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Implementing Agreement on
Demand-Side Management
Technologies and Programmes

EVALUATING ENERGY EFFICIENCY POLICY MEASURES & DSM PROGRAMMES

VOLUME II
COUNTRY REPORTS AND CASE EXAMPLES USED FOR THE EVALUATION GUIDE BOOK

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1. Introduction

1.1.1 Introduction

Experts from Sweden, the Netherlands, Korea, Italy, France, Denmark, Canada and Belgium worked together to prepare an evaluation guidebook, which contains two volumes: this volume (II) which covers the country examples and the evaluation tradition in these countries. This information is used to prepare the Evaluation Guidebook Volume I which deals with evaluation theory and advises on how to conduct evaluations for five types of policy measures and programmes.

In the sections below we summarise the information from Volume I regarding definitions (section 1.2) and typology of policy measures (section 1.3). In section 1.4 an overview of the case examples and the structure of the presentations of the selected evaluations is included. Ahead of the country reports we present in chapter 2 some general finding from the case examples.

This volume holds the country reports for:

Belgium
Canada
Denmark
France
Italy
Republic of Korea
The Netherlands
Sweden

Structure of the country reports

1. Introduction
2. National system of energy efficiency policy measures
3. System for evaluating, monitoring and data collection on energy policy measures and relevant scenarios
4. Method on evaluating energy efficiency programmes (1995 onwards); short overview for programmes
   - 4.1 Methods used
   - 4.2 Baseline (ex ante evaluation) and relation with national scenario/model
   - 4.3 Ex post evaluation
   - 4.4 Use of indicators
   - 4.5 Calculations on GHG emission impact for evaluated programmes
5. Method used for selected evaluated EE policy measures, **case examples**
   For each case example a common structure is used (see later)
6. Relations with international work
7. Sources

A country report starts with background information relevant to understand the evaluations as presented in the case examples. This information is presented in the first three chapters. As the case examples are a selection of conducted evaluations the country experts present also a more general overview on the methods used on evaluating in chapter 4. The major parts of the country report deals with the case examples, which are presented in chapter 5. The relation with other international work is the subject of chapter six, while the sources used for the country report are presented in chapter seven.

1.2. Basic Definition Policy measures, programmes and projects

To facilitate development of the *Guidebook*, as well as subsequent reporting of programme evaluation results, it was necessary to develop clear definitions of terms such as 'policy', 'measure', 'programme', and 'project'. Based on a review of this literature and our own understanding of common practice (see section 1.1.1 in Volume I), we decided to use the following structure and adopt the following definitions for use in these reports.

Policy measure: A specific type of political action or market intervention designed to persuade energy consumers to reduce energy use and encourage market parties to promote energy-efficient goods and services.

Programme: An organised set of projects targeted towards defined market parties over a specific time period to achieve increased end-use energy efficiency or reduced use of energy services. A package of selected policy measures is used. This selection is based on a programme theory.

Project: An organised set of activities to create output(s).

1.3. Typology of policy measures

The experts discussed several options for structuring a list of policies, policy measures and programme types, based on literature and common use in the participating countries and decided to use the following structure for policy measures and programmes:

1. Regulations.
2. Related information.
3. Economic incentives.
4. Voluntary agreements.
5. Combinations of policy measures and programmes.

Policy Measure Type 1: Regulation. In this *Guidebook*, the term 'Regulation' refers to laws and implementation regulations that require certain devices, practices, or systems design to improve energy efficiency. The most common forms of regulation are:

- ***Building Codes.*** In some countries and regional jurisdictions, commercial and residential building codes contain provisions specifying required physical or performance characteristics for buildings or building subsystems.
- ***Minimum Energy Performance Standards.*** Minimum energy performance standards (MEPS) apply to energy-using devices such as domestic appliances, household electronics equipment, office equipment, transformers, electric motors, and packaged heating, ventilating, and air conditioning (HVAC) equipment. These standards generally contain two parts: the first states a minimum performance standard in terms that are

relevant for the particular device, and the second specifies the testing procedures used to estimate or classify the energy efficiency of the subject devices or materials.

Policy Measure Type 2: Information. This policy measure is designed to:

- Increase the various parties' awareness and understanding of energy-efficient products and services, as well as their economic and environmental benefits.
- Persuade actors to change their behaviour towards adopting energy-efficient products and practices.
- Provide actors with the technical information they need to identify and adopt energy-efficient practices.

The evaluation literature identifies the following more specific types of information-based energy efficiency policy measures.

- ***General Information*.** These policy measures consist of paid advertising and public-relations campaigns designed to make consumers aware of the need to save energy, the means at their disposal to achieve this, and the consequences of not doing so.
- ***Labelling.*** Most of the EU countries plus Japan, Canada, and the United States have adopted statutes and rules that specify product performance standards, testing procedures, and labelling procedures for energy-using products.
- ***Energy Audits.*** Energy audits consist of a structured inspection of a facility to estimate energy use and identify opportunities for increasing energy efficiency. In some cases, it is the customers themselves who carry out the inspection using protocols developed by the programme manager. Onsite observations are analysed to allocate metered facility energy use for specific end-uses, estimate savings associated with applicable efficiency measures, estimate the costs of those measures, and prepare investment analyses of those measures. Energy audits are designed to help facility owners overcome a number of common barriers to implementation of energy efficiency measures. These include reducing information costs, mitigating information asymmetries (by providing economic analysis of potential measures from a party with no financial interest in their implementation), and reducing perceptions of risk.
- ***Information Centres*.** Information centres package and disseminate relatively technical information on energy-efficient products and practices. These centres are generally designed to support the work of equipment vendors, engineers, and plant managers working in a relatively narrow market, defined by technology (e.g. lighting) or a specific branch of industry (e.g. food processing).
- ***Education and Training*.** Education concentrates on providing focused information on energy efficiency opportunities and the application of efficient technologies in particular end uses. Training focuses more on practical experiences.
- ***Demonstration.*** Once a new or improved technology for energy conversion or energy saving has been developed, this technology needs to be introduced into the market. After a new or improved technology for energy conversion or energy saving is developed, this technology needs to be introduced onto the market. Demonstration refers to the phase during which this new product or technique is tested in practice. This serves to generate information on the usefulness, costs and energy savings during real use or to demonstrate this product or technique to potential users or decision makers.
- ***Governing by Example*.** Governments (e.g. Belgium and the Netherlands) sometimes choose their own governmental buildings, appliances purchasing etc., for a programme to demonstrate energy savings.

Policy Measure Type 3: Economic. Economic policy measures offer the stakeholders financial incentives to adopt specified energy-efficient technologies in equipment replacement, remodelling, and new construction projects. The wide variety of financial incentives currently in use includes:

- ***Project or product-related subsidies (rebates).*** Rebates are offered for the documented use of specific products or construction techniques. Rebates are generally gauged according to the efficiency level and quantity of equipment installed.
- ***Targeted taxes, tax exemptions, and tax credits.*** Several European countries offer tax credits or accelerated depreciation for purchasing specified energy-efficient equipment. In some countries, partial exemption from fuel taxation is offered to facilities that meet agreed requirements for voluntary energy use reduction.
- ***Financing guarantees.*** Programme sponsors may offer credit guarantees to reduce risk premiums charged on loans to finance energy efficiency projects.
- ***Third-party financing facilitation.*** Third-party financing approaches, such as energy performance contracting, are used to finance energy efficiency projects. They often include a subsidy or credit guarantee that reduces the cost of the project to the customer.
- ***Reduced-interest loans.*** Some organisations offer reduced-interest loans to finance projects that incorporate specified energy-efficient technologies.
- ***Bulk purchasing.*** Organisations may aggregate large orders of energy-efficient equipment to receive favourable pricing from manufacturers. These price reductions are then passed on to the final customers purchasing the equipment.
- ***Grants.*** Amount of money given to an individual or to an organisation for a particular purpose.
- ***Technology procurement.*** A process through which a commodity, service or system is procured, and for which development of new technical solutions is essential in order to meet a specified requirement set by a buyer (or group of buyers). The development work may concern the product, system or the production process for which it is developed.
- ***Certificate trading systems.*** A system of green (or white) energy certificates is used to facilitate the market for renewable energy, energy savings or for energy efficiency improvements.

Policy Measure Type 4: Voluntary Agreements. Voluntary Agreements, as defined in this *Guidebook,* refer to policy instruments under which representatives of national or provincial governments enter into negotiation with facility owners or branch organisations to obtain a commitment to reduce energy consumption by a specified amount over a given time period. Such agreements frequently contain energy consumption monitoring protocols and provisions for technical assistance to participating facilities. The signatories generally face financial penalties for failure to meet their commitments under the agreement. This approach is often used in conjunction with targeted tax exemptions.

- ***Industrial companies.*** Voluntary agreements, negotiated agreements or long-term agreements between representatives of a government and a group of industrial companies, or an industrial association.
- ***Energy production, transformation and distribution companies.*** Voluntary agreements between representatives of a government and energy production, transformation and distribution companies (or their trade association).
- ***Commercial or institutional organisations.*** Voluntary agreements between representatives of a government and commercial organisations (e.g. financial organisations), institutional organisations (e.g. hospitals, schools) or even ministries (or their association).

Policy Measure Type 5: Combinations. Many contemporary energy efficiency programmes combine elements of two or more of the basic policy measures. There is a current trend towards combinations and packages of an increasing number of policy measures indicated in the subcategories. For example, efforts to promote energy-efficient appliances have featured label specifications (regulation), broad-based branding and merchandising efforts (information), consumer rebates for qualifying products (economic incentives), bulk purchasing by government entities (economic incentives), and support of design competitions to expand the supply of qualifying products.

1.4 Case examples on conducted evaluations

The country reports hold the case examples in chapters 5. These chapters follow the five types of policy measures presented ahead: starting with regulation and ending with combinations of policy measures. These presentations follow for each case example the structure:

- Programme description
    A. Name of the programme
    B. Sponsoring Agency
    C. Objectives
    D. Programme activities
    E. Development and operation
    F. Administration
- Evaluation objectives, activities, results
    A. Evaluation objectives
    B. Evaluation activities
    C. Principal conclusions
- General conclusions

Figure 1.1 holds an overview of the 32 case examples by type of policy measures. Almost half of the case examples (15) are related to information and six case examples deal with economic incentives. Five case examples are in the field of regulation and two in combined policy measures, while four case examples are on voluntary agreements.

Figure 1.1: Overview of evaluation case examples by type of policy measure

	Policy type	Case examples	Country
1	Regulation	Building codes	Belgium
		Energy Efficiency Regulations for Residential Equipment	Canada
		Energy management scheme for large buildings	Denmark
		Minimum energy performance standards	Korea
		Energy Performance Standard (EPS) for houses	Netherlands
2	Information	Local energy efficiency information centres	Belgium
		Energuide for houses	Canada
		Energy labelling of small buildings	Denmark
		Free-of-charge electricity audit	Denmark
		Project 'Red-Hot' (element of stand-by campaign)	Denmark
		The 'A' campaign 1999	Denmark
		Promotion campaign for efficient ventilation	Denmark
		Information campaign (2001)	France
		Local energy information centres (Espaces Info Energie, EIE)	France
		Audits ("Aides a la decision")	France
		Energy audits in industry	Korea
		Energy audits in buildings	Korea
		Energy Efficiency Rating Labelling	Korea
		Information centres in local region	Sweden
		Information and education programme 1998-2002	Sweden
3	Economic	Criteria adopted for the evaluation of primary energy savings in end-uses	Italy
		EE Certificates	Italy
		Rebate programme for highly efficient electric inverters	Korea
		Financial incentives for DSM	Korea
		Energy premium scheme households	Netherlands
		Energy Investment Reduction (EIA and EINP)	Netherlands
4	Voluntary Agreements	Canadian Industry Program for Energy Conservation (CIPEC)	Canada
		Voluntary Agreements	Korea
		Voluntary Agreements on Industrial energy Conservation 1990 - 2000	Netherlands
		Eco-energy	Sweden
5	Combined policy Measures	Rebate programme for household appliances	Belgium
		STEM programmes	Sweden

Chapter 2 General overview on the case examples

2.1. Introduction

The country experts collected case examples on conducted evaluations in the participating countries. In total 32 case examples are presented in this volume. In volume I we introduced seven key analytic elements for evaluations. In the next section 2.2 we summarise to what extent in the selected country evaluations attention is given to these seven key analytic elements. During round table discussions experts presented the case examples and although only two case examples are in the category "combinations of policy measures", the evaluated programmes often holds elements from several (sub)types of policy measures. E.g. a subsidy policy may have a major component in information to consumers to get their attention from the products that are subsidised. In section 2.3 we summarise the combinations that are in the case examples.

2.2. Case examples and the seven key analytic elements for evaluations

In Volume I we argue that each evaluation should pay attention to the follow seven key analytic elements:

1. Policy measure theory that is used for developing and implementing a measure.
- Specification of the policy measure domain;
- Statement of policy measure effects hypotheses

1. The choice and specification of indicators for the success of a measure.
- Input (e.g. man-hours).
- Output (e.g. agreements with producers).
- Outcome (e.g. producers that comply with the agreement).
- Impacts, specified for energy savings and emission reductions.

2. The baselines for the selected indicators.
3. Assessment of outputs and outcomes of the policy measure.
4. Assessment of energy savings and emissions reductions and other relevant impacts of the policy measure.
5. Calculation of cost, cost-efficiency and cost-effectiveness.
6. The choice of level (for evaluation efforts).

For a more detailed description of these elements we refer to Volume 1, section 1.3. As argued in that section an evaluator has not to carry out the work related to these elements from scratch. If a programme is well developed, the information on the first three elements – statement of the theory, specification of indicators and baseline – should already be available for the evaluators. In theory it does not matter whether one evaluates a policy measure, such as a building code, or a programme that is targeted to increase the good use of a building code through informational campaigns, subsidies and tools. But of course the list is not a recommended sequence for undertaking the evaluation. The best order always depends on the specific circumstances within policy instruments (or combination of instruments) and the emphasis within the evaluation.

In figure 2.1 we present an overview to what extent the evaluations presented in the case examples give attention to the seven key analytic elements. We use for the first six elements the notation of plus and minus (+ = Attention; +/- = Some attention; - = (Almost) none attention). For the seventh element – the level of evaluation efforts – we use the A, B and C levels as described in Volume 1, where A is the highest, a comprehensive evaluation, B is a targeted evaluation and C is the lowest, a review evaluation.

The elements that get the lowest attention are the baselines and the indicators. In only a few evaluations the baselines got (major) attention. The low attention for the indicators is mainly caused by the fact that at the start of a policy measure often no *specific* indicators were selected and especially the outcome indicators were missing. In almost all evaluations the (expected) energy savings (and related emission reductions) are included, this while at the start of a programme these often are not well specified. Often the energy savings are based on (estimated) utilisation data and were not adjusted to external parameters.
The baselines often get some attention but only in a few cases more specific attention. This is mainly caused that the baselines are referred too as 'business as usual' scenario and these assumption is also included in the calculated energy savings. In almost all presented evaluations the output and outcomes are included, but seldom an in-depth analysis is conducted on these. So the plus indicating in the table might be a little coloured.

2.1.1 Figure 2.1. Overview case examples and 7 key elements

Case	Country	1. Theory	2. Indicators	3. Baselines	4. Output and outcome	5. E-savings and emissions	6.Costs	7. Level of evaluation efforts
Policy Type: Regulation								
Building codes	Belgium	+ (law)	-	-	+	-	-	B/C
Energy Efficiency Regulations for Residential Equipment	Canada	+ (law)	+	+/-	+	+	+	B
Energy management scheme for large buildings	Denmark	+ (law)	+	+	+	+	+	B
Minimum energy performance standards	Korea	+ (law)	-	-	+	+	-	C
Energy Performance Standard (EPS) for houses	Netherlands	+ (law)	-	+	+	+	+	A/B
Policy Type: Information								
Local energy efficiency information centres	Belgium	-	-	-	-/+	-	-	C
Energuide for houses	Canada	-	+	+/-	+/-	+	-	B
Energy labelling of small buildings	Denmark	+ (law)	-	+/-	+	+	+	B
Free-of-charge electricity audit	Denmark	+	+	+/-	+	-	+	A
Project 'Red-Hot' (element of stand-by campaign)	Denmark	+	+	-	+	-	+/-	A
The 'A' campaign 1999	Denmark	+	+/-	+/-	+	+	+	B/C
Promotion campaign for efficient ventilation	Denmark	+	+	+	+	+	+	A
Information campaign (2001)	France	-	-	-	+	-	+	B
Local energy information centres (Espaces Info Energie, EIE)	France	+	+/-	-	+	+	+	A/B
Audits ("Aides a la decision")	France	+/-	+	+/-	+	+	+	B
Energy audits in industry	Korea	+/-	-	+/-	+	+	+	C
Energy audits in buildings	Korea	+/-	-	+/-	+	+	-	C
Energy Efficiency Rating Labelling	Korea	+	-	+/-	+	+	-	A
Information centres in local region	Sweden	+	-	-	+	+	-	A/B
Information and education programme 1998-2002	Sweden	-	+	+/-	+/-	+	-	B
Policy type Economic								
Criteria adopted for the evaluation of primary energy savings in end-uses / EE Certificates	Italy	-	+	+	-	+	+/-	C
Rebate programme for highly efficient electric inverters	Korea	-	-	-	+	+	-	C
Financial incentives for DSM	Korea	+	-	-	+	+	+	C
Energy premium scheme households	Netherlands	+	-	+/-	+	+	+	A/B
Energy Investment Reduction (EIA and EINP)	Netherlands	+	-	+/-	+	+	+	C

Case	Country	1. Theory	2. Indicators	3. Baselines	4. Output and outcome	5. E-savings and emissions	6.Costs	7. Level of evaluation efforts
Policy Type: Voluntary Agreements								
Canadian Industry Program for Energy Conservation (CIPEC)	Canada	+/-	+	+	+/-	+/-	-	A/B
Voluntary Agreements	Korea	+/-	-	+/-	+	+	-	C
Voluntary Agreements on Industrial energy Conservation 1990 – 2000	Netherlands	+	+/-	+/-	+	+	+	A/B
Eco-energy	Sweden	+/-	+	+	+/-	+/-	-	A/B
Policy Type: Combination of policy measures								
Rebate programme for household appliances	Belgium	+	+/-	+/-	+	+	+	A/B
STEM programmes	Sweden	+	+	+/-	+	+/-	+/-	A/B

+ = Attention
+/- = Some attention
- = (Almost) none attention

A: comprehensive evaluation
B: targeted evaluation
C: review evaluation

2.3. Case examples and combined elements of policy measures

Figure 2.2 summarise the types and subcategories of the policy measures and elements from other categories the case examples include. The five case examples on regulation all hold information elements – general information, labelling, audits and education and training – and one also include demonstration and project subsidy. In total eight other elements than regulation are important and/or included in the case examples.
For only four of the information programmes elements from the economic category are included: three hold subsidies while one holds grants. On the other hand the majority of these programmes in the case examples combine several information elements.
The case examples in the category economic almost all include general information as an element in the programme.

Figure 2. 2 Overview of policy measure elements included in the case examples

		Regulation				
		Building codes	Energy Efficiency Regulations for Residential Equipment	Energy management scheme for large buildings	Minimum energy performance standards	Energy Performance Standard (EPS) for houses
		Belgium	Canada	Denmark	Korea	Netherlands
1	**Regulation**					
1.1	Building Codes and Enforcement	X	X	`X		X
1.2	Minimum Equipment Energy Performance Standards				X	
2	**Information**					
2.1	General Information	X				X
2.2	Labelling		X	X		
2.3	Information Centres					
2.4	Energy Audits			X		
2.5	Education and Training	X				X
2.6	Demonstration					X
2.7	Governing by Example					
3	**Economic**					
3.1	Project or Product-related Subsidies (rebates)					X
3.2	Targeted Taxes, Tax Exemption, Tax Credits					
3.3	Financing Guarantees					
3.4	Third-party Financing Facilitation					
3.5	Reduced-interest Loans					
3.6	Bulk Purchasing					
3.7	Grants					
3.8	Technology procurement					
3.9	Certificate trading systems					
4	**Voluntary Agreements**					
4.1	Industrial Companies					
4.2	Energy Production, Transformation and Distribution Companies					
4.3	Commercial or Institutional Organisations					

		Information						
		Local energy efficiency information centres	Energuide for houses	Energy labelling of small buildings	Free-of-charge electricity audit	Project 'Red-Hot' (element of stand-by campaign)	The 'A' campaign 1999	Promotion campaign for efficient ventilation
		Belgium	Canada	Denmark	Denmark	Denmark	Denmark	Denmark
1	**Regulation**							
1.1	Building Codes and Enforcement			X				
1.2	Minimum Equipment Energy Performance Standards							
2	**Information**							
2.1	General Information	X	X				X	X
2.2	Labelling		X	X				
2.3	Information Centres	X				X		
2.4	Energy Audits	X	X	X	X			
2.5	Education and Training		X					
2.6	Demonstration							
2.7	Governing by Example							
3	**Economic**							
3.1	Project or Product-related Subsidies (rebates)		X				X	X
3.2	Targeted Taxes, Tax Exemption, Tax Credits							
3.3	Financing Guarantees							
3.4	Third-party Financing Facilitation							
3.5	Reduced-interest Loans							
3.6	Bulk Purchasing							
3.7	Grants					X		
3.8	Technology procurement							
3.9	Certificate trading systems							
4	**Voluntary Agreements**							
4.1	Industrial Companies							
4.2	Energy Production, Transformation and Distribution Companies							
4.3	Commercial or Institutional Organisations							

		Information							
		Information campaign (2001)	Local energy information centres (Espaces Info Energie, EIE)	Audits ("Aides a la decision")	Energy audits in industry	Energy audits in buildings	Energy Efficiency Rating Labelling	Information centres in local region	Information and education programme 1998-2002
		France	France	France	Korea	Korea	Korea	Sweden	Sweden
1	**Regulation**								
1.1	Building Codes and Enforcement								
1.2	Minimum Equipment Energy Performance Standards						X		
2	**Information**								
2.1	General Information	X	X					X	X
2.2	Labelling						X		
2.3	Information Centres		X					X	X
2.4	Energy Audits			X	X	X			X
2.5	Education and Training		X						
2.6	Demonstration								
2.7	Governing by Example						X		
3	**Economic**								
3.1	Project or Product-related Subsidies (rebates)								
3.2	Targeted Taxes, Tax Exemption, Tax Credits								
3.3	Financing Guarantees								
3.4	Third-party Financing Facilitation								
3.5	Reduced-interest Loans								
3.6	Bulk Purchasing								
3.7	Grants								
3.8	Technology procurement								
3.9	Certificate trading systems								
4	**Voluntary Agreements**								
4.1	Industrial Companies								
4.2	Energy Production, Transformation and Distribution Companies								
4.3	Commercial or Institutional Organisations								

		Economic					**Voluntary Agreements**			
		Criteria for evaluation of prim. energy savings / EE Certificates	Rebate programme for highly efficient electric inverters	Financial incentives for DSM	Energy premium scheme households	Energy Investment Reduction (EIA and EINP)	Canadian Industry Program for Energy Conservation	Voluntary Agreements	Vol. Agreements Industrial energy Conservation 1990 – 2000	Eco-energy
		Italy	Korea	Korea	Netherlands	Netherlands	Canada	Korea	Netherlands	Sweden
1	**Regulation**									
1.1	Building Codes and Enforcement									
1.2	Minimum Equipment Energy Performance Standards									
2	**Information**									
2.1	General Information	X	X	X	X	X	X			
2.2	Labelling									X
2.3	Information Centres									
2.4	Energy Audits						X			X
2.5	Education and Training									
2.6	Demonstration									
2.7	Governing by Example									
3	**Economic**									
3.1	Project or Product-related Subsidies (rebates)		X	X	X				X	
3.2	Targeted Taxes, Tax Exemption, Tax Credits			X	X	X				
3.3	Financing Guarantees									
3.4	Third-party Financing Facilitation									
3.5	Reduced-interest Loans									
3.6	Bulk Purchasing									
3.7	Grants									
3.8	Technology procurement									
3.9	Certificate trading systems									
4	**Voluntary Agreements**									
4.1	Industrial Companies						X	X	X	X
4.2	Energy Production, Transformation and Distribution Companies									
4.3	Commercial or Institutional Organisations									

Country Report Belgium

Including case examples on:

Regulation	• Building codes
Information	• Municipal Energy Information Centres
Combinations of policy measures	• Campaigns for a more rational use of energy by the power distribution companies

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February 2004

1. Introduction

An effective energy efficiency policy is complicated in Belgium because constitutionally the competence over energy efficiency is in the hands of the 3 regions (Flanders, Walloon and Brussels) while the competence on energy prices is in the hands of the federal (national) government. The latter is loosing importance because markets for power and gas are gradually liberalised, and as a consequence only pricing of transport of power and gas transport is still regulated. Several energy efficiency programmes have been applied, but few have been evaluated and documented. This report deals with the policy programmes and measures of energy efficiency and the evaluation of these in Belgium.
In chapter 2 the major energy efficiency programmes and policies in the period 1990-2002 are presented. In this chapter we present the major characteristics since 1990: the main actors, the budgets and budget changes over the years, and major policy changes in the programmes and policy framework.
In chapter 3 we deal with the national system for evaluation, monitoring and data collections as well as relevant scenarios. In this chapter we present an overview of all relevant evaluations since 1990.
Chapter 4 holds information on methods used in evaluations conducted. This is followed with selected evaluation case examples for categories of policy measures in chapter 5. At the end we include relevant sources.

