Mission Impossible? A Pilot International Meta-Analysis of Appliance Energy Efficiency Programme Evaluations

Nigel Jollands, Energy Efficiency & Environment Division, Paris, France
Mark Ellis, Mark Ellis and Associates, Wagstaffe NSW, Australia

Abstract

Energy efficiency evaluation and the secret services have at least one thing in common – the prospect of Mission Impossible. In energy efficiency, the Mission Impossible could be considered an international meta-analysis of evaluations of appliance energy efficiency programmes. It is difficult enough to evaluate a single programme, let alone compare multiple evaluations across different contexts that use different methods. Nevertheless, as part of a broader study of appliance energy efficiency policies, the IEA decided to attempt to do just that – to pilot an international meta-analysis on 8 relatively comparable case studies from six countries covering a range of different measures relating to appliances. The motivation for pursuing the study is the knowledge needed by many emerging and developing countries around the world who are in the process of developing their own energy efficiency policy portfolios. They are interested to learn from the knowledge of those countries that have long-standing experience with energy efficiency.

This study comments on the methodological challenges with an international meta-analysis of this nature. As a result of our limited analysis, we make some tentative conclusions and we find that despite the difficulties, such international meta-analyses need not be impossible. And given improvements in the extent of evaluation activity, harmonisation of methods and greater experience with conducting international meta-analyses, international comparisons could even be potentially useful.

1. Introduction

IEA member countries have many years of experience in energy efficiency policy development and implementation. As part of its support for implementation of high-quality energy efficiency policies and programmes worldwide, the IEA initiated a pilot study to identify best practices via an international meta-analysis of energy efficiency evaluations. This is a first stage of an exploration of whether enough data that exists to compare programs across various countries. The motivation for pursuing the study is the knowledge that many emerging and developing countries around the world are in the process of developing their own energy efficiency policy portfolios. They are interested to learn from the knowledge of those countries that have long-standing experience with energy efficiency.

Appliances have been the focus of energy efficiency policies in IEA member countries for several decades. IEA governments have targeted the energy use of appliances with a range of policies and programmes including regulations, information campaigns, labelling requirements and subsidies. And more than any other policy area, appliance energy efficiency policies and programmes have been the subject of extensive ex-post evaluations.

Evaluating the effectiveness of energy efficiency programmes is difficult enough. But being able to generalise about the effectiveness of a whole class of programmes across many countries presents a whole further range of difficulties. It is complicated by the many different types of energy efficiency programmes and the variable assumptions made by evaluation experts. This could lead some to declare an international energy efficiency evaluation meta-analysis as a mission impossible.

But international meta-analyses of energy efficiency programme evaluations are just what are needed if countries are to learn from one-another's experience and to share this experience with other countries. This is particularly the case for the many non-OECD countries that are taking the first steps to develop their energy efficiency policy portfolios. As they prepare their action plans they ask, "what lessons can we learn from international energy efficiency policy experience that can help guide us in selecting our policies"? An international meta-analysis can also assist those countries with a longer history of energy efficiency action fine tune their portfolio to select the policies most suited to their needs.

Several studies have attempted to collate and summarise the lessons from evaluations for Europe and the USA (see, for example, Ecofys (2007) and Gillingham (2004)). However, there have been relatively few attempts at such meta-analyses at a global scale – that is, comparing evaluations across continents (the one exception being Lund (2007) who did not focus on appliances).

The purpose of this paper is to pilot an international meta analysis of energy efficiency programmes with available data. In doing so, the aims are to first identify the challenges associated with such a meta-analysis and second, to attend, where possible, to evaluate the evidence of the cost effectiveness of measures to improve the energy efficiency of appliances. Specifically, this analysis found 8 relatively comparable case studies from 6 countries covering a range of different programmes relating to appliances. This study is part of a broader IEA study analysing appliance energy efficiency policies.

