, the incentive continues to be available no matter how many people apply for it.

One cautionary tale is Arizona’s flexible fuel vehicle incentive. This incentive was set at a fairly generous level with the expectation that it would be available for all who applied. But the specification turned out to be easy to meet and the program began to cost much more than had been anticipated. As a result, lawmakers deauthorized the program.

The Arizona program had an additional flaw with respect to complementary policies. The tax incentive encouraged the purchase of alternate fueled vehicles but did nothing to encourage the availability of the fuels that they would rely on. Indeed, the runaway success of the program in putting vehicles on the road also overwhelmed the

fueling infrastructure for alternative fuels, making the program even more of a failure than it would appear from the direct cost of the program.

This experience points out the importance of getting the structure of tax incentives right. If a few of the incentives have to be withdrawn or changed radically, then the advantage of long-term stability is lost. The incentives will no longer have credibility with the elements of the market that they are trying to influence.

The Oregon program is of particular interest because it has been operating for a longer time than any of the other state or apparently national level programs and because there is at least strong anecdotal evidence of its continuing success. (See Appendix B.) The Oregon program sets qualifying levels for energy efficiency – or in the case of commercial buildings, for “green buildings” and offers fully transferable tax credits for purchasers of equipment that qualifies.¹⁵ The transferability means that they can be used by organizations that do not pay taxes.

In general, the qualification levels are selected after careful analysis of the market by Oregon Office of Energy staff. The levels chosen generally are quite high: they often correspond to the higher efficiency tiers of the Consortium for Energy Efficiency (CEE)¹⁶, or else Oregon invents its own qualification thresholds that generally exceed (often by a lot) the EnergyStar® thresholds.

Another unique aspect of the Oregon program is that the applications for the tax credit are processed by state energy office staff rather than being handled through the much slower process of filing annual income taxes. This high level of staff participation is expensive, but it contributes to a very favorable perception in consumer surveys of the attractiveness of the program.

For many products, the Oregon program offers a fixed dollar incentive for meeting a specified target of efficiency for a particular product. In the case of green buildings, the incentive is a percentage of cost up to a limit that varies with the level of greenness achieved on the LEED™ scale. For the business energy efficiency tax credit, qualification is based on meeting a performance-based goal, but the level of incentive is based on the incremental costs of efficiency.¹⁷

¹⁵ <http://egov.oregon.gov/ENERGY/CONS/RES/RETC.shtml>
<http://egov.oregon.gov/ENERGY/CONS/BUS/BETC.shtml>

¹⁶ <http://www.cee1.org/resid/resid-main.php3>

¹⁷ Incremental costs are impossible to measure, however, since they represent the difference between the cost of the building that was built—which can be measured—and the cost of what was not built—which can only be estimated. For a large jurisdiction, incremental costs would be subject to manipulation by the building owner. This was the

Target levels are adjusted upward annually as necessary to control the budget of the program and to encourage ever-advanced technologies for energy efficiency.

While there have not been any formal evaluations of the Oregon program, some informal evaluations as well as anecdotal evidence suggests that the program has been effective. For example, the market share of Energy Star-qualified clothes washers appears to have increased at a faster rate than in neighboring states, which is a significant result since some of the neighboring states include utilities that offer financial incentives for similar products. Anecdotes suggest the widespread and increasing availability of high efficiency furnaces that meet the very stringent Oregon specification. Oregon has the third highest number of LEED™-certified commercial buildings, despite being one of the smaller states. And Oregon has by far the highest concentration of hybrid motor vehicles that qualify for the state tax incentive. (See Appendix B).

Because of its reliance on technical analysis and frequent revisions of specifications performed by expert agency staff, the Oregon tax credit program resembles DSM programs more closely than it resembles long-term tax incentive programs. The only thing that it has in common with the long-term programs is that the Oregon Office of Energy's staff has set a very demanding qualification level for products and buildings that can qualify for the tax incentive.

The Oregon program also resembles managed incentive programs, such as DSM programs, in the degree of staff administrative involvement required to make the program work properly. Perhaps because Oregon is such a small state, staff is able to administer some of its financial incentive programs – such as loans to businesses – on the basis of individual applications rather than prescribed general rules.

U.S. state tax incentive programs are effectively funded out of the general revenue base of the state. That is, overall tax collections are providing the subsidy used for energy efficiency. On one level, this would not seem to be attractive either theoretically or politically, but in several states, with Oregon as a particular example, the political paradigm into which the tax incentives fit are “tax relief for businesses and consumers.” This has allowed many of the programs to be enacted or remain in effect despite their apparent competition with other government spending priorities.

experience in California when incremental costs were used to determine whether particular energy efficiency measures were required by the Energy Code.

IV. Managed Incentives and Long-Term Incentives

A. *Managed Incentives*

Managed incentives refer to programs that are operated by an agency that has active oversight of the design of the program and of its administration and implementation. Programs are managed in the sense that when they are unsuccessful in terms of marketing, different approaches can be taken, including alterations in the program design itself. Conversely, management sometimes may consist of shutting down programs that have become too successful in the sense that they have outrun their budgets.

A key element of management for many of these programs is formal measurement and evaluation of the programs' results at the end of the program year. These measurement studies look at statistically significant subsets of program participants and non-participants and try to establish using conservative assumptions how much energy was saved by the program compared to what would have happened in the absence of the program. These evaluations also look at the cost to the program administrator and to the end user that is making the energy efficiency investment to determine a basis for calculating cost effectiveness.

Managed programs can be very significant in terms of their effects on the marketplace. California, for example, spends almost \$100 million annually on energy efficiency programs for commercial buildings; these buildings account for some 1 billion square meters of conditioned floor space.

Of this financial amount, some \$20 million is used for new construction.

The residential new construction programs cost roughly \$20 million annually. Some 15% of new homes constructed in California – or about 25,000-30,000 homes per year, qualify for new construction incentive programs.

We will focus next on the results of these relatively large-scale managed incentive programs. These are important for two reasons:

- They have been subject to formal evaluation, and publicly available recommendations exist for program administration, and
- The magnitude of these programs is sufficient to produce measurable reductions in regional energy and electricity consumption.

Also, these programs are important because they fit into the context of matching incentives with revenue sources. In the case of utility programs, distribution utilities are authorized to collect a “wires charge” or “public benefits fund” of a fixed amount per kilowatt hour sold (regardless of who the energy supplier chosen by the consumer may be), and also, in some cases, the distribution utilities are permitted to spend money on DSM to avoid spending larger amounts of money on energy supply contracts of the same magnitude in megawatts and kilowatt hours.

Stated in different terms, approximately 1% of a typical utility bill goes to fund energy efficiency programs. It is current state policy in California to at least double the size of these programs in the next several years. Programs of comparable magnitude exist in a handful of other U.S. states, but appear not to exist outside of the U.S. (This is not to say that there are no managed incentive programs elsewhere, but rather that there are no programs that even approach the magnitude of those in U.S. states where efficiency is a serious part of public policy.) These states where at least 1% of utility revenues are used to fund efficiency programs include California, New York, New Jersey, Massachusetts, Rhode Island, Connecticut, Vermont, Wisconsin, and Montana. Note that most of the budget goes to retrofit incentives rather than new construction.

The design of managed incentive programs for new buildings consist of an interplay between the levels of efficiency required in the energy code, the availability and cost effectiveness of additional measures, and the desire to achieve a significant market share.

Over the last decade, particularly in California, the success of earlier managed incentive programs has led to a series of upgrades in the energy code, which in turn make it more difficult for succeeding years’ programs to find available and cost-effective measures, particularly for the first year or two after the new code is adopted.

In California, key examples of the incentive programs’ influencing the building energy code were:

- Residential
 - In the early 1990’s thermal conductances of windows were not measured or simulated. Instead, default values were chosen based on the number of panes of glass and the thickness of air space between the panes. These numbers turned out to be overly optimistic because they fail to account for heat transmission through the generally metal window frames and the separators of the lites of glass. A national rating system for windows was developed in response to the needs of the incentive programs, and for several years, the incentive programs provided startup support for testing laboratories to validate computer simulated thermal ratings for windows and then to encourage the installation of windows that scored well on

these tests. This allowed much more stringent standards for windows to be adopted in the 1995 Energy Code.

- Incentive programs also worked to encourage tested leak free air distribution ducts. In California, the overwhelming majority of homes distribute heat from a central furnace and air conditioner using ducts. These ducts tended to lose over 20% of the air introduced into them through leaks. Incentive programs developed procedures for making duct systems leak free and for field testing the tightness of the system. Requirements for leak free ducts were introduced into the Energy Code in 2001.
 - Managed incentive programs have been encouraging high quality compact fluorescent lighting in residential applications. As a result of these programs, more stringent requirements for the use of compact fluorescent lighting in kitchens, bathrooms, and workspaces within homes were introduced into the Energy Code in 2005.
 - Incentive programs for high efficiency air conditioners contributed to the adoption at both state and federal levels of a mandatory standard for air conditioner efficiency that was also incorporated into the California Energy Code. The approximate level of efficiency required was a COP of 3.2.
- Commercial
 - Incentive programs encouraging the use of T-8 lamps and electronic ballasts established a market experience of over a million square meters of lighting projects typically at power densities of 10-12 watts per square meter for offices. This led to a reduction in the energy code limit of about 20% in 1998 – to about 13 watts per square meter.
 - Further experience with more advanced incentivized equipment allowed a reduction to about 12 watts per square meter in 2005.¹⁸
 - Utility programs demonstrated the feasibility of higher efficiency packaged air conditioning equipment for commercial buildings; these were adopted as mandatory equipment standard as well as the basis for the 2005 Energy Code.

¹⁸ Interestingly, this experience may have also have led to China's adoption of relatively stringent lighting power density limits in 2004. The Chinese lighting experts that recommended the requirements that were adopted by the Ministry of Construction looked in detail at the California energy code and the lighting design experience incentivized by managed incentive programs.

During the mid-1990's, before these rapid steps towards more efficiency in the Energy Code, a well-run new construction incentive program could achieve a market share well in excess of 50%. Today, the development and implementation of managed incentive programs is a tradeoff that is influenced by the success in accelerating code improvements.

First, the incorporation of many cost effective energy efficiency measures into the code requirements means that fewer cost effective measures are available for beyond-code programs. While this is likely to change when the market fully adjusts to the new code, it presents short-term constraints on the level of energy efficiency that can be demanded from the point of view of cost effectiveness.

The incorporation of more advanced energy efficiency measures into the code also means that the remaining measures available for beyond-code performance are, at least initially, less available and less familiar to designers and contractors. In the commercial sector, the response has been the development by utilities of programs focused on the design team and the creation of design guidance documents such as the advanced lighting guidelines and the advanced buildings benchmark and its supporting suite of marketing tools and training materials as a technical resource.

This pattern of efficiency measures moving from managed incentive programs to code requirements is intentional: most of the programs were designed and implemented specifically with this goal in mind.

The experience of managed incentives programs has been summarized in a series of reports available online at www.eebestpractices.com. These reports discuss program designs of specific administrators in detail and draw general conclusions concerning program design and implementation. These conclusions appear to be valid advice both for managed programs and for long-term programs. The key recommendations were:

- communications and outreach to a wide variety of stakeholders,
- accurate reporting and tracking of results,
- third party verification of the quality of installation of energy efficiency measures, and
- the use of truly performance-based incentives, in which a fixed incentive amount is paid per home that achieves a fixed energy target.