2. Energy Efficiency Policies and Measures in Belgium 1990-2002

The Walloon region has applied thermal insulation requirements for new houses and apartments since 1984. This regulation was revised and extended by the Walloon Government order of February 15th, 1996 and the Ministerial Order of February 15th, 1996. The thermal insulation coefficient was revised for new residential dwellings. The scope of the regulation was broadened a) to other types of buildings and b) from new constructions only to transformations of existing constructions. Ventilation requirements were also indicated[1].
Since January 1st, 2000, the Brussels Capital Region has adopted thermal insulation standards similar to those in force in Wallonia[1]. The Flemish region adopted minimal requirements on thermal insulation for dwellings and public buildings on September 18th, 1991, with amendments made on July 30th, 1992[1]. These standards only regulate insulation and thus cover only 10-30 % of the energy losses of these buildings. For most building types (office buildings in Brussels and Flanders; shops, sport facilities and swimming pools, industrial buildings, etc.) no building standards at all exist anywhere in the country. The existing building codes for dwellings have proved to be not effective because the compliance rate is low (20 %) and did not change after the introduction of building codes. (BBRI/WenK, 2000). The main reasons for the low compliance is that there is no control, and apparently the builders do not think that it is useful to apply the buildings standards. A new Law proposal has now been laid down at the Parliament in Flanders, which would introduce energy performance standards for dwellings, schools and office buildings, and which would cover all energy uses (not just transmission losses, but also heating,

[1] Belgium Building Research Institute, s.a., *Sustainable construction in Belgium*, on-line available on: http://www.bbri.be2002,

ventilation, lighting, cooling, hot water). The building codes would also be controlled, in order to raise compliance rate.

For appliances, there are no standards other than the one for heating boilers and for domestic refrigerators/freezers, imposed by the European Commission resp. in 1992 and 1996. *Electric appliances* are mainly determined by EU policies. However, the distribution of sales volume into labelling classes for Belgium shows - at least for refrigeration appliances - more progress in the most efficient appliances than in many other EU countries. This development is linked to the large subsidies / grants / rebate programmes of the electricity distribution companies in the period 1996-2001 of > 50 million €, which are one of the few programmes which has been evaluated in a serious way (see further in Chapter 3, 4 and 5), although no budget had explicitly been dedicated for internal or external evaluations.

In order to achieve energy efficiency in the industry, the regional government in Flanders and the federal (national) government use moderate tax deductions as an incentive. No evaluations or results are known except for the Walloon region, where the approved amount for subsidies rose from 740 MBEF (1994) to 2.086 MBEF (2001).

The Walloon government (2000) followed by the Flemish government (2003) have started with *voluntary agreements*. In Walloon, industrial energy users can sign an Audit Agreement, under which they promise to audit their energy use and to execute a 10-year plan with recommended measures. In Flanders, the benchmarking approach from The Netherlands is used for large energy-intensive companies (yearly energy consumption > 0,5 PJ/year). In this group, there are 105 companies which are responsible for 74 % of industrial energy use. The companies which sign the agreement promise that by 2012 their energy efficiency will be among the 10 % best plants in the world. Medium industrial energy users can sign an Audit Agreement, under which they promise to audit their energy use and to execute all recommended measures with an Internal Rate of Return higher than a certain %.

As for information programmes, three main initiatives must be mentioned. First of all, the Walloon region has set up a network of currently 13 Energy Information Desks (EID, Guichet de l'énergie) since 1985. The EIDs are a public service, free and independent. The EID consultants advise the general public (and companies) objectively on matters of heating, sanitary hot water production, thermal insulation of the building shell, ventilation requirements, rational use of electric appliances and renewable energy, in order to reduce the household energy bill and/or to improve the thermal comfort of dwellings[2]. In particular[3]:

- EIDs have abundant information at their disposal, both general and technical. Brochures providing information and motivations on energy savings are available by simple request.
- EIDs perform 4 kinds of energy audits: 1) qualitative audits on construction or renovation projects, and quantitative audits on 2) the thermal insulation of the building shell and the energy efficiencies of the heating systems, 3) energy consumption of electric household appliances, lighting, heating and 4) the production of sanitary hot water by means of solar heating.

[2] Direction Générale des Technologies, de la Recherche et de l'Energie, 2002, *Les Guichets de l'Energie: présentation*, on-line http://mrw.wallonie.be/dgtre/guichets/Presentation/body_presentation.html#Titre

[3] CWAPE, 2002, Projet de décret relatif à l'organisation du marché régional du gaz, on-line available on: http://www.cwape.be/pdf/decretgaz.pdf

- To motivate individuals for RUE, the region regularly sets up multi-media campaigns (TV and radio spots, articles in local newspapers, flyers…). Furthermore, EID consultants participate in exhibitions, information sessions, etc.
- EIDs are involved in inspections of thermal insulation regulations and in tasks of the MEBAR programme; they house the technical managers of the MEBAR programme.

The budget for the year 2001 amounted to 2 million €. On a yearly basis, approximately 10,000 consumers frequent the EIDs and 19,000 phone calls are answered. However, feedback on the advice given and possible changes of behaviour is problematic[4]. The EIDs are currently being restructured.

Second, the Walloon region has a long-running, permanent information desk for professionals in the building sector (architects, engineers, building managers, etc.), mainly targeted to commercial and public buildings. This includes a website, a CD-ROM, a yearly training of 30 courses, a newsletter etc.

Third, the Flanders region has a network of 5 local information centres for small and medium enterprises, which include a consultant for energy efficiency. No evaluations or results are known.

A fourth information programme is the Demonstration Programme for Innovative Energy Technologies of the regional government of Flanders. Demonstration projects can be subsidised since 1992. The budget spent for this programme is around 0.9 million € per year and declining the last years. A major shortcoming of the Energy Demonstration Programme in Flanders is that there is (almost) no dissemination of the results. It is also remarkable that only 3 % of the budget goes to energy-efficient building projects, while buildings are a major source of energy consumption in Flanders.

The regional and federal governments in Belgium have also promoted improved energy efficiency through *research and development (R&D) programmes*. IEA data for the year 1999 show that the R&D efforts for energy efficiency vary widely among European countries: at the lower end are countries like France with 1.9 % and the UK with 1.7 % of their energy R&D budget for energy efficiency, while at the higher end are countries like Finland with 44.5 %, the Netherlands with 37 % and Sweden with 32 %. Belgium is with 8.1 % in the lower range, below the EU average of 14 %. In absolute term the government budget of Belgium for the whole energy efficiency R&D was 3.8 million US$ in 1999.

The total budget of the Belgian energy efficiency programmes in 1996-2001 is not monitored and is unknown to us. The total evaluation costs of those programmes and policy measures which have been evaluated is also not monitored nor reported, but we have collected the figures for most of them.

[4] Direction Générale des Technologies, de la Recherche et de l'Energie, 2002, *Les Guichets de l'Energie: présentation*, on-line http://mrw.wallonie.be/dgtre/guichets/Presentation/body_presentation.html#Titre
Institut Wallon, s.a., *Overview of policy instruments in Belgium*, personal communication from Némry, F.

The policy programmes of 1990-2004 have been coordinated by the tree regional Administrations of Energy of Flanders, Walloon and Brussels. The programmes and the policy measures have included several actors active in the energy efficiency system such as product developers, suppliers, salesmen, consumers, architects, builders, energy companies, local authorities, and organisations.

3. System for evaluating, monitoring and data collection on energy policies and measures and relevant scenarios

Some evaluations of the Belgian measures for energy efficiency have been performed over the years. Some of them have been in more general terms describing the up-date of the programme and the individual measures. Only a few evaluations have assessed the effect caused by different measures. The evaluations have been internal as well as external evaluations. All evaluations are presented in Table 2; the evaluations are referred to in the text by the Roman numerals given in the table.

Table 2. Evaluations of Belgian energy efficiency programmes and policy measures. BCEO = Beheers Comité Elektriciteits Ondernemingen. DGTRE = Energy Administration of the Walloon Region ;

	Evaluation year	**Evaluators**	**E/I**	**Reference**
I	1998	BCEO	I	BCEO 1998 (D, F)
II	1999	BCEO	I	BCEO 1999 (D, F)
III	2000	BCEO	I	BCEO 2000 (D, F)
IV	2000	VITO	E*	VITO, 2000 (D)
V	2000	Belgium Building Research Institute/WenK	E	BBRI/WenK 2000 (D)
VI	2001	DGTRE	I	DGTRE 2001 (F)
VII	2002	DGTRE	I	DGTRE 2002 (F)
VIII	2002	3E/HIVA	E*	3E/HIVA 2002 (D)
IX	2003	Université de Mons, Division Energie	E**	Université de Mons 2003 (F)

I=internal; E=external;
(D) only available in Dutch (F) only available in French
* Commissioned by ANRE (the Energy Administration of the Flemish Region)
** Commissioned by DGTRE (the Energy Administration of the Walloon Region). Since the early 1990s data for evaluations have been collected by Université de Mons

Next to these evaluations, some data collection of the different Energy Administrations exists, which include:

- Interviews before and after activities, measuring number of consumers reached, and increase in knowledge.
- Number of persons visiting exhibitions, number of persons visiting the homepage, distribution of information sheets and booklets, etc.
- The amount of attributed subsidies for energy efficiency investments

4. Methods on evaluating energy efficiency programmes/ policies/measures: a short overview for programmes

4.1 Methods used

As mentioned and as can be seen in the previous table, only a few Belgian energy efficiency programmes and policy measures have been evaluated. One of the largest programmes, in terms of budget (the rebate programmes of electricity distribution companies) has been evaluated by three different evaluators (BCEO, VITO and 3E/HIVA). Most evaluations are limited to a data collection of number of consumers reached, numbers of efficient appliances sold, etc. One evaluation estimated net energy savings of a programmes, taking into account number of participants, estimated energy saved per sold appliance, free rider effect, rebound effects, etc. (3E/HIVA 2002). Two evaluations (BBRI/WenK 2000, 3E/HIVA 2002) have included scenarios or baselines.

4.2 Baseline (ex ante evaluation) and relation with national scenario/model

Baselines have in general not been developed for the energy efficiency programmes. Only two evaluations have used baselines : the evaluation of the compliance with the building code for dwellings in Flanders, where a sample of 200 dwellings included houses built before and after the introduction of the building code (BBRI/WenK 2002), and to some degree one evaluation of the energy efficiency programmes of electricity distribution companies in the period 1996-2001 (3E / HIVA 2002).

4.3 Ex post evaluation

All evaluations of the Belgian energy efficiency programmes have been ex post evaluations. However, the evaluations have not been thoughtfully planned from the start of the programmes, but have rather been developed contemporaneously with the programmes. Therefore many data were lost and had to be estimated or extrapolated in e.g. the evaluation of the rebate programmes of electricity distribution companies (3E/HIVA 2002).

4.4 Use of indicators

The use of indicators is strongly different in the various evaluations (Table 3).

Table 3. Focus and structure of the evaluations of Belgian energy efficiency programmes and policy measures.

Evaluation	Category of Policy measures						Baseline	Indicators			Savings	GHG emissions
	Regulation	Audits	Information	Incentive	Voluntary Agreements	Others		Technology	Market	Behaviour		
I		X	X	X		X		X	X		X	X
II		X	X	X		X		X	X		X	X
III		X	X	X		X		X	X		X	X
IV		X	X	X		X		X			X	
V	X						X	X				
VI			X	X		X			X*			

Evaluation	Category of Policy measures						Baseline	Indicators			Savings	GHG emissions
	Regulation	Audits	Information	Incentive	Voluntary Agreements	Others		Technology	Market	Behaviour		
VII			X	X		X			X*			
VIII		X	X	X		X	(X)	X	X	X	X	X
IX				X				X			X	

** Only collects data on the number of people who asked for advice, type of questions asked, number and amounts of grants attributed, …*

4.5 Calculations on GHG emission impact for evaluated programmes

Two of the evaluations include calculations on GHG emission reduction, by a simple conversion of the estimated net energy savings. The latter are based on theoretical efficiency improvements, estimated utilisation data, and sales data. In one case these estimated savings are adjusted to rebound effects, free rider effects, etc.

5. Method used for selected evaluated energy efficiency policies or measures

This chapter holds the selected country programmes in Belgium and has been updated after each round table discussion during experts meetings for this project on the evaluation guidebook.

5.1. Case for category Regulation: Building codes

Programme description

A. Name of the policy measure: Building codes

B. Regulating bodies: Flanders' Government, Walloon Government, Brussels' Government

C. Objectives: Full compliance with the building codes.
The Walloon region has applied thermal insulation requirements for new houses and apartments since 1984. This regulation was revised and extended by the Walloon Government in 1996. The thermal insulation coefficient was revised for new residential dwellings. The scope of the regulation was broadened a) to other types of buildings and b) from new constructions only to transformations of existing constructions. Since January 1st, 2000, the Brussels Capital Region has adopted thermal insulation standards similar to those in force in Wallonia. The Flemish region adopted minimal requirements on thermal insulation for dwellings and public buildings in 1991, with amendments made in 1992. These standards only regulate insulation and thus cover only 10-30 % of the energy losses of these buildings. For most building types (office buildings in Brussels and Flanders, shops, sport facilities and swimming pools in the whole country, etc.), no building standards at all exist.

D. Accompanying activities: A number of information and education instruments are used by the different Administrations of Energy to guide architects in the technical requirements of the building code (information sheets, booklets, website development etc)

E. Development and operation:

F. Administration: ANRE
Staff working on the control of the building codes was, at the time of the evaluation, 1 person in the Flanders Administration of Energy ANRE, who could rely on some partially available field inspectors.

Evaluation objectives, activities, results

A. Evaluation objectives:
The evaluation objective is clearly the compliance with the building codes.

B. Evaluation activities:
As mentioned, compliance with the building codes has been evaluated thoroughly in the Flanders region in the period 1993-1997 (BBRI/WenK 2000). In fact, this was a large investigation project on insulation, thermal comfort, ventilation and energy use in new houses in Flanders, and the investigation of the compliance with the building code was only one of the objectives. In a sample of 200 newly built houses in Flanders, both built before and after the legal introduction of the building codes, many characteristics were measured (dimensions and type of rooms, glazing, walls, etc.; insulation thickness; indoor temperatures; energy consumption (only in 50 houses in the sample)). With these data, the average insulation value including the effect of thermal bridges, could be calculated, and compliance with the building code could be tested.

To address this issue, officials of the Flemish Administration of Energy ANRE increased the number of on site checks, on top of the existing administrative checks. In the year 1999, 742 on site random checks of residential building sites were carried out, as opposed to the previous 450 per year. In the years 2000 and 2001, the checks dropped back to 622 and 540 respectively[5]. The administrative checks involve a conformity control of every insulation form (BNRE/ISO1 for new estate and BNRE/ISO2 for renovation) that is submitted with ANRE. The insulation forms are obligatory for obtaining a building permit. The on site checks take place on the basis of these insulation forms. During the inspections, the global K value is not verified, but rather the individual U-values of the wall elements[6]. Results of the inspections are not yet available, but Mr. Vandroogenbroeck, official at the Flemish Administration of Energy ANRE, believes that there are still big differences between the information on the insulation form and reality. The problem is that the officials can only warn architects and principals in case of non-compliance, but can not impose sanctions in the present insulation decree.

In the Walloon region, current checks (administrative and at the first stage of construction) are just as little sufficient to assure compliance with the regulation. Therefore, sensitisation campaigns for future builders and architects have been launched and more effective site controls are planned.

In the Brussels-Capital region, local authorities exercise only administrative supervisions of the insulation forms.

[5] Vlaams Parlement, 19 March 2002, Commissievergadering, on-line http://jsp.vlaamsparlement.be/htmldocs/htm-vrg/317785.html

[6] Vandroogenbroeck, F. (ANRE), October 2002, *Overzicht reglementering*

C. Principal results:
The evaluation of BBRI/WenK indicated that around 80 % of the dwellings failed to comply with the present standards. Only 20 % did comply, but this was the same number as before the introduction of the building codes in 1992. The net result of the building code in Flanders is therefore nihil, at least during the 90s.
Soon, the update of the evaluation by ANRE will show if recently this has changed. For Walloon and Brussels, no evaluations have been done.

Conclusions
The information gathered by the one in-depth evaluation of BRRI/WenK is relevant and of considerable importance for the evaluation of the regulation. The data given, based on field measurements, indicate the real compliance with the building code, as opposed to an administrative check where one does not know weather the data on insulation thickness in the building permit will be those in reality.
As we can see, no important aspects are missing in the evaluation of BBRI/WenK.

The main reasons for the low compliance is that there is no control, and apparently the builders do not think that it is useful to apply the buildings standards. A new Law proposal has now been laid down at the Parliament in Flanders, which would facilitate the control of the building codes, and which will make immediate sanctions possible by specialised staff of ANRE.

Critical issues
The evaluations of the building codes in the Flanders is based on administrative checks as well as on site checks. In Brussels and Walloon, the evaluation is restricted to administrative check and at the first stage of construction. The quality of evaluations can be improved to use information based in field controls too, as in the Flanders.

5.2. Case for category Information: Municipal Energy information centres

General information

In Belgium, information has been used as a policy instrument to improve energy efficiency since the early 1980s. Major information programmes since the beginning of the 90's are: "Training and information programme for architects, engineers, building managers etc. on energy efficiency in commercial and public buildings in Walloon", "Local energy information centres for consumers in the Walloon region", and "Demonstration Programme for Innovative Energy Technologies of the regional government of Flanders". The budget for these tree programmes in the period 1990-2002 is unknown. No quantified goal of saved energy was set for these programmes by the governments.
We include the evaluation of a programme focused on information on energy efficiency: "Local energy information centres for consumers in the Walloon region".

Programme description

A. Name of the programme: Local energy information centres for consumers in Walloon

B. Sponsoring agency: DGTRE (the Walloon Energy Administration)

C. Objectives: Improve knowledge and stimulate energy efficiency.
Targeted market actors is the local public at large. No quantitative goals are available.

D. Program activities: Consumers are given information and support for energy efficiency including information support, individual audits, education etc.

E. Development and operation: The first Energy Information Desks (EID, Guichet de l'énergie) was opened in 1985. Currently there is a network of 13 Energy Information Desks.

F. Administration: Funding for Municipal information centres on energy issues administrated by DGTRE, The budget for the year 2001 amounted to 2 million euro.

The EID consultants advise the general public (and companies) objectively on matters of heating, sanitary hot water production, thermal insulation of the building shell, ventilation requirements, rational use of electric appliances and renewable energy, in order to reduce the household energy bill and/or to improve the thermal comfort of dwellings[7]. In particular:

- EIDs have abundant information at their disposal, both general and technical. Brochures providing information and motivations on energy savings are available by simple request.
- EIDs perform 4 kinds of energy audits: 1) qualitative audits on construction or renovation projects, and quantitative audits on 2) the thermal insulation of the building shell and the energy efficiencies of the heating systems, 3) energy consumption of electric household appliances, lighting, heating and 4) the production of sanitary hot water by means of solar heating.
- To motivate individuals for RUE, the region regularly sets up multi-media campaigns (TV and radio spots, articles in local newspapers, flyers…). Furthermore, EID consultants participate in exhibitions, information sessions, etc.
- EIDs are involved in inspections of thermal insulation regulations and in tasks of the MEBAR programme; they house the technical managers of the MEBAR programme.

On a yearly basis, approximately 10,000 consumers frequent the EIDs and 19,000 phone calls are answered. However, feedback on the advice given and possible changes of behaviour is problematic[8]. The EIDs are currently being restructured.

Evaluation objectives, activities, results

A. Evaluation objectives:
Each year the municipal information centres have to report their activities to DGTRE, in form of a questionnaire developed by DGTRE. The results of these questionnaires have been summarised for 2000 and 2001 (DGTRE 2001; DGTRE 2002).

[7] Direction Générale des Technologies, de la Recherche et de l'Energie, 2002, *Les Guichets de l'Energie: présentation*, on-line http://mrw.wallonie.be/dgtre/guichets/Presentation/body_presentation.html#Titre

[8] Direction Générale des Technologies, de la Recherche et de l'Energie, 2002, *Les Guichets de l'Energie: présentation*, on-line http://mrw.wallonie.be/dgtre/guichets/Presentation/body_presentation.html#Titre
Institut Wallon, s.a., *Overview of policy instruments in Belgium*, personal communication from Némry, F.

Table 3 Evaluators of Belgian energy efficiency programmes of power distribution companies .

Evaluation	Evaluation year	Evaluators	Reference
V	2001	DGTRE 2001, Rapport d'Activités 2000, Direction Générale des Technologies, de la Recherche et de l'Energie, Ministère de la Région Wallonne	DGTRE 2001
VI	2002	DGTRE 2002, Rapport d'Activités 2001, Direction Générale des Technologies, de la Recherche et de l'Energie, Ministère de la Région Wallonne	DGTRE 2002

The goal of this evaluation was to count the number of families asking for advice, the type of questions (divided in several categories), …

B. Evaluation activities:
The reports by DGTRE summarise the results of the questionnaire answered by the Information centres.

C. Principal results:

The questionnaire has only resulted in indicators of, for example, number of families asking for advice, the type of questions (divided in several categories), etc. No market effects, in terms of changes in knowledge and behaviour, or increase in sale have been estimated. No baseline estimations, no calculations on energy savings and no calculations of emission reductions have been done.

Conclusions
The evaluation of the Municipal information centres is weak. DGTRE has developed a questionnaire for the evaluation of the activity, which, however, only describes the activities in view of the persons active at the Municipal information centres.
Several aspects are missing in the evaluations:

- information of market effects, i.e. consumers changes in knowledge and behaviour
- no baseline has been estimated
- no calculations of the savings of emission reductions have been done

Critical issues
Related to short term evaluations we see two critical issues:

- Improve the information for market effect indicators as actors changes in knowledge and behaviour, Sales data etc.
- Try to estimate the effect of separate activities.

For the long term evaluations the following key elements could get more attention:

- Baseline development
- Energy savings estimated
- Emission reduction estimated
- Cost effectiveness of the activity
- Estimated transaction costs
- Estimate the effect of separate activities

5.3. Case(s) for category Economic incentives

The rebate programmes of electricity distribution companies will be treated under section 5.6 ”Combinations of Policy Measures”.

5.4. Case(s) for category Voluntary agreements

As these Voluntary Agreements only recently started in Belgium, it is too early to evaluate them and so no example is available.

5.6. Case for category “Combinations of policy measures”: Campaigns for a more Rational Use of Energy set up by the power distribution companies, 1996-2002

Program description

A. Name of the programme: Campaigns for a more Rational Use of Energy by the power distribution companies

B. Sponsoring agency: The power distribution companies in Belgium

C. Objectives: The programmes was focused on efficient use of electricity, although in some of them (e.g. energy audits; promotion of solar thermal energy) also a more efficient use of fuel and even renewable energy was involved. The purpose of the programme was defined to stimulate efficient energy use, to exploit long-term prospects for efficient energy use, to strengthen the flexibility in energy use, etc.

D. Program activities: To stimulate market penetration of energy efficient technologies through rebates combined with additional measures such as information for consumers, training of sales staff in electric household appliances shops, energy audits, and general awareness campaigns

E. Development and operation: The programme was implemented for the period 1996-2001

F. Administration: The programme was administrated by the different power distribution companies, Budget: 64,6 million EUR over 6 years

In 1995 the power sector decided to establish programmes for energy efficiency. The programmes ran between 1996 and 2001 and included market transformation supportive policy measures for both the household sector (approximately 6 technologies)[9] and the commercial/industrial sector (approximately 5 technologies)[10]. To stimulate market penetration financial incentives (rebates) for end-users were combined with additional measures such as information for consumers, training of sales staff in electric household appliances shops, energy audits, and general awareness campaigns.

Those programmes for energy efficiency have been focused on market enlargement, rather than on technology introduction and commercialisation. The design of each programme has been partially based on the characteristics of the technology, actors concerned, and the market needs and conditions; the programme design processes have been in most cases focused on technical assumptions of energy-saving potential and market statistics, and in some cases also on behavioural surveys.

[9] Cold domestic appliances (refrigerators and freezers); Washing machines; Energy-efficient bulbs; Energy- and water-efficient showerheads; Solar thermal systems; Heating pumps

[10] Relighting ; Adjustable speed drives (ASD) ; Solar thermal systems ; Christmas lighting ; heating pumps

The electric utilities, grouped in their 2 associations Intermixt and Interregies and their common platform B.C.E.O. (BeheersComité ElektriciteitsOndernemingen), have been the co-ordinator and designer of the programmes. The programmers were financed by a levy of 0,01 BEF per kWh (0,00025 c€ per kWh) sold to the end-users of the utilities. Key tasks have in the co-ordination have been building-up internal know-how on electric efficiency, gathering market statistics, raising awareness campaigns, setting up promotion and training for sales staff in electric household appliances shops, etc.