2. The case studies

There are a variety of policy measures available for promoting energy efficiency in appliances (see for example, www.iea.org/textbase/pm/index-effi.asep). Comparability of appliance energy efficiency evaluations is often difficult because there is no single agreed method for conducting energy efficiency programme evaluations. The heterogeneity of appliance policies and programmes means that evaluations adopt different boundary definitions, different methods for measuring energy savings etc to suit their individual context. For example, some studies attempt to take account of free-rider issues, while others don't and some studies provide a break down of costs and benefits by sector (government, industry, end-user, society) while others don't. In addition, there is a huge variance in the degree of detail provided in evaluation reports (some simply provide totals of their calculations without background data, while others provide detailed annual breakdowns of costs and energy savings). Such different approaches is the case within countries, and even more so at the global level.

As a result, the analysis presented here is based on a subset of 36 initially considered evaluations. Out of the 36 evaluations, we identified a set of 8 case studies for which we have detailed data in a consistent format. That is, these evaluations:

- Estimated net energy savings;
- Provided sufficient information for recalculation of results into net present value euros;
- Attempted to account for free-rider and rebound effect;
- None addressed the spill-over effect.

The list of 8 case studies is presented in Table 1.

Table 1: The full set of 8 case studies

	Policy	Country	Appliance type	Policy category	Programme cost (to Government) (2006 terms) (€ millions)
Case studies for which direct comparisons are possible					
1	Netherlands appliance labelling	Netherlands	Household electrical appliances	Package (R + F + I)	€ 232.00
2	KFW Soft Loans	Germany	Appliances for new buildings	F	€ 2,900.00
3	British Enery Efficiency Commitment (AID-EE)	UK	Lighting (24% of funding), Appliances (11%), Heating (9%) and Insulation (56%)	U (F+I)	€ 1,460.00
4	New York ENERGY STAR Market Support Program	USA	Appliances	Package (VA + F + P + I)	€ 28.14
5	New York EmPower Program - Low Income	USA	Energy-efficient lighting, appliances, electric-resistance space and water heating, and demand management (addressing utility summer system peak constraints)	I	€ 16.44
6	Thin Tube CFL Program	Thailand	Fluorescent lamps	U (VA)	€ 9.09
7	Danish Kitchen Appliance	Denmark	Kitchen appliances	F	€ 3.64
8	California Multi-Family Rebate Program	USA	Energy efficient equipment	F + I	€ 14.90

Key: *R = regulatory; F = financial instrument; I = incentive; U = utility programme; VA = voluntary agreement; "Package" (indicates combination of elements).*

This paper does not present a comprehensive analysis of appliance energy efficiency programme evaluations. Conducting such a comprehensive analysis of all evaluations conducted internationally was outside the scope of this study principally because of the lack of comparable evaluation studies.

3. Detailed description of case studies

The 8 case studies chosen for detailed comparative analysis all address appliance energy efficiency, either directly or indirectly. Seven out of the eight case studies are from North America and Europe. This is not surprising, given that evaluation of energy efficiency policies and programmes is much more embedded in the 'culture' of the policy process in these regions than in some other parts of the world.

All eight case studies use one or more of the common approaches to promoting energy efficiency in appliances. Financial incentives for energy efficiency and information provision were the most common programmes in the eight case studies -- five of the case studies provided financial incentives; four case studies used information transfer. Two case studies were utility-based energy efficiency programmes, and two case studies relied on voluntary agreements. Only one case study used regulatory measures to achieve energy efficiency improvements (Netherlands appliance labelling programme). With only one regulartory-based programme in the eight case studies, they can not be taken as a representative sample of appliance energy efficiency programmes. Regulatory policies have been the most commonly used measure to achieve energy efficiency improvements and appliances worldwide (see for example, IEA (2009)).

All eight case studies have been successful in that they have produced tangible energy efficiency improvements in the market.

3.1 The Netherlands appliance labelling

This evaluation studies the effectiveness of the Netherland's comparative energy labelling for household electrical appliances and the associated subsidy programme (Luttmer 2006). Energy labelling of appliances was first introduced in the Netherlands in 1995 to stimulate both the demand side of the market (creating awareness and influencing purchase behaviour) and the supply side (creating awareness and influencing design and production). Since 1995 several other "large" energy consuming appliances were added to the list; washing machines and electric tumble dryers in 1996, washing and drying combinations in 1998, dishwashers in 1999, lighting in 2001, and ovens and air-conditioners in 2003. There are various EU directives that require energy labels for electrical appliances (Directives 94/2/EC; 95/12/EC; 96/60/EC; 97/17/EC; 98/11/EC; 92/42/EC; 96/57/EEC; 2002/31/EC) (Luttmer 2006). The label shows the energy efficiency of appliances compared with similar models. "A" rated are the most efficient and "G" are the least efficient. Electricity consumption in kWh is also displayed on the label.