In some cases, multiple targets or a sliding scale of targets were established, with commensurate financial incentives. In some cases, the amount of financial incentive was

established based on a comparison to the expected incremental cost for compliance; in any event, typical incentives paid for two-thirds of the incremental cost or lower.

For commercial buildings, the recommendations focused on emphasizing whole building performance and integrated design, as opposed to specific measures. The program designs were empirical – that is, program designers developed them drawing on experience rather than just theory. Incentives were intended not merely to buy down the cost of energy efficiency but to establish the credibility of high efficiency in the minds of both the designers and the owners.

Incentives to both designers and owners seem to be gaining in popularity. For commercial buildings even more than for residential buildings, quality assurance and verification procedures were considered critical. Program administrators were advised to allow flexibility in the design of programs, suggesting that a combination of managed programs with design flexibility and longer term programs with more ambitious goals but in which flexibility is impossible would work best.

B. Long-term incentives

We have seen in this review that the difference between long-term incentives and managed incentives, or the difference between incentives administered through a DSM-like system or those administered through a tax system are not differences between fundamentally dissimilar programs, but rather differences of degree. For example, DSM-sponsored market transformation programs have more in common with long-term incentives than they do with managed incentives. And several of the state and national tax incentive programs are functionally indistinguishable from DSM programs from the point of view of the energy end user.

The key difference between managed programs and long-term incentive programs is the very fact of management in the shorter-term programs. Management has the disadvantage that the market cannot rely on the program to make long-term investments in fundamentally different and much more efficient technologies. To solve this problem requires that analysts have sufficiently well designed programs and sufficient budgetary resources to be able to commit to supporting a higher level of efficiency for the long time frame. In practice, since budgets are almost always limited, this reinforces the need to set ambitious energy efficiency goals, because a sufficiently ambitious goal will assure that not too many people apply for the incentive that the budget is overrun.

Long-term incentives that are not funded through a public benefits charge or general government revenues will require some dedicated source of revenue. In many countries and regions, this can be the corporate income tax. Corporations are taxed on net profits, which means revenues minus expenses. Energy costs are an expense that reduces reported profits and thus government revenues. Inducing users of energy that are

corporations to use less means that the government collects tax revenue at the marginal corporate tax rate on the value of all energy savings. This provides a revenue source that is directly coupled to the success of the long-term incentive.

It is mathematically possible to construct incentive levels so that they fully payback government expenses for the incentive whenever the corporate tax rate is higher than about 5%-10%.

The best thought out proposal for long-term incentives in the U.S. is the current Snowe- Feinstein Bill (S. 680), a bi-partisan bill under consideration in the U.S. Congress. Considerable dialogue and discussion between energy experts, stakeholders, and government officials went into the design of this bill. This discussion is reflected in the recommendations below. More details are presented in Appendix D, which describes an earlier version of the bill that uses the identical policy principles.

Long-term incentives would appear to benefit from the following design criteria:

- Set ambitious targets that are well within the top 1% of the current market
 - Lower targets should be incentivized using managed incentives or normative labels.
- Base the incentives on performance and not on cost.
- Establish incentives that are worth from 25% to 40% of the expected incremental costs of compliance
 - actual incremental costs are likely to be below expected costs due to increased competition and innovation that are likely to result from a performance-based incentive.
 - expected incremental costs will be below today's costs, because the tiny market share of existing products makes it difficult to procure or design them: the only customers who buy the product today want it so badly that they will pay premium prices.
- Provide the incentive for 3-7 years and then plan to end the incentive
 - a year or two before the incentive expires, the success of the incentive should be evaluated. If the program is successful, either the efficiency level can be obtained in the future without incentives at all or through managed incentives.

- Consider whether a new long-term incentive should be established with a higher target.
- Specify clearly how to measure or verify that the energy use target is made and who is authorized to certify that compliance has been achieved.
 - Make the compliance documentation useful in the marketplace by employing variants of currently used documents or by providing information such as annual energy costs that will be useful in the marketplace.
- Coordinate with other programs, particularly information-based programs and labeling programs, as well as managed incentives, to create the largest overall effect.

Ambitious targets are needed to control the budgetary impact of the program. The whole point of the long-term program is to allow designers and manufacturers to make investments that rely on the continued existence of the incentive. If the level of efficiency demanded is too lenient, the number of applicants for the incentive can be much larger than expected. This creates a policy conflict: either the budget for the incentive is drastically exceeded or the government breaks faith with the firms that it is trying to influence by cutting short the incentive or reducing its value. Policymakers should not be presented with this sort of choice.

Of course, it is still possible that no matter how ambitious the goal, the program can be a runaway success. But with a very ambitious goal, the policymakers will be able to justify the budgetary impacts because of the unexpectedly large and rapid energy savings and technology development that were accomplished.

Basing the incentives on performance and not cost establishes competition among different suppliers of goods and services to meet the energy goal at the lowest cost. Even a partially cost-based incentive dilutes the market competition. For example, if a program pays one half of the incremental cost of obtaining efficiency, then a building owner that can save a million Yuan by meeting the target using a more innovative solution will be less encouraged to do so because the savings to the owner is only one half million Yuan.

The incentive should not cover 100% of incremental costs for several reasons: first, evaluation studies consistently show that the first cost barrier is not the most important reason why the efficiency investments have not been made. First cost is a problem, but other problems are more important. Treating the problem as if it is entirely a first cost problem raises the budget for the program unnecessarily. Second, the goal of long-term programs is to bring down the incremental cost. If the incentive already pays

close to 100% of the incremental cost, owners will be less motivated to seek cheaper solutions. Many market transformation programs have accomplished their goal by paying incentives in the 25% to 40% range.

Also, with long-term incentives, if the first cost barrier turns out to be a bigger problem than anticipated, the managed program can add temporary incentives to the long-term incentives in order to increase customer interest. But there does not need to be a commitment to the larger payment for the full term of the tax incentive.

The incentive should sunset because the goal is to encourage continuous improvement in energy efficiency. An advanced energy efficiency building constructed in 1975 no longer looks advanced; while the most efficient refrigerator produced in 1975 would consume more than three times as much energy as the minimally required level of efficiency in the U.S. and other countries. By establishing a firm “sunset” date on the incentive, policymakers have the ability to evaluate what an appropriate target is for the next period.

It is also possible that market mechanisms will have rendered the need for incentives completely unnecessary. While there are hardly any examples yet of this having happened, the discussion in appendix D suggests potential mechanisms for commercial buildings and retrofit homes that could allow further efficiency gains to be made without the need for fiscal stimulus.

For pieces of equipment, the specification of energy test protocols and who can provide documentation are straightforward: they are the same as for a labeling or standards program. For buildings, the process should be developed in parallel with the building energy codes. The types of calculations used to comply with the energy savings goals for the incentives should be the same or substantially the same as the methods used to establish performance-based compliance with the building code. The people who are allowed to make certifications, and the professional standards that they must meet, should be parallel to those used for the energy code.

Thus, a rater who qualifies a building owner for the incentive might also be able to submit the same documentation to the local code authority to show that the building met energy code. This is done in Vermont for compliance with the state’s energy code, using the Home Energy Rating Systems (HERS) methods for compliance. The newly adopted “International Energy Conservation Code” 2004 Supplement also recommends that states allow home energy rating system (HERS) ratings to be used as the basis of code compliance. Similarly, S. 680 relies on the existing home energy rating infrastructure for new and retrofit homes and calls for the creation of a similar and parallel infrastructure for rating commercial buildings.

Specifically, the process used in S. 680 is to require that certifications be made by individuals who are qualified by an organization recognized by the government as meeting 2 key requirements:

- quality assurance standards for its raters, such as providing training and testing of their competence, and
- providing standards of financial independence of the rater from the owner of the building that is applying for the incentive.

The reliance on the system of home energy rating systems (HERS) is particularly important because the mortgage lending industry in the United States recognizes these ratings as providing the basis for a loan: the bank will loan the amount of money needed for a retrofit or a loan the prospective buyer of a new home more money than they otherwise would, based on the present value of energy savings of the retrofit, or the present value of energy savings in the new home compared to minimum energy code compliance. By requiring the same documentation, the incentives encourage market forces to work at promoting efficiency.

V. Policy Recommendations for China

Based on this review, China could advance its policies to promote energy efficiency in buildings, and more broadly, use energy efficiency policy as a way of promoting prosperity and economic growth by following a set of strategies that are being used by leading regions and countries in many places throughout the world.

The types of policies can be discussed at two levels.

At the highest levels, the policies should be:

- Continued updates to energy codes based on the incorporation of available and cost-effective technologies for efficiency coupled with
 - Expanded implementation and enforcement of the energy codes with the goal that 100% of new construction is planned checked and field inspected by financially-disinterested government or private sector officials, and
 - Energy compliance documents are made part of the legal property records of the building, so that they can be used to establish the value of energy efficiency in the marketplace.

- Based on consistency with the energy code, the government should establish a rating system for buildings that measures their energy efficiency, focusing on higher levels of efficiency that go beyond the code.
- The government should consider establishing one or more “recommended levels of energy efficiency” that are substantially higher than code.
- An agency or agencies should be given the budget authority and charge with responsibility of developing managed incentives to encourage efficiency technologies that could be available in the very short term and that do not require major changes in practice. This could be done through the utility system by decoupling profits from sales and establishing a public benefits fund to support DSM; or it could be provided through a government or non-profit agency that is provided with a revenue source commensurate with the task.
- The government should develop long-term incentives that complement the managed incentives by establishing much more ambitious targets and relatively long-term (4-7 year, for example) commitments to the qualification level and the funding level. These could be provided through the tax code, or could be provided by the entity that administers DSM programs, or by some other organization.
- All of these policies should be coordinate so that they are mutually reinforcing and non-duplicative.

At a much lower level of generality, it is possible to make recommendations about how these programs should be designed and administered.

For managed incentives, the reports available at www.eebestpractices.com provide comprehensive guidance.

From the experience with energy codes and managed incentives, we can develop a set of policy criteria for the development of long-term incentives. These would appear to be:

- Set a whole building energy performance target that qualifies for a fixed incentive measured in monetary value per dwelling unit or per square meter.
- Coordinate the methods for calculating energy consumption and energy savings and the methods for validating them--both on paper, through calculations, and in the field--in parallel with the procedures used for code compliance.

- Try to develop infrastructures of people who can check plans and check buildings that can perform this service equally for incentive qualification and for code compliance.
- Develop whole building targets based on a reference to the Energy Code, such as percent better than code, or adding specified prescriptive measures to those required in the code.
- Set ambitious targets relative to the levels of efficiency achieved through managed incentives. Ideally, empirical results of the managed incentives program can provide a distribution function of efficiency levels found in the field that will guide in the selection of a sufficiently ambitious but still reachable goal for the long-term incentives.
- The incentives should be designed to cover a significant fraction but much less than 100% of the expected incremental cost of energy efficiency. Particularly over the term of these incentives, it is reasonable to expect that the cost of efficiency will decline significantly through innovation and competition as well as through the learning curve effect of increased production of more efficient designs and products.
- The incentives should be evaluated rigorously after about 3 years and again after they expire.
- The incentives should be of moderate, limited duration, such as 3-7 years. After evaluations have been made, the program can be discontinued or changed (for example by increasing the energy efficiency of the target).
- Do not assume that the mere promulgation of long-term incentives will cause their acceptance in the marketplace. Work with government agencies and others interested in promoting efficiency to publicize the tax incentives and to provide marketing and design assistance for those who may wish to try to comply.