The total budget of the Belgian energy efficiency programmes of power distribution companies in 1996-2001 was 64,6 million €. Between 1996 and 2001, approximately 53,3 million € was used for rebates, sensitisation and training, and energy audits. The internal administration of the programmes (including building up know-how of energy efficiency) was budgeted to 11,4 million EUR (approx. 17,6 % of the total programme costs) (Herremans 2003).

Evaluation objectives, activities, results

A. Evaluation objectives:

Since the early 1990s, the programmes have been evaluated by the power sector and by external evaluators, see Table 5.7.1. (The evaluations will be referred to by the Roman numerals given in Table 5.7.1). The objective of the programme evaluations, defined in each evaluation report, has never been to investigate whether a programme has been successful or not, and to provide information in order to improve the programmes. In fact, the objective of the evaluations was always to calculate how much energy had been saved by the (different) programme(s).

Table 4. Evaluators of Belgian energy efficiency programmes of power distribution companies.

Evaluation	Evaluation year	Evaluators	Reference
I	1998	BCEO, REG-Actieplan van de distributie: Verslag 1996-1997 (internal evaluation by power sector)	BCEO 1998
II	1999	BCEO, REG-Actieplan van de distributie: Verslag 1998 (internal evaluation by power sector)	BCEO 1999
III	2000	BCEO, REG-Actieplan van de distributie : Verslag 1999 (internal evaluation by power sector)	BCEO 2000
IV	2000 (*)	VITO (external evaluation)	VITO, 2000
VIII	2002 (*)	3E/HIVA (external evaluation)	3E/HIVA 2002

* Commissioned by the Administration of Energy of Flanders

B: Evaluation activities

The evaluations have analysed the results of the programmes and, to a small extent, also analysed the outline of the programmes. Only the period 1997-1999 has been evaluated by at least one external evaluator. The focus and structure of evaluations of Belgian energy efficiency programmes of Belgian electricity distribution companies in the period 1997-1999 are presented in Table 5.7.2. The internal evaluations of efficiency programmes of Belgian electricity distribution companies focused only on the gross energy savings and the costs of the programmes (I, II, III). Subsequent external evaluations tried to determine the net energy savings, and included more precise and direct analysis of specific programmes and the cost of specific programmes (IV, VIII). One evaluation (VIII) also tried to analyse changes in

consumers behaviour, be it in a qualitative way. None of the evaluations has been used in order to improve the impacts or the quality of the energy efficiency programmes.

Table 5 Focus and structure of the evaluations of Belgian energy efficiency programmes of power distribution companies .

Evaluation	I	II	III	IV	VIII
Focus of evaluation					
- direction & procedure					
- programme outline					
- market transform. Effects	X	X	X	X	X
Indicators of market transformation					
- changes in actors' behaviour					X
- market development	X	X	X	X	X
Baseline calculation					X
Savings achieved	X (1)	X (1)	X (1)	X (2)	X (2)

(1) Gross energy savings
(2) Net energy savings

The evaluations of programme results developed contemporaneously with the programmes and, over time, methods for the evaluation of the energy efficiency programmes were developed. The market transformation and energy saving results of the programmes were first evaluated internally by an committee of the Belgian power sector, the BCEO in 1998 (I), 1999 (II) and 2000 (III). These first evaluations were based on indicators of market development of the different programmes (e.g. number of energy-efficient bulbs sold per year) and on estimates of the energy saving per sold energy-efficient appliance. All sales in Belgium of energy-efficient appliances covered by the programmes of the electricity distribution sector was put entirely on the account of the actions the electricity distribution companies.
In 2000 and 2002, these reports were supplemented with reports from external evaluators, contracted by the Administration of Energy of Flanders (IV, VIII).

The most comprehensive evaluation with respect to the actions of the power distribution companies in Belgium was published in 2002 (3E/HIVA 2002) and was performed by two external research teams on behalf of the Administration of Energy in the Flemish' part of the country. This evaluation estimated net energy savings of the programmes, taking into account number of participants, estimated energy saved per sold appliance, free rider effect, rebound effects, and a baseline scenario. This report contained an evaluation that included an analysis of cause, effect and objective, an economic analysis (techno-economic analysis). The evaluation was based on sales statistics, market surveys, interviews with 25 industrial energy-users, and questionnaires among 1.000 households. However, most of the data used and presented were based on former evaluation reports. Because the evaluations have not been thoughtfully planned from the start of the programmes, many data were lost and had to be estimated or extrapolated even in this most comprehensive evaluation.

Evaluations of the Belgian electricity distribution companies' programmes have used indicators to monitor changes in market transformation. First, the indicators used were few and described only sales data and/or market share (I, II, III, IV). In the most recent and most in-depth evaluation however, indicators were developed to describe sales data, market share, changes in manufacturers' assortment, and change in knowledge, attitudes and behaviour of important actors (VIII). All evaluations of these programmes included additional indicators describing spin-off effects.

The evaluations of the Belgian electricity distribution companies' programmes have, however, not been thoughtfully planned from the start of the programmes, but have rather been developed after programmes ended. During the programmes, pre-programme levels of market indicators were only estimated for indicators that described sales and energy efficiency (reports I,II, III and IV). Only in the last evaluation, which was carried out after the programmes were running, pre-programme levels have also come to describe indicators of actors' behaviour (VIII). Evaluation VIII has also described the changes in actors' attitudes and behaviour, the increase in diffusion of energy-efficient technologies, and the contribution to the market transformation caused by the programmes of the utilities. The latter evaluation included standardised telephone interviews and deep interviews with important actors. Statistical methods were used to evaluate relations such as (1) how achievement creates knowledge, (2) how knowledge changes attitudes, (3) how attitudes direct behaviour, and (4) how behaviour affects the prospects for further diffusion of the technology. Pre-programme evaluations, nor progress evaluations, were performed.

All of the reports (I, II, III, IV, VIII) have estimated gross energy savings: based on theoretical efficiency improvements, statistical figures of occupancy or usage intensity, and sales data. These estimated savings were, however, based on estimated utilisation data, and were not adjusted to external parameters. Only evaluation report (VIII) tried to test the underlying assumptions against average values found in e.g. foreign literature. From these gross energy savings, one evaluation report (VIII) tried to deduce real (net) energy savings, taking into account free rider effect, rebound effects, and a baseline scenario.

The total cost of the energy efficiency programmes of power distribution companies in the period 1996-2001 was 64,6 million €. Of this amount, 31,0 million € (48 %) was spent to rebates, 14,4 million € (22 %) to information, sensitisation and training, 7,8 million € (12 %) to audits, and 11,4 million EUR (17,6 %) to the internal administration of the programmes (including building up know-how of energy efficiency) (Herremans 2003). Only for the period 1997-1999, details on the split of the rebates into the different technologies and target groups are known. During this period the cost of the rebates for cold domestic appliances (refrigerators and freezers) was approximately EUR 6 million, the cost of the rebates for washing machines was approximately EUR 5,78 million, the cost of the rebates for non-residential relighting was approximately EUR 1,9 million, the cost of the rebates for variable speed drives (VSD's) was approximately EUR 1,2 million, the cost of the rebates for solar thermal systems was approximately EUR 0,28 million, the cost of the rebates for energy-efficient domestic bulbs (Compact Fluorescent Light) was approximately EUR 0,1 million ; the other programmes (dishwashers, showerheads and heatpumps) did have costs for rebates of less then EUR 0,1 million (3E/HIVA 2002). These costs included only the cost to the electricity distribution companies and not the costs to manufacturers, property owners, end-users, etc.

C. Principal conclusions

The results of the different evaluations indicate that the energy saving programmes of the Belgian electricity distribution companies have succeeded in establishing changes in the market. Firstly, these programmes have increased the *sales volume or market share of the targeted technologies* (energy-efficient refrigerators, adjustable speed drives, etc.) (I, II, III, IV, VIII).

The evaluations show that market penetration differs considerably between technologies. Some technologies have attained a smaller market share. In 1999, 3 years after initiation of the rebate programme, the market share of A-labelled energy-efficient refrigerators/freezers was 41,1 % of new sales (III, IV, VIII). Other technologies, such as heat pumps, have not attained any

significant degree of market penetration. The reason for the failure has been very likely the very limited (if any) energy savings, and the huge investment costs for heat pumps (even with the generous subsidies and rebates).

Moreover, the evaluations imply a potential for energy savings in addition to those estimated by simply multiplying market share or sales of selected energy-efficient technologies with an estimated amount of energy saved per appliance sold. While the internal evaluations (I, II, III) attribute the entire observed sales of e.g. energy-efficient lamps as a spin-off effect of the rebate campaigns, the external evaluators do not. This is the main reason why the estimated amount of energy saved by the programmes differs a factor 3 to 4 between the internal evaluators (I, II, III) and the external evaluators (IV, VIII).

Conclusions

Most evaluations of the energy saving programmes of the Belgian electricity distribution companies have focused on the same aspects (sales volume or market share) and had the same structure. Only one included a baseline scenario and was therefore able to estimate net energy savings.

Critical issues

The evaluations of the energy saving programmes of the Belgian electricity distribution companies have some limitations.
The first and very serious limitation is that crucial data, necessary for an impact evaluation, are missing (IV, VIII). The data can only be collected with field inquiries. In the future it is therefore imperative that before a programme starts a standard evaluation methodology is fixed, with acceptable assumptions and a baseline scenario, and with a definition of the required data and the methodology of how these data will be collected (statistics, enquiries, etc.) (IV). For non-households (SME's, public sector and industry), the energy saving should be estimated case by case and be stored in a database. Often a feasibility study is available and should also be handed over together with the request for a rebate; the utility should control these data and also put these in a database (VIII).
The energy savings actually estimated, have been based on estimated utilisation data. These estimated data could be improved by using spot tests to verify the calculated savings. Moreover, market effects and energy savings should be estimated and presented with a discussion of the uncertainty i.e. comments on biases, unmeasured assumptions, and statistical uncertainty. The estimates of market effects and energy savings should be based on a defined baseline and be adjusted for external parameters.

6. Relations with international work (IEA, EU, UNFCCC)

- Belgium's 3rd Communication in the UNFCC Framework
- Analyses based on the ODYSSEE Data Base from the SAVE Project "Cross-country comparison on energy efficiency indicators (Belgian participant : Econotec)
- Eichhammer W. (ed.), Beheer van de Energievraag in het Raam van de door België te leveren Inspanningen om de Uitstoot van Broeikasgassen te verminderen. Study for the Ministry of Economic Affairs, Belgium. Analyses based on the ODYSSEE Data Base

7. Sources

Overview of programmes

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- Vanlommel G. 1998 , REG-acties van de Belgische elektriciteitsverdelers in de huishoudelijke sector. Energie & Milieu nr. 5, september/oktober
- VITO 2000, Evaluatie van de methodologie van de elektriciteitsdistributiesector voor berekening van de kWh-besparing van hun REG-acties in 1996-1998.

Country Report Canada

Including case examples on:

Regulation	Energy Efficiency Regulations for Residential Equipment
Information	EnerGuide for Houses
Voluntary Agreements	Canadian Industry Program for Energy Conservation (CIPEC)

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1. Introduction

Energy efficiency is an important issue to Canada. The federal government has pursued initiatives concerning energy conservation since at least the early 1970s. Initially, these were focused on security of supply following the oil crises of that decade, and were primarily oriented to promoting energy conservation. With the deregulation of energy prices in the late 1980s, all levels of government in Canada reduced funding for alternative energy activities. By the late 1990s, however, growing concern about the effect of fossil fuel consumption on greenhouse gas (GHG) emissions and climate change had renewed interest in conservation and in improving energy efficiency. Under the Kyoto Protocol on Climate Change, Canada has committed to reducing GHG emissions to 6% below 1990 levels. The Climate Change plan of the government of Canada relies on energy efficiency (EE) as a tool to achieve the GHG emissions targets. To that end, impact evaluations of EE policies and programs are often geared towards quantifying reductions in GHG emissions.

This report follows the standard outline of country reports for this guidebook. The second chapter outlines the national system of EE policy measures and programs, including identifying the major actors involved with EE in Canada and a description of all current EE programs delivered by the federal government. Chapter 3 outlines the current system for evaluating the various EE programs and the state of EE in Canada in general, while Chapter 4 goes into detail on some of the methods used to perform those evaluations. Three of those evaluations are described in Chapter 5 as case studies, using the standard outline for this guidebook. It should be noted that these are only a sample of the recently conducted evaluations. Due to human resource constraints, it was not possible to provide a comprehensive overview of all EE evaluations to date. As such, the case studies should be taken as examples of the kind of work that is often conducted. Chapter 6 and 7 conclude this country profile by outlining international linkages and the source material referenced.

2. National system of energy efficiency policy measures

1.1. Background and organisation

Energy efficiency in Canada is complicated due to the constitutional division of powers between the federal government and the provincial and territorial governments. Canada is a federal nation, with 10 provinces and 3 territories. The federal government has jurisdiction over standards and labelling for equipment, appliances, and vehicles, while the provincial governments have jurisdiction over the supply of energy and the setting and enforcing of building codes. The federal government cannot regulate energy supply or building codes without the agreement of the respective provincial government. Each level of government can, however, engage in voluntary programs and use fiscal incentives in areas that it does not have the jurisdiction to regulate.

The focus of this country profile is the policies and programs of the federal government, however, many of the provinces engage in EE measures as well. These measures are either delivered by the energy utilities or by another provincial organization. The structure of the energy utilities differs from province to province, with some organized as regulated market systems, some as regulated monopolies, and some as crown owned monopolies. For the most part, in the past, the provinces have not included EE measures in building codes. If they have or

do, they are generally not stringent or are designed with the expressed goal to improve the energy efficiency of buildings.

At the federal level, EE policy and programs are handled primarily through the department of Natural Resources (NRCan), with some cooperation with the department of the Environment on policy and programs related directly to GHG emissions. The Efficiency and Alternative Energy (EAE) program of NRCan was created in 1991, and in 1998 the Office of Energy Efficiency (OEE) was established to expand on the EAE. With a mandate to "renew, strengthen and expand Canada's commitment to energy efficiency"[11], the OEE is responsible for: collecting and analyzing data on energy end-use; developing and modifying measures for energy efficiency improvement; reporting annually on the state of energy efficiency in Canada; and managing Canada's Energy Efficiency Awards. Technology development related to EE is also handled through NRCan. The Office of Energy Research and Development (OERD) coordinates and funds research and development, while the actual technology development activities are managed through the Canada Centre for Mineral and Energy Technology (CANMET) Energy Technology Centre (CETC), and the Minerals and Metals Sector (MMS) Mineral Technology Branch.

The major piece of federal legislation that governs EE in Canada is the Energy Efficiency Act of 1992. The Act allows the federal government to enforce regulations on energy efficiency for energy using products, as well as promote EE and the use of alternative energy sources through incentives, demonstration projects, research, information or any other projects, programs or activities that are deemed appropriate.

All EE policy and programs at the federal level are managed solely by or jointly with the OEE. As of 2004, the OEE manages 22 programs and activities aimed at the residential, commercial/institutional, industrial and transportation sectors, as well as several multi-sectoral initiatives. Overall, the 2004 budget of the OEE was about CDN$70 million, and it employs over 300 people.

2.2. Energy efficiency policies and programmes

The OEE uses a variety of policy tools to work towards the vision of "Leading Canadians to Energy Efficiency at home, at work and on the road". Leadership, information and labeling, regulations and standards, economic incentives, voluntary agreements, and technology development are all used in EE programs managed by the federal government. These programs are applied to different sectors of the Canadian economy to promote EE. Some of the programs have commonalities, and similar programs may be applied to different sectors under the same name. In particular, the OEE manages a rating and labeling program called EnerGuide. Within each specific product line or sector, an EnerGuide program generally involves an energy efficiency rating of that product and a standardized labeling system. EnerGuide does not regulate standards, but rather is designed to provide information to consumers so they can make informed choices about the energy use of the products they purchase. In North America, labeling is an important tool in market transformation programs to shift consumer preference towards more energy efficient products.

In the residential housing sector, the federal government targets the energy efficiency of both new and existing homes. While the federal government cannot regulate building standards, it

[11] OEE website

does encourage Canadians to build new homes that are more energy efficient through the optional standard R-2000, a voluntary technical performance standard that encourages builders to build, and consumers to purchase, houses that are more energy efficient and environmentally responsible than is required by current building codes. No economic incentives are given to build to R-2000, but NRCan trains and licenses home builders and other service providers in R-2000 construction techniques and practices, and provides third-party quality assurance by testing and certifying every R-2000 home.

For existing houses, the federal government provides a reduced cost energy-auditing program titled 'EnerGuide for Houses'. The program offers homeowners personalized expert advice on how to improve the energy efficiency of their homes. At the request of the homeowner, a qualified evaluator gathers energy-related information during a site inspection and undertakes a computerized analysis of the house's energy efficiency. The evaluator gives the homeowner a report that includes an estimate of the house's annual energy requirements, recommended energy efficiency improvements, and a label with an EnerGuide home energy efficiency rating. The information can be used to plan home energy efficiency upgrades by the homeowner. Economic incentives are provided to encourage homeowners to invest in energy efficiency improvements. After retrofits have been completed, a second audit is performed and homeowners can qualify for a non-taxable grant, which represents about 10-20% of their energy related expenditures, based on the differential improvement in the house's energy ratings.

The OEE runs several programs targeted at the buildings and operations of the industrial, commercial and institutional sectors. As an overall program, commercial organizations and public institutions can become members of the Energy Innovators Initiative (EII) simply by expressing interest. The Initiative helps members explore energy efficiency options and strategies, offering them access to tools and financial assistance to help reduce energy use. National Energy Efficiency awards are given out on an annual basis to recognize the efforts made by companies across Canada to reduce energy use and GHG emissions.

For buildings, two programs are aimed at improving the energy efficiency of new buildings: the Industrial Building Incentive Program (IBIP) for industry only, and the Commercial Building Incentive Program (CBIP) for commercial, institutional and multi-unit residential buildings. The programs give a financial incentive to cover a portion of the incremental capital cost of improving energy efficiency, but in order to qualify for the incentive, buildings must be at least 25 percent more efficient than a standard building. In the CBIP, for example, up to $60 000 is available per building, and any particular organization can receive a maximum of $250 000. The federal government also financially supports retrofits of existing commercial and institutional buildings through the Retrofits of Existing Commercial Buildings Program.

For industrial operations, the over arching program is the Canadian Industry Program for Energy Conservation (CIPEC), a government-industry partnership that addresses barriers to planning, implementing and tracking energy efficiency projects at the sector and company levels. This long running program – over twenty five years and ongoing - is a voluntary agreement between different sectors, trade associations and individual companies and currently covers 98 percent of secondary industrial energy demand in Canada. Through this government-industry partnership, energy efficiency potential improvement opportunities, difficulties and challenges are identified. The program delivers a number of workshops for company managers to assist them in planning and administering energy efficiency initiatives.

The energy efficiency of both residential appliances and industrial equipment in Canada are approached in similar fashions. Both a 'carrot' and a 'stick' are used to improve energy efficiency. As the carrot, major household appliances and industrial equipment are labeled through two separate EnerGuide programs. The EnerGuide label identifies how much energy a particular model consumes, and graphically shows how that consumption relates to other models of the same product. The labels are mandatory for all products covered under the program, so consumers are able to make informed decisions about the energy efficiency of the products they purchase. The most energy efficient products are given the additional label of EnergyStar, which is actively promoted to consumers as a way to save money and energy.

The labeling programs are designed to move consumer preference toward more energy efficient models; however, the 'stick' of federal regulation of minimum efficiency standards pushes along the 'back end' of the efficiency spectrum. The Energy Efficiency Act, 1992, allowed minimum standards to be set for energy using products. The act is amended regularly to bring in new efficiency standards – eight amendments have been made between 1992 and 2004, and a ninth is currently in progress.

In the transportation sector, the federal government has a number of active programs aimed at individual consumers, vehicle fleets, and the industry. On an annual basis, vehicles to be sold in Canada are tested and fuel consumption ratings for each model are published. Similar to other sectors, vehicle fuel efficiency is labelled under the EnerGuide for New Vehicles program. Since 1999, the labelling program has been mandatory for all new vehicles sold in Canada. Fuel efficiency for each model is also published on the OEE website.

Beyond the labelling, the OEE targets individuals with programs aimed at encouraging private motorists to develop energy efficient vehicle purchase, use and maintenance practices. The programs include an anti-idling campaign, driver education to teach fuel-efficient driving techniques, and information on proper tire maintenance and inflation. For vehicle fleets, the OEE provides information materials, workshops, technical demonstrations and driver training programs to help fleet operators assess and pursue opportunities to increase energy efficiency in their operations.

The federal government is also currently negotiating with the automotive industry to achieve a voluntary fuel efficiency target for new vehicles of about a 25% improvement by 2010.

One of the pillars of the Climate Change Plan is the leadership of the federal government in taking action to increase energy efficiency and reduce GHG emissions. The Government of Canada set a target of 31 percent reduction in GHG emissions from its own operations by 2010. A 24 percent reduction has already been achieved, and an additional 12 percent is on track for 2010.

The Federal House in Order initiative consists of various complementary activities, including GHG inventory and tracking, purchases of renewable energy electricity, and efforts to reduce emissions associated with federal activities. Energy efficiency actions target three areas: buildings, vehicles and operations. For buildings, the Federal Building Initiative facilitates energy efficiency upgrades and retrofits for departments, agencies and crown corporations through partnerships with energy management firms, as well as through advice, financing options, and training. The Federal Vehicles Initiative provides government fleet managers with an assessment of fleets and technical advice on reducing their fleet vehicle fuel consumption and increasing their use of alternative transportation fuels vehicles. Finally, as part of operations, the

Federal Industrial Boiler Program ensures that federal government departments and organizations consider environmentally responsible technologies when then replace or modify their space heating and cooling systems by providing technical and project management assistance.

To increase Canadians' awareness and understanding of climate change and the link to energy use, the federal government provides information and uses activities to encourage the Canadian public to integrate energy efficiency into their energy use decisions. The major program is 'The One-Tonne Challenge' (OTC), the federal government's challenge to all Canadians to reduce their GHG emissions by 1 tonne per year (approximately 20% of the average Canadian's personal emissions). It is a long-term, cohesive, social marketing approach that includes a national marketing campaign, supporting tools and publications to assist individuals in reducing their GHG emissions and energy use, and alliances with public, private and non-profit organizations to encourage Canadians to take up the challenge. The OTC is managed jointly by Natural Resources Canada and Environment Canada.

2. System for evaluating, monitoring and data collection on energy policy measures and relevant scenarios

The Office of Energy Efficiency (OEE) is directly involved in the assessment, evaluation, monitoring and data collection of energy efficiency (EE) in Canada in general and specifically related to each program managed by the OEE. Many assessments and evaluations of Canadian EE measures have been done over the years; however, most of those have been on a sector-by-sector basis or by program or policy, rather than as a holistic view of EE programs in general. There are a limited few that look at EE in Canada as a whole.

In 1997, the Auditor General of Canada recommended that the OEE improve the performance reporting information of its EE initiatives. Since then, the OEE has developed indicators, targets and other program monitoring and tracking variables through its business planning process and annual Report to Parliament, as well as undergone several analyses of the energy and GHG emissions impacts of its programs. Within the OEE, divisions do their own program performance assessment, while the Demand Policy & Analysis Division (DPAD) is involved in impact evaluation. External to the OEE but internal to NRCan, the Audit and Evaluation Branch (AEB) also does impact evaluation as part of a more general assessment of processes and cost-effectiveness. For some programs, NRCan has also commissioned external evaluations. A summary of both impact evaluations and performance assessments since 1992 is shown in Table 1.

Table 1: Evaluations of Canadian energy efficiency programs and policies from 1992 to 2004

	Year	Evaluators	E/I	References
I	1994	EAE	I	Canada Gazette, 1994 (E) (F)
II	1995	EAE	I	Canada Gazette, 1995 (E) (F)
III	1996	AEB	I	AEB, 1996 (E) (F)
IV	1997	EAE	I	Canada Gazette, 1997 (E) (F)
V	1998	OEE	I	OEE, 1998 (E) (F)
VI	1999	DPAD	I	Canada Gazette, 1999 (E) (F)

	Year	Evaluators	E/I	References
VII	1999	OEE	I	OEE, 1999 (E) (F)
VIII	2000	AEB	I	AEB, 2000 (E) (F)
IX	2000	DPAD (NEUD)	I	DPAD (NEUD), 2000 (E) (F)
X	2000	OEE	I	OEE, 2000 (E) (F)
XI	2001	AEB	I	AEB, 2001a (E) (F)
XII	2001	AEB	I	AEB, 2001b (E) (F)
XIII	2001	AEB	I	AEB, 2001c (E) (F)
XIV	2001	DPAD	I	Canada Gazette, 2001 (E) (F)
XV	2001	OEE	I	OEE, 2001 (E) (F)
XVI	2001	DPAD (NEUD)	I	DPAD (NEUD), 2001 (E) (F)
XVII	2001	DPAD	I	DPAD, 2001 (E)
XVIII	2002	OEE	I	OEE, 2002 (E) (F)
XIX	2002	Pollara*	E	Pollara, 2002 (E)
XX	2002	Marketexplorers*	E	Marketexplorers, 2002 (E)
XXI	2003	AEB	I	AEB, 2003a (E) (F)
XXII	2003	AEB	I	AEB, 2003b (E) (F)
XXIII	2003	DPAD	I	Canada Gazette, 2003a (E) (F)
XXIV	2003	DPAD	I	Canada Gazette, 2003b (E) (F)
XXV	2003	OEE	I	OEE, 2003 (E) (F)
XXVI	2003	DPAD (NEUD)	I	DPAD (NEUD), 2003 (E) (F)
XXVII	2003	Habart & Associates*	E	Habart & Associates, 2003a (E)
XXVIII	2003	Habart & Associates*	E	Habart & Associates, 2003b (E)
XXIX	2004	DPAD	I	Canada Gazette, 2004 (E) (F)
XXX	2004	OEE	I	OEE, 2004 (E) (F)

Note: (E) in English; (F) in French
OEE is the Office of Energy Efficiency, part of Natural Resources Canada
EAE is the Efficiency and Alternative Energy Branch, and has been replaced by the OEE
AEB is the Audit and Evaluation Branch of Natural Resources Canada, and is not part of the OEE
DPAD is the Demand Policy and Analysis Division of the OEE
NEUD is the National Energy Use Database, managed by DPAD
(*) Study commissioned by DPAD

Impact evaluations and performance assessments are often distinct, although they may sometimes overlap. Each program engages in a performance assessment to determine if the program was or is being delivered successfully. The objectives of the program are measured against particular indicators, such as number of rebates given or audits conducted. Performance assessments are completed on an annual basis as part of the Business Planning process in the OEE and have been ongoing since 1998. These assessments (V, VII, X, XV, XVIII, XXV, XXX) are published internally within the OEE and assist program managers in the delivery of their initiatives year after year. Part of the performance assessment may include an evaluation of impacts. However, the primary focus is program management.