Other policy instruments included in the package considered by the evaluation were the subsidy programme MAP (Environmental Action Plan, 1991-2000) and the EPR (Energy Premium Regulation, 2000- 2003). From the beginning, energy labelling had a strong relation to MAP and EPR as subsidies could only be received when the appliance has an "A" label.

3.2 Kreditanstalt für Wiederaufbau (Bank for reconstruction- KfW) soft loans

This evaluation covers the KfW programme to provide loans at reduced interest rates for implementation of energy saving measures in households in Germany (Korytarova 2006). Established in 1996, the programme has been restructured many times. The current evaluation focuses on two aspects of the programme:

i. CO_2 Reduction Programme - established in 1996, this programme originally made soft loans available to Eastern Germany and Eastern Berlin only. In 1999, the programme was expanded to cover the whole of Germany. The programme initially supported individual renovations in existing buildings. In 1998, the programme was also used to support measures in new buildings. The programme also financed the introduction of renewable energy sources in new and existing homes;
ii. CO_2 Building Rehabilitation Programme - established in 2001, this programme provided loans for retrofits of buildings built before 1979 as well as demolition of empty residential rental buildings. The programme provided partial debt relief in 2003. The programme offered 6 different packages of measures (some of which covered replacement of household heating equipment).

Over the evaluation period (1996 - 2004), the €2.9 billion program saved between 6.1 and 8.7 TWh (depending on how free rider effects were addressed) (Korytarova 2006).

3.3 British energy efficiency commitment (EEC)

The EEC covers the obligation placed on gas/electricity suppliers by the UK government to achieve mandatory targets for the promotion of higher energy efficiency in the residential sector (Forfori 2006). To encourage the least-cost solution for obliged parties, the EEC gives the option to suppliers to trade their obligation or energy savings on a bilateral basis with other suppliers. Supplier savings are accredited based on ex- ante savings estimate basis.

The overall energy savings target was set by the Department for Environment, Food and Rural Affairs (DEFRA) and was 62 TWh (fuel-standardised (FS) and lifetime discounted) (excluding free-riders and the rebound effect). At least half of this target was to be achieved in the priority group of

customers who were those households who spend more than 10% of their income on heating their homes.

The EEC gave suppliers freedom with respect to how they would comply with the obligations. Nevertheless, the EEC did encourage some measures (see page 5 of Forfori (2006)). Suppliers' activity mainly affected lighting (24% of ex post-evaluated energy savings achieved), appliances (11%), heating (9%) and Insulation (56%).

3.4 New York Energy Star market support programme

This USD41.3m (New York State Energy Research and Development Authority (NYSERDA) 2007 p. 3-5) programme provides support services to New York's building performance and low-income energy efficiency programmes by increasing the availability of energy-efficient products and consumer demand for services. There are three major components to the Market Support Program:

- the ENERGY STAR Products Initiative;
- the Program Marketing Initiative;
- the GetEnergySmart.org website.

The NYSERDA products programme provides a range of initiatives to support energy-efficient product uptake including cooperative promotion and market-share incentives to mid and up-stream partners, sales staff training, free point-of- purchase materials, website listings, and participation in statewide/national initiatives. Consumer demand is built through extensive multi-media campaigns. The marketing also supports other NYSERDA residential programmes such as the ENERGY STAR® Products & Residential ENERGY STAR® Marketing Programs.

3.5 New York EmPower programme

EmPower was launched in 2004 (total resource cost USD22.6m (EUR15.4m)) to provide energy efficiency measures and energy-use management education (on-site) to participants in the Niagara Mohawk and New York State Electric and Gas (NYSEG) low income programmes. By March 2007, the programme had led to evaluated net savings of around 50GWh. The programme is now available to customers of Central Hudson, Consolidated Edison, Orange and Rockland and Rochester Gas and Electric. The programme provides cost- effective electric reduction measures, particularly lighting and refrigerator replacements, as well as insulation and health and safety measures.