Appendix A:

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide

This listing summarizes information that we obtained from published documents or personal interviews or websites. The list is comprehensive but has not been reviewed independently. Thus, programs that appear in the reference material to be relevant to the goals of this report but which in fact may not be within its scope are nonetheless reported. Some of the reference sources do not seem to distinguish carefully between programs that are implemented and those that exist on paper but are not really available. In some cases, the references are not clear on whether an incentive program is proposed or whether it is enacted. No attempt at verification has been made here; in some cases, our views are expressed as notes.

The program descriptions in the table contain as much technical detail as the primary references, although they may be summarized.

This table is based on materials and interviews and experience cited in the body of the report and in addition on “Energy Efficiency Report: European Union Member States,” Helen O’Neill and Andrew Warren, Association for the Conservation of Energy, London, UK, 2001; and “Survey of Energy Efficiency Laws and Policy Provisions in 22 Countries in Two Regions: Recommendations for Policy Makers,” by Astghine Pasoyan and Eric Carlson, Alliance to Save Energy, Washington, DC; “Towards Energy Efficient Buildings in Europe,” Rod Janssen, the European Alliance for Energy Efficiency in Buildings (EuroACE), London, June 2004; National Energy Efficiency Committee, Singapore (www.neec.gov.sg).

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide		
Region	Description of Program	Notes
Armenia	Import tax reductions for energy efficiency products.	

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide

Region	Description of Program	Notes
Austria	1.5 billion ÖS per year retrofit fund; each of the provinces provides subsidies for insulation measures as part of housing policy. . Tax of €0.044/m ³ on natural gas and €0.0073/kWh on electricity used to subsidize provincial energy efficiency programs, e.g., district heating plants and renewables. Some provinces and utilities offer soft loans for thermal improvement of houses. Expenses for energy efficiency measures are tax deductible; some provinces provide subsidies for boiler replacement. Some subsidy programs for commercial energy efficiency investments. Two provinces offer cost-based subsidies for unspecified efficiency investments.	
Belgium	Some regions offer subsidies for energy efficiency investments. One province provides up to 50% cost-based incentive for demonstration projects. Walloon region subsidizes low income households to improve energy efficiency	
Czech Republic	Subsidies for energy efficiency measures and CHP. . Grants for RD&D to subsidize energy-efficient technologies for households. Reduced VAT is on purchase of designated “Environmentally Friendly” technologies, including energy-efficient equipment.	VAT policy is not restricted to buildings.

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide

Region	Description of Program	Notes
Denmark	Taxes on CO ₂ and SO ₂ emissions as well as energy use. These revenues are used to support energy efficiency measures and audits, both in the industrial sector and in the building sector. Subsidies for energy efficiency measures in low-income homes since 1993 (€135 million per year). Some of the carbon tax funds energy efficiency investment subsidies. The ministry of trade and industry established MOTIVA, which has been involved in market transformation programs. These have included technology promotion for retrofit windows, a competitive bid for efficient supermarket refrigeration, a competition for commercial luminaire manufacturers that produced office lighting at 5-10 watts per square meters.	
Estonia	Establishing an energy efficiency fund.	
EU	A fund has been established to develop new technologies and finance pilot projects.	
Finland	Grants (about €252 million per year) for R&D and pilot projects for energy saving technologies. Subsidy for energy audits of 40-50%.	Grant facility is cross-sectoral. Energy audits are for commercial buildings and industry.
France	Income tax credits for building weatherization (insulation and heating controls) and boilers; accelerated depreciation in some cases; loans for energy efficiency projects. A number of tax incentives have been available since 1990 in different areas, but no details are available on the structure of the program. Subsidies for efficiency retrofits for low income dwellers whose houses are older than 20 years,	

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide

Region	Description of Program	Notes
	and rental units older than 15 years.	
Georgia	Tax incentives for imports of energy efficiency equipment, including energy meters; natural resources taxes for funding.	
Germany	Excise tax exemption for energy efficiency light bulbs. Subsidies up to 35% for CHP, especially modernizing district heating plants, local heat distribution networks, and deploying energy measurement technologies. There are a series of apparently cost-based tax incentives for energy efficiency and retrofit buildings and for technology such as heat pumps and solar. For instance, households can receive €255.65 per year for 8 years for purchasing certain heat pumps, solar systems or heat recovery boilers, or low-energy homes. Households with energy demand 25% below standards established by the Heat Insulation Ordinance are eligible for further support. Grants for RD&D for power generation and efficient technologies in a variety of sectors including buildings and industry. Low-interest loans through private banks for investment in municipal infrastructure, SMEs and households, including energy-efficient technologies, up to 50% of project costs.	

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide

Region	Description of Program	Notes
Greece	Tax incentive for active solar systems and retrofit energy efficiency measures.	
Hungary	Grants for retrofits (insulation, heating system including connection to district heating, windows) of residential buildings. Grants for renewable energy technologies, e.g., solar collectors	Grants for renewables are cross-sectoral.
Ireland	Grants to low income and elderly households for insulation. Subsidies for commercial building and industrial energy audits up to 40%of cost to maximum of IR€5,000.	
Japan	Subsidized soft loans, loan guarantees, temporary tax reductions for investments in energy efficient equipment and processes.	
Lithuania	Long-term loans for energy efficiency improvements in households.	Lithuania
Luxemburg	Subsidies up to 25% for energy efficiency and other environmental investments.	
Moldova	Local energy conservation equipment manufacturers receive VAT exemption and 50% sales tax cut for 5 years; a list of energy efficiency equipment to be included in the state budget; a state energy conservation fund for financing projects; its disbursements are tax exempt.	

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide

Region	Description of Program	Notes
Netherlands	A “green fund” to finance environmental projects broadly, accelerated depreciation and incomes tax credits for certain energy efficiency investments. Subsidized mortgage (1.5 percentage points) for buildings that meet sustainability criteria, including energy efficiency. Subsidies are drawn from income-tax-exempt green investment funds. Subsidies through utilities for listed energy-efficient household appliances and building improvements; utilities partially recover cost of subsidies through tax allowance. Former program provided grants up to 25% for double-glazing and insulation for rental units.	
Norway	Grants for R&D for energy-efficient technologies.	Cross-sectoral program
Poland	National and local energy efficiency funds have been established. For instance, a national program for retrofits to apartment buildings has covered 2.4 million units.	
Portugal	Grants to households for energy measurement, investments in efficient technologies, and demonstration of prototypes.	

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide

Region	Description of Program	Notes
Romania	Energy efficiency is financed through at least three federal sources and state and local budgets and international assistance programs. Consumers can receive financial assistance for energy efficiency measures. Energy efficiency investments by corporations are exempt from income tax. Subsidized loans are available for energy efficiency. Energy efficiency devices and equipment are exempt from customs duties. Loans for energy efficiency projects receive an interest rate subsidy of 25%.	
Russia	A number of programs are authorized.	
Singapore	Accelerated income tax depreciation (over one year instead of three years) for businesses that invest in listed energy-efficient equipment, including new installations and retrofits.	Cross-sectoral program, but mainly affects buildings.
Slovak Republic	Grants for energy efficiency investments in apartments. Loan subsidy for insulation of flats and houses up to 70% of interest, short term three-year loan, or bank guarantee of 75% of loan value.	Slovak Republic
Slovenia	Income tax credits for purchase of efficient appliances. For households, free energy advice and grants for new windows and loft insulation. Subsidy of 50% for energy audits of apartment buildings, and commercial buildings.	Audit subsidy is cross-sectoral.

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide

Region	Description of Program	Notes
Sweden	<p>Government grants and subsidized loans were provided for energy efficiency in buildings, reduced use of electricity for space heating, and for combined heat and power. NUTEK and its successor STEM, the Swedish national authority initiated some 30 technology procurement projects, several of which have been evaluated formally. Four of the five evaluated programs demonstrated clear success. The technology procurement budget is 100 million SEK over 7 years.</p>	
Ukraine	<p>Two domestic funds have been established for energy efficiency financing; funds are also obtained from municipal budgets and multi-lateral development banks. Grants are provided for energy efficiency measures and for energy audits, training, and standards setting. A subsidized loan program is based on the extent of energy savings.</p>	
United Kingdom	<p>The establishment of a VAT on residential fuel use tax incentives (typically about 22% of cost) for specified energy efficiency investments. Grants for energy efficiency improvements to homeowners, focusing on targets socioeconomic groups. For instance, the Homes Energy Efficiency Scheme provides grants up to €492 to low income households for insulation, including draft-proofing, loft insulation, and energy advice. Under the Energy Efficiency Commitment, utilities must meet targets for promoting energy efficiency, and may contribute to the cost of energy efficiency measures taken by consumers.</p>	

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide

Region	Description of Program	Notes
United States: National	The Energy Tax Act of 1978 established a residential tax credit of 15% of the cost of retrofit measures and 10% of the cost of specified business energy efficiency measures. Various bills that have been introduced in Congress in the 21 st Century have proposed tax credits or deductions for commercial buildings, new homes, retrofit homes, energy efficiency equipment and appliance, and combined heat and power systems.	The 1978 programs were evaluated and shown to have been ineffective. The newly proposed programs include both cost-based programs and performance-based programs.
States: United States: Arizona	Income tax subtraction for homes that reduce energy use by 50% in effect 2002-2010. Typical value to the consumer about \$200. An administrative agency is delegated the authority to raise the qualification level. Alternative fuel vehicles tax credit was established in 1999 at several thousand dollars per vehicle.	The vehicles program was discontinued due to unexpectedly high cost.
States: United States: Idaho	Income tax deductions for insulation and renewable energy, cost-based, up to a value of about \$400.	No formal evaluation, but usage of this incentive is small.
States: United States: Maryland	Sales tax waiver for certain Energy Star products and for hybrid vehicles; green buildings incentive based on the LEED system; in addition, energy savings must be at least 35%.	The effectiveness of the buildings and equipment program is not clear. The vehicles program appears not to have been very effective because of lack of information at dealers about its availability.

Listing of Energy Efficiency Incentive Programs for Buildings Worldwide		
Region	Description of Program	Notes
States: United States: Minnesota	Sales tax exemption for compact fluorescent lamps and fixtures and for efficient furnaces and water heaters. The qualification levels for non-lighting equipment are beyond Energy Star levels.	
States: United States: New Jersey	Tax exemption for natural gas used in cogeneration systems.	Informal evaluation suggests this incentive is effective.
States: United States: New York	Green buildings incentive program based on state regulations similar to LEED, but developed by state authorities; in addition, energy savings must be at least 35%. There is a fixed annual budget for this program.	
States: United States: Oregon	Tax incentives for appliances, efficient new buildings, and green buildings. Appliance incentives are performance-based; business incentives are based both on performance and cost. Green building incentive is based on LEED levels.	Informal evaluations suggest that this program has been highly effective.

Appendix B



Oregon

Theodore R. Kulongoski, Governor



OREGON
DEPARTMENT OF
ENERGY

March 24, 2005

Dr. David Goldstein
Natural Resources Defense Council

Dear David:

625 Marion St. NE
Salem, OR 97301-3737
Phone: (503) 378-4040
Toll Free: 1-800-221-
8035
FAX: (503) 373-7806

In response to your inquiry with regard to incentive programs for efficient buildings, I'm sending this letter to outline what we can say about our tax credit program for this area. We haven't performed any recent formal evaluations on the program, especially for those program elements that are newer. But because we work closely with all of the Oregon stakeholders in this particular field, there are some things we can convey.