The final piece of the monitoring and data collection efforts of the OEE is a data collection system and series of publications made available to the public. Data is compiled on all sectors in the Canadian economy through the National Energy Use Database (NEUD). Information comes

from national surveys of energy use, industry and other associations, as well as from other sources. Annually, there are five major publications that monitor and report on energy efficiency in Canada:

1) Report to Parliament

The federal government was mandated by the Energy Efficiency Act (1992) to annually report the status of energy efficiency measures to Parliament. The report includes both energy efficiency as well as renewable energy in Canada. Included in the report is a summary of energy efficiency trends in Canada, their relation to federal program objectives, progress on meeting Canada's commitments under the Kyoto Protocol, and a discussion of the policy context of EE measures in Canada. Detail on program mechanics and activities is given about each program or initiative, as well as the success at meeting program objectives. It includes market and program indicators on all sectors and programs related to energy efficiency and alternative energy, including those run by the Office of Energy Efficiency (OEE), Electricity Resources Branch (ERB), Canada Centre for Mineral and Energy Technology (CANMET) Energy Technology Centre (CETC), and the Minerals and Metals Sector (MMS).

2) Energy Efficiency Trends in Canada

This technical document is a summary of energy end use in Canada on a sector-by-sector basis and is companion document to the *Energy Use Handbook*. A key component is the OEE Energy Efficiency Index, which shows changes in the efficiency of how Canadians use energy to heat and cool their homes and workplaces and to operate appliances, vehicles and factories. Changes in energy use by each sector are attributed to changes in the structural make up of the sector, level of activity in the sector, and energy efficiency of the sector. Energy savings and GHG emission reductions due to increases in energy efficiency are quantified. The OEE Index shows a 13 percent improvement in energy efficiency over 1990–2002. This document does not attribute changes in energy efficiency to particular programs or policies of the federal government or any other level of government.

3) Energy Use Handbook

The handbook is a companion document to the *Energy Efficiency Trends in Canada*. It includes a statistical overview of Canada's energy use on a sector-by-sector basis. The handbook includes data on a multi-year basis from 1990 until the most recently available year before publication. The data is presented in a very straightforward manner, with analysis of the data and trends left to the companion document. Programs are not discussed in this document.

4) The State of Energy Efficiency in Canada

This document is a summary of energy efficiency in Canada, and references the *Energy Efficiency Trends in Canada*. It adds commentary on the trends and discusses energy efficiency within the context of OEE program objectives and progress to meeting Canada's commitments under the Kyoto Protocol. The document includes information on the links between energy efficiency, energy use, GHGs and climate change. For each major sector, it also includes: market trends, progress indicators and OEE program descriptions. It is both a marketing document for the OEE, as well as a reporting document.

5) Emissions Reductions from Federal Operations

This report documents the Federal House in Order (FHIO) initiative, a formal effort on the part of the federal government to monitor, track and reduce GHG emissions from its own operations. It includes the GHG emission targets of the federal government, how those targets were set, progress the government is making towards meeting those targets, and highlights of methods the government is using to measure progress.

In addition to these five publications, the OEE publishes a number of other technical documents related to energy consumption and energy efficiency. Many of the programs have technical guides for consumers to learn about and implement energy efficiency measures. There are also a number of 'one-off' publications that have statistical detail about a particular sector of interest but are not published on an annual basis; many of these are published under the auspices of the NEUD. The publications can be viewed http://oee.nrcan.gc.ca/neud/dpa/data_e/publications.cfm.

3. Method on evaluating energy efficiency programmes (1995 onwards); short overview for programmes

Several methods are used to evaluate EE programs. Programs are evaluated for both overall performance and market impacts. Program performance is measured using various indicators related to the program's objectives, while program impacts are measured through the actual impact upon energy use and GHG emissions. The discussion here is on methods used to evaluate the impact of energy efficiency programs.

4.1 Methods used

The basic methodology of evaluating program impacts focuses on estimating the incremental energy savings associated with each program. Incrementality is defined as the difference between baseline levels of energy consumption for a specific group, and actual levels (i.e., levels observed in the market) of energy consumption for the same target group. Baselines are defined as the level of consumption that would have occurred, for a specific target group or market, in the absence of the program.

A number of evaluations have been performed since 1992, either as stand-alone impact evaluations, or as part of combination performance and impact evaluations. These evaluations have been both internal (to NRCan) and external, as shown in Table 1 above. The Demand Policy & Analysis Division of the OEE performed the most comprehensive evaluation in 2001 (XVII). A summary of the types of policy measures that have been evaluated, and the focus of the evaluations, is presented in Table 2 below.

Table 2: Focus and structure of evaluations of Canadian energy efficiency programs and policies from 1992 to 2004

Evaluation	Category of Policy measures						Baseline	Indicators			Savings	GHG emissions
	Regulation	Audits	Information	Incentive	Voluntary Agreement	Others		Technology	Market	Behaviour		
	X						(X)	X	X		X	X
I	X						(X)	X	X		X	X
II			X						X		X	X
III	X						(X)	X	X		X	X
IV	X	X	X	X	X	X		X	X	X		
V	X						(X)	X	X		X	X
VI	X	X	X	X	X	X		X	X	X		
VII			X				X		X	X	X	X
VIII	X		X					X	X			
IX	X	X	X	X	X	X		X	X	X		
X		X	X	X			(X)		X	X	X	X
XI		X	X			X	(X)		X	X	X	X
XII		X	X	X	X		(X)		X	X	X	X
XIII	X						(X)	X	X		X	X
XIV	X	X	X	X	X	X		X	X	X		
XV	X		X				X	X	X		X	
XVI	X	X	X	X	X		X	X	X	X	X	X
XVII	X	X	X	X	X	X		X	X	X		
XVIII			X					X		X		
XIX	X		X			X	X	X	X		X	X
XX						X		X				
XXI			X		X		X			X	X	X
XXII	X						(X)	X	X		X	X
XXIII	X						(X)	X	X		X	X
XXIV	X	X	X	X	X	X		X	X	X		
XXV	X		X				X	X	X		X	
XXVI			X		X		X			X	X	X
XXVII		X	X			X	X		X	X	X	X
XXVIII	X						(X)	X	X		X	X
XXIX	X	X	X	X	X	X		X	X	X		
XXX												

In its general, simplified form, program impacts are estimated by using the following formula:

Gross Program Impacts = (Baseline Energy Use) – (Post-program Energy Use)

The gross program impact generally does *not* include non-program factors like weather and economic changes, or natural energy efficiency improvements; these are typically removed from the analysis. While a good measure of overall program impact, the gross program impact

calculation does not explicitly consider issues such as attribution, or how much of the gross program impact actually occurred solely as a result of program activities. Mainly, it does not take into account "free riders", or those impacts that occur as a result of program participants who would have adopted particular EE measures even in the absence of the program. Thus, gross program impacts generally overstate the impact of a program.

A more useful measure is the net program impact, which is the energy use and/or GHG emissions solely attributable to the program. Net program impacts accounts for, among other things, free rider effects as well as and any indirect impacts (spillover effects) of the program. Therefore, net program impacts can be estimated as:

Net program impact = Gross Program Impacts – (free-rider effects) + (spillover/indirect impacts)

4.2 Baseline (ex-ante evaluation) and relation with national scenario/model

Since baselines are taken as an estimation of the energy consumption that would have occurred in the absence of the program, the baseline can be thought of as the "pre-program" level of energy consumption. Given that it is difficult to know exactly what would have happened in the absence of a specific program, the estimation of baselines is a necessarily hypothetical exercise, based on both historical and forecasted trends, and on the expert judgment of veteran program managers. Baselines were estimated for the majority of evaluations listed in Table 2. In many of the evaluations, actual market data on energy consumption was used to answer questions about "what might have been", and to reconstruct baselines for all EE programs.

4.3 Ex-post evaluation

As noted in 4.1, the incremental energy savings for each program is defined as the difference between the baseline energy consumption and the actual energy consumption. Actual energy consumption refers to the "post-program" level of energy consumption associated with a program's target public as observed in the market.

The major challenge of evaluating program impacts is accurately distinguishing between naturally occurring changes in energy efficiency (observed market effects), and changes that occur solely as a result of program activities. That is, establishing the net program impact is the central difficulty. However, separating program impacts from the impacts of other factors requires detailed knowledge of how the energy consuming behaviour of a program's target group changes directly as a result of only program activities.

Much effort has been made in the impact evaluations of OEE programs to determine what proportion of market changes can be accurately attributed to each program. Central to this question is the issue of free riders. Determining what portion of program participants would have adopted EE measures in the absence of the program is difficult. One method is to survey participants as to whether they would have adopted specific EE measures without the program. This approach deals directly with the issue of program participation and enables program managers to have detail on how members of the target market make decisions. Its major limitation, however, is that it is more qualitative instead of quantitative. An alternative method is the *discrete choice* modeling of program impacts. Since 2001, both internal and external evaluations of OEE programs have increasingly used discrete choice methods (DCM) to determine the free rider effects for different programs. DCM consistently and explicitly allow for consumer preferences for products or product characteristics (e.g., price, colour, energy

efficiency level, etc.) to be taken into account. Furthermore, DCM allows for the *impact* of these consumer preference to be quantified.

In a typical study, a relatively large sample of consumers may be asked to make repeated hypothetical purchasing decisions based on product or other information provided to them, in a controlled, experimental setting. Or, the impact of a program on energy savings is can be determined through pre/post difference with a comparison group, using a suitable normalization (e.g., weather adjusted billing data). In either case, the energy efficiency decisions of the target group or sector are examined. Because the outcome of decision-making scenarios is often either to install or not install an efficient measure (e.g., lightbulb), or to purchase or not purchase an efficient piece of equipment (e.g., refrigerator), the decisions are seen as discrete (i.e., one or the other choice is made). These discrete decisions, or choices, can be influenced by a number of different factors, of both the program (e.g., participation in an EE or DSM program) and non-program variety (e.g., socio-demographic characteristics). By employing logit analysis (non-linear regression), we can analyze the impact that these different variables have on the decision of whether or not to invest in EE. That is, the probability of a decision-maker "acting a certain way" as a result of the influence of specific factors can be quantified. These probability estimates can then be used as a basis for estimating the probable impact of information/outreach and incentive-based programs (such as EE programs) on the behaviour of the public. In turn, related energy savings and GHG emissions reductions can be calculated. Examining behaviour using DCM can therefore allow for more refined estimates of net program impacts to be estimated.

The use of DCM for evaluation can be time and resource expensive, so not all program OEE impact evaluations use DCM. If there are no specific studies related to the particular program being evaluated, sometimes attribution rates can be estimated from other data. However, in general, unless there is evidence indicating an accurate level of attribution for a specific or similar program, gross program impacts are relied on. This provides an "upper bound" to the level of incremental energy savings associated with a program.

4.4 Use of indicators

Indicators have been used in evaluations and assessments of OEE energy efficiency programs and policies for some time, although their use has increased since 1997. Annual program performance assessments use indicators extensively to determine the success of the delivery of the program, however, those indicators are not necessarily related to energy efficiency. Indicators vary with different programs, but may include the number of participants in workshops, requests for information, agreements signed, publications distributed, or level of awareness among program target market, among other indicators that have to do with the intermediate or longer-term objectives of the particular program. The primary purpose of these indicators is to help program managers effectively deliver and improve their programs, not to evaluate the actual impact on energy use or energy efficiency in Canada.

For impact evaluations, indicators are also used to help determine the incremental energy savings for each program. Indicators are taken from market surveys and sales data from industry associations, as well as from program data. In general, a narrower subset of the indicators typically used in performance assessments are also used for impact evaluations.

4.5 Calculations on GHG emissions impacts for evaluated programmes

All of the federal EE programs have reducing GHG emissions as at least one of their primary objectives. Thus, most impact evaluations of EE programs include an estimation of GHG emissions reductions. However, assessing changes in GHG emissions and the extent to which they occur in response to particular EE programs is fairly complicated. The most frequently used process is to convert a program's energy savings into equivalent GHG emissions reductions by multiplying the energy savings estimates by the appropriate GHG emissions factors. However, uncertainty surrounds the choice of an appropriate emissions factor, and depends on several assumptions about changes that are likely to occur in the energy delivery system. For example, the emissions factor varies significantly depending on whether or not upstream energy effects are taken into account. For example, if a reduction in energy end-use causes a reduction in energy production in Canada, then the reduction in GHG emissions attributed to the program includes savings at both the end-use stage and the production stage. However, if the supply of energy does not decrease, and instead it is exported from Canada, then the reduction in GHG emissions attributed to the program can only include the decrease at the end-use stage. Given the size and integrated nature of the energy system in Canada, it is not always possible to know whether or not, or to what extent, a program may be having upstream effects.

Quantifying reductions in GHG emissions at the end-use level can also be complicated. Energy savings can be converted into GHG emissions reductions by using average GHG factors, which reflect the average mix of end-use fuels used in a particular sector for a specific province or the country as a whole. This may be appropriate for measures aimed at saving gasoline or natural gas, for example. Electricity savings, though, must be converted to GHG emissions reductions using a factor that reflects the GHG intensity of the fuels used to generate electricity in each region or province. That factor can either be an average (based on all fuels used to produce electricity), or a marginal factor (based on the fuel that would be most likely affected by a reduction on electricity demand).

In sum, a range of GHG emissions factors can be used to convert energy savings associated with each program into reductions of GHG emissions. Those factors depend on the nature of the program being evaluated, an understanding of the energy supply system, and the assumptions made about that system.

4. Method used for selected evaluated EE policy measures, case examples

Case Examples

5.1. Case for category Regulation: Energy Efficiency Regulations for Residential Equipment

Programme description

A. Name of Programme: EnerGuide for Houses

B. Sponsoring Agency: Office of Energy Efficiency (Government of Canada)

C. Objectives: To encourage Canadians to improve the energy efficiency of their homes.

D. Programme activities:

EnerGuide for Houses provides Canadians with the facts they need to improve the energy efficiency of their homes, especially while undertaking home renovation and maintenance projects. It offers homeowners personalized expert advice on how to improve the energy performance of their homes. At the request of the homeowner, a qualified evaluator gathers energy-related information during a site inspection and undertakes a computerized analysis of the house's energy efficiency. The evaluator gives the homeowner a report that includes an estimate of the house's annual energy requirements, recommended energy efficiency improvements, and a label with an EnerGuide home energy efficiency rating. The report can be used to:

- plan energy improvements and renovations;
- qualify homeowners for home-improvement loans;
- qualify home buyers for "green mortgages" by financial institutions
- compare the EnerGuide ratings of different houses, when selling or buying a home.

The initial audit is called the 'A' audit. After improvements have been made, the homeowner can request a second, follow-up audit, called a 'B' audit. The homeowner is issued an updated EnerGuide for Houses certificate to reflect the new energy efficiency rating of the home. Since October 2003, economic incentives are provided to encourage homeowners to invest in energy efficiency improvements. The retrofit economic incentives are based off the rating differential between the 'A' audit and the 'B' audit. The evaluation discussed below was published in July 2003, and does not cover impacts of the incentive component.

E. Development and operation:

The Office of Energy Efficiency (OEE) developed the program and it was launched April 1998. The retrofit incentive was launched in October 2003. Both activities are ongoing.

F. Administration:

The Office of Energy Efficiency provides national coordination, technical support, quality assurance, software tools and training, generic information materials and national marketing, as well as partial funding for the home audits. Third parties deliver the initiative under license from the OEE; they hire and train energy assessors and quality control personnel and provide local marketing and delivery. The budget for fiscal year 2004-2005 was CDN$30 million, including funding for the retrofit incentives.[12]

Evaluation objectives, activities, results

A. Evaluation objectives:

The evaluations of the EnerGuide for Houses program have been designed to accomplish two overall goals:

1) determine the savings in energy and GHG emissions that can be attributed to the EnerGuide for Houses program and
2) provide management with information in order to improve the program.

[12] Office of Energy Efficiency budget planning, 2004-2005

The program impact has been formally evaluated twice since 1998: once internally by the Audit and Evaluation branch of Natural Resources Canada in 2001 and once externally by Habart & Associates in 2003. These are listed in Tables 1 and 2 as VII and XXVIII respectively.

The objectives of the internal evaluation (VII) were to provide senior management of the OEE with key impacts realized by the program and with information that could assist in decision-making about the delivery of the program.

The objectives of the external evaluation (XXVIII) were more focused on program impacts and not on program management issues. In particular, the stated objectives were:
1) To estimate the percentage of overall market effects which were solely attributable to the efforts of the program; specifically the number of higher efficiency home renovations that occurred solely because of recommendations to the homeowner by the home auditor.
2) To identify, develop, and apply a discrete choice based methodology.
3) To quantify, using the method developed, the impact attribution for the program in terms of energy savings and related GHG savings.

B. Evaluation activities:

Both evaluations (VII and XXVIII) estimated energy savings and GHG savings as a result of the EnerGuide for Houses program; however, they used different methods to perform the evaluation and covered different time periods. The first evaluation (VII) covered the period April 1998 to October 2000, while the second (XXVIII) covered the period April 1998 to 2002/03. One evaluation (VII) calculated energy and GHG savings by assuming an estimation of the average savings of a program participant, while the other (XXVIII) calculated savings through two separate methods: discrete-choice methodology and a participant survey to determine attribution rates.

Both evaluations used a survey to obtain necessary data. The purpose of the survey was two fold:
1) to determine if participants in the program had made energy efficiency improvements since the EnerGuide for Houses audit and
2) to obtain their opinions and perceptions on the program in order to improve management.

Internal Evaluation (VII)
The average energy and GHG savings for all program participants was calculated using the average differential between the pre-retrofit ('A') and post-retrofit ('B') energy use. By comparing the 'B' audit with the 'A' audit, the actual reduction in energy use and the impact on GHG emissions could be calculated based on the energy sources used in the home. However, many homeowners had not requested a 'B' audit, so a random telephone survey of those homeowners that had not had a 'B' audit was conducted. The percentage of homeowners that had carried out improvements and their average expenditure on renovations was determined from the survey. Energy savings were converted into savings of GHG emissions through the use of GHG emissions factors.

External Evaluation (XXVIII)
Discrete-choice methodology was used to determine what improvement in energy efficiency could be attributed the EnerGuide for Houses program, as well as what measures were being taken specifically as a result of the program. The differential in the energy efficiency ratings between the 'A' audits and 'B' audits was not taken into account – rather the savings were

derived using energy savings as calculated from engineering equations for each particular measure. To obtain a secondary estimation of energy and GHG savings using alternate attribution rates, program participants were asked in a survey how important their participation in the EnerGuide for Houses program was in their decision to undertake various renovations. The fraction of program participants that could be considered free riders – participants that would have undertaken the energy efficiency measure anyway – was calculated using the survey results.

The survey also asked if participants and non-participants alike had renovated for certain energy efficiency measures. This 'measure adopted/measure not adopted' variable formed the basis for the discrete-choice analysis. A simple model was used with variables representing program participation, fuel costs and income, as shown below, to calculate the attribution rate of program participation for that measure.

Measure Installation$_i$ = F(audit participation, fuel cost, household income)

There were eight measures considered as part of the model, ranging from the installation of insulation in ceilings, walls or foundations, to new energy efficient windows or furnaces. Information on the energy savings from each measure adopted was estimated from engineering data for each measure. The energy savings for each combination of fuel type, region and energy end-use was calculated using the following formula:

Energy savings = (consumption per end-use per building) * (savings rate) * (attribution rate) * (number of program participants)

Savings in terms of GHG emissions was calculated using an estimation of the carbon intensity of a unit of energy for each fuel type.

GHG savings = (energy savings) * (CO_2 per unit of energy)

For the survey-based estimation of energy savings, the same basic method was used, however, attribution rates were calculated using the free-rider approach discussed above.

C. Principal conclusions:

Two separate evaluations produced different estimations of the impact of the EnerGuide for Houses program. For the internal evaluation (VII), if all the energy efficiency improvements identified in the 18 300 'A' audits performed from April 1998 to October 2000 had been undertaken, the energy savings were estimated to be 1 million GigaJoules annually with an associated GHG reduction of approximately 52 500 tonnes annually. In the 1400 homes that had undergone both an 'A' audit and a 'B audit' at the time of the impact evaluation, the average energy savings was 13.6% after the renovations, approximately half the potential reduction identified by the 'A' audits. Average GHG emissions reductions from those homes was in the order of 1.4 tonnes. The telephone survey revealed that 7 out of 10 homeowners that had an 'A' audit but not a 'B' audit had carried out improvements, and 50% of the remaining intended to carry out some of the energy efficiency improvements that had been identified to them. An average savings of GHG emissions of 1.4 tonnes per participating household was assumed, so the total annual savings were estimated to be 22 000 tonnes of GHG annually.

For the external evaluation (XXVIII), the energy and GHG emissions savings depended on how attribution rates were calculated. The evaluation concluded that energy savings ranged between about 120 and 345 TeraJoules annually, with GHG emissions reductions of between 6620 and 19 111 tonnes annually. Based on the attribution rates from the survey-based method, free rider rates are generally in the range of 30% or less. The method used in the internal evaluation does not take into account free rider effects, but rather assumes that all improvements in efficiency are due to the EnerGuide for Houses program.

General conclusions

All evaluations of the EnerGuide for Houses program indicate that there is an increase in the energy efficiency of the homes that participate in the program. The program has undergone improvement and expansion since the evaluations discussed above were completed, most notably the launch of a retrofit incentive program occurred in 2003. The majority of participants surveyed indicated that economic incentives would be a significant factor in their decision to invest in more energy efficiency improvement measures. Overall, participants were very satisfied with the program, and over two thirds recommended it to a friend, neighbour or relative. In terms of particular measures, the program was most influential in convincing homeowners to improve their foundation and ceiling insulation, mechanical ventilation systems, and weather stripping.

5.2. Case for category Information: EnerGuide for Houses

Program Description

A. Name of the programme: Energy Efficiency Regulations for Residential Equipment

B. Sponsoring Agency: Office of Energy Efficiency (Government of Canada)

C. Objectives:

To eliminate the less energy-efficient of energy using equipment from the market through minimum performance regulations

D. Programme activities:

Authorized by the Energy Efficiency Act, the Energy Efficiency Regulations prescribe minimum energy performance standards and labelling requirements that include testing procedures to determine the energy performance of the equipment. The Regulations prohibit imports of, or interprovincial trade in, prescribed products that fail to meet minimum energy-performance levels or labelling requirements.

As of 2004, the Regulations cover products that consume over 80% of the energy used in the residential sector and 50% of the energy used in the commercial-institutional sector; performance requirements are prescribed for over thirty products and eight major household appliances require labelling. Compliance measures include reporting, third-party verification and import monitoring for all prescribed products.

E. Development and operation:

The Energy Efficiency Act was passed by the Canadian Parliament into law in 1992. The Act is amended regularly to bring in new and updated efficiency standards – eight amendments have been made between 1992 and 2004.

F. Administration:

The Regulations are primarily enforced by a combination of NRCan and the Canada Customs and Revenue Agency (for products shipped into Canada). The Regulations are set by Natural Resources Canada through an amendment to the Energy Efficiency Act. The Demand Policy and Analysis Division (DPAD) of the Office of Energy Efficiency (OEE) is involved in performing analysis related to the market for the relevant products that are either regulated, or may become regulated. The analysis by DPAD leads directly to the determination of the minimum level of energy efficiency to which products will be regulated. Much of the data is collected through the National Energy Use Database (NEUD) from members of the Canadian Appliance Manufacturers Alliance (CAMA). Under the agreement, key CAMA members provide their annual Canadian appliance shipment data, by model, for the six major household appliance categories – refrigerators, freezers, electric ranges, dishwashers, clothes washers, and electric clothes dryers.