Under the latest round of New York Energy Smart funding, EmPower was merged with the Weatherization Network Initiative to simplify the programme structure and provide more comprehensive services to eligible participants. The Weatherization Network Initiative (WNI) was launched by NYSERDA in 2003 to deliver electric reduction measures through a statewide network of Community Based Organizations (CBOs) in coordination with the Weatherization Assistance Programme. (New York State Energy Research and Development Authority (NYSERDA) 2007).

3.6 Thailand Thin Tube programme

The Thin Tube programme was the first of Thailand's DSM Programs. The two-year programme began in 1993 with the objective to transform the fluorescent lamp market from 40W and 20W (thick tubes) to 36W and 18W (thin tubes) (Agra Monenco and Hydro 2000). The programme incurred costs of around THB336,000[1] and had an evaluated savings of 1,553 GWh. The Electricity Generating Authority of Thailand (EGAT) negotiated directly with manufacturers to switch production to the more efficient

[1] About USD13,400

tubes. In return, EGAT focused on the delivery of an advertising campaign to promote new energy saving lamps. Production technology was available and the incremental cost minimal, therefore, no additional financial incentives were offered. Within two years, all manufacturers had completely switched production to thin tubes, and the advertising campaign substantially accelerated acceptance of the transition. Market share of T-8 "thin tube" fluorescent lamps grew from 40 percent at the program launch to 100 percent in 1997.

3.7 Danish Kitchen Appliance programme

In the Spring of 2004, the Danish Energy Saving Trust carried out a campaign to increase the sales of energy efficient refrigerators/freezers (Danish Energy Association 2006). A subsidy of 500 Dkk (USD88) was offered to consumers when purchasing A+ or A++ appliances. For the period June 2004 to September 2005, the program cost DKK52.4m (USD9.2m) and saved 83 GWh (projected to be 440GWh over the lifetime of the appliances).

3.8 California Multi-family Rebate programme

The 2004-2005 California Statewide Multifamily Rebate Program addresses the unique needs of the multifamily sector (KEMA 2006). The programme was innovative because it is designed to address the unique barriers faced by the multifamily sector, primarily the split-incentive barrier. The rebates to owners and tenants of multifamily building units helped reduce -and in some cases totally eliminate- the higher first costs for energy-efficient equipment. The program also helped to encourage the participation of multifamily property owners and managers by offering rebates for energy-efficient measures installed in common areas.

The program cost utilities a total of USD19,075,919 and was offered across all of California and promoted energy savings in apartment dwelling units and in the common areas of apartment and condominium complexes and mobile home parks. Property owners (and property managers, as authorized agents for property owners) of existing residential multifamily complexes with five or more dwelling units could qualify for rebates for installing a variety of energy efficiency measures. These included:

i. Apartment improvement measures (e.g. interior and exterior hardwired fixtures, ceiling fans, compact fluorescent lights (CFLs), clothes washers, and dishwashers);
ii. Common-area improvement measures (e.g., exit signs, occupancy sensors, photocells, high-performance dual-paned windows);
iii. Mechanical improvement measures;
iv. High-efficiency heating and cooling equipment.

The programme saved 51.3 GWh over the two-year period (with projected lifetime Savings (2004-2012) of 384GWh) (KEMA 2006).

4. Some tentative results

Making any generalisations from the set of evaluations in this analysis is difficult – perhaps impossible for two main reasons. First, we have a very limited sample of programmes that we could normalise. Second, the set of evaluations are very diverse, from large bank-related programmes to small-scale, very focused programmes. Nevertheless, we attempt the heroic and try to explore what limited lessons we can from what we have available.

Table 2 summarises the lifetime energy impact and cost effectiveness of the 8 programmes.