I'll confine most of my input to the Business Energy Tax Credit Program, though I can briefly note a couple of things from the residential side of the program:

- 1) According to our regional Toyota representative, Oregon has 5 times the number of registered hybrid vehicles as the next state on that list. While we won't argue that our tax credit (\$1,500) is entirely responsible for this fact, we're quite sure that it has something positive to do with it. A survey conducted by the Oregon Environmental Council seems to confirm this.
- 2) According to NW Natural (conversation with Steve Bicker in the summer of 2002), the market penetration of condensing gas furnaces in the furnace replacement market went from 35 percent to 52 percent in the first four months the tax credits for these furnaces were available (they became available on October 8th, 2001). Market penetration in this same segment is estimated at more than 75 percent today, and still climbing.
- 3) Oregon and Vermont have the highest market penetration rate for efficient clothes washers, according to reports from the Energy Star program. Again, we can't say that our tax credit is responsible for all of that lead, but based on a brief investigation of the factors in play in the

Pacific Northwest, Dave Hewitt estimated that the tax credits might account for 13 to 38 percent more sales than in the other Northwest states.

In the business program, we have two pathways to incentives that apply to buildings. The first and oldest path calculates the credit based on the incremental cost of efficiency. It inherently assumes that more efficient buildings and equipment cost more. That program path has been in place since 1979 and continues today.

The second path was authorized by the legislature in 1999, and began on January 1st, 2000. Called the Sustainable Building Project path, it provides incentives based on the project's certification level under the U.S. Green Building Council's (USGBC's) LEED7 rating system. In basic terms, the credits are awarded on a per square foot of building area basis, and the credit amounts increase with higher levels of certification. Minimum certification level is Silver.

This new path was adopted very quickly by Oregon's development sector, with some of the larger and more successful developers, such as Gerding Edlen, stacking up projects for application before the program was officially in place. The first building certified under the program (Gold level) was the redevelopment project now known as the Ecotrust Building in Portland's Pearl District.

Reaction to the program on the part of the development community, especially the more progressive elements therein, has been overwhelmingly positive. As project teams have gained experience working with the LEED7 rating system and the tax credit adjunct, enthusiasm and ambition have grown, rapidly. At this point, according to the USGBC, Portland has the highest number of LEED7-registered projects of any city in the country. As a state, Oregon has the third highest number of projects. Again, while we can't say that the tax credits are solely responsible for the success of the green building community in Oregon, program participants are quick to acknowledge the risk-sharing benefit of the credits as project owners contemplate the up-front investments required to build very high performance buildings. Most of the investment is in extensive and iterative engineering modeling, commissioning, and in the certification process itself (mostly documentation). It's not clear to many owners just what the return on the investment in these "soft" processes will be. So the State's sponsorship of a substantial portion of the costs becomes a critical incentive at the right time.

I'm told pretty often by developers that the sustainable buildings tax credit is key to their ability to pursue their most ambitious projects. If you'd like to chat with one or two, I can put you in contact with them. It's also been observed that in our area (northern Oregon and the state of Washington), the firms engaged in "green" building are thriving at the moment. Most of the rest are struggling as the economy staggers along. One of the architecture firms that was first to pursue this work has recently had to nearly double its staff and move to larger quarters in order keep up with the demand for their services. They seem to be hiring the best talent from the firms who are not engaged in green building, and who are laying off staff.

There are probably other factors that contribute to the success of the tax credit programs in general, and the sustainable building tax credits in particular. For instance, any project owner in Oregon can receive the benefit of the tax credits, including non-profits, government agencies, churches, etc. This is accomplished with a pass-through mechanism in which a taxable financial partner delivers the net present value of the 5-year credit to the project owner, in return for the ability to take the full credit over the 5-year period. A significant number of projects make use of this feature of the program. Since a large fraction of the LEED7-registered projects nationwide, and in Oregon, are government buildings or owned by non-profits, this becomes critical in moving the marketplace overall.

As we contemplate the future of our programs, we find that the response to the much more comprehensive sustainable building portion of our programs is much more positive and energizing than the reaction to any of the energy efficiency elements alone. Consequently, we will be evolving our programs much more in this direction. Now that the USGBC is piloting its residential rating system, for instance, we will likely consider its use as the basis for residential tax credits. Our interest in that will depend on how the final rating system is structured and on its requirements. We usually tend toward more rigorous specifications than national standards produce. In any event, our goal is to make Oregon more sustainable, not just more energy efficient. Energy efficiency is necessary, but not sufficient.

Let me know if there is anything I haven't conveyed, but could. Charlie

Appendix C:

Detailed Discussion of National Programs

Part C-1

April 11, 2005

To: David Goldstein, NRDC
From: Alan North
Re: Research for International Best Practices Regarding Tax Incentives to Promote Energy Efficiency

Hi David,

As you suspected, finding information about the development of tax incentives to promote energy efficiency is challenging, however, some information has emerged that may be useful for China as they develop a program.

This memo contains the following list of issues and items:

1. BC's Tax Incentives for Energy Star Products
2. Korean Tax Incentives
3. Dialogue with Authors of World Energy Council's Report on Energy Efficiency Policy
4. Challenge of Evaluation In Thailand and the Region
5. World Energy Council's Report on Energy Efficiency

In addition, it contains:

6. Additional Information About the Use of Tax Incentives
7. Thoughts and Suggestions About Additional Research

1. BC's Tax Incentives for Energy Star Products

The government of British Columbia, Canada, has a program that exempts the sale of Energy Star products plus some oil furnaces from the BC social services tax (PST), which is essentially a sales tax. The PST rate is 7%. The program is scheduled to operate from February 16, 2005 to April 1, 2007.

I spoke with Andrew Pape-Salmon about the program. He told me that the technologies were chosen by the Federal Government, which made it easy for the Province. He said that tax rate was chosen by the Province and equals the full sales tax available within the Province's control. Since the savings are issued at the point of purchase by the retailer, as a non-collection, the program is very easy to implement.

Andrew said that while 7% does not seem like much, on a furnace the savings are applied to the full purchase price and often reflect a \$200 savings, which can go a long way to reducing the \$500 incremental cost between standard and high efficiency units.

One thing that makes the program unique, and exemplary of a good practice, is the coordinated effort between the Provincial and Federal governments. He also said that this is the first such program in Canada.

According to Andrew, there will be an annual impact evaluation of this program that will calculate energy savings but will not address free-riders. (There is an unexpressed assumption that there will be significant free-ridership.) More details will be announced about the program and its evaluation April 13.

Program information can be found:

<http://www.rev.gov.bc.ca/ctb/notices/NoticeFurnacesBoilersHeatPumps.pdf>

<http://www.rev.gov.bc.ca/ctb/EnergyStarQualified.htm>

http://www.rev.gov.bc.ca/ctb/publications/bulletins/sst_011.pdf

Source:

Conversations April 1, and April 8, 2005 with Andrew Pape-Salmon, P.Eng., MRM
Senior Policy Advisor - Energy Efficiency and Conservation

Alternative Energy Policy Branch

Ministry of Energy and Mines

Government of British Columbia

Email: Andrew.PapeSalmon@gems8.gov.bc.ca

Tel: 250-952-0819

<http://www.em.gov.bc.ca/AlternativeEnergy/default.htm>

2. Korean Tax Incentives

The Korean Government provides 10% income tax credit for energy efficiency investments. The replacement or installation of the facilities and equipment listed below qualified for the income tax credit: (a) replacement of old industrial kilns, (b) installation of energy-saving facilities, (c) alternative fuel-using facilities, (d) other facilities which are assessed as being able to bring forth more than 10% of energy-saving effects. The tax credit is based on the full cost of the purchased energy efficient technology, independent of the cost of base case technology.

In an email correspondence, Sung-Chul Yang said, “The level of incentive was not determined by specific and in-depth research. I think Government officials consulted other countries cases. Therefore, as far as I know, there is no theoretical framework.”

He also said, “We did not conduct the evaluation of the tax incentive program.”

Source:

Sung-Chul Yang, Researcher

Electricity Industry Policy Research Group

Korea Electrotechnology Research Institute
Email: scyang@keri.re.kr
Tel: 82(country code)-31-420-6147

3. Dialogue with Authors of World Energy Council's Report on Energy Efficiency Policy

In a conversation with Professor Bruno Lapillonne, he said that the best programs are in the UK, Netherlands and Germany. He said that, while the development phase of tax incentives may be based on analysis, in the end incentives are political because the Ministry of Finance sets them, not the Ministry of Environment. Quantifying the effect of tax incentives is very difficult because the consumer makes decisions based on price and there are many factors that effect price, including the price of a barrel of oil. He said that econometric models are used to attempt to quantify the impacts but he did not think they offered much because there are so many other contributing factors and it is hard to isolate the impact of tax incentives.

He said that France is about to offer a new tax credit program for condensing boilers.

Source:

Conversation with Professor Bruno Lapillonne, April 7, 2005,
Co-Author and Technical Coordinator of World Energy Council's report on Energy Efficiency Policy
Vice President, Engineer, PhD Energy Economics ENERDATA
Email: b.lapillonne@enerdata.fr
Tel: 33 (0)4 76 42 25 46

In an email correspondence, Philippe Menanteau said that his contribution to the World Energy Council's report on Energy Efficiency Policy was strictly limited to the analysis of energy efficiency policies in the field of home appliances. He said, "In this sector tax incentives are not really effective as the consumer response to price signal is limited." He went on to say that his analysis was "focused on the instruments that provide clear positive results" over a period of one or two decades and these instruments were "labels, standards and voluntary agreements."

Source:

Dr. Philippe Menanteau
Co-Author World Energy Council's report on Energy Efficiency
Email: Philippe.Menanteau@upmf-grenoble.fr
Tel: 33 4 56 52 85 74

I also spoke with Dr. Wolfgang Eichhammer, Co-Author World Energy Council's report on Energy Efficiency. He reiterated the value of speaking with people in Ministries of Finance to better understand how tax incentive programs were developed.

4. Challenge of Evaluation In Thailand and the Region

I spoke with John Busch who has extensive experience in Thailand and the neighboring region. He said that in Thailand, there is a utility run DSM program and a government run incentive

program. He says the government program is well funded from an oil tax but is very bureaucratic and therefore not many projects are done. The projects funded tend to be of mid economic value; the thought being that projects with good economics should be self-funded and that projects with really poor economics should not be funded at all.

Regarding program evaluation, John said that he does not know of any that have been done. Part of the reason is cultural; losing face is a major social taboo. No one wants to lose face and, as significant, no one wants someone else to lose face. The loss of face issue presents a significant programmatic issue throughout the region including in China. The best solution would be for programs to be designed with culturally acceptable ways of accurately assessing program results.

Source:

Conversation with John Busch, PhD, March 31, 2005

Lawrence Berkeley National Laboratory

Email: fbusch@lbl.gov

Tel: (510) 486-7279

5. World Energy Council's Report on Energy Efficiency

The World Energy Council's report on Energy Efficiency discusses three types of tax incentives: tax credits, tax deductions and accelerated depreciations. The report considers tax incentives better than subsidies because tax incentives are the easiest to implement. It also says that tax incentives can be effective if the tax collection rate is high enough. However, it warns that tax incentives perform poorly if the economy is in recession or in transition.

Source: World Energy Council's report, Energy Efficiency: A Worldwide Review, Indicators, Policy, Evaluation, 2004, Page 74.