Evaluation objectives, activities, results

D. Evaluation objectives:

There are two stages to the evaluation of the Regulations, each with separate objectives. The first occurs prior to a particular regulation being set, with the objective of determining what level of energy efficiency should become the minimum performance standard. These evaluations are published as the Regulatory Impact Analysis Statement (RIAS) along side the Regulations (I, II, IV, VI, XIV, XXIII, XXIV, XXIX).

The second evaluation is of the actual energy performance of major household appliances in Canada after implementation of the Regulations. The objective of this evaluation is to examine the trends in the energy efficiency of the major product classes covered under the Regulations. This evaluation is currently published every two years under the title "Energy Consumption of Major Household Appliances Shipped in Canada" (IX, XVI, XXVI), based on data from CAMA collected under the NEUD. This evaluation does not look at costs or benefits, but rather documents the trends in energy performance from a base year and calculates savings in energy use and GHG emissions.

E. Evaluation activities:

The evaluation activities and methodology for the pre-regulation and post-regulation evaluations are different, although they are largely based off the same data set. However, the pre-regulation RIAS also uses data related to cost of manufacturing equipment with higher energy performance.

Regulation Impact Analysis Statement
The RIAS is the evaluation used to determine what level of energy efficiency will become the minimum energy performance for that particular product under the Regulations. The RIAS

focuses on the benefits and costs of increasing the minimum energy performance of the particular products. Possible increases are evaluated in two ways: 1) economic benefits and costs to society and 2) reductions in energy use and GHG emissions.

The proposed increase in the energy performance standard undergoes a quantitative analysis of the net benefits to determine the economic attractiveness of improving the energy efficiency of the particular product. The cost-benefit analysis framework uses the net present value of costs and benefits calculated by subtracting the present value of incremental costs from the present value of incremental benefits, over the useful life of the product. The incremental cost is the difference between the benchmark product price and the cost of that product with the level of efficiency proposed for regulation. The incremental benefit is the present value of the cost of the energy savings associated with the efficiency improvement. A negative net present value indicates that the efficiency improvement is not economically attractive (costs exceed benefits), whereas a positive present value indicates the efficiency improvement is economically attractive (benefits exceed costs).

Energy savings are calculated by comparing the energy use of the benchmark model to the energy use of a model at the proposed regulation level. In general, the least energy efficient products for sale in Canada have been used as the benchmark model in the analysis, although more recent analyses have used the most popular model below the proposed regulation level as the benchmark. The difference in energy use is the energy savings. The analysis framework assumes the all of the energy savings from removing the least efficient models can be attributed to the regulations. Assuming less than 100% attribution would reduce the energy savings that could be attributed to the Regulations, however, less than 100% attribution would still imply that the least efficient models are being eliminated from the market, but through market forces rather than the regulation. The calculation of energy savings also assumes that the sales of models with efficiency levels below the proposed regulation will shift to models with the minimum regulated efficiency. However, it is likely that the sales would shift to models of varying efficiency, either at or more efficient than the minimum regulated level. Assuming that all sales shift to the lowest regulated level of energy efficiency results in a conservative estimate of energy savings.

The economic analysis involves a base case and a sensitivity analysis. Several assumptions are made through the analysis, economically and about the characteristics of each product. In particular, the economic analysis assumes a real discount rate of 7% and Canadian average prices for energy based on forecasts. Product specific assumptions include average product life and a standard baseline capacity or models. The net present value is calculated based on the assumptions and sensitivity to changing those assumptions.

The second part of the analysis is to determine the energy and GHG emissions savings associated with the proposed increase in the energy efficiency standard by comparing the business-as-usual case (no new regulations) and the impact case (the business-as-usual case including the new regulations). The savings in energy are discussed above and are used as part of the economic case for the regulations. The reductions in GHG emissions are calculated by applying emissions factors to the marginal fuels used to generate the electricity that would be saved through the new regulation.

Energy use trends for major household appliances

In an ongoing effort to improve the monitoring of trends in energy use in Canada, the OEE reports on the energy use of major household appliances every two years. The most recent report was released in 2003 and covered the period 1990-2001. For the purposes of outlining the

methodology, it will be discussed here. The trends are used to examine how the energy efficiency of residential appliances in Canada is changing over time. The reporting does not currently attribute any improvement in energy efficiency specifically to the regulations or other programs, however, the 2003 report did note that research and development carried out by the appliance manufacturers, the minimum energy performance standards (Regulations), and the EnerGuide for Equipment Labelling Program are largely responsible for the improvement in energy efficiency.

CAMA members contributed their annual shipment data, including appliance type, model number and number shipped, for six appliance categories – refrigerators, freezers, electric ranges, dishwashers, clothes washers and electric clothes dryers – for analysis. To keep each appliance manufacturer's data confidential, a third party (Electro Federation Canada, EFC) received and prepared the database in a format that conceals the shipment data for an individual model or manufacturer. The report combined shipment data provided by CAMA with the energy use information contained in the annual EnerGuide Appliance Directory. Analysts from EFC matched the model number from the manufacturer with the corresponding model in the EnerGuide Directory.

EFC calculated total energy consumption represented by all shipments of each model within each year and aggregated those figures to provide the data presented in the trends report. The OEE prepared the report based on those data, after it had been stripped of any information that could identify the manufacturer or the model number. The shipment-weighted average annual unit energy consumption (UEC) by category is calculated as total energy consumption of a particular category sold in Canada divided by total number of shipments in that category.

Calculating the incremental energy savings depended on an estimation of the baseline levels of energy consumption for each appliance type for each year between 1990 and 2001. For all appliances, baseline levels of energy consumption reflected assumptions about how much energy each appliance type would have consumed without the energy efficiency improvements made by manufacturers and the minimum energy performance standards. To estimate baseline levels of energy consumption, two assumptions were made:

1) without the implementation of the Regulations and the general energy efficiency improvements made by manufacturers, the unit energy consumption for all appliance types would have remained constant at the 1992 levels (pre-Energy Efficiency Act), and
2) the number of units shipped would have remained the same between 1990 and 2001 even in the absence of the general efficiency improvements made by manufacturers and the implementation of the Regulations. Incremental energy savings for all appliances were then calculated as the difference between baseline and actual levels of energy consumption.

F. Principal conclusions:

As part of the overall effort to improve energy efficiency in Canada, the regulated minimum energy performance standards under the Energy Efficiency Act have had an impact on energy use in Canada. Regulations are usually proposed and brought into force when the economic case for new or increased standards is positive (when economic benefits exceed the costs), however, they have had a significant impact on energy use and GHG emissions. The Regulations implemented through 2003 inclusively are estimated to, by 2020, have resulted in over 29 MegaTonnes per year of GHG emissions reductions. The evaluation of the trends in energy efficiency, as described above, show that the average annual energy savings for major appliances is estimated to be 1.56 PetaJoules between 1992 and 2001, with the largest annual saving of 2.45

PetaJoules in 2001. On a cumulative basis, between 1992 and 2001, 14.02 PetaJoules less energy was used for major appliances than would otherwise have been used had it not been for manufacturers' improvements in energy efficiency and the Regulations.

While the best estimates of energy and GHG savings from improved efficiency of major household appliances indicate that the improvements have had a significant impact, some uncertainty still exists. While there is reasonable confidence in the evaluations, more work could be done on expanding the uncertainty and sensitivity analysis in the RIAS. The evaluation reports a single number as an estimation of energy savings, but no variance around that number is given. However, more work on uncertainty and variance would require more resources to be available for the evaluations that set the Regulations.

General conclusions

Overall, the Regulations are estimated to have had a significant impact on the energy efficiency of residential equipment. Due to the Regulations under the Energy Efficiency Act, energy use in Canada has been reduced at little to no economic cost to Canada, as the Act is only amended to include a particular minimum energy performance standard if the economic benefits exceed the costs. However, the economic benefits in the analysis do not include any value for the amount of GHG emissions saved from the Regulation. With the coming into force of the Kyoto Protocol, GHG emissions may have a real, economic value. In the future, the RIAS may include an economic benefit per tonne of GHG emissions saved in the analysis of the possible minimum energy performance standard.

5.3 Case for Category Voluntary Agreement: Canadian Industry Program for Energy Conservation (CIPEC)

Programme description

A. Name of the programme: Canadian Industry Program for Energy Conservation (CIPEC)

B. Sponsoring Agency: Office of Energy Efficiency (Government of Canada)

C. Objectives:

To help Canadian industry use energy efficiency investments to improve competitiveness and to contribute to Canada's climate change goals.

D. Programme activities:

The CIPEC program is a government-industry partnership that addresses barriers to planning, implementing and tracking energy efficiency projects at the sector and company levels. While CIPEC operates at the sector level, direct company involvement occurs through the Industrial Energy Innovators (IEI) component.

CIPEC's network comprises 25 sector Task Forces, more than 450 IEIs, and includes partnerships with 45 trade associations, covering 98 percent of secondary industrial energy demand in Canada. Sector Task Forces, which are the heart of the program, consist of representatives from associations and companies engaged in similar industrial activities. The

Task Forces act as focal points for identifying energy efficiency potential, improvement opportunities, difficulties and challenges through the use networking meetings, events, publications, and energy management training sessions. In particular, the key activities of CIPEC are: the establishment of energy efficiency improvement targets at a sector and company level; preparation of energy efficiency action plans; tracking of energy efficiency improvements on a per-unit-of-production basis; reporting of results; celebration of success; and development and delivery of products and services, such as meetings, energy forums, benchmarking efforts, workshops and communication products.

E. Development and operation:

The CIPEC program was developed and launched in 1975, at the beginning of government efforts to reduce energy use. It continues to operate as of 2004, with the number of sectors that participate in CIPEC expanding over nearly 30 years. The roster of program activities has also increased considerably.

F. Administration:

CIPEC is a partnership between government and industry, and is entirely voluntary on the part of the industrial participants. The program is sponsored by the OEE, which provides support and facilitation for all CIPEC activities. Overall, strategic direction and leadership is provided by a cross industry group of senior executives from sector-representative companies called the Executive Board.

Evaluation objectives, activities, results

G. Evaluation objectives:

CIPEC has been evaluated twice, once externally (XIX) and once internally by DPAD (XVIII). Both evaluations were focused on estimating the savings of energy and GHG emissions that can be attributed to the program.

The internal evaluation (XVIII) had the sole objective of quantifying the savings in energy and GHG emissions based on a series of assumptions about the market effects of CIPEC.

The external evaluation by Pollara (XIX) had three objectives:
- Develop and apply a discrete choice approach
- Estimate the percentage of overall market effects that are solely attributable to CIPEC, using the discrete choice method developed
- Quantify the impact of CIPEC, using the discrete choice approach, in terms of energy savings and associated GHG emissions reductions

The evaluation also included some conclusions about the program that were relevant to the management of the program.

H. Evaluation activities:

Both evaluations were aimed at estimating energy savings and GHG emissions reductions that could be attributed to the program; however, the approaches and time periods were different for

each. The internal evaluation covered the period 1990 to 1999, while the external evaluation estimated savings for the five-year period leading up to 1999. The external evaluation also used a discrete choice approach to determine attribution rates, while the internal evaluation made assumptions in the absence of such an approach.

Internal Evaluation (XVIII)
Over time, the energy intensity of Canada's industrial sector has changed. Taking into account GDP growth and changes in energy consumption for CIPEC industries, aggregate energy intensity for CIPEC industries improved by 17% between 1990 and 1999. However, changes in energy intensity are due to two main factors: structural shifts (shifts in the mix of industries) and changes in energy efficiency.

Further, there are 'natural' improvements in energy intensity over time, often referred to as autonomous energy efficiency improvements (AEEI). The estimated AEEI value for Canada used in this evaluation was 0.7% (i.e. energy intensity is expected to 'naturally' decline by about 0.7% per year).

Since CIPEC's objective is to encourage energy efficiency in industry, only the portion of the aggregate intensity change that resulted from improved energy efficiency is relevant for estimating program impacts. More specifically, only the energy efficiency changes that occur solely as a result of the program activities, and not the AEEI, are relevant.

In order to estimate the energy efficiency changes, assumptions had to be made about baseline energy use in the CIPEC industries and the attribution of energy savings. For the baseline, the assumption was made that aggregate energy intensity and energy efficiency would have changed even in the absence of the program, but that the improvements were greater with the program in place. For attribution, the assumption was made that two thirds (67%) of the estimated energy savings are attributable to AEEI, and one third (33%) are solely attributable to program activities. The AEEI was also assumed to be 0.7%, based on the best available data.

A factorization method was used to identify the individual contributions of structural change and pure energy efficiency improvements on the aggregate improvement in energy intensity. Once the improvement in energy efficiency was identified, the energy savings and GHG reductions attributable to CIPEC were calculated based on the attribution assumptions.

External Evaluation (XIX)

The external evaluation by Pollara used a discrete choice approach to determine the amount of energy savings that could be attributed to CIPEC. A discrete choice approach allowed the relationships between choices about energy efficiency improvements and CIPEC program components to be quantified.

Two groups – one that participated in CIPEC, one that did not – were compared based on their reported energy consumption. A telephone survey was administered to a randomly selected sample of firms that participated in the CIPEC program components (ranging from as little as receiving a newsletter to attending a workshop) and firms that did not participate. Results from the survey were broken down based on the different program components of CIPEC, allowing the discrete choice approach to model the sole impact of each component. Extraneous variables, such as business size, industry and other business background characteristics that could mask the

true sole impact of CIPEC programs, were also factored out. In sum, the model used for the discrete choice approach was:

Changes in consumption = (weight1)*(component1) + (weight2)*(component2) +… etc. + (coeight1)*(characteristic1) + (coeight2)*(characteristic2) +… etc.

Where:
- Weight for each component of the program is the derived importance or sole impact of that component
- Coweight is the effect of each extraneous characteristic, removing those effects the sole impact of CIPEC program elements are quantified

The telephone survey conducted 1223 interviews, including 450 participants and 773 non-participants. All those surveyed were asked to identify the extent to which they used energy management tools, and to report information on their energy use, including fuel types and the primary uses of energy in their facility. Survey respondents were also asked how much energy they saved on ten specific energy systems, such as lighting, HVAC, and production machinery. However, since the energy use data was self-reported, external data were used to verify if the reported changes in energy use were valid.

Finally, an ANACOVA analysis (analysis of covariance) was done both for the CIPEC program overall and for the impact of each program component. In both, the dependent variable in the analysis was the five-year change in energy consumption.

I. Principal conclusions:

The two evaluations demonstrated that CIPEC helped reduce energy consumption by industry in Canada, compared to a baseline level of energy consumption.

The internal evaluation concentrated on overall energy and GHG emissions savings. The factorization revealed that approximately one third (33%) of the change in aggregate energy intensity resulted from improvements in pure energy efficiency. Based on the attribution assumption, only one third of this energy efficiency improvement occurred as a result of the program activities. Over the period 1990 to 1999, CIPEC's cumulative energy and GHG savings were about 50 PetaJoules and 1.89 MegaTonnes, respectively.

The Pollara evaluation concentrated on comparing energy use by CIPEC participants to energy use by non-participants. Cumulative savings in terms of energy use and GHG emissions were not quantified. However, the effect of CIPEC in mitigating growth of energy use by industry was assessed. Over the five-year period under analysis, facilities that had participated in CIPEC reported an increase in energy consumption of only 0.70%, while non-participant facilities showed a 4.24% increase in energy consumption. Correcting for extraneous factors such as weather, changes in business size and production, the mean 5-year change in energy consumption was an increase of 5.2% among non-participants and only 2.2% among CIPEC program participants.

On all ten specific energy-using systems identified in the Pollara evaluation, non-participants had higher average increases in energy consumption over the five-year period compared to CIPEC participants. For particular program components, only two of the 14 components evaluated had

a statistically significant[13] effect on energy consumption, but on both those components, the energy consumption for CIPEC participants was less than the energy consumption of the non-participants.

General conclusions

For all ten energy-using systems evaluated, and for facilities as a whole, increased energy consumption was more common than decreased consumption over the 5-year period covered by the external evaluation. However, CIPEC participants had relatively lower increases in energy consumption than non-participants.

Overall, the evaluations helped determine the impact of the program and also provided managers with feedback on the overall performance. For example, the Pollara evaluation identified that running production machinery and building HVAC are by far the most prominent uses of energy, and that electricity and natural gas are the most heavily used sources of fuel, indicating that the CIPEC program would be most effective if it placed priority on these two energy uses and these two fuel sources. As well, some program elements were determined to be more effective than other elements in reducing energy consumption.

5. Relations with international work

Energy efficiency programs in Canada are primarily aimed at the domestic market and reducing energy use and GHG emissions within Canada. However, there are some international linkages. Overall, EE programs in Canada are part of the international effort on climate change. Canada also has more specific relations with international work where opportunity exists to learn from other countries and adopt program ideas or best practices. Canada participates as a member of the International Energy Association (IEA) and the Organization for Economic Co-operation and Development (OECD), both forums for sharing information, coordinating policies and cooperating in the development of programs. Canada also collaborates with research centres in member countries of the IEA and facilitates research and development and commercial business ventures abroad by Canadian firms.

Bilaterally, Canada cooperates with the governments of Tunisia, Mexico, and the United States. Canada assists Mexico through improving the design and delivery of energy efficiency programs, sponsoring information workshops, and enhancing trade, investment and technical exchanges, among other activities. With Tunisia, Canada provides training on analytical techniques related to energy efficiency assessment. Canada also participates with the United States and Mexico in the North American Energy Working Group's Energy Efficiency Experts Group to promote the harmonization of energy efficiency test methods, mutual recognition of conformity assessment systems for energy efficiency standards and cooperation on energy efficiency labeling programs. The United States and Canada are also both involved in negotiations with the automotive industry over vehicle fuel efficiency.

[13] Since not all members of the population were part of the sample group, it is possible that findings may occur due to chance. A finding is statistically significant if the probability that the finding is due solely to such sampling error is low, in this case, below 5% (1 in 20).

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Country Report Denmark

Including case examples on:

Regulation	• Energy labelling of small buildings • Energy management scheme for large building
Information	• Free-of-charge electricity audits • Project 'Red Hot' • The 'A' campaign 1999 • Voluntary agreements for industry • Promotion campaign for efficient ventilation

Report

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May 2004

1. Introduction

Denmark has committed internationally to reduce green house gas emissions by 21% in the period 2008-12 in relation to 1990. The difference between the expected emissions and the obligation will be about 20-25 million tons CO_2/year in the period 2008-2012, if no new initiatives are launched. Denmark faces a special problem in that the import of electricity was large in 1990 and the export has increased in the recent year. This translates to an obligation to save about 25 million tons CO_2/year instead of 20 million tons CO_2/year if correction for net import/export is not allowed.
Some of the emission reduction will be achieved by a change in the supply mix while the remaining part must be brought about by improvements in energy efficiency. It was at the time of issue estimated that the current Bill on promotion of savings in energy consumption (Act. no. 450 of 31st May 2000) could lead to a reduction of CO_2 emissions in 2005 by 750-800,000 tons and a 1,400-1,600 ton reduction in 2010 (rough estimate).

2. National system of Energy Efficiency Policy Measures

2.1. Main actors and their budget

Energy efficiency has been on the political agenda in Denmark since the oil crisis in 1973. The main actors in the Danish system are the Danish Energy Authority, the Electricity Saving Trust and the energy network companies. Although the natural gas and district heat network companies carry out energy efficiency activities, the electricity network companies initiate the majority of the activities, often coordinated by their umbrella organisation, ELFOR.
The objective of the work of the Danish Energy Authority is, firstly, to establish the basis for the political decisions concerning energy saving policy and, secondly, to work for the implementation of energy savings in households, public and private service and trade, and industry. There are, in addition, tasks involving the energy consumption of the transport sector but these are not included in the present description of the Danish situation.

The Danish Energy Authority

The Danish Energy Authority, created in 1976, is as of 27th November 2001 an authority under the Ministry of Economic and Business Affairs. It defines the framework for implementation of the politically decided overall strategy for energy efficiency. The future activity of the Danish Energy Authority will focus on cooperation with other actors and the utilisation of market-based measures to promote energy savings. In the future international policy measures will play a larger role in energy efficiency activities. The role of the Danish Energy Authority has changed over the years. The Danish Energy Authority is relatively unique in that its responsibilities comprise both professional tasks as well as political tasks.
Whereas earlier the Danish Energy Authority was also actively developing and offering energy efficiency programs, the focus of the Danish Energy Authority today is to ensure cohesion and coordination of the various activities and the efficient utilisation of State funds and active involvement in the development of related EU directives and their implementation. The Danish Energy Authority thus issues a so-called 'Task Letter' annually, which outlines the general direction that the activities of the network companies should take in the next planning period. For example, the most recent Task Letter for district heat network companies, emphasizes the need for an increased level of energy saving activities, for coordination of the effort with

electricity and natural gas network companies, for a focus on the public sector, for continued efforts to convert electric heating to district heating, for assistance in promoting the Energy Labelling program towards small buildings in particular, and for preparation of the introduction of informative heating bills. The Task Letter for the three sectors electricity, natural gas, and district heating are quite similar, since their overall aim is the same and coordination of efforts is required to reach optimal impact.
According to the terms of Act no. 450, the Minister is to present an annual report to the Danish Parliament on the implementation of energy savings.
The Danish Energy Authority Budget has a total net budget of 130.7 million DKK for 2003[14]. The tasks related to energy efficiency planned for 2003 have a total budget of 800,000 DKK and 5.5 man-years ('More efficient markets for energy efficient solutions' and 'Ensuring coordination between energy research, technology development, and the energy political goals').

The Electricity Saving Trust

The Electricity Saving Trust was created in 1996 and its aim is to develop and test cost-effective policy measures that will make it simple, safe and cheap for the consumers to get energy efficient equipment or to replace electric heating with natural gas or district heating. The Energy Saving Trust is expected to contribute 5% the national reduction target, i.e. to bring about 0.6 million tonnes CO_2 reduction in 2005.
The main tasks include:

- Electric heat conversion in natural gas and district heat areas;
- Energy wise purchase of electricity consuming appliances;
- Energy wise purchase in the public sector.

Their domain does not include the private business sector. The work of the Energy Saving Trust is financed through a special electricity tax on the energy consumption of households and the public sector, which is 0.006 DKK/kWh, giving a budget of roughly 90 million DKK[15] per year.

The Electricity Network Companies

According to Act no. 350 of 3rd May 2000, the electricity network companies are obliged to carry out activities promoting energy efficiency. The electricity network companies:

- "are to plan and implement energy savings activities and
- by energy savings activities is meant activities the purpose of which to promote efficient utilisation of energy products, or by exerting an influence on consumer behaviour and general knowledge of energy saving.
- The necessary costs to the networks undertakings in planning and implementing energy savings activities pursuant to the provisions of this Executive Order can be included when establishing the revenue frames of the undertakings."

The extent of their obligation is to promote energy efficiency to 10% of the consumption or 10% of the customers. The electricity network companies are also obliged to offer three types of energy saving activities to their customers free-of-charge, namely:

[14] Resultatkontrakt 2003, Energistyrelsen.

[15] 1 EUR ~ 7.5 DKK.

1. General information on energy savings to consumers (e.g. distribution of information material, information campaigns, teaching and other information activity);
2. Individual energy consultancy to households (e.g. consulting services, information on appliance energy consumption);
3. Soliciting energy consultancy for commercial undertakings, institutions and the like, the purpose of which is to advice the recipient on efficient energy usage and to identify the energy savings potentials.

The network companies are also obliged to draw up plans for implementation of energy savings activities in their supply areas in a specified period, currently for periods of three years. The plans must include the following:

- Mapping and forecasting of electricity consumption, by consumer categories and applications,
- Planning of the energy saving activities, and
- Status of ongoing and completed energy savings activities and the results of evaluations of these activities.

Each single network company prepares a plan using common methodologies and computer based tools such as 'SaxeE'[16] for planning of the energy saving activities and 'Unitool[17]' for registration and documentation of the results of the activities. And joint plan is then prepared based on the individual plans, again using the SaveE tool.

It is thus statutory for the network companies to contribute significantly to the compliance of the Government's energy policy aims to reduce CO_2-emissions (recently confirmed in the electricity Bill reform of 1st January 2002). The costs of their activities are covered through the price of electricity. The program activity costs for 2002 were 162.3 million DKK, which equals approx. 0.005 DKK/kWh sold to the consumers.

2.2. Policy measures

The Government's Climate Strategy of February 2003 sets 120 DKK/ton CO_2 as a benchmark for when a given program (i.e. policy measure or package of policy measures) is cost-effective. Additional reasons for the activities may result in accepting a higher cost. Prioritisation guidelines also include consideration of the size of the energy saving potentials within the different sectors and end-uses as well as reflections on the future development of society and technology[18].

The Danish Energy Authority

The most important measures currently in use are:

- Regulatory measures:
  - Energy labelling of small and large buildings (see case description);
  - Energy labelling of appliances and lighting;
  - Standards for energy efficiency and agreements;
- Economic measures:

[16] The earlier version was called 'SaveX'.

[17] The earlier version was called 'ENIbasen'.

[18] Fremme af energibesparelser 2001 – Baggrundsrapport i forbindelse med Energispareredegørelse 2001, Oktober 2001, Energistyrelsen.