Table 2: Lifetime impact and cost effectiveness of case studies (converted to common units)

Policy	Energy impact (GWh)	Policy cost effectiveness (Euros net benefit/kWh)	Period of programme (years)	Programme cost (to Government) (2006 terms) (€ millions)
Case studies for which direct comparisons are possible				
1 Netherlands appliance labelling	472.2	0.07	17	€ 232.00
2 KFW Soft Loans	8749.8	-0.02	16	€ 2,900.00
3 British Enery Efficiency Commitment (AID-EE)	111663.5	-0.01	10	€ 1,460.00
4 New York ENERGY STAR Market Support Program	756.7	0.80	12	€ 28.14
5 New York EmPower Program - Low Income	50.1	0.50	7	€ 16.44
6 Thin Tube CFL Program	1543.2	0.13	4	€ 9.09
7 Danish Kitchen Appliance	440.4	0.01	1	€ 3.64
8 California Multi-Family Rebate Program	384.0	0.05	6	€ 14.90
Weighted Average (weighted by energy impact)		-0.01		
Correllation coefficient (with cost-effectiveness)	-0.3	1	0.064	-0.42

The 8 programmes delivered significant energy savings in a cost-effective manner[2] – a finding that is corroborated by many other energy efficiency policy evaluations that could not be standardised into a comparable format. For example, other elements of the Thailand DSM programme (Agra Monenco and Hydro 2000), the New York load reduction programme (New York State Energy Research and Development Authority (NYSERDA) 2007) all report energy savings at a benefit-cost ratio of around 2:1 or higher.

The most effective program, from a net benefit per kWh saved perspective was the New York Energy Star Market Support Programme. This programme aimed at promoting ENERGY STAR appliances and equipment through a package of measures. Given the small sample of programmes in this analysis, it is difficult to generalise about why this programme was so much more cost-effective than the other programmes. Was it because the programme was relatively small and well targeted? Or perhaps it was because the programme used a package of instruments? The small sample presented here suggests that a package approach appears to assist overall of cost-effectiveness.

On an energy savings weighted average basis, the cost-effectiveness of all programmes is -0.1 euros/kWh. This negative result is a consequence of the large British EEC programme's negative cost-effectiveness 'swamping' the other more cost-effective programmes' results (if the large British EEC programme is removed, the weighted average net benefit per kWh is 0.0024 euros/kWh). This result is interesting - it indicates that the larger programmes in this sample tend to have lower cost-effectiveness than the smaller programmes. Indeed, the Pearson Correlation coefficient (a measure of the linear relationship) between the energy impact (kWh) and cost effectiveness is negative (- 0.1). This, negative relationship can be clearly seen in Figure 1 below (line A). Or perhaps a better relationship is shown by the curve (B)?

It would indeed be heroic to use this small set to suggest that the larger the programme (in terms of energy savings), the lower the cost-effectiveness. However, it does pose an interesting question that could be the focus of future research in this areas – are small, focused programmes using a package approach generally more cost-effective than large programmes?

[2] This is still the case for the case studies that report negative net benefit/kWh (in other words,a cost per kWh) since these costs are very low and below cost of supply.