Appendix 2 Pages 12 – 13 contains tables showing the type of tax incentive by country and sector. (Page 210 – 211 in PDF Document)

6. Additional Information About the Use of Tax Incentives

**

{In the United Kingdom there will be a £600 tax break for the sale of energy efficient houses. Homeowners will get tax cuts of up to £600 for making their houses "green" and energy efficient, under official plans to combat global warming.}

[NOTE: The information in brackets {} above may be slightly incorrect; According to the Energy Savings Trust this program is still in the proposal stage and it is likely that it may be implemented, if at all, offering a much lower tax credit than this report claims.]

People who sell their homes can offer potential buyers a discount of up to 40 per cent off their stamp duty as a reward for making their properties much more energy efficient - so making them easier to sell. If they have no plans to move, homeowners could get a one-off discount on their council tax.

The proposals will be unveiled this week by Tony Blair's senior adviser on energy efficiency, Eddie Hyams, the new chairman of the government-funded Energy Saving Trust.

The trust claims the tax cut should be based on the homebuyers' information packs, which everyone selling a house will be legally required to have from 2007. These packs, which will contain basic information about a house for prospective buyers, will include an energy rating.

Environment ministers also want this rating to be used to give homes an "energy label" when they go on the market.

If homeowners or people renting their homes aren't about to sell, the trust has pointed to a scheme launched last November by Braintree council in Essex with British Gas. It gives a £100 council tax rebate to people who buy a £175 insulation package.

Copyright 2005, Independent

Date: March 20, 2005

Byline: Severin Carrell

Source: <http://news.independent.co.uk/uk/environment/story.jsp?story=621872>

Fenland's Council Tax Scheme to promote energy efficient homes.

The Fenland Energy Tax Credit scheme is part funded by EST's Innovation Programme,. The scheme aims to encourage both homeowners and landlords to invest in energy-efficient and renewable technologies. The scheme is open to anyone who has carried out energy efficiency work in their property in the current year. These households can apply to have their home surveyed and energy rated. After the survey, the householder receives feedback on the energy standard of their home (No rating, Bronze, Silver, Gold) and what they need to do to improve the standard. The standards are based on SAP ratings, with Bronze being awarded to those whose properties meeting the average SAP rating for private housing in the district (46). The silver level requires significant investment in energy reduction, and the gold level can be achieved by additionally investing in renewable technologies. Council tax credits are awarded as follows: £100 for Gold, £50 for silver and £25 for bronze.

Source

<http://www.fenland.gov.uk/ccm/content/council-tax/taxcredits.en>

**

The Johannesburg Renewable Energy Coalition website has some tax incentive information.

Sweden - Tax Reduction for Installation Costs of Biomass Heating Systems and Energy Efficient Windows

Italy - Tax Credit for Geothermal Energy and Biomass

Finland - Tax subsidies for power production based on renewable energy sources

Singapore - Tax Incentive for Energy Efficient Equipment

Source: <http://www.iea.org/textbase/pamsdb/jrlist.aspx?by=techno>

**

The Singapore National Environment Agency Planning and Development Department published the following information about their tax incentives for energy efficient equipment.

TAX INCENTIVE SCHEMES

A) ENERGY-EFFICIENT AND ENERGY-SAVING EQUIPMENT AND HIGHLY EFFICIENT POLLUTION CONTROL EQUIPMENT

To encourage the use of energy-efficient equipment and highly efficient pollution control equipment, the Ministry of Finance has decided to allow all expenditure for such equipment incurred with effect from 1 Jan 96 to enjoy 100 percent depreciation in the first year. This means that the qualifying expenditure on such equipment can be written off completely against the taxable income of the enterprise in the year following the year of purchase.

These tax incentives are administered under two schemes. These are:

One-year Accelerated Depreciation Allowance for Energy-efficient equipment and Technology

One-year Accelerated Depreciation Allowance for Highly Efficient Pollution Control Equipment

Source: http://app.nea.gov.sg/cms/htdocs/category_sub.asp?cid=148

**

The following information about Greece is from Ente per le Nuove Tecnologie (ENEA)

Greek policy concerning the acquisition of new EET is contained in a number of laws. Greek policy concerning investment activity for the manufacturing of EET is contained in a number of laws that establish a variety of financing mechanisms and incentives for investors in the public and private sectors. The incentives provided are:

Grants for machinery, buildings, and other assets;
Interest rate subsidies;
Tax-free allowances;
Extra depreciation rates;
Lower social security contributions; and
Favorable tax rates.

Source: http://alpha.cres.gr/enerweb/country_profiles/gr/gr6n.htm

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Information about tax credits for energy efficiency projects in Malaysia

GUIDELINES IN APPLYING ENERGY EFFICIENCY INCENTIVES

1. Energy Efficiency Incentives

A. Companies Providing Energy Conservation Services:

- i. Pioneer Status with tax exemption of 70% of statutory income for a period of 5 years or Investment Tax Allowance of 60% on the qualifying capital expenditure incurred within a period of 5 years with the allowance deducted in each year of assessment be set-off against 70% of statutory income; and
- ii. Import duty and sales tax exemption for equipment used in the related project, which are not produced locally. Equipment purchased from local manufacturers is given sales tax exemption.

This incentive is for applications received from 28 October 2000 until 31 December 2005. The company is required to implement the project within one year from the date of approval of the incentive.

B. Companies Which Incur Capital Expenditure For Conserving Energy For Own Consumption:

- i. Accelerated Capital Allowance on related equipment to be fully written off within a period of 1 year effective from the assessment year 2003; and
- ii. Import duty and sales tax exemption for equipment used in energy conservation, which are not produced locally. Equipment purchased from local manufacturers is given sales tax exemption.

Source:

http://www.ktkm.gov.my/template01.asp?Content_ID=412&Cat_ID=2&CatType_ID=90&SubCat_ID=143

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Information on tax incentives by country can be found in the report published by Alliance to Save Energy called "Survey of Energy Efficiency Laws and Policy Provisions in 22 Countries and Two Regions: Recommendations for Policymakers." The pertinent table starts on page 24.

Source: http://www.munee.org/media_center/files/Survey%20EE%20Laws%20210504.pdf

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There is a site containing a lot of data energy efficiency programs in the EU

<http://www.mure2.com/home.shtml>

This site was recommended by Professor Bruno Lapillonne and Dr. Wolfgang Eichhammer, co-authors of the World Energy Council's report on energy efficiency.

7. Thoughts and Suggestions About Additional Research

A. Conducting More Interviews

Based on the research done so far it appears that the best information about the development and implementation of tax incentives to promote energy efficiency would likely be found by contacting policy developers with Ministries of Finance in target countries. According to the authors of the World Energy Council's report on energy efficiency, the countries with the most advanced tax incentive programs that promote energy efficiency are the UK, Netherlands and Germany. Given that challenges presented by language, time zones and the nature of finding ones way through a bureaucracy, some effort would be required to identify and contact the appropriate people in each of those countries. The decision to seek those people should only be made if there are clear research objectives.

B. Separating the Assessment of Program Funding from Program Implementation

Research shows that in the short-term, energy consumers will change their consumption for any number of reasons, but in the long-term, energy efficient technology decisions are almost always made based on economic criteria. From a consumer's perspective incentives of any type affects the benefit side of the equation while program participation requirements affect the cost side of the equation. As such, while the amount of funding is important, the funding entity is irrelevant to the consumer. Likewise, while the specifics of implementation are critical, the implementing entity is not important. From the consumers perspective there is no difference between a sales tax credit incentive offered by a government and an instant rebate offered by a utility. By the same token the consumer would make the same decision about whether to participate in an energy efficiency program whether it was labeled as a utility DSM program, government DSM program, or government tax incentive program provided the logistical requirements of participation and benefits were the same. Hence it follows that the funding mechanism should be assessed independent of the implementing mechanism. Correspondingly, the assessment of best practices should look at the implementation of all energy efficiency programs, independent of the funding mechanism.

C. Follow up in Thailand

Based on the email from Peter du Pont, it appears that Thailand is taking a performance-based approach to tax incentives. As the only example we have found of performance-based tax incentives, it could warrant a fairly comprehensive investigation of the delivery mechanism including verification, customer response and energy savings impact.

Part C-1

The tax system and sustainable energy measures in the UK

In successive Budgets the government has highlighted that economic instruments have a role to play in the promotion of domestic energy efficiency. This note summarises the economic instruments currently used to promote domestic energy efficiency, and outlines the current tax treatment of other sustainable energy measures.

Reduced rate of VAT

VAT has been reduced from 17.5% to 5% on a range of professionally installed energy saving materials in the home including:

- Insulation
- Hot water and central heating system controls
- Draft stripping
- Solar panels
- Wind turbines
- Water turbines
- Ground source heat pumps

Budget 2005 announced reduced VAT rates for:

- Micro-combined heat and power
- Air source heat pumps

DIY installations do not benefit from reduced VAT. Grant funded installations of certain heating equipment also benefit from reduced VAT. This is only available for supplies made under a grant scheme that has an objective of funding the installation of energy-efficiency measures in the homes of less well off people. The reduced rate applies to the installation of:

- Heating appliances
- Central heating systems
- Renewable source heating systems

In Budget 2004 Government announced plans to possibly reduce VAT for micro combined heat and power units from 2005. Any move to do so would however be dependent on the emerging findings of the micro combined heat and power field trials.

Reduced rates of VAT do not apply to the installation of other energy-efficient products, such as energy efficient boilers (unless grant funded), secondary or double glazing, low-emissivity glass, or energy-efficient fridge freezers.

For new dwellings energy-saving materials installed during the course of construction benefit from zero-rated VAT.

Government has also highlighted its commitment to negotiate with its European partners to extend the categories of permitted reduced rate VAT rates to include the purchase of energy saving-materials for DIY installation and energy-efficient products.

Landlord's Energy Saving Allowance

Budget 2004 announced a landlord's energy saving allowance (LESA). The scheme has been effective since 6th April 2004 and provides all private landlords who pay income tax with upfront relief on capital expenditure for installations of loft and cavity wall insulation in rented

accommodation, including first-time installations. This means that landlords can deduct for income tax purposes up to a maximum of £1,500 when they install loft or cavity wall insulation in a dwelling house which they let. The 2005 budget announced an extension of this scheme to cover solid wall insulation. Treasury also have the power to amend or extend the definition of allowable expenditure for this purpose by statutory instrument. This scheme expires on 5th April 2009.

LESA is targeted at helping smaller private landlords so it only applies to individual landlords and other landlords who pay income tax. It is not available for landlords who pay corporation tax.

LESA is in addition to the deduction that Inland Revenue allows for wear and tear of furniture, fixtures and fittings. The wear and tear allowance is currently 10% of the annual rent.

It is important to note here that capital expenditure cannot be claimed for expenditure on plant or machinery for use in a dwelling house and as such plant and machinery are not covered under LESA.

Green Landlord Scheme

In addition, Budget 2004 announced that the government would consider the introduction of a 'green landlord scheme'. This would aim to incentivise landlords to invest, possibly through recognition of properties that achieve a sufficient level of energy efficiency. Work on the Green landlord scheme is currently under way, with the aim of identifying further effective ways to improve household energy efficiency in the short and longer term. This includes targeting particular areas of improvement within households and raising the overall energy efficiency levels of properties.

Landlords – Replacement with nearest modern equivalents

In the past the Inland Revenue took the view that replacing single-glazed windows with double-glazed windows was an improvement and therefore capital expenditure. However, given the types replacement windows available from retailers and the tightening of building regulations the Inland Revenue now accept that replacing single-glazed windows by double-glazed equivalents counts as allowable expenditure on repairs.