- Energy and CO_2 tax on the energy consumption of households and the public sector;
- CO_2 tax on the energy consumption of the industry and commerce;
- Economic incentives for energy savings in pensioners' dwellings;

- Voluntary measures:
  - Voluntary agreements with the industry and commerce (see case description);
- Other or combinations of measures:
  - *Electricity Saving Trust (economic incentives to conversion from electric heating to natural gas or district heating and efficient appliances);*
  - *Energy savings activities of the electricity, natural gas, and district heating network companies;*
  - A special effort to promote energy savings in the public sector (government, county, municipality), including guidelines for energy efficient purchase.

The Electricity Saving Trust

The planned activities of the Electricity Saving Trust in 2002 and their estimated required budget were as follows:

- Conversion from electric heating – 62.0 million DKK (48 incentive, 9.5 information and marketing, and 4.5 various)
- Lighting and ventilation – 12.35 million DKK (of which lighting makes up 11 million DKK)
- Development and dissemination of energy efficient appliances – 3.4 million DKK (see case description)
- Data purchase and analyses – 3 million DKK
- Product and price information via the Internet – 3.65 million DKK
- Evaluation and other minor projects – 1.25 million DKK
- Energy wise purchase in the public and private sectors ('A-club') – 2.7 million DKK

In total 88.35 million DKK.

The Electricity Network Companies

The activities planned for 2002 included:

- General information on energy savings to consumers – 41 million DKK distributed between:
  - Exhibitions, energy savings committees, other – 23 million DKK
  - Campaigns targeted at households – 12 million DKK
  - Campaigns targeted at commercial undertakings, institutions and the like – 6 million DKK;
- Individual energy consultancy to households – 47 million DKK distributed between:
  - Individual consultancy – 26 million DKK
  - Schools, themes, other – 33 million DKK (see case description);
- Soliciting energy consultancy for commercial undertakings, institutions and the like – 101 million DKK distributed between:

- Individual consultancy to consumers above 20 MWh/year – 96 million DKK (see case description)
- Other individual consultancy – 2 million DKK
- Themes, new installations, energy management, pilot projects, other – 3 million DKK.

More and more the efforts of the main actors are coordinated to achieve as good results and impact as possible. A specific example is the Campaign for Efficient Ventilation launched in 1999 and completed in late 2002. The campaign was organised and financed by ELFOR but the Danish Energy Authority supplemented the campaign with financial incentives to participants purchasing an efficient fan within the first two years of the more than three years campaign period. This was done to create added interest and to help the campaign take-off (Often fore-runners, who can represent success stories, play a significant role in program impact achievement).

3. System for evaluating, monitoring and data collection on energy policies and measures and relevant scenarios

3.1. Overview of evaluation reports

All Danish energy savings activities are typically evaluated, normally using external/independent consultants. A list of some of the evaluations can be found at the back of this country report.

3.2. Overview of monitoring system and data collection

Some of the most important sources of secondary information useful in evaluations are listed in the table below.

Source	Data examples	Frequency
Association of Danish Energy Companies	Production and supply data	Annual, every 10 years
Energy network companies	Consumption and load data	Annual
ELFOR	Registration and documentation of activities within the electricity sector	Running and tri-annual
ELFOR	Electricity consumption panels (representative information on electricity consumption by type of consumer)	Quarterly
BBR (the Building and Housing Register)	Heating system and area per building	Running
Danish Statistical Office	Various data on households and other consumers and energy balances	Annual
CVR (the Central Company Register)	Company addresses, branches, no. of employees	Running
Various retail branch organisations	Sales statistics	Annual
Danish Energy Authority	Emission factors, fuel prices, taxes, and interest rates	Regularly
ELFOR, Danish Energy Authority, Electricity Saving Trust	EL-model bolig	Annual

3.3. Scenarios and/or baselines in evaluation

Act no. 450 of 31st May 2000 determines the overall framework for the energy efficiency improvements. In addition, the Danish Energy Authority publishes 'Energy Saving Statements' outlining the focus areas for the coming period and 'Energy Savings Reports' regularly.
The scenarios used in the Energy Savings Reports to track the developments (not to forecast) are 1) actual consumption, 2) estimated consumption without improvements in energy efficiency on the demand-side, and 3) estimated consumption without improvements in energy efficiency on both supply- and demand-side (i.e. consumption due to economic growth). Scenarios 2 and 3 are derived using a combination of top-down and bottom-up approaches, partially based on results of individual impact evaluations.
Forecasts of future energy consumption without the introduction of new measures are based on assessments of the economic growth (from the report 'Denmark 2010 – A Sustainable Future'), energy price development estimates prepared by the IEA and the Danish Energy Authority, and end-use and technology trends. Impacts of current activities on consumption excluding private households are thus modelled using a top-down approach in the model 'EMMA'. The consumption of households is modelled bottom-up using the model 'EL-model bolig' for electric end-uses and the Danish Energy Authority's own models for other household end-uses. Such 'total' forecasts are, however, rarely used as baselines in the evaluations.

4. Methods on evaluating energy efficiency programmes/ policies/measures: a short overview for programmes

4.1. Methods used

As mentioned earlier, the electricity network companies and gradually also the natural gas and district heat network companies are obliged to map consumption and evaluate their energy saving activities. Furthermore, the DEA can request evaluations of the network activities.
According to § 6 item 1 in the 'Act no. 450 of 31st May 2000 on the promotion of savings in energy consumption', "The Minister for the Environment and Energy[19] is to ensure that energy-saving activities are planned and implemented as efficiently as possible in accordance with the objective of the Act. To accomplish this, the Minister can initiate impartial evaluations of energy-saving activities, …" with a view to assessing the extent to which the activities or services fulfil the objectives.
Until recently no explicit evaluation guidelines existed. In 2002, a Danish handbook in evaluation of energy saving activities was developed to systemize evaluation efforts and transfer expertise from the electricity sector to the natural gas and district heat sectors. The aim of the handbook is to reduce the cost and time needed for evaluation of energy saving activities and to increase the outcome of future evaluations in relation to the effort invested. This in turn is expected to help increase the efficiency of future energy saving activities.
A feature of the handbook is a division of the ambition of the evaluations into three levels (ABC) depending on the purpose of the evaluation and the type of activity in question. It applies current knowledge on evaluation to categorise activities into five groups with common characteristics that allow common recommendations for the activities in each group.
It is the intention that the handbook functions as a common language for evaluations in Denmark and will facilitate comparison of evaluation results irrespective of the type of activity or energy involved (gas, district heating, or electricity). When requesting an evaluation, the terms used in the handbook can be used to outline the wanted direction of the evaluation.

[19] Now the Minister of Economy and Business Affairs.

Strong databases built up over many years with data relevant to the Danish energy demand hold valuable information of great importance to the planners and evaluators of energy savings activities.
Most often the evaluations encompass impact, costs, and some process assessments, since an assessment of the CO_2 abatement cost is one of the necessary parameters to justify the expenditures. Additional smaller evaluations are sometimes initiated with the aim to clarify certain items e.g. lifetime assumptions or local differences in strengths/weaknesses in customer contact (see case description).
Typically, both ex-ante and ex-post evaluations are carried out. Activities lasting for longer periods of time are also typically evaluated at least once during the activity period, so that adjustments can be made based on lessons learned in order to improve impact and cost-effectiveness if possible.
There still remains room for improvement of the quality of some of the evaluations examined in relation to this IEA guidebook – jumps in assumptions occur, explanations of how figures are derived are unclear or missing, baseline development is not considered, or attempts could have been made to check energy impacts through measurements.

4.2. Baseline (ex-ante evaluation) and relation with national scenario/model

Typically great care is taken to assess the situation before introduction of a measure. Often independent consultants perform the assessments. For activities involving labelling of technologies or promoting especially efficient technology it is vital that credible and clear descriptions are developed, preferably by an independent party but consulting the producers, installers, and users (see case description).
Except for energy and CO_2 taxes no reference is made to national scenarios. Instead other possibilities are used. It seems that evaluation is not planned in detail before program launch although evaluation is intended, but normally care is taken to establish the characteristics of the situation before the measure, so that some type of net-impact can be calculated.

4.3. Ex-post evaluation

There is a tendency to evaluate programs spanning a short period (less than three years) shortly after completion, while longer programs are evaluated during, after, and even later. Typically, both the first year's savings and the lifetime savings are calculated. In this way, the evaluators try to distinguish between results that can be verified with a relatively large degree of certainty and results that are more dependent on assumptions and future events.
The regular preparation of plans for energy savings activities combined with evaluations allows comparison of expected and realised impact and costs. This is important to accumulate experience and increase the understanding of how the energy saving measures best achieve the intended targets. Whereas earlier measurable targets were not always listed before initiating a program, it seems that activities being launched today have clear targets against which evaluation results can be compared.

4.4 use of indicators

The choice of indicators depends greatly on the type and size of activity and it is therefore difficult to avoid generalisation. Still the following holds true: In relation to **regulatory policy measures** one must be wary of compliance rates and assessments of whether a development is truly forced or too close to the 'natural' development. Standards that are not updated in step with technological development risk becoming a hindrance to energy efficient initiatives. **Audits** do

not equal implementation of energy efficient measures. The monitoring performed by the auditors try to take this into account by contacting all audited companies 6-12 months after completion. In addition, evaluations have been carried to investigate the typical delay in implementation. **Information activities to promote sales** of energy efficient technologies often rely on sales forecasts and the forecasts should be reviewed with a critical mind. It is not clear whether that is normal practise. **Information activities to promote changes in behaviour** must overcome several barriers since information does not automatically lead to changes in behaviour (Rice & Atkin, 2001 operate with 13 steps in communication[20]). Comparison groups can be of use here. Evaluations of **economic** policy measures should take into account the possibility of free-riders (and rebound). Free-riders are in Danish evaluations typically handled using sales forecasts while advanced sales are not discussed, since these require at least one-two 'seasons' to pass before the evaluation can be carried out. Maybe a lower number of issued incentives can achieve the same impact. This has as far as we are informed not been evaluated in Denmark. **Voluntary agreements** risk being accepted by those already interested in energy efficiency (i.e. no additionality) and some of the investigated evaluations have tried to ascertain whether only certain sections of the target group responded positively.

Activities, which require some degree of contact with the program staff and program 'ambassadors', are usually also evaluated with regard to how the contact works. This provides information to be used for improving the programs. Since cooperation between the main actors is increasing as well as the involvement of stakeholders such as producers, retailers and installers is used more and more often, Danish evaluations also encompass an assessment of the cooperation process, typically based on interviews.

The following table presents an overview of methods and indicators used for the evaluated programs launched by the electricity network companies.

[20] 1 – Tuning in, 2 – Attending the communication, 3 – Taking an interest, 4 – Comprehending its contents, 5 – Generating related cognitions, 6 – Acquiring relevant skills, 7 – Agreeing with the communicated message, 8 – Storing the message, 9 – Retrieval of message when relevant, 10 – Decision to act, 11 – Acting, 12 – Post-action cognitive integration of this behaviour, 13 – Trying to persuade other to behave likewise.

Program name	Methodology assessment used							
	kWh/emission	Economy	Financial	Key figures	Sales figures	Ex-post	National baseline	Technology baseline
Information programs:								
Ventilation fan information campaign	X	X	X	X	X	X		X
Efficient motors information campaign	X	X	X	X	X	X		X
Energy management information campaign	X	X	X	X	X	X		X
Washing by 60ºC information campaign	X	X	X	X	X	X		X
Education:								
Stand-by losses		X	X	X		X		X
Labelling:								
Refrigerators and freezers	X	X	X	X	X	X		X
CFLs	X	X	X	X	X	X		X

4.5. Calculations on GHG emission impact for evaluated programs

Important to a comparable estimation of CO_2 and other green house gas emissions is that all evaluations apply the same conversion factors. The Danish Energy Authority therefore publishes the conditions and figures to be used in the calculation of societal costs and emissions. The present publications are:

- Fuel Price Preconditions (2002-2030), February 2003 – For example, the CO_2 emission for electricity at 0.4 kV voltage level is set to 805 kg/MWh in 2002 falling to 794 kg/MWh in 2010.
- General Preconditions for Calculation of Societal Costs, March 2003.

5. Method used for selected evaluated energy efficiency policies or measures

In this chapter examples of a number of specific evaluations are presented. In some cases the program (i.e. the policy measure or package of policy measures) in question have been subject to several evaluations. The chosen evaluations have not been selected as examples of particularly good or bad evaluation practise. The choice was primarily determined by the access to the reports and whether certain critical aspects of evaluation theory could be illustrated. The investigated evaluations are presented in the table below. The table is followed by an overview of the topics discussed in each case and the applied evaluation methods.

Figure 1.1: Overview of policy measure elements included in the Danish case examples.

Policy Measure	Energy labelling of small buildings	Energy management scheme for large buildings	Free-of-charge electricity audits	Project 'Red-Hot' (element of stand-by campaign)	The 'A' campaign 1999	Voluntary agreements for industry	Promotion campaign for efficient ventilation
Regulation							
Building codes and enforcement	X	X					
Min. Equipment energy performance standards							
Information							
General information programs					X		X
Labelling	X	X					
Energy audits	X	X	X			X	
Information centres							
Education and training				X			
Governing by example							
Economic							
Project or product-related subsidies (rebates)					X		X
Reduced-interest loans							
Financing guarantees							
Third party financing facilitation							
Targeted taxes, tax exemption, tax credits						X	
Bulk purchasing							
Grants				(X)		X	
Technology procurement							
White certificates							
Voluntary agreements							
Industrial companies						X	
Power production, transmission and distribution companies							
Commercial or institutional organisations						X	

Figure 1.2: Overview of topics discussed in each of the Danish case examples.

Case example	Evaluation of …	Level of effort	Discussed topics
Energy labelling of small buildings	Impact and process	B	• Monitoring data quality • Validity of data • Influence of stakeholders • Compliance versus impact • Comparability of comparison groups
Energy management scheme for large buildings	Impact and process	B	• Baseline development • Choice of indicators • Credibility of the evaluation
Free-of-charge electricity audits	Impact and process	C	• Lifetime of measures • Tracking systems • Timing of the evaluation • Extrapolation of results
Project 'Red-Hot' (element of stand-by campaign)	Impact and process	C	• Baseline development • Lifetime of savings • Indicators versus energy saving • Cost optimisation • Impact versus process evaluation
The 'A' campaign 1999	Impact and process	A/B	• Context dependency • Costs • Choice of indicators • Timing of the evaluation • Advanced sales and free-riders • Verification of claimed efficiencies • Allocation of impact
Voluntary agreements for industry			•
Promotion campaign for efficient ventilation	Impact and process	Not known	• Use of evaluation results to achieve greater impact • Allocation of impact • Timing of evaluation when aiming at market changes • Choice of indicators • Indicator versus measured energy savings • Transfer of program

Figure1.3: Overview of evaluation methods applied in each of the Danish case examples (Q – Questioning methods, O – Observation methods, D – Documentary methods).

Case example	Data collection method	Baseline
Energy labelling of small buildings	Q – Telephone interviews (600 building owners, 170 consultants, 150 real estate agents) Q – Informal interviews Q – Focus group interview (6 building buyers) D – Database research	Comparison group After measurements
Energy management scheme for large buildings	Q – Telephone interviews (600 building owners, 300 consultants) Q – Focus group interview (5 participants, 1 non-participant) D – Database research D – Document research	Comparison group After measurements
Free-of-charge electricity audits	Q – Questionnaires (131 participants) D – Database research D – Document research	Not relevant
Project 'Red-Hot' (element of stand-by campaign)	Q – Telephone interviews (110 participants) Q – Face-to-face interviews (30 influenced participants)	After measurements
The 'A' campaign 1999	Q – Telephone survey (1,043 participants) Q – Interviews (8 stakeholders) O – On site spot check of retail marketing efforts O – Sampling test of real consumption versus label indications (<10% of total number) O – Post test of marketing D – Invoice control (all) D – Sales statistics	Before and after measurements
Voluntary agreements for industry		
Promotion campaign for efficient ventilation	Q – Telephone survey (327 target group companies) Q – Survey (target group, auditors, retailers) D – Sales statistics	After measurements

5.1. Case for category Regulation: Building codes

Programme description

A. Name of the programme: Energy Management Scheme for Large Buildings

Energy Management Scheme for Large Buildings (i.e. above 1,500 m^2) (in Danish: 'Energiledelses-ordningen for store ejendomme') – industrial buildings exempted since they are covered by other programs.

B. Sponsoring Agency

The Danish Energy Authority is responsible for the communication of the program. Authorised energy management consultants (called ELO consultants) function as ambassadors for the program and carry out the inventories. A Registration Committee with representatives of the stakeholders is responsible for the administration (servicing the ELO consultants, developing tools and training of consultants) and the Secretariat.

C. Objectives

Program participation is required by law[1] for all buildings with an area larger than 1,500 m^2 (i.e. 28.000 buildings). The intention is to help visualise the energy consumption and to provide decision makers (i.e. owners/tenants) with the information necessary to act energy conscientiously.
The program targets all heat, electricity and water end-uses. The intention is to provoke building owners/tenants to integrate energy management systems in the ordinary business activities.
The target is to achieve a 0.5%/year saving on the total net heat consumption (i.e. 0.435 PJ/year) of the total target group. Additional targets for this program and the Energy Labelling of Small Buildings program combined were to achieve 4-6 PJ net heat saving of the total target group, 300-600 GWh electricity, 5-10 million m^3 water and 0.6-0.8 million tonnes CO_2 by year 2005. The social economic cost is expected to be 100-300 DKK/ton CO_2 for heat and electricity, respectively.

D. Programme activities

The main policy measures applied in the program are regulation combined with information and energy audits. The building owner/tenant is obliged to receive a visit by the ELO consultants once every year and to prepare an Annual Energy Plan. The owners/tenants have to report actual monthly consumption figures and pay the ELO consultants to prepare an overview of the energy consumption of the building compared to an average building of the same category of use and to identify cost-effective energy savings opportunities. The ELO consultant also issues an Energy Label based on the audit.
The audit includes heat, electricity and water end-uses.
A sanction possibility for non-compliance exists in the form of fines but it has not been used.

E. Development and operation

The program was introduced in January 1997 and still ongoing.

[1] Law 485 of 12/06/1996.

F. Administration

The social economic administration costs amounted in 1999 to 148.2 million DKK (representing 14,380 buildings). In other words approximately 10,300 DKK/building.

Stated evaluation objectives		
➢ Determine impact and costs ➢ Assess possibilities for program improvement		
Produced output	**Some assessed outcome indicators**	**Energy impact**
➢ Energy Label ➢ Annual Energy Plan concepts	➢ No. who knows of the program ➢ Quality of information material ➢ Satisfaction amongst participants and ELO consultants ➢ Absolute and relative no. of labelled buildings by size, building use and geographical distribution ➢ Identified potentials for savings in labelled buildings ➢ Required investments ➢ Realised investments	➢ Realised heat, electricity and water savings ➢ CO2-reduction ➢ (CO2 abatement cost)

Evaluation objectives, activities, results

A. Evaluation objectives

Already at the introduction of the program it was planned to evaluate the program after a couple of years (interim evaluations).
Kragelund Kommunikation carried out an evaluation in January 2000 to investigate possible barriers using quantitative analysis based on telephone interviews and a questionnaire survey. Some of the findings were that the frequency of the audits and the price are appropriate and that the use of sanctions would have beneficial effect on motivation.
The investigated evaluation was carried out by COWI and Advice Analyse and had three objectives:

1. Savings achieved (heat, electricity, water, CO_2 reduction, CO_2 reduction costs).
2. Administrative set-up (is it appropriate, effective, possible improvements).
3. Discuss a number of issues.

The ambition level is level B for the impact evaluation (after measurements with comparison group) and level B for the process evaluation (representatives of all stakeholders are consulted). The evaluation described in the following was carried out June-November 2000 with a final report in February 2001.

B. Evaluation activities

Regarding no. 1 – Database analysis, public building registration database (BBR), telephone interview with 600 building owners/tenants about investments in energy efficiency and savings.
Regarding no. 2 – Telephone interviews with 300 consultants and 300 buildings, reader-workshop and analysis of information material.
Regarding no. 3 – See techniques listed under item 1 and 2.

C. Principal conclusions

Item 1 – Savings achieved:

- About 14,380 buildings (42%) had signed up medio 2000 (representing 25.000 labels).

- Compliance varies geographically (no. of buildings), by size of building (m^2) area, and by building use. There are more large buildings that comply and there are very few businesses.
- The registered potentials are 7% (3,6 PJ) of the total heat consumption of the registered buildings, 5% (0.173 TWh) of total electricity and 7% (5 million m^3) water. The investments required to realise these potentials are 72, 16, and 26 DKK/m^2, respectively. Implemented recommendations are not registered. Investments in water saving measures appear to be higher amongst non-subscribers.
- The social economic reduction cost is estimated to 342-856 DKK/tonne CO_2 for heat and 228-367 DKK/tonne CO_2 for electricity and 7-12 DKK/1,000 m^3.

Item 2 – Administrative set-up:

- The aim of the database is unclear and the data quality not optimal.
- The administrative and organisational set-up can be improved.
- The greatest barrier to compliance is lack of awareness of the program. However, the existing information material is rated good including the label.

Item 3 – Various issues:

- Information about the program and that fees can be negotiated is not widely spread.
- About 1% of non-complying buildings specify the consultant fee as the reason while 35% lack of financial means as the reason. Both consultants and building owners/tenants are of the opinion that access to funding possibilities would increase the implementation of suggested measures.
- The 1,500 m^2 limit should be kept.
- Making the labels publicly available will make it possible for stakeholders such as consultants and equipment suppliers to market themselves to those holding cost-effective potentials.
- Although the annual review of the issued labels was intended to function as a follow up to suggestions made the previous year, the workshop results indicate that there is a great demand for specific examples of success stories and exchange of experience. Focus at the time of evaluation was primarily on identification of potentials and not whether these actually do get realised.
- An effect of the evaluation findings has been the introduction of new elements to encourage compliance and increase owner/tenant benefits of the program.
- Demonstration projects (success stories),
- Practical and operational tools[1], and
- Local dialogue networks (so-called 'ERFA' groups).

General conclusions

Baseline development:

- Buildings already energy efficiently managed are not excluded from the Energy Management Scheme and they can therefore become free-riders in the assessment of the compliance (or

[1] www.energiledelse.com

maybe hesitate to comply, although less likely). An assessment of the existing energy management level could for example be made the first time a label is issued to a building thus allowing an assessment of free-riders at a negligible cost.

- The investigated evaluation seeks to gain an impression of the implemented measures, associated investments and achieved savings is through use of comparison groups (150 registered and 150 non-registered buildings). However, it is not clear whether they are truly comparative. One of the findings of the evaluation was that those complying are larger buildings, which could indicate that the two groups are not comparable. Free-riders may also distort the comparison. Their individual overall energy consumption, absolute and per m^2 or other suitable unit, could help shed light on this issue.

Choice of indicators:

- While the registered geographical differences could be due to local differences in for example energy awareness levels and the availability and quality of ELO consultants, the main reason found is that the size of the buildings varies geographically and since the large building are more likely to comply, a geographical difference in degree of compliance arises. Indicators should therefore be interpreted with insight.
- While consumption per area (m^2) is often used for comparing the energy efficiency of different buildings it might be misleading. Alternative units could be number of employees, number of serviced persons, or units of production.
- When introducing an obligation to use an authorised expert or other types of bureaucratic control the expedience with which each case is handled and the credibility and availability of the necessary experts are important factors in the compliance. The buildings owners/tenants interviewed in the investigated evaluation did not hint to such problems but instead that the issue at hand in this case is more one of priority of resources.

Credibility of the evaluation:

- The credibility of findings such as the estimated social economic CO_2 reduction cost is enhanced by detailed and clear presentation of underlying assumptions and values.

5.2. Case for category Information: (1) Energy Labelling of Small Buildings (2) Free-of-Charge Electricity Audits (3)'Project Red-Hot' (4) The 'A' Campaign 1999

Programme description (1)

A. Name of the programme: Energy Labelling of Small Buildings

Energy Labelling of Small Buildings (i.e. below 1,500 m^2) (in Danish: 'Energimærkningsordningen for små bygninger')

B. Sponsoring Agency

The Danish Energy Authority is responsible for the communication of the program. Authorised energy consultants function as ambassadors for the program and carry out the audits. A Registration Committee with representatives of the stakeholders is responsible for the

administration (labels, servicing the energy consultants, developing tools and training of consultants) and the Secretariat.
The program is self sustained i.e. the administrative costs of the program are covered by the consultants' fee (that covers label fee, annual license fee and profit margin of the consultants) while the Danish Energy Authority finances for the information activity toward building owners and real estate agents.

C. Objectives

Program participation is required by law[1] for all existing buildings with an area smaller than 1,500 m^2, that are being sold on. The intention is to achieve the same level of energy efficiency in existing buildings as in new buildings.
The program targets all heat, electricity and water end-uses.
No separate set targets were defined for this program. However, the targets for this program and the Energy Management Scheme program combined were to achieve 4-6 PJ net heat saving of the total target group, 300-600 GWh electricity, 5-10 million m^3 water and 0.6-0.8 million tonnes CO_2 by year 2005. The social economic cost is expected to be 100-300 DKK/ton CO_2 for heat and electricity, respectively.