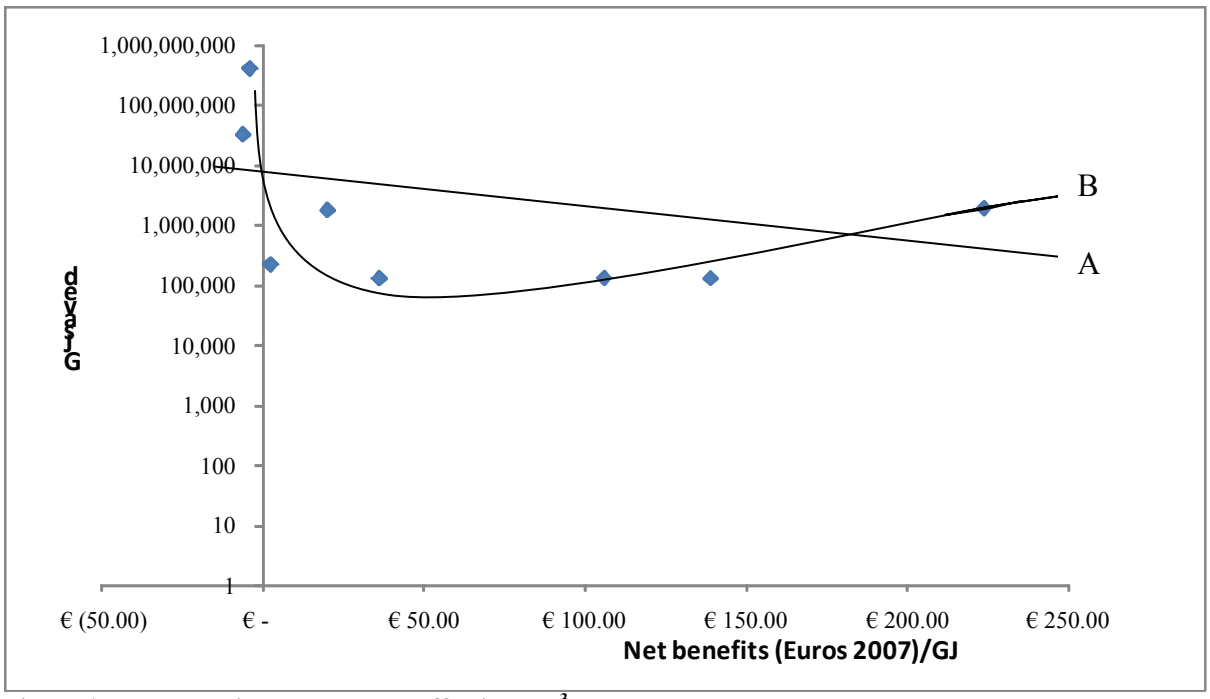

Figure 1: energy savings versus cost effectiveness[3]

Again, it is difficult to identify why this negative correlation may exist given the small sample of programmes analysed. However, it may be related to the programme size or the programme life (the correlation co-efficient between cost-effectiveness and cost of the programme is -0.5). This makes sense - smaller programmes tend to focus on "low hanging fruit" (e.g. kitchen appliances or CFLs where significant gains can be made quickly) whereas larger programmes tend to attempt the more difficult task of market transformation. Another reason for this result may be related to the complexity of the instruments used to achieve the energy savings - although it is difficult to gauge if the EEC is a more complex programme than, say the New York market support package.

It is not possible to make any clear conclusions about the relative cost effectiveness of different program types. However, what is clear is that all programs analysed were able to deliver energy savings at a lower cost (and often significantly lower) than the cost of energy supply. This small body of analysis tends to support the results of numerous other studies that conclude that energy efficiency delivers cost-effective energy savings.

5. Conclusions

Extending this meta-analysis beyond 8 case studies presented above has been all the more difficult because of a range of issues associated with energy efficiency evaluation. In this section we draw on our limited meta-analysis experience of very different market interventions in very diverse contexts, to identify 3 main issues that affect international meta-analysis: limited pool of evaluations outside the US; the lack of consistent evaluation methodology; and limited experience with international meta-analysis.

Despite the value of evaluating energy efficiency measures ***there is a limited pool of evaluations to draw on*** for an international meta analyse – this is particularly the case outside the US. Many energy efficiency policies and programmes go unassessed internationally. This appears to be for a variety of

[3] 1 GJ = 277.77 kWh

reasons, including scant resources, methodological difficulties, inadequate expertise and political interest all contribute to the lack of evaluation.

And even where energy efficiency policy evaluation is carried out, it is done so in a rather ad hoc manner. For example, much historical evaluation effort has been focused on a few policy areas and within relatively few jurisdictions. The one exception is the United States, where evaluation is more widely undertaken than many other regions. In the USA 3 to 5% of energy efficiency programme costs are typically allocated for evaluation, and up to 8% in California. This has led to the development of substantial capacity and expertise.

As a result of the limited pool of evaluations, it is difficult to find a set that is sufficiently diverse geographically to develop an international meta analysis.

Another challenge with conducting meta analyses of energy efficiency evaluations (whether international or not), is ***the diverse range of methods and boundaries applied*** to the evaluations. For example, some evaluations attempt to address rebound effects or spill-over effects while others do not. Often this diversity is sensible as the evaluators attempt to accommodate the unique context associated with their specific energy efficiency programme. However, it also means that the evaluations are difficult to compare.