This extends to other products and Inland Revenue guidance states 'if the replacement of a part of the 'entirety' is like-for-like or the nearest modern equivalent, we accept the expenditure is allowable revenue expenditure'.

Elaine Waterson

12 April 2005

Appendix D:

Tax Incentives for Energy Efficient Buildings Legislation

Senators Olympia Snowe (R-ME) and Dianne Feinstein (D-CA)

Representatives Randy ("Duke") Cunningham (R-CA) and Ed Markey (D-MA)

S. 507/H.R. 1271 (predecessor to S. 680)

I. Introduction

S. 507/H.R. 1271 proposes tax incentives for energy efficient buildings and equipment. This bill offers multiple public policy benefits. It is a constructive short-term response to high energy prices and the problems of electric reliability that is even more effective in the long term. It promotes economic development by encouraging businesses and consumers to invest in new technologies that offer higher returns than most other investments.

This bill has wide support from public interest organizations, states, and industry. The environmental community enthusiastically supports this bill because it offers significant reductions in air pollution emissions while accomplishing other worthy energy and environmental goals. Many utilities support this legislation because it complements their programs to offer improved customer service through energy efficiency, and because it helps solve the problem of blackouts that could impact the electric system in many regions throughout the next several years. Industry organizations support the legislation because it assists their efforts to market high efficiency equipment that offers enhanced customer value. States and state energy officials support the bill because it enhances their programs to promote energy efficiency and solve the problems of high energy cost and electric reliability. Other business organizations support the bill because of its favorable economic impact on their industries and on consumers.

A. What the Bill Does

This bill provides tax incentives for:

- Efficient new homes, including manufactured housing, saving 30% or 50% of energy cost to the homeowner compared to national model codes, with a higher incentive for the higher savings.
- Retrofits of existing homes to reduce heating and cooling costs by 30% or 50%. The incentives are available regardless of whether the home is rented or owner-occupied.
- Efficient heating, cooling, and water heating equipment that reduces consumer energy costs, and, for air conditioners, reduces peak electric power demand, by about 20% (lower incentives) and 30%-50% (higher incentives) compared to national standards.
- New and existing commercial buildings, including rental housing, schools, and other public buildings, with 50% reductions in energy costs to the owner or tenant, and
- Solar hot water and photovoltaic systems.

The incentives are based on performance, not cost, in order to foster competition between suppliers of different technologies that can meet the proposed target. For the case of buildings and equipment, there are one or two tiers of energy cost reduction targets that qualify the taxpayer for a fixed incentive per appliance, per home, or per square foot of non-residential building. For solar systems, the incentives are based on energy production, on a sliding scale. The incentives are provided for a 6-year period, taxable years 2003 through 2008, after which they sunset.

The incentives are provided to the person or company that invests in energy efficiency. For new homes, a tax credit goes to the builder. For non-residential buildings, the incentives are in the form of a fixed dollar amount deduction to the business entity that pays for the construction. However, if the business entity is a public entity, such as a school district, the deduction is assignable by the owner to the architect with primary responsibility for the design.

B. Public Policy Benefits of the Bill: Summary

- Buildings account for some 35% of air emissions nationwide and \$250 billion of annual customers' annual utility bills – so tax incentives for reducing energy use will reduce pollution and promote economic growth and competitiveness while saving individual consumers and businesses tens of billion of dollars.
- Buildings also constitute a significant part of America's infrastructure. Improving their energy-efficiency (and quality) results in long term durability and productivity benefits that would not otherwise occur and enables the U.S. to be more competitive in the global marketplace.
- Reducing energy bills increases profitability as well as corporate tax revenues. Tax incentives actually increase federal tax revenues by encouraging property owners to make less use of current provisions in the tax code that inadvertently subsidize energy waste. This year, some \$100 billion of energy costs in commercial buildings will be deducted from the tax returns of commercial building owners.
- Tax incentives provide additional benefits in the energy policy area: maintaining the reliability of the electric system operating during the summer peak and addressing the imbalance of supply and demand that regularly lead to high fuel prices. Providing enough electric supply at the peak hour to prevent blackouts and brownouts and mitigate the huge increases in electricity prices when supplies are tight – nearly 100-fold wholesale cost spikes in some cases.
- By passing a tax incentives bill this year, we have the ability to start mitigating the electric reliability problem as soon as this summer. None of the other options

(e.g., new transmission lines or power plants) can be implemented this quickly or efficiently.

II. What Are The Benefits of This Bill?

The following estimate assumes that 50% of new construction in buildings will reach the energy efficiency goals of the legislation over the next decade. This is a realistic expectation, as discussed on pages 9-10.

A. Environmental Benefits

- Overall air pollution emissions will be reduced by over 3% by 2013, increasing dramatically with time. This is equivalent to taking 20% of the cars off America's roads.
- Air pollution is correlated to 60,000 excess deaths annually; a 3% reduction means saving almost 2000 lives annually.
- Peak electricity demand in the summer will drop by at least 110,000 MW – the output of 275 large power plants.
- The U.S. will achieve almost 10% of the greenhouse gas emissions reductions needed to comply with the Kyoto protocol.

B. Economic Benefits

- Direct economic savings to consumers and businesses will exceed \$250 billion.
- More than \$200 billion in new economic activity (new investment in energy efficiency) will occur, creating more than 100,000 net new jobs in building construction and related areas.
- Energy efficiency replaces the need for a commensurate amount of energy supply, and energy efficiency saves money compared to these supply alternatives. Energy supply is one of the least labor-intensive areas of the economy. Average expenditures on energy efficiency or on whatever consumers will do with the savings produce about ten times as many jobs as energy supply expenditures. Thus, the bill will generate 400,000 additional jobs.

- Energy efficiency also reduces the nation's need for imported energy, particularly oil in the regions that rely on oil heating, and gas in most of the country.
- New products and services will become available for the construction industry, allowing the production of healthier, more comfortable and more productive buildings, while encouraging U.S. competitiveness.

C. *Electric Reliability*

- Reliability problems are particularly crucial: the Department of Energy and several regional studies predict increasing problems in the next several years with "keeping the lights on." Recent experience in the West shows that even if blackouts can be avoided, there is still a large risk of very high electricity prices.
- Supply-side options have long lead times and cannot make much of a dent in the reliability problem until 2007 or later. But the energy efficiency measures promoted in this legislation can begin to have an impact as soon as summer 2003.
- If this legislation is passed by April 2003, manufacturers will recognize that super-efficient air conditioner will begin to sell in much larger numbers during this year's cooling season. They can begin planning production increases as soon as the legislation passes, and be prepared to provide some additional products this year, and substantial numbers of more efficient air conditioner beginning in the 2003 cooling season. Thus, this legislation presents one of the few opportunities available to start mitigating the electricity supply crunch as soon as this year.

D. *Benefits to the U.S. Treasury*

- The current tax system inadvertently subsidizes energy waste. A typical commercial building uses almost \$2/square foot for utilities. If it is owned by an entity that pays corporate income taxes, this \$1 will be a deductible business expense that reduces federal taxes, typically by 35 cents. If tax incentives induce new buildings to use only \$1 per square foot instead of \$2, the federal Treasury will reap 35 cents of that dollar savings (while the owner keeps the remaining 65 cents). Numerically, this revenue increase to the Treasury pays back the tax incentive in approximately two years.

During a 5-year scoring period, revenue gains to the Treasury from commercial buildings are approximately twice as big as revenue losses. And, while savings in the out years (from 11 to 50 years) are not typically counted in scoring, they are nonetheless real. An investment in, for example, a more efficient central air conditioning system for a large building will enhance federal revenues for its

entire 20-year lifetime. In the long run, the net enhancement of federal revenue efficiency measures will be in the tens of billions of dollars per year range.

III. Market Transformation

Q. How can tax incentives promote economic growth and environmental quality at the same time?

A. Because a number of new technologies now exist that can cut energy use by half – and reduce emissions proportionately. These new technologies and designs pay back the initial cost to the consumer with an excellent return on investment. Helping commercialize these new technologies in a way that promotes competition between different approaches lowers the costs of efficiency and gives U.S. industries an incentive to modernize while providing large dollar savings to home and business consumers.

Q. If these technologies pay for themselves why aren't they already being used?

A. New efficiency technologies are confronted with a vast array of market barriers. Detailed studies¹⁹ of multi-million-dollar investments to promote energy efficiency by utilities have identified the most important of these barriers.

The four most important barriers, as identified in surveys conducted as part of these studies, are split incentives, performance uncertainties, organizational practices, and bounded rationality. Split incentives refers to the situation where a particular party makes the decision concerning an energy efficiency investment, but another party reaps the benefit of the decision. An example is where the building owner passes through energy costs on a pro-rata basis to tenants. Neither the owner nor the tenant has the incentive to invest in energy efficiency because the savings will be shared among all the (other) tenants. Note that split incentives are not limited to different corporations receiving the benefits compared to the costs; often merely the use of different budget units (e.g., capital costs vs. operating costs) can cause the same split incentives within a single organization.

Performance uncertainties illustrate that there is not a reliable and unbiased source of information available to market actors concerning the performance of energy-efficient designs or technologies. Utility information-based programs are intended to address this barrier.

Organizational practices refers to procedures that decisionmakers follow that are based on their organization's rules but prevent the decisionmaker from taking otherwise rational actions.

¹⁹ PG&E Energy Center *Market Effects Study*, John H. Reed and Nicholas P. Hall, TecMRKT Works, Arlington, VA, May 1998; and Final Report: *Non-Residential New Construction Baseline Study*, RLW Analytics Inc., Sonoma, CA, July 1999.

Bounded rationality refers to the decisionmaker's inability to focus attention on all aspects of profit and loss but rather to concentrate on a few critical areas. Since energy cost is seldom the biggest or even second-biggest cost a manager is responsible for, it may be ignored completely.

Other market barriers include asymmetric information availability, and limited product availability. Incentive programs and supporting informational activities have been effective in lowering these barriers, according to the studies.

Extensive research has also verified that, as a matter of fact, these huge unexploited opportunities for cost savings through energy efficiency really do exist. In several states, utility regulatory commissions increase the revenue that utilities are allowed to collect based on the measured success of their programs at saving money for consumers through efficiency technologies. Since these increased revenue allowances come at the expense of ratepayers, the proceedings in which savings estimates are adopted by the commissions are controversial.

Stakeholders have an incentive to demonstrate that the savings paid for by utilities would have happened anyway: that measured savings fail to live up to projections. But, in contested regulatory decisions, the commissions have found universally that well-design utility incentive programs can induce consumers to invest in efficiency measures with paybacks as short as one or two years that would not have been installed without the program.

There are even more formidable barriers to the commercial success of technologies that save 30%-50% of energy use, rather than 10% or 20%.

Q. What are the barriers to the proper function of markets for energy efficiency?

A. The biggest problems concern "chicken and egg" dependencies in introducing technologies. Three-year paybacks generally don't sell. Manufacturers generally don't have much of an incentive to produce them and distributors have no incentive to give them much shelf space. Thus, when a consumer looks for these new technologies, he or she can't find them and goes on to something else. In other cases, installation of the new technologies requires an infrastructure of businesses or contractors. But that infrastructure won't come into existence until the demand is already there.

The reader can see this directly. If you live in an area where utilities have not been actively promoting energy efficiency, try to find a compact-fluorescent lamp that meets your needs for size and appearance. You will most likely find that they either aren't available at the same retailers where you buy light bulbs, or that the choice is minimal. Yet, in areas where active promotions have taken place, the products are a lot easier to find and many people buy these bulbs, even without the incentive.