D. Programme activities

The main policy measure of the program is regulation combined with information about the obligations and an energy audit.
The vendors of buildings smaller than 1,500 m^2 are obliged to pay an energy consultant to audit the building and to issue an Energy Label and prepare an Energy Plan identifying cost-effective energy savings opportunities. The Energy Plan uses a calculated consumption based on the appliances and structural elements of the building and not the existing consumption figures. The audit includes heat, electricity and water end-uses. The fee of the consultants is regulated (min and max). The consultant reports to a joint database administered by a Registration Committee. No sanction possibility for non-compliance exists. The real estate agents are encouraged to inform sellers/buyers about the existence of the labelling program.

E. Development and operation

The program[2] was introduced in January 1997 and is still ongoing. This program together with the Energy Management Scheme for Large Buildings replaced the VKO and EK programs.

F. Administration

The social economic administration costs amounted in 1999 to 81.5 million DKK (representing 39,000 buildings) of which 1.5 were made up of the information cost of the Energy Authority. In other words the cost amounted to approximately 2,089 DKK/label issued.

[1] Law 485 of 12/06/1996.

[2] This program together with the Energy Management Scheme for Large Buildings replaced the VKO and EK programs.

Stated evaluation objectives		
➢ Determine impact and costs ➢ Assess possibilities for program improvement		
Produced output	**Some assessed outcome indicators**	**Energy impact**
➢ Energy Label ➢ Energy Plan concepts	➢ No. who knows of the program ➢ Satisfaction amongst participants, real estate agents and auditors ➢ Absolute and relative no. of labelled buildings by size and geographical distribution ➢ Identified potentials for savings in labelled buildings ➢ Required investments ➢ Realised investments	➢ Realised heat, electricity and water savings ➢ CO2-reduction ➢ (CO2 abatement cost)

Evaluation objectives, activities, results

A. Evaluation objectives

Already at the introduction of the program it was planned to evaluate the program after a couple of years (interim evaluation). The aim of the investigated evaluation (carried out June-December 2002) was to establish the impact and cost so far and to assess whether improvements in the program structure could be made to increase impact and reduce costs. The evaluation was carried out by COWI and Advice Analyse and had three objectives:

1) To determine the achieved impact and the related costs (saved heat, electricity and water, CO_2 reduction caused by the program, CO_2 abatement costs).
2) To assess the administrative set-up (is it appropriate, effective, improvements possible).
3) To discuss a number of issues (is the 1,500 m^2 limit appropriate, follow-up possibilities to the labelling, are the rules for fees considered maximum prices).

The chosen level of ambition for the evaluation was level B using after measurements in target and comparison groups for the impact evaluation and questioning of involved stakeholders for the process evaluation.

The program was also evaluated in April 1999 by AC Nielsen AIM with the purpose to investigate whether house-owner with an Energy label and Energy Plan do undertake investments in energy efficiency improvements. 399 house owners were questioned and results showed that 22% remembered receiving the label and the plan and had invested or planned to invest in energy efficiency improvements.

B. Evaluation activities

Regarding no. 1: Database analysis using the program database, the public building registration database (BBR), the Duty and Tax Authority database on building sales. Telephone interviews with 600 building owners (about investments in energy efficiency improvements and savings). The used indicators of impact were building area, number of buildings, geographical distribution, size of estimated potential, necessary investments, and implemented investments. The Danish Energy Authority sets the conversion rates for CO_2 emissions[1].

[1] Heating oil 0.265, natural gas 0.205, electricity 0.750 and district heating variable kg CO_2/kWh.

Regarding no. 2: Informal interviews with stakeholders, telephone interviews with 170 consultants and 150 real estate agents, telephone interviews with owners of one-family houses with (300) and without (300) an Energy Label, reader-workshop with 6 buyers of one-family houses (focus group interview).

Regarding no. 3: See the techniques listed under items 1 and 2.

C. Principal conclusions

Item 1 – Effect resulting from the program:

- Registration database is of poor quality (missing and faulty data) and should be improved.
- Telephone interviews are not suited to gain information about investments and savings and should maybe be replaced by visits at selected houses three years after the label was issued.
- The overall additional effect of the program (i.e. the effects that can be attributed to the program alone) is small in spite of an estimated potential of 6-18% of consumption and the costs per CO_2 saved high (268-1,152 DKK/tonne CO_2 and 8-10 DKK/m^3 water).
- Information about the existence of the program is not widely spread (only 12% of house owners know of the program). The take-up of the labelling is in average about 50-60% in spite of the labelling being obligatory.

Item 2 – Administrative set-up:

- The real estate agents who are supposed to function as important ambassadors are not keen on the program (56% are dissatisfied compared to 65% satisfaction for the energy consultants). They find the labelling useless and the calculations unreliable.
- House owners rate the information material on the program good but PR is needed to increase the knowledge of its existence.
- The distribution of the tasks between the Registration Committee, the Secretariat and the Energy Authority can be improved to allow better handling of the support to the energy consultants, promotion towards house owners and administration of reporting and complaint cases.

Item 3 – Various issues:

- The 1,500 m^2 limit does in reality not apply; the program has become a program for one-family housing (excluding among other buildings for other purposes).
- Given the low rating of knowledge of the labelling program, information campaigns should be initiated. Other possible supporting activities could include visits to consumers to establish energy impact, registration of which measures are suggested in the energy plans and prepare campaigns to support their implementation, cooperation with various stake holders including workmen and energy companies, making labelling status of the individual houses accessible on the internet, better preparation of data for analyses, introduction of rewards for implementation of measures.
- The maximum limit on the fees does not seem to hinder price competition.

General conclusions

Monitoring data quality: The evaluation shows that it is not enough to establish a recording system for certain program parameters. The input to the program parameter databases must be monitored to ensure complete and correct data otherwise the databases are rendered more or less useless for evaluation purposes. Furthermore, the issue of measuring impact using suitable indicators should be dealt with at the program start to facilitate the planned evaluation.
Validity of data: Can information about investments be trusted? There are for example two possible sources of error:

1. Investments can be made in aesthetic improvements, which do not lead to energy savings. Can the house-owners distinguish between these even if willing?
2. Does the existence of a black market for construction work have an erroneous impact on house owner investment costs?

Influence of stakeholders: The views of involved and not involved stakeholders can be investigated with respect to perceived advantages and disadvantages of the program to reveal possible barriers to program success.
Compliance versus impact: The Energy Label and the Energy Plan themselves do not automatically lead to energy efficiency improvements. An energy impact assessment at level A must therefore include indicators other than the amount of labels issued.
Comparability of comparison groups: When using comparison groups, check the comparability. For example, in this evaluation case, are the group of houses with labels and the group of houses without labels truly comparable or are there significant differences in features such as age, size, window area, etc. that were not intended? What is the relationship between houses with energy labels and their energy consumption (and age) at the time of sale, i.e. are already efficient houses more likely to be labelled and not the houses most in need for improvement?

Programme description (2)

A. Name of the programme: Free-of-Charge Electricity Audits (in Danish: 'Vederlagsfri erhvervsrådgivning')

B. Sponsoring Agency: Association of Danish Electricity Network Companies (ELFOR

C. Objectives

The program is based on the understanding that a large potential for electricity savings in public and private industry and commerce is not realised and the two main barriers are lack of knowledge at company level about the cost-effectiveness and about how best to start implementing measures.
An electricity audit can provide companies with the required information about cost-effectiveness and "how-to". The program theory is that this information in many cases will be sufficient to help the companies from *thinking* about energy efficiency to *acting* energy efficiently. Also, it is assumed that the audit must be free in order to create sufficient interest in taking the first step. One of the modifications that have been made to the program over the years is that the companies may choose between two types of audit; namely a complete audit or a partial audit of the company. The partial audit focuses on specific installations or systems. Should a company decide to realise some of the identified electricity savings measures, a more detailed audit can be carried out, however, not free of charge.
The program primarily targets all electricity end-uses since only audit costs related to electricity end-uses can be recovered by the electricity network companies via the electricity tariffs. In

some cases other energy and water end-uses may improve due to the electricity audit without additional work. To accommodate the needs of the customers, some auditors offer to carry out audits of all end-uses and then recover the extra cost in other ways.
No definite targets were defined for this program. However, the costs and benefits for each audit are monitored through a common database (ENIbasen[1]) and analysis of the cost-effectiveness and avoided CO_2 emissions carried out regularly as part of the overall DSM planning regime of ELFOR. Also, the Danish Energy Authority has demanded that each year 10% of the companies are offered an energy audit. Assuming that 20% of the 10% do not wish to accept the offer, all companies should be reached within an 8 years cycle.

D. Programme activities

The electricity audits consist of the following elements:

- Overview of electricity consumption and savings potentials – This also includes a discussion on production data, energy management, and the profitability requirements of the company.
- Mapping – A more detailed review of the energy use by 13 different end-use categories (lighting, pressurized air, cooling, etc.) and a catalogue of energy saving ideas.
- Plan for electricity savings – Selected ideas from the catalogue are described in more detail and form the basis for decisions regarding implementation of some of the ideas within the company.
- Follow-up – Typically 6-12 months later the audited company receives a phone call or a visit from the auditor.
- Written report to the audited company.
- Reporting to the common database (ENIbasen) – The information is treated as confidential information and is collected for documentation of the program.

There are currently about 200 electricity auditors and they are equipped with various tools (models, guidebooks) that help make the offer more uniform across the country and ensure a certain professional quality.

E. Development and operation

The program was introduced in the early 1990's and is still ongoing. This program supplements a variety of other programs such as the 'Campaign for efficient ventilation' offered by ELFOR and the 'Energy management scheme for large buildings'.
The total number of cases reported to the ENIbasen was about 17,000 in 2001.
ENIbasen was modified in 1995 in order to accommodate tracking more details on the individual cases. Also changes in customer ID were made, which makes comparison of data before and after the change difficult.

F. Administration

The annual budget for electricity audits is at present about 100 million DKK (i.e. about 13 million EUR assuming 1 EUR = 7.5 DKK). This figures does not include the cost, which the companies themselves incur due to time spent in relation to the audit and investments made in

[1] The most recent version is called 'Unitool'.

energy efficiency improvement but these are estimated to 250 million DKK. The expected savings are 130 GWh the first year and about 1 TWh during the lifetime of the savings[1].

Evaluation objectives, activities, results

The program has been subject to several evaluations partly because it is a large activity and because it has existed for many years.

The **cost-effectiveness** of the program is assessed biannually using the database, i.e. the input relative to the outcome. Factors of uncertainty are realised savings (are they truly due to the audit and not something else, how long is the delay from advise to realisation) and company costs (which part of the investment can be said to be in energy improvement and not general upgrade of equipment). Also the **cost-efficiency** is measured, i.e. the input relative to output, and ways to improve the cost-efficiency debated.
The **barriers** to energy efficiency within the companies have been analysed using various approaches: Survey of companies in general, survey of companies who have accepted an energy audit, case studies of companies which prioritise energy efficiency, and so forth. Focus has both been on the audit and the contact between the auditors and the companies as well as the conditions within the companies that may further energy efficiency or not (InterSEE 1998).
Also possible **geographical differences** have been investigated in an effort to optimise the offer (What makes an audit or auditor especially successful?, Elfor, 1999).
Assumptions such as the lifetime of implemented measures were originally based on engineering estimates and have since been tested for example using surveys of real lifetime. The "completeness" and quality of the data input to the **database,** which many of the evaluations rely upon for information, has also been subject to assessment.
Furthermore, the role of the auditors as **ambassadors** for other programs and the **alternatives** to the free audit in its existing set-up have been explored (AKF, 1997).
As one result of these evaluations and the continuous monitoring, the **problem theory** and the **program theory** have been gradually expanded and the program modified to take new understandings into account. One evaluation showed that part of the target group appreciates targeted advice, i.e. advice relating to a certain area of production/business instead of a complete audit and the target group may now select between targeted or broad advice. As time passes the companies with the greatest potential for cost-effective savings will have realised their savings and the remaining segment of companies becomes gradually less and less cost-effective to target. In step with this change the program is altered.
A new evaluation is planned for 2004. The main aim is to investigate in detail the difference in energy efficiency between the participating and non-participating companies within comparable groups in order to calculate the **net-impact** of the program. Since a large number of energy efficiency activities have been targeted at businesses over the years and still is, it will be interesting to see how much of the change in energy efficiency can be attributed to the audit program alone. It is also generally believed that the audit program sensitises businesses to other activities such as the campaign for energy efficient ventilation.

[1] DSM-Plan 2002-2004, ELFOR, 2001, page 30.

Stated evaluation objectives		
➢ What types of advice are implemented? ➢ What is the lifetime of the implemented advice?		
Produced output	**Assessed outcome indicators**	**Energy impact**
➢ Audits reports ➢ Audit concepts ➢ No. of audits offered	➢ No. of audits ➢ No. of implemented advice by type ➢ Lifetime of implemented advice ➢ Customer satisfaction with audits and auditors	➢ (Not assessed)

A. Evaluation objectives

Vedkom Kommunikation carried out the evaluation presented in the following in autumn 2001. The objective was to investigate lifetimes of measures in order to assess whether lifetime time estimates used in the algorithms of the calculation of electricity saving impact are correct. Any differences by company branches, company sizes, or company electricity consumption levels were to be identified.

B. Evaluation activities

The evaluation was explorative i.e. the main purpose was to establish what type of advice is implemented and what the lifetime of the implemented advice typically is, so that the lifetime assumptions applied in the electricity saving algorithms in the modelling of expected impact could be verified. A B-level impact evaluation was intended but during the evaluation it was found that the data and the quality of the data at hand did only allow a C-level evaluation.
The evaluation activities consisted of a comparison of the data in the existing database and 131 company questionnaires about 357 different advice supplemented by document research of some audit case files. The questionnaires primarily related to the degree of implementation, lifetime and quality of audits.

C. Principal conclusions

The evaluation was complicated by the fact that the database has been altered in 1995. The data material thus did not allow statements on lifetime past 6 years, i.e. relating to companies audited after the change in the database. Also it proved a problem in the data collection that the companies modify the advice and do not recognise/remember the initial advice. And the database does not allow modification of an entry on an advice.
The small size of 'useful' data did not allow research of differences by company branches, company sizes, nor company energy consumption levels.
Furthermore, extrapolation of the results to produce a picture of the entire population was made impossible by the small size of the sample (it was not representative) and the short time span (6 years) made it impossible to provide conclusive information on lifetime expiration.
Some of the results of the evaluation were:

- The lifetime of an advice equals the remaining life of the related equipment component. The reasons for termination are typically purchase of new and better equipment, a move, or other radical changes. The lifetime is very individual from customer to customer. It appears that it is the customers who are able to make the best estimate. The auditors instead of using typical technical life or typical expected life assumptions should therefore collect their estimates. The evaluator suggests that the ENIbasen registers when the lifetime expires.

- Electricity saving measures consisting of a behavioural change and non-specific measures are less likely to be implemented than other specific technical measures.

- The companies would like the electricity network companies and the auditors to be more 'aggressive' i.e. active in contacting the customers unsolicited.

- The customers are very satisfied with the audits and the auditors. Only 3% of the companies questioned find that one or more of the advice given is of no use.

- ENIbasen is not particularly popular with the users. It is considered heavy, tedious and an administrative burden. For example does the database does not allow modification of an entry on an advice.

The evaluator suggested that customers could possibly be enticed to provide up-to-date status data using the Internet or post cards if promised a prize. The prize could, for example, be access too benchmark figures for the winning company's branch.

General conclusions

Lifetime of measures – Lifetime assumptions are critical to calculations of full impact of measures during their lifetime. This problem can be handled sensibly when determining cost-effectiveness of an initiative by calculating two versions of energy saving impact, namely first year impact and lifetime impact.

Tracking systems – A program database is typically created in order to track performance and impact over time and to collect data for future evaluation purposes. The database must be kept up-to-date and some control of correctness of input carried out. Regular check on the quality and missing elements are therefore important. At the same time data shouldn't be collected just because they can be collected. It is equally important that the data is used to gain knowledge and that this is reported back to those providing input to the database, so that they realise the value of the work done. Databases for activities taking place over a longer period of time will often be modified and improved as user friendliness is tested and new information needs arise as a result of gathered experience. However, larger modifications can cause problems with consistency for long time series analyses, which are often one of the reasons why the database was established in the first place. A demand for anonymity of customers can also cause difficulties in back-tracing audit case reports. It can be very difficult if not impossible to design a database that can handle the complexities of the real life situations. For example, an auditor might visit a company with the purpose of discussing ventilation systems but end up also giving advice on motors, advice which is then implemented instead of the ventilation advice.

Timing of the evaluation – For a measure such as audits a significant time delay may occur from advice is given in the shape of an audit report to the implementation of recommended measures. The implementation of measures will depend on production plans and scheduled maintenance and upgrades in addition to available financial means. This has repercussions for the evaluation. Time must be allowed to pass before evaluation takes place if all resulting impact is to be taken into account.

Extrapolation of results – It is better to produce credible findings for a small sample of a population instead of making an extrapolation based on a non-representative sample.

Programme description (3)

A. Name of the programme: 'Project Red-Hot'

'Project Red-Hot' (in Danish: 'Projekt Rødglødende'). This project was only one element of a major campaign to limit stand-by consumption carried out by ELFOR and the Electricity Saving Trust in cooperation, which besides Project Red-hot consisted of the following elements:

- Information folder
- Homepage with shopping guide introducing the Energy Arrow label (www.energipilen.dk)
- TV commercial
- Involvement of 500 retail shops selling TV, videos and radios offering advice, handing out 45,000 Save-o-metres and a number of CD-roms with music and a small calculation program.

The Danish Energy Authority administrates the Energy Arrow.

B. Sponsoring Agency Association of Danish Electricity Network Companies (ELFOR).

C. Objectives

Project Red-Hot was targeted 7th grade school children (about 14 years old) and their families. About 300 classes all over the country participated.
The targeted end-uses were all electricity stand-by consumption in the households. An average household in Denmark consumes 4,000 kWh/year and 10% is stand-by consumption alone. TVs, videos and radios make up 60% and PC, printer, fax and modem make up 20% of the stand-by consumption. No specific impact targets were identified.
The messages were to buy equipment with low stand-by consumption and to switch off equipment when possible to avoid stand-by consumption.

D. Programme activities

The main policy measure of the project was education (a subcategory of information policy measures) combined with a grant (a subcategory of economic policy measures) in the form of a prize competition.
It consisted of material to be used in interdisciplinary education and a competition with 3 prizes (20,000, 15,000 and 15,000 DKK) handed over by the Energy Minister and other official persons.

E. Development and operation
The project was carried out in the period 17th September – 31st October 2001.

F. Administration
The cost of Project Red-Hot was 3 million DKK.

Evaluation objectives, activities, results

Stated evaluation objectives		
➢ What is the impact on energy saving behaviour of families of children involved?		
Produced output	**Assessed outcome indicators**	**Energy impact**
➢ Teaching material ➢ Prize competition ➢ No. of children/classes taught	➢ No. who browsed through material ➢ No. who read material ➢ No. who had discussions with family ➢ No. who remember seeing TV-campaign ➢ No. who changed energy saving awareness ➢ No. who turn off stand-by	➢ (Not assessed)

A. Evaluation objectives

Ziirsen Research carried out an evaluation after the project targeted at schools ended to assess to which extent the project had an impact on the energy saving behaviour of the families of the children involved.

B. Evaluation activities

Given the nature of the program a large-scale evaluation cannot be justified and a C-level impact (after measurement in target group) and process evaluation was therefore carried out. The evaluation activities consisted of

- 110 telephone interviews in September and October 2001 with parents of children involved in Project Red-hot aiming at a quantitative assessment of impact and
- 30 face-to-face interviews in January 2002 with parents who had indicated in the telephone interview to have been influenced by the project, the aim being to elaborate on the results from the first interview i.e. qualitative assessment of important factors.

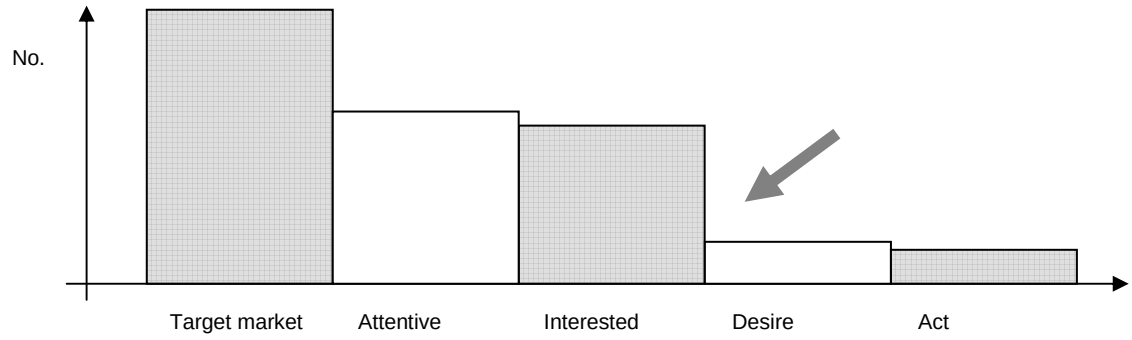
C. Principal conclusions

In short the key findings were:

- 40% always turn off stand-by. 29% claim to have changed their energy saving awareness due to the project while 18% have changed their behaviour due to the project.
- 38% have browsed through and 8% have read the school material.
- 23% answer that they have had discussions in the family about energy and such as result of the project, 44% somewhat, 15% to a lesser extent and 14% definitely not.
- 50% recall having seen the parallel standby campaign in TV.

General conclusions

Baseline development: A lack of 'before' measurements makes it impossible to establish that changes have actually taken place (no baseline). By outlining the ex-post evaluation already before program launch 'before' data can be obtained. Without comparison group it is also difficult to establish that a given program truly contributes to the changes that might take place and not something else.
Lifetime of savings: In the case of information programs achieved levels of recognition and knowledge might not last very long – How long can the impact be expected to last?
Indicators versus measured energy savings: Reported intentions of energy efficient behaviour does not equal savings but evaluators may have to settle for reported intentions if the energy impact is too costly to measure seen in relation to program cost. Awareness as well as intentions may be several steps away from action and may not lead to energy savings, irrespective of how sincerely the respondents wish to behave energy efficiently. Tracking the indicators for the different steps of the decision process may help identify what steps the program has difficulty overcoming. The rough sketch below illustrates a situation where a significant part of the target group is 'lost' between 'interest' and 'desire'.



Cost optimisation: Could the impact in the described case be achieved without the TV commercial and thus cost be reduced? Even if it was found that the TV commercial does not add to the uptake of the message it may be important to the 'feel good factor' of those who have done the 'right thing' – see it is important enough to be on TV and we are involved – which in turn might increase the positive attitude towards the topic and future energy efficiency messages.
Impact versus process: Process evaluation is important to the understanding of why. The face-to-face interviews in this case revealed four important elements of the project, which help increase the understanding of the program theory and pave the way for improvements:

1. Children can function as ambassadors and give access to parents who do not read material from for example local energy company (as can TV).
2. Many families are of the opinion that they have a lower energy consumption than other families and therefore do not feel that the messages concerning saving energy are relevant to them.
3. Also the cost of 1 kWh is often not known and need to be converted to an understandable unit.
4. The Save-o-metre proved a very strong means of communication.

Programme description (4)

G. Name of the programme: The 'A' Campaign 1999 (in Danish: 'A-kampagnen 1999')

H. Sponsoring Agency: The Electricity Saving Trust.

I. Objectives

The overall objective was to strengthen/hasten the market share of certain A-labelled electric appliances by increasing both market demand and range of supply, through two parallel activities, namely a rebate campaign and introduction of an internet based listing of A-appliances. The appliances included were combis, refrigerators, freezers, and dryers. The primary target group was households but also commercial customers were included. The web page was targeted at persons above 24 years who use the Internet more than once each month (i.e. 1,136,000).
Information campaign goals were:

- Increase expected sales of A-appliances from 2,500 to 19,300 (11 weeks).
- Increase range of supply (presently 61 units all 4 categories combined) and reduce the average price of A-appliances.

Web page goals were:

- That every 5th purchase is based on information from the list (estimated to 800 consumers per week).
- That 40% of retailers report to the list.

Shortly before program launch it was found that the Association of Electricity Network Companies (ELFOR) planned a similar program. The program encompassed all white goods (i.e. chest freezers, washing machines and dishwashers in addition to the goods targeted by the Electricity Saving Trust) but did not include a product list. ELFOR had already established sound contact to the retailers in particular. Both programs were quickly adjusted to have the same message and the timing coordinated. The ELFOR campaign is not included in the following description.

J. Programme activities

Information campaign activities were:

- Rebates (economic incentives) to increase customer demand for A-labelled appliances. If there are only a few dominant suppliers then rebates can function like subsidies. In the described case price reductions were therefore negotiated (10%) for freezers and dryers to allow rebates.
- Dialogue with suppliers/retailers to increase the availability of A-label appliances at retail level.
- Marketing towards consumers, retailers and suppliers consisting of 1) TV- and radio-spots plus press announcements, advertisement in written media, 2) in-store and trade materials, and finally 3) dialogue to secure a certain supply and to involve supply sales staff as ambassadors towards retailers.