Many publications offer direction on the appropriate methods for conducting energy efficiency policy and programme evaluation. Notable examples of such guides include the IEA's DSM Evaluation Guidebook (2005), the Energy Charter Working Party on Energy Efficiency's *Evaluating Energy Efficiency Policies and Measures* (2006) and the International Performance Measurement and Verification Protocol (IPMVP) (EETD Newsletter 2002). Despite these guidelines, the question remains whether it is appropriate to force all evaluations to follow the same method. We suspect that the answer to this question is somewhat of a compromise. That evaluations should be consistent with respect to some issues (for example, it is imperative that all evaluations account for free riders and spill over effects), but free to select their independent approach for others. Quite what should be consistent and what not, should be the subject of international discussion.

As a result of these difficulties with conducting meta analyses there is, not surprisingly, ***limited experience with conducting robust, international meta-analyses***. Gillingham et al (2004) and www.eebestpractices.com present two of the few meta-analyses of energy efficiency programs and measures. Covering a range of policies, their analysis is nonetheless limited in two aspects. First, they are restricted to experience in the United States. Second, particularly for the Gillingham et al study, it is not always clear whether the methodologies of the reference studies on which they based their meta-analysis are compatible, opening the possibility of comparing apples and oranges. The lack of international experience conducting these meta-analysis means that there is little guidance on how to address with the challenging methodological issues.

In conclusion, we have attempted what we thought would be impossible. In the process we found that, while not exactly impossible, the process was plagued with challenges. Given the small sample of programmes in this analysis, it is difficult to generalise about cost-effectiveness or whether one programme is more useful than another. Nevertheless, despite the difficulties, we at the IEA do not resile from the important challenge of transferring knowledge of international best practice to those countries who are beginning there energy efficiency policy development. Mission impossible? We think not. And at least this message won't self-distruct in 10 seconds.

6. References

Agra Monenco, and B. Hydro. 2000. Of the Electricity Generating Authority of Thailand - DSM programme evaluation - conservation programme. Agra Monenco.

Danish Energy Association. 2006. Evaluation of Danish Electricity Saving Initiatives: Householder Consultations. Danish Energy Association, Copenhagen.

Ecofys. 2007. Success and failure in energy efficiency policies: ex-post evaluation of 20 instruments to improve energy efficiency across Europe. Ecofys, Utrecht.

EETD Newsletter. 2002. IPMVP—from a DOE-Funded Initiative to a Not-for-Profit Organization.

Energy Charter Secretariat. 2006. Evaluating Energy Efficiency Policies and Measures. Draft report CS (06)1064 PEEREA 109.

Forfori, F. 2006. Evaluation of British Energy Efficiency Commitment - case study executed within the framework of the AID-EE project. Ecofys, Lund University, ERG and the Institute of Work and Technology, North Rhine, Westphalia.

Gillingham, K., R. Newell, and K. Palmer. 2004. Retrospective Examination of Demand-Side Energy Efficiency Policies. Resources for the Future, Washington, DC.

International Energy Agency. 2009. GADGETS and GIGAWATTS: policies for energy efficient electronics OECD/IEA, Paris.

International Energy Agency Implementing Agreement on Demand-Side Management Technologies and Programs. 2005. Evaluating Energy Efficiency Policy Measures & DSM programmes - volume 1 Evaluation Guidebook. OECD/IEA, Paris.

KEMA. 2006. Evaluation of the 2004-2005 Statewide Multifamily Rebate Program – Volume I. The California Public Utilities Commission, Pacific Gas & Electric Company, San Diego Gas & Electric Company, Southern California Edison, Southern California Gas Company,, San Diego.

Korytarova, K. 2006. Evaluation of KFW for a building modernisation - case study executed within the framework of the AID-EE project. Ecofys, Lund University, ERG and the Institute of Work and Technology, North Rhine, Westphalia.

Lund, P. 2007. Effectiveness of policy measures in transforming the energy system. Energy Policy **35**:627- 639.

Luttmer, M. 2006. Evaluation of labelling of Appliances in the Netherland - case study executed within the framework of the AID-EE project. Ecofys, Lund University, ERG and the Institute of Work and Technology, North Rhine, Westphalia.

New York State Energy Research and Development Authority (NYSERDA). 2007. New York Energy $MART^{SM} program quarterly evaluation and status report - quarterly report to the Public Service Commission - quarter ending March 31, 2007. New York State Energy Research and Development Authority, New York.