The tax incentives bill provides significant incentives for heat pump water heaters [in place of conventional electric] and “condensing” water heaters; those with a DOE rated energy factor greater than 80%) [in place of conventional gas water heaters]. The reader should call his/her plumber or air conditioner supplier and ask for an estimate for either of these products. What you will find is that the contractor either doesn’t know that they exist, can’t order them in a reasonable period of time, and/or asks an exorbitant price.

Beginning in the 1990’s, government and utility programs began trying to address this problem. The resulting programs are called “market transformation.” There is an excellent track record of success in getting out of this chicken and egg dilemma, and introducing new technologies into the marketplace in a broad way.

Q. What are the advantages of market transformation?

A. Market transformation programs set a very ambitious energy goal, based on products that could become available but are not yet on the market, or products that are available in theory, but very hard to buy in practice. The programs provide relatively large incentives for a long period of time. The existence of these incentives makes it worthwhile for manufacturers to invest in new production lines and for distributors to stock products they would not ordinarily stock. In addition, the subsidies make consumers more likely to accept the efficient products.

In the commercial sector, sometimes the subsidies are necessary simply to get the attention of management onto a 3-year payback that they should have been interested in without the incentive. But extensive field experience shows that it takes the additional incentive to get their attention.

After the program is complete, markets exist for the new high efficiency product or service. These markets demonstrate persistence: they continue to thrive even after the subsidy is withdrawn or reduced. In some cases, the subsidy can be eliminated completely. In other cases, the amount of the subsidy can be substantially reduced and/or the level of performance required to qualify can be increased.

Q. Will supporters of this legislation be back in 5 years asking for an extension of the same tax incentives?

A. Definitely not. If the same incentives are required after the 6-year period offered in the legislation, we would consider this program to have been a failure. As with utility programs, we would hope that the field-measured results of the program can be evaluated in three or four years, and appropriate adjustments made. These adjustments would either involve termination of the program, reduction of the subsidies, or an increase in the performance needed to collect the tax incentive.

Q. Why do this through the tax system?

A. One of the most difficult problems with utility-sponsored incentive programs is making multiple-year commitments. This is particularly important in new construction, where 2 or more years may elapse between the design phase for a building – the phase when key energy efficiency decisions are made by the architect – and the construction phase after which inspections are needed to determine whether the proposed design was actually implemented. For the architect to make a commitment to spend more money for energy efficiency design in, say the year 2003, he/she has to know that the incentive will still be available even if the building isn't finished until the year 2006. Given state utility budgeting proceedings, which are similar to the annual appropriations process in Congress, such assurances are difficult or impossible to provide.

This problem was recognized by the House Bill's author in the 107th Congress, Randy ("Duke") Cunningham, who is a member of the House Appropriations Committee. Rep. Cunningham introduced this bill in part to be able to make the kind of multi-year commitments that he was unable to do in appropriations bills.

Q. Why will market transformation tax incentives work?

A. Programs similar to the tax incentives have succeeded in bringing a cost-effective technology from a tiny market niche to 100% market share in less than 10 years. A few examples are:

- In 1992, a consortium of utilities offered a \$30,000,000 competition for marketing a refrigerator that saved 30% of energy use and eliminated the worst ozone depleting chemicals. No such product existed at the time anywhere in the world. By 1995, all manufacturers had agreed to produce all refrigerators at this level of efficiency. This agreement is embodied in a Department of Energy standard supported by manufacturers as well as environmental advocates, utilities, and states.
- In the late 1980s, EPA introduced an EnergyStar recognition program for computers that would power down the screen and hard drive during periods of non-use, adapting the technologies used for extending battery life in laptops to a desktop machine. The federal government reinforced this spec in the marketplace by bulk purchases. By the late 1990s, almost all computers offered this effective energy saving feature.
- In the early 1990s, California utilities offered incentives for commercial lighting equipment and designs that saved 20% of energy use. In 1997, the lighting industry supported a proposal that the California Energy Commission later adopted requiring a 20% reduction in lighting energy in all buildings through the state's energy code, (Title 24) effective in 1999.

- A national program to develop clothes washers with more than a 50% reduction in energy use was initiated by the Consortium for Energy Efficiency in the early 1990s. By 2000, newly designed compliant products were offered under the brand names of 5 major U.S. companies, as well as a number of smaller and foreign-based brands. Total market share was approximately 10%, enough for manufacturers to agree to a standard that requires all products to meet this level by the year 2007.
- Research at a national laboratory demonstrated in the early 1980s how to make a fluorescent lamp ballast that cut lighting energy 20% while improving lighting quality. The product was introduced commercially in the 1980s but languished at 1-2% market share or less. After 1990, utilities began incentivizing this product, especially in California, and EPA promoted it through its EnergyStar programs. By 1999, market share had increased to 50% nationwide and about 90% in California. Industry agreed in 1999 to a mandatory near-total phaseout of the older, less efficient product between 2005 and 2010.

These successful examples of market transformation illustrate how a relatively small, but well-targeted financial incentive can encourage changes in the economy on a large scale – much larger than the original scope that was directly influenced by the incentive payments.

Q. Do these incentives apply only to new buildings or also to renovations?

A. The incentives apply to all new construction, whether in an existing building or a new building. For residential buildings, the targets are different for new homes than for existing homes. For new homes, the reduction targets are in comparison to a national model efficiency standard. For existing homes, the base case is the as-is condition of the house, which is usually much less efficient than the national standard. The incentives for efficient equipment and solar energy are available to owners and tenants in existing homes.

For commercial buildings, new construction frequently is related to changes of tenant in an existing building, or to renovations that modernize the building. Often, these renovations only affect one energy-using system, such as lighting. The tax incentives are available for new construction and renovation projects. For projects that only affect one of the building systems, the deduction is available on a pro-rated basis: if the construction project affects only one of the three building subsystems and it meets an energy efficiency goal consistent with saving 50% for the whole building, it qualifies for one third of the incentive, that is, for a deduction of \$0.75 per square foot.

IV. Overcoming Potential Problems

Q. How do you know that the tax incentives proposal will be administratively feasible? What about fraud or abuse?

A. Problems of verifiability of savings have been at the top of the list of issues that energy analysts have had to confront in utility-sponsored programs. Through working with utilities on these programs, the energy efficiency community has participated in a learning process that has found which sorts of controls work and which don't.

S. 507/H.R.1271 specifies many of the administrative details in legislation where they might normally be specified through regulation. But to guide the Department of Energy to promulgate the most effective regulations in the least amount of time, the bill requires DOE to rely first on models developed at the state level that have a track record of success.

Q. How much review has this proposal received?

A. A lot! The legislation was drafted after reviewing a discussion draft that has been through multiple round of comments by expert stakeholders. It began with proposals embodied in the Thomas Bill of 1999 and the Clinton Administration's Matsui Bill of the same year. This proposal had been developed by consultations between the White House, the Department of Energy, the Environmental Protection Agency, and the Treasury Department. Several stakeholders with extensive state-level experience had a number of concerns with initial drafts of this bill, focused precisely on administrative workability, resistance to fraud and to "creative" interpretation of requirements by contractors.

The stakeholders attended a number of meetings with these federal agencies, in which many of our suggestions were accepted and incorporated into both the Thomas Bill and the Matsui Bill. S.207/H.R.778, introduced in the 107th Congress, added additional detail based on detailed analysis and drafting efforts by Congressional staff and extensive review by the parties with greatest experience and expertise in this area: utilities who have run multi-tens-of-millions-of-dollars-per-year programs; the energy efficiency professionals who administer these programs; and similar programs for performance-based compliance with state energy codes, state energy offices that have been enforcing building codes that must rely on similar inspection and verification protocols; the Home Energy Rating System (HERS) industry, and the Florida Solar Energy Center, which has provided expert advice to both the HERS industry and the state building code officials. S.507/H.R.1271 was based on S.207/H.R. 778 and on the further dialogue that led to H.R. 4. Additional commentary from stakeholders as well as dialogue among Congressional staff produced the current bill.

The methods used in this legislative proposal are based on building code experience in Florida and California, under which over 2 million buildings, both residential and non residential, have demonstrated compliance with the building code and have been subject to subsequent measurements verifying that almost 100% of the predicted savings were realized.

Throughout this process, there have been numerous consultations between stakeholders and Senate staff; including tax staff of the Senate Finance Committee. Since this is a multi-issue bill, review by staff working for Senators on environment and energy as well as tax provided the most thorough process for getting both the broad policies and the technical details right.

Q. How do you know that the targets specified for receiving the tax incentives make sense?

A. For residential buildings, the bill provides two targets. The first, a 30% reduction in energy cost, is generally consistent with the Environmental Protection Agency's ENERGY STAR program, and has been endorsed by the California Building Industry Association as well as the National Association of Home Builders as a reasonable target that, on one hand, is buildable by most builders, but on the other hand, may not occur as quickly without intervention in the marketplace. The incentive is only offered for three years to limit the risk of runaway tax revenue loss from the growth of the ENERGY STAR program. The incentive covers most of the incremental costs of meeting this level.

The 50% reduction goal is the target of a number of Department of Energy demonstration programs. The experience with DOE's Building America project shows this to be an achievable target. An estimate consistent with several experts' experience is that the \$2,000 credit would provide slightly more than half of the present incremental costs of compliance.

For residential equipment, the two tiers of target levels are similar to those proposed in previous legislation (H.R. 4) and have been reviewed by experts in the energy efficiency community. The lower level for air conditioners represents well under 5% of the market, while the higher level is available, but virtually impossible to buy at present. In addition, this proposal requires improvements in summer peak performance – to help keep the electric system from blacking out.

For non-residential buildings, a detailed study drawing on a data set of almost 1000 buildings in California performed by Charles Eley Associates and funded by Pacific Gas & Electric Company looked at the energy efficiency achievements that were typical of new construction in California in the 1990's, when utilities were running significant voluntary programs for energy efficiency. (Most of the sample were not participants in the utility incentive programs, however.) The study found that the 50% savings target has been achieved by roughly 5% of new buildings in California, but that significantly larger numbers of buildings were already achieving a 40% savings and some 25% of the sample was achieving 30% savings.

Experts in California, Wisconsin, New York, and other states have verified that the 50% target can be met, and in the case of designers, those with the greatest experience on energy efficiency feel that they could meet the target in their projects. On one hand, the target is ambitious; in a number of states, most buildings do not even achieve the base standard level, much less reduction from it. But on the other hand, lowering the target would dramatically increase the free ridership in the bill and its likely cost to the Treasury. Both the free ridership

problem and the budgetary impact problem are exacerbated by the six year extent of the tax incentives availability. A lower target than about 50% would risk the expenditure of significantly greater tax revenues while establishing a market benchmark that is less efficient than what we could achieve.

Q. What does the bill do to eliminate free ridership – paying for people to do something they were going to do anyway?

A. The targets were chosen intentionally to be quite high compared to current practice. There is extensive data from DOE projecting only very slow improvements in efficiency occurring in the marketplace in the future. Indeed, if an advocate of energy efficiency advanced a claim that the building sector would, without policy intervention, become 30%-50% lower in energy use over the next 6 years, this claim would be (correctly) treated dismissively by energy experts²⁰. If this legislation were to fail, it would more likely be because the targets were too ambitious than because lots of taxpayers' money was thrown away in paying for improvements that would have occurred in any event.

Market transformation programs more often produce “free drivers” rather than free riders, that is, they encourage people to take advantage of the efficiency without the government having to lose revenue from the tax incentive. This occurs because the market contains products or services that are bought by people who cannot qualify for the tax incentive, or never get around to filing the form. This has been the experience of a number of utility programs.

Free drivership is virtually assured to occur for programs with a sunset date. After the program sunsets, anyone who purchases the more efficient product or service is providing the public policy benefits for free. There are numerous examples of programs that have demonstrated very high leverage: the utility pays for only a small fraction of the efficiency measures that are eventually installed as a direct result of its program.

Q. Are there other potential spill-over effects?

A. S. 507/H.R.1271 maximizes the opportunity for spill-over effects. One striking example is in the new housing proposal. While the bill does not require any particular technology to be used in order to qualify for the savings percentage thresholds, certain methods are likely to be used extensively because they cost less than competing methods.

One of these is home diagnostics: contractors who can test to assure that ducts are leak free (currently duct systems frequently lose 25% of the heated or cooled air into the basement or attic), and test to see that there aren't drafts of cold air into the house in winter. Most new homes do not take advantage of these techniques because builders do not have access to contractors who are qualified to do the work. In turn, these contractors aren't there because the market has not

²⁰ For example, the newly issued revision of ASHRAE/IESNA/ANSI Standard 90.1-1999, a widely known benchmark of energy efficiency in buildings, saves only about 5% compared to the ten-year-old standard that it updates.

demanded them as of yet. In some areas, there are not there at all; in other areas, primarily those where state energy offices or utilities have provided education or incentives, qualified contractors exist but there aren't very many of them.

By providing the likelihood of strong additional economic opportunity, this bill could encourage the dramatic growth of contractors qualified to prevent air leakage in homes. This industry offers multiple advantage to the homebuyer, once it is available: houses with reduce leakage not only save energy, but have higher indoor air quality, are safer, and are likely to be less noisy.

This industry and the related home rating industry will have to expand greatly to provide enough service to the number of houses that are likely to seek qualification for the tax incentive. But the expanded industry can also find additional niches in the market once it's established. For example, both major players in the residential mortgage secondary market recognize energy efficiency improvements in homes and allow buyers to qualify for additional monthly payments on their mortgage when they have demonstrated that these payments will be compensated by lower monthly energy bills. The same energy ratings used to qualify the builder, landlord, or homeowner for the tax incentive will also be usable for qualifying the potential buyer for a higher mortgage.

By getting the lending industry used to processing large amounts of energy efficient mortgages – this is a tiny niche product at present – the motivations to continue to provide energy efficiency after the tax incentives have sunset is strong.

In many cases, upgrades in efficiency reducing energy costs in an existing house by 30% can be so cost effective that the construction costs can be financed by a loan that is entirely paid off by the energy savings offered by the retrofit. The tax incentives will encourage this retrofit activity.

Q. Are there spillover benefits for commercial buildings as well?

A. The spillover benefits may be greatest for commercial buildings. The same documentation that will be used to qualify for the tax incentive could provide self-sustaining incentives for building owners to invest in the same energy efficiency measures after the tax incentives sunset.

At present, most buildings are appraised by the “net operating income” method. Using this method, property values are established by multiplying a capitalization factor times net operating income. Net operating income includes operating revenue, such as rentals, less expenses, including energy expenses.

At present, appraisers have no method for estimating energy costs accurately, so they simply default to regional averages. But with government approved methods for estimating energy costs accurately, and an infrastructure of third party consultants who can use these methods, property owner may be able to obtain increased appraisals as a result of energy efficiency investments. These increased appraisals would allow a developer to borrow the entire incremental cost of efficiency and more. This change could completely eliminate the first cost barrier for energy efficiency investments, which is one of the most important market barriers.

(The Institute for Market Transformation, a non-profit, is currently working with state energy agencies, utilities, and the appraisal industry in developing procedures that would allow appraisers to use building energy ratings.²¹)

Q. Won't this legislation require a new bureaucracy for enforcement?

A. The certification procedures used in this bill are simple enough that auditors from the Internal Revenue Service or the Department of Energy need mere spot check simple to read forms and rely on the accuracy of the automated methods used to generate the forms and the objectivity of the third-party inspectors to assure quality. All of the actual inspectors would be employed in the private sector.

These private sector inspectors will be performing a value-added service that can be expected to persist in the construction industry for good economic reasons once it is no longer needed to fill out IRS forms. This is because the same information that is needed to verify compliance with the IRS can also be used to establish valuation in both the residential and commercial markets.

For residential buildings, an energy rating accomplishes two purposes. First, the raters will be capable of performing some of the most effective energy efficiency improvements – leak free ducts and draft resistant construction. Second, the energy report can be used to attract higher amounts of mortgage lending for the same income of the applicant under current products available from Fannie Mae and Freddie Mac. The same documents could also be used to establish higher resale values by proving to future buyers that the building is more energy efficient.

For the commercial sector, an energy rating provides two valuable services to the owner. First, as indicated above, it could lead in many cases to the builders being able to claim higher property value and greater borrowing power, as well as a higher resale price. Second, projections of energy consumption used in the rating can be employed by the owner as a benchmark for actual operating expenses. A building whose actual expenses exceed those

²¹ "Energy Cost and Valuation of Commercial Properties by Appraisers and Lenders," M. Chao, D.B. Goldstein, T.P. Conlon, Proceedings of the 1998 ACEEE Summer Study on Energy Efficiency in Buildings, American Council for an Energy Efficient Economy, Washington, DC, 1998.

projected in the audit is likely to have some system that is malfunctioning, and the energy documentation will help identify and correct such problems.

Q. How does S.507/H.R.1271 deal with market competition?

A. Among the lessons of the tax credits of the 1970's was that it is not a very good idea to pick winners and it is a particularly bad idea to base tax incentives on expenditures rather than performance. The ideal result of an incentive for increased energy efficiency would be the introduction of new technologies that achieve the energy gains at no cost at all. If the tax incentives are a fraction of cost, this won't happen. Indeed, the first response to the solar tax incentives, which were a fraction of cost, was for contractors to mark up costs and simply pocket the difference. The intention of expanding sales of solar devices was thereby frustrated.

The incentives in this bill are based on the overall performance of certain pieces of equipment, or the complete performance of whole buildings. Different technologies will compete with each other for achieving these energy goals at the lowest cost. For houses, the duct sealing and leak sealing contractors will be competing with insulation contractors, window suppliers, passive solar design architects, concrete or masonry industry firms, and others, to meet the energy goal. The contracting industry is good at minimizing costs: where they have failed for energy efficiency is they minimized the cost of meeting a marginally acceptable level of energy efficiency to the consumer rather than an optimal level.

Various stakeholders who are supporting the bill, in state and federal energy agencies who have contributed to it, have their own forecasts of what technologies will be used to qualify for both residential and non-residential whole buildings tax incentives, and even what technologies are likely to be used to improve the performance of heating, cooling and water heating equipment. But they need not be right: industry could use different methods that cost even less.

The experience with energy efficiency has shown a consistent pattern that when regulations or incentives promote market forces of competition, energy efficiency results are delivered at far lower costs than even the optimists predicted.

Q. How does S.507/H.R.1271 deal with the competition between different heating fuels?

A. The legislation was designed very carefully, with broad stakeholder input, to avoid favoring one heating fuel supplier over another. If this had not been done, there might be some circumstances in which a builder or building designer would find it easier to qualify for a tax incentive if they switched heating fuels from, say, electricity to gas or vice versa. But this bill specifies in great detail that the *same* energy efficiency measures must qualify a building for the tax incentive regardless of whether the heating is provided by a gas or oil furnace or by an electric heat pump.

There is a related political controversy between gas heating and electric heating interests concerning how energy use and energy savings are measured. Some electric heating interests have recommended the use of “site” energy calculations, in which one kilowatt hour of electricity is set equal to 3,413 Btu of fuel energy, because that is the energy content of the kilowatt hour. But gas heating interests argue that it took much more energy, typically around 11,000 Btu, to produce the kilowatt hour and thus energy should be measured in terms of “source” energy. This bill rejects both approaches, and instead measures energy use by its cost. This is an approach that has achieved industry consensus through the ANSI process three times in the past 15 years. Both gas and electric interests accepted ASHRAE Standards 90.1-1989, 90.1-1999, and 90.2-1993 when they used energy cost as the measurement of energy consumption or savings.

These approaches are not the preferred option of hard-liners in any of these industry groups; instead, they take a compromise approach. Advocates of an approach biased towards their product may not be satisfied, but the approach of fuel parity taken in the bill is fair and equitable and has strong policy justification.

Q. Doesn't this legislation favor the wealthy?

A. No. The legislation includes manufactured housing, often the most affordable choice. By extending tax incentives to include rental housing as well as owner-occupied housing, the benefits of energy efficiency are extended to renters as well as those who can afford a new home. The retrofit and equipment efficiency incentives are structured to provide incentives to whoever pays for the upgrade, whether it is the occupant or the landlord.

Q. What does this bill do to minimize the opportunities for fraud and abuse?

A. Minimizing fraud and abuse was one of the main issues addressed in crafting this bill. It will not serve the environmental community's interest to have to explain five years from now why this bill didn't work as expected. Reductions in pollution and savings in cost that exist only on paper do no one any good. Most of the technical review this proposal has received has centered on assuring quality control.

DOE is directed by the legislation to rely on methods that have been developed in California to enforce building codes based on whole building energy performance, which are almost exactly analogous to the criteria used for qualifying for the tax incentives. The Department of Energy is directed to begin with the California rules for calculating energy use, for relying on simple inputs and outputs that can be entered appropriately by the building designer and inspected by a building code official (for the code) or a third party inspector for the tax incentives. The California manuals that DOE is referred to are over 400 pages long and have been developed over a 15-year period through feedback from enforcement officials and state energy officials from field tests concerning what has worked and what has failed to work and needed correction. They are widely recognized as successful by those who have worked with them. (Similar procedures are used in Florida and are equally effective.)

One crucial feature is the reliance on third-party certification to demonstrate qualification for the tax incentives. The Department of Energy is directed to develop procedures for certifying organizations that can qualify third party individuals with the expertise and training necessary to do energy ratings. Such expert energy raters and their certifying organizations exist in a number of states already.

Q. Won't this be very complicated?

A. The only parts that are complicated do not have to be used by either the applicant for the tax incentive or the third party certifier who inspects the building. So the system is actually very simple for the user and for auditors of the IRS. In an analogy, a word processing computer program is extremely complicated, but the user sitting at his or her computer doesn't need to understand the software details of the program to use it. The whole point of the program is to make it easy for the user. The complication is buried in the software and is generally intended to make the user interface as simple and intuitive as possible.

The same procedure has been used in verifying energy savings. A few software designers who want to provide private sector software that the Department of Energy will certify as capable of qualifying the user for the tax incentive will have to read the 450-page manuals. Indeed, some potential entrants to this market are intimately familiar with the California manual on which the DOE regulations will be based, and would require only a few weeks to develop revised software that would be applicable for the tax incentive program.

The compliance software in Florida and California is virtually "idiot proof": it requires only limited input from the designer and provides simple outputs that can be understood both by an auditor at the IRS and by a third-party inspector who verifies whether the building was constructed as designed. A result of simplifying the outputs, under-trained building inspectors who are pressed for time and often don't prioritize energy code enforcement very highly have nevertheless achieved very an excellent rate of success in assuring that actual building energy use is similar to the levels required by code.