Web page (information) activities were:

- In line with the motto of the Electricity Saving Trust ("It should be easy to shop energy wisely") an Internet based list showing which appliances can be bought where and at what price was developed. An important feature is the continuous up-date by retailers.
- Marketing of the list in the form of 15 seconds TV spot, advertisement in daily newspapers, and banner advertisement.

K. Development and operation

The campaign lasted from September 22nd to December 4th, 1999 (11 weeks) and the Internet based list was supposed to step into function at the same time but the introduction was delayed to October 13th. While the rebates only were given during the campaign period, the web page continues to exist and to be up-dated.

The listing of A-appliances with prices can be very time-consuming due to continuous updates and requires great skill. The task was carried out by the Consumer Protection Agency ('Forbrugerstyrelsen') to avoid accusations of bias. Retailers can to some extent be involved through self-reporting up-dates via the Internet.

L. Administration

Information campaign costs:

- Rebates 18.0 million DKK (expected 10.5 with 5.0 in additional reserve).
- Marketing 800,000 DKK; public announcement as required by law 250,000 DKK; project management, economic audit, and control 950,000 DKK (expected 1.5 million DKK).

Web page costs:

- About 235.000 DKK for developing the appliance list.
- About 2.5 million DKK for the marketing

Stated evaluation objectives		
➢ Documentation of all program phases		
Produced output	**Some assessed outcome indicators**	**Energy impact**
➢ In-store and trade material ➢ Rebate system ➢ Public announcements (TV, radio, press announcements, other advertisement) ➢ Web-list of A-appliances	➢ No. of customers who were motivated to buy by the rebate ➢ No. of customers who know of the web-page ➢ No. of customers who feel that the recommendation by the electricity company was important to their purchase ➢ Sales of A-appliances by type ➢ Market shares of A-appliances by type ➢ Product range by type ➢ Price reductions by type ➢ Hits on web-page ➢ No. of retailers who reports to web-list ➢ Supply compared to demand ➢ Retailer satisfaction	➢ Realised electricity savings ➢ CO2-reduction ➢ (CO2 abatement cost)

Evaluation objectives, activities, results

D. Evaluation objectives

The objectives were to document the program in all its phases (background, implementation and result) and gather information for future use.

An A-level impact evaluation and a B-level process evaluation were carried out. The program was national and therefore no comparison group could be found within Danish territory. Instead the sales were monitored before and after the program and a crude assessment of whether something unusual has happened within the period, which might have influenced the program results, was made.

E. Evaluation activities

During the rebate campaign:

- In-store Kompagniet – On site spot check of retail marketing efforts during the campaign.
- Dansk Varefakta Nævn and Forbrugerstyrelsen – Sampling test of real consumption level of appliances (less than 10% of total number) compared to label indications during the campaign.

After the rebate campaign:

- Telescope Analysebureau – Invoice control and telephone survey of a sample of 1,043 consumers in the participant group (i.e. buyers of A-appliances) based on contact details from invoices.
- Media.com – Post test of marketing.
- Grey Promotion – Impact analysis of sales statistics reported by the branch organisation for producers and importers of electric appliances (FEHA) and process analysis based on interviews with representative stakeholders (8 persons).

F. Principal conclusions

Telescope Analysebureau:

- About 36% of respondents were motivated by the rebate to purchase an appliance within the campaign period. About 37% would have bought an appliance anyway.
- About 19% list the rebate as very important for the choice of appliance (33% not) and 21% felt the recommendation "recommended by your electricity company" was important to their choice (an element of the ELFOR program). About 30% know of the web page Media.com:
- Click-through rate was 0.22% and the cost 11.45 DKK/click.

Grey Promotion:

- Involvement of retailers (and suppliers) and respecting their conditions for cooperation in as far as possible is vital to gaining their full support. The introduction of the Internet page was rushed which created some obstacles.
- Smaller retailers proved more interested in participating than large retail chains.
- Supply wasn't quite able to follow the increased demand for dryers.
- The administration of the refunding of rebate outlays to retailers was too heavy and can be improved.
- The estimated baseline was found to deviate from the real (not due to errors but due to unexpected natural market development): Instead of a market share of 10% before the campaign start the market share was found to be 15.9% for A-appliances. Whether the evaluation results were adjusted accordingly is not clear based on the available material.
- The impact achieved during the campaign period was according to the Electricity Saving Trust 0.23 kg CO_2 abatement per DKK[1] rebate and the social economic shadow price –138 DKK/tonne CO_2. If both the estimated impact during and the impact after the campaign are included then the values are 1.20 kg CO_2/DKK rebate and 311 DKK/tonne CO_2. These figures do not include the expenses incurred by ELFOR (4.86 million DKK). In addition it is not clear from the material at hand how these figures are derived.
- Examples of other findings are listed in the table below.

[1] Using 0.78825 kg CO_2/kWh.

Indicator	Before	During	After (primo May 2000)	Goal
A-sales in 11 weeks	2,500	34,894	-	19,300 units
Product range	61	122	174	-
Price reductions	-	-	(10-15%)	-
Visits to web-list	-	1,000	300-500	800 hits/week
Reports to web-list	-	10% (50 retailers)	< 6% (30 retailers)	40% of retailers

General conclusions

Context dependency: Unintended media exposure can influence results (positively and negatively) albeit being very difficult to quantify. In this particular case, the discussions between program initiator and appliance retailers gained media interest. Other examples could be an unexpected interruption of electricity supply as the one that took place in Southern Sweden and Eastern Denmark in September 2003, which will give programs following immediately after public added attention.
Costs: The costs incurred by the suppliers and retailers were not included in the cost calculations in the described evaluation. These costs can be difficult to quantify but can be important to supplier and retailer acceptance of the program. At the same time the additional income due to extra sales are not included.
Choice of indicators: Counting hits indiscriminatingly does not allow the evaluator to distinguish hits made by consumers (who are the target group) from hits made by retailers (who might check prices several times daily). However, in this example the Electricity Saving Trust is confident that not all individual retailers check the website. Instead the main office of the approximately 5 retail chains will check the prices on behalf of their chain to make sure their prices are continuously competitive.
Timing of the evaluation: Timely planning of the evaluation and identification of clear measurable program goals allow access to "before" measurements.
Advanced sales and free-riders: Rebates intended to increase the market share of a given product are likely to step-up the natural replacement during the rebate period leading to a fall in sales the subsequent seasons. While the number of sold units is absolute, the "true" impact on the market share can therefore first be established after a number of seasons. It is also relevant to keep an eye on which products loose market share to the promoted product. Some of the rebates issued in the described case are issued to free-riders. However, this "unnecessary" cost is here considered an acceptable/unavoidable expense. The environmental benefits of these appear to be included in the claimed results, which is not the correct procedure.
Verification of claimed efficiencies: Reported efficiency levels of purchased appliances can be verified through adequate tracking of sales and control samples as part of the overall program monitoring. The engineering estimates are typically accepted as equal to the achieved savings. But here it is again important to keep an eye on which products loose market share to the promoted product. With a program like the described, the savings are not the difference between the newly purchased unit and the old unit but the difference between the newly purchased unit and the unit that would have been purchased had the program not existed.
Allocation of impact: The described evaluation does not take into account the expenses incurred by ELFOR and probably claims the full impact achieved by the two together although stressing that cooperation was developed as soon as it was realised that two parallel and close to identical programs were planned. Furthermore, the existing relation between suppliers/retailers and ELFOR may have had a significant influence on the achieved results.

Programme description (5)

A. Name of the programme: Promotion Campaign for Efficient Ventilation
Promotion Campaign for Efficient Ventilation (in Danish: 'Ventilationskampagnen')

B. Sponsoring Agency: ELFRO and DEA

The Association of Danish Electricity Network Companies (ELFOR) financed the entire campaign while the Danish Energy Authority provided the rebates offered at the same time.

C. Objectives

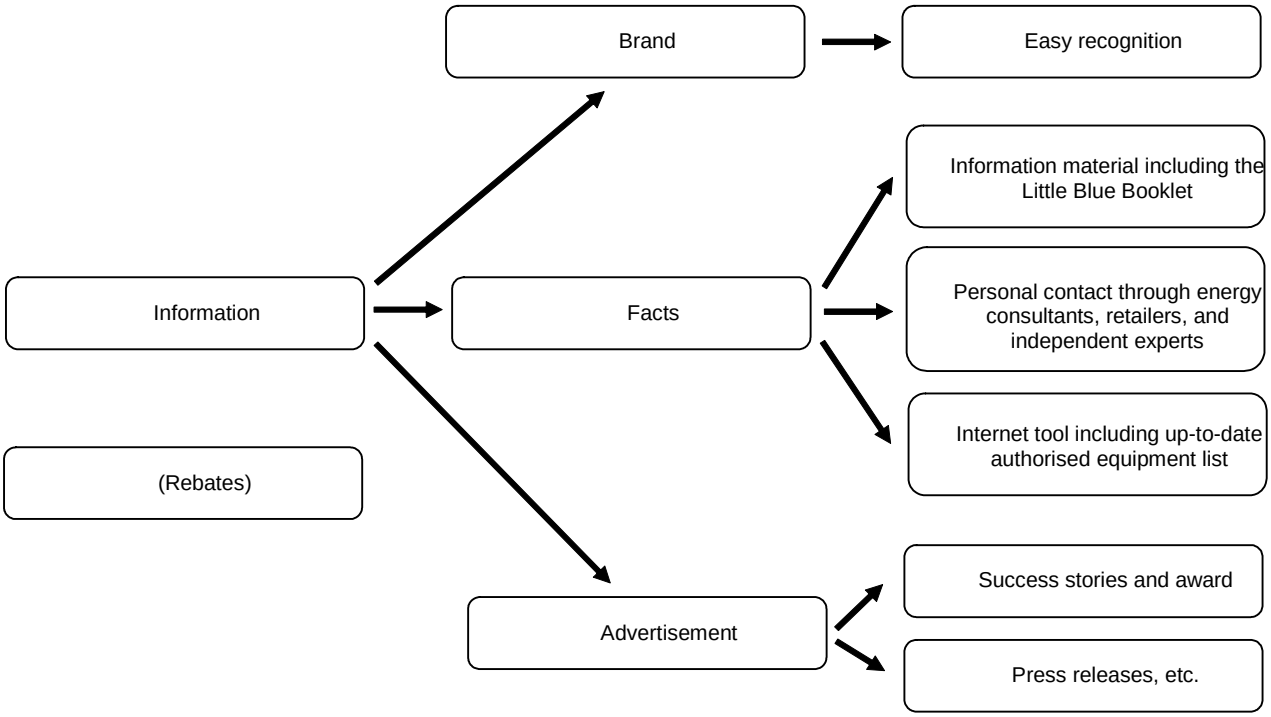
The end-use targeted was ventilation and the goal of the campaign was an additional sale of minimum 9,000 units during the campaign period September 1999 to end 2002, i.e. bringing the market share of efficient ventilation from insignificant up to approximately 10%. Other success criteria can be found in the table below.

Criteria	**Year 1**	**Year 2**	**Year 3**
Un-aided awareness (opmærksomhedsgrad)	65%	75%	75%
Aided awareness (kendskabsgrad)	50%	65%	80%
Recognition (vidensgrad)	20%	35%	50%

The message of the information campaign was that by selecting an efficient ventilator/fan (not the entire ventilation system) the energy consumption will be reduced by up to 30% and an additional 40% by optimisation of the various operational parameters. No forced replacement (i.e. retrofitting) was intended – only natural replacement and new installations.
The target groups were 1) managers and operational managers ('driftsansvarlige') of companies with significant energy consumption, 2) producers and suppliers of ventilators, and 3) external advisors.

D. Programme activities

The main tool of the campaign is information; however, the Danish Energy Authority ran a parallel rebate program the first two years of the ventilation campaign to help kick-start an interest in the topic. Thus both information and economic policy measures were applied.
A brand was created to clearly set-apart efficient ventilators. The campaign relies on energy consultants with contact to the target companies and to some extent on an obligation for large consumers to apply energy management. The campaign also included advertisement in written media, a web page (www.spareventilator.dk), direct mail, and an award for best practice.
An overview of the elements of the strategy aimed at managing directors and operational managers of the companies is presented below.



The campaign was developed in close cooperation with the suppliers and producers of ventilators (definition of efficient ventilators, self-control) and independent experts in ventilation (Technological Institute, DEFU and Glenco regarding specs, sample control, information material and education of energy consultants) – just like it is the case for A-labelling of household appliances. The suppliers and producers themselves update the list of approved ventilators, which has dynamic specifications i.e. gradual increase in required efficiency level.

E. Development and operation

Prior to the launch of the campaign, several studies were carried out:

- Preliminary assessment (Forprojekt 1998, DEFU) – Where is the largest potential in industry i.e. comparison of cooling, pressurised air, pumps and ventilation (which should be addressed first).

- Pre-study (November 1998, Alsted Research) – Qualitative market analysis on attitude, opinions, and behaviour towards ventilation in order to identify barriers in the target group for exploiting the potential of efficient ventilation equipment.

- Pre-study (Foranalyse, December 1998, Jysk Analyse Institut) – Identification of practice regarding purchase and operation of ventilation systems (telephone survey with 401 companies, random sample, structured with fixed answer categories) based upon which the steering committee can form realistic campaign goals and the marketing bureau can get information useful for the shape of campaign.

The campaign period stretched form September 1999 to end 2002.

F. Administration

The campaign cost 10 million DKK and the socio-economic gain was 100 million DKK, which equals approximately 30 DKK/tonne CO_2 saved (the Government Climate Strategy 2003 uses 120 DKK/t as guide mark for cost-effectiveness of Danish activities).

Evaluation objectives, activities, results

Stated evaluation objectives		
➢ Establish target group knowledge to disclose communication challenges ➢ Determine brand awareness		
Produced output	**Some assessed outcome indicators**	**Energy impact**
➢ Brand ➢ Little Blue Booklet ➢ Web-list ➢ Advertisement in written media ➢ Direct mail ➢ Best Practise Award	➢ Un-aided awareness in target groups ➢ Aided awareness in target groups ➢ Recognition in target groups ➢ Sales of efficient ventilators ➢ No. of customer who will give attention to ventilation energy consumption (customer view and retailer view) ➢ No. of customer who would choose efficient ventilation in the future ➢ User satisfaction with web-page	➢ Realised electricity savings ➢ CO2-reduction

A. Evaluation objectives

The law requires documentation of all energy saving activities carried out under the "public service obligation", however, ex-post evaluation of impact is not required.
An evaluation was carried out to allow adjustments mid-term and another evaluation was carried out after completion of the campaign:

- Interim evaluation (Midtvejsevaluering, April 2000, Jysk Analyse Institut) – Target group analysis to establish target group knowledge on electricity consumption and ventilation, efficient ventilators, and receipt and use of mail (random sample, telephone survey with 327 companies, structured with closed and open answers) to disclose communication challenges and suitable messages for each target group.
- Ex-post impact evaluation (June 2002, Ziirsen) – Brand awareness assessment amongst target group, auditors and retailers and analysis of sales statistics converted into CO_2 savings. The level of ambition for the ex-post impact evaluation could not be assessed based on the material at hand.

B. Evaluation activities

See above

C. Principal conclusions

Interim evaluation
This work resulted in a further segmentation, more focus on the energy consultants, and development of the Little Blue Booklet.
Ex-post impact evaluation
The campaign is considered a success since 30,449 units were sold (i.e. 3 times target or 30% market share). This equals approximately 500 GWh during equipment lifetime for the sales

within period (not including the positive effects of the future sales of efficient ventilators) representing more 100 million DKK economic benefits.
About 69% of the users say they give more attention to ventilation energy consumption now while 50% of suppliers say that their customers give more attention to the issue. About 29% of the companies indicate that they would definitely choose efficient ventilators next time, 35% probably and 13% will consider it.
The users are satisfied with the quick overview of the choice of efficient ventilators provided by the web site. The concept of the Little Blue Booklet is recommended used in future campaigns.
The program is a 'vertical' campaign i.e. it addresses all levels of the ventilation chain instead of just a single one (and is combined with a 'horizontal' campaign aiming to establish energy consultants as a powerful actor). This gives a greater chance of impact and a longer lasting impact since all sources of information are consistent with one another.

General conclusions

Use of evaluation results to achieve greater impact: For a longer program a mid-term evaluation can function as a vital opportunity to adjust program theory and improve program concept, impact and cost-effectiveness.
Allocation of impact: Running horizontal and vertical programs at the same time can help increase impact of vertical programs but it can be difficult to allocate impacts between the two. The role of the rebate in the size of uptake is not discussed in the ex-post impact evaluation of the presented case. What happened in years 1 and 2 compared to year 3? And the cost of the rebates is not included in the cost-benefit analysis. Experience shows that forerunners are important to the uptake of a new behaviour. Rebates help create forerunners quickly.
Timing of evaluation when aiming at market changes: Market changes registered during or right after a program might not be lasting. If a lasting impact is intended, then the evaluation should be extended to include at least 2-3 sales cycles after program stop. Time limited rebates can also step up the natural replacement leading to a fall in replacement in the subsequent years.
Choice of indicators: The road from energy efficiency message to realised energy savings can be long and consists of several steps. In the objectives of the described program, the planners have defined a number of indicators (awareness, recognition, knowledge, additional sales) to help them get a better understanding of which steps are the difficult ones – information that is valuable to future improvements or other similar programs. However, their experience was also, that it can be very difficult to obtain the right sales figures since these are considered confidential, even in spite of earlier agreements granting access. Another problem is that the sales statistics aren't tailored to show for example energy efficient ventilator systems or certain energy efficient combinations of components, which can make the usefulness of the sales statistics limited.
Indicators versus measured energy savings: A comparison of estimated savings (so-called 'engineering estimates') and measured savings in a small sample can help verify the validity of the estimates. Significant deviations influence the cost-benefit of the campaign and not the uptake result.
Transfer of program: The claimed success of the described program might to some extent rely on the fact that a prior 'vertical' program of similar set-up targeted at efficient motors had been well received and that a 'horizontal' energy consultant program exists plus the reputation of the program initiator. A context assessment is therefore relevant when transferring a program concept from one context to another.

7. Sources

Law Material:

- Act no. 450 of 31st May 2000 – Promotion of savings in energy consumption.
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- General Preconditions for Calculation of Societal Costs (Generelle forudsætninger for beregning af samfundsøkonomiske omkostninger), March 2003, the Danish Energy Authority.
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- Promotion of Energy Savings 2001 – Background Report in relation to the Energy Saving Statement 2001 (Fremme af energibesparelser 2001 – Baggrundsrapport i forbindelse med Energispare-redegørelse 2001), October 2001, the Danish Energy Authority.
- Public Communication Campaigns (3rd ed.), Ronald E. Rice and Charles K. Atkin, Sage Publications, Thousand Oaks, CA, 2001.

Country Report France

Including case examples on:

Information

- Information campaign (2001)
- Local energy information centres (Espaces Info Energie, EIE
- Audits ("Aides a la decision")

Bruno Lapillonne, Enerdata and
Didier Bosseboeuf, Ademe
2005

1. Introduction

Energy efficiency has been an important component of the French energy policy since the mid 70', immediately after the first shock when an energy saving agency was set up and a first energy conservation programme designed. Since then, this agency has been transformed several times and different energy efficiency programmes have been implemented.

This report describes the energy efficiency policy and measures in France and its system of evaluation. It will first review the national system of energy efficiency policies as it is now, and its historical evolution since the creation of ADEME: who is doing what, which are the public budgets involved in the energy efficiency policy (Chapter 2)?. It will then present the national system for evaluation, monitoring and data collections (Chapter 3). This chapter will present the main evaluations carried out since 1990. This will be followed by three selected evaluation case studies for recent policy measures. The case studies considered are the following:

- A public information campaign (2001)
- Audits schemes
- Local energy information centres

2. National system of Energy Efficiency Policy Measures

The responsibility for the designing of the energy efficiency policy is shared by two Ministries: The Ministry of Economy , Finance and Industry (MINEFI) and the Ministry of Ecology and Sustainable Development (MEDD). They rely mainly on the national efficiency agency ADEME for its implementation.

In the Ministry of Economy (MINEFI), the Directorate in charge of energy is DGEMP ("Délégation Générale à l'Energie et aux Matières Premières"), and the technical responsibility for energy efficiency matters is within a sub-division called "Demande et Maîtrise de l' Energie". In the Ministry of Ecology (MEDD), the department concerned is DPPR.

ADEME is the result of the merger in 1992 of three national agencies : AFME, "Agence Française pour la Maîtrise de l'Energie (AFME)", AQA,"Agence pour la Qualité de l'Air" (Agency for Air Quality), and ANRED, the Agency for waste management. At that time, environmental considerations were joined to energy efficiency preoccupations in the institutional arrangements. AFME was created in 1982 as the successor of "Agence des Economies d'Energie (AEE)" set up in the mid 70', i.e. immediately after the first oil shock of 1973/1974.

ADEME is since its creation under the responsibility of three Ministries that are respectively in charge of Economy (MINEFI), Environment (MEDD) and Research, from which it receives budget allocations. Therefore, apart from energy efficiency activities, a significant part of the ADEME budget is for research activities, and another one for environment activities, mainly waste management and air pollution control. ADEME relies on 22 regional branches to implement its programs. The staff of ADEME dealing with energy efficiency and renewables is around 250, out of a total of 850.

The budget of ADEME is split in two parts: one for its own operation, the other one for the measures implemented and the studies and research activities that are supported. Financial resources come from budget allocations and taxes on waste. ADEME get also some minor additional funds from its expertise, through contracts with private enterprises or international institutions.

The budget of ADEME and its predecessors (AFME and AEE) allocated to energy efficiency and renewables has fluctuated a lot depending on the government policy and the price of oil on the international market: high budget between 1982 and 1985; sharp reduction after 1986; increase since 1999. It has increased by a factor 6 since 1990 but is almost stable since 2000 (around 90 M€ / year between 2000 and 2003). The budget dedicated to renewables continue growing and represented about 2/3 of the total in 2003 (**Table 1**).

Table 1: Budget of ADEME dedicated to energy efficiency and renewables[1]

10^6 Euros	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
total	**15.2**	**64.3**	**91.8**	**93.7**	**116**	**90**
of which						
- Industry			10.2	14		
- Buildings			11.6	11		
- DSM			6.1	6.6		
- Transport			13.1	15.9		
- Renewables			**44.5**	**39.8**	**84**	**64**
- Training, communication etc			6.3	6.4		

Source : ADEME

Although ADEME is the national body for the execution of the national energy efficiency policy, other Ministries and public bodies also take part in the national effort:

- The Ministry of Transport and Equipment is rather active in energy efficiency programmes dealing with buildings on the one hand, with transport on the other hand.
- Some regional and local authorities have also their own energy efficiency agencies[2].
- Housing agencies (e.g. ANAH) that support investment in energy efficiency in certain types of dwellings

A new energy law, proposed by the government in June 2004 and to be voted by the Parliament early 2005, and a new Climate Plan adopted in July 2004, are now the main driving forces of the policy measures in the field of energy efficiency and climate change. In 2000, a National Programme on Energy Efficiency Enhancement was adopted by the Parliament. All these programmes include or complement the EU Directives in the field of energy efficiency, of renewables and climate change.

[1] Authorized programme

[2] There are presently 6 regional agencies depending on regional administrations (eg RhoneAlpes Energie Environnement, ARENE) and 13 local agencies at the level of cities or urban agglomerations.

- **The new Energy Law**

The objectives and the main orientations of the energy law in the field of energy efficiency and climate changes are the following:

- To encourage energy efficiency with the objective to reduce the energy intensity by 2% per year until 2015
- to preserve the environment, with the objective to divide by 4 the emissions of greenhouse gases in 2050.
- to diversify the energy sources by promoting renewables (21% of the gross electricity consumption supplied from renewables in 2010[1])

Within the new Energy Law, it is planned to have mandatory energy savings for energy utilities and some selected other stakeholders with a market of "white certificates", such as in Italy.

- **The Climate Plan**

The new Climate Plan reinforces the National Programme against Climate Change of January 2000 (known as "PNLCC"). It proposes additional measures to complement and/or replace the measures of the 2000 programme[2]. Its objective is to bring down the emissions of greenhouses gases in 2010 to their 1990 level, as allocated for France in the Kyoto Protocole; without these additional measures, the emissions would be 10% above the 1990 level.

Through these additional measures, the Climate Plan identified a potential of reduction of greenhouse gases of 72.3 MtCO2 in 2010 compared to a reference scenario[3].

- **The National Program on Energy Efficiency Enhancement**

The National Program on Energy Efficiency Enhancement includes the following measures:

- Creation by ADEME, in partnership with local or regional authorities, of local energy information centres through the whole country to inform households and small companies on energy efficiency (around 155 local info centres created from 2001 to 2003) (see case study)
- Support to audits so as to assist consumers, in all sectors, in their investments decision for energy efficiency and renewables (see case study)
- Creation by ADEME of two new funds for energy efficiency development in industry, mainly targeted to SME's (FIDEME : investment fund for energy efficiency) and FOGIME (guarantee fund)[4]
- Financial support to demonstration and pilot projects to accelerate the penetration of new technologies or process into the market,

[1] French commitment in the EU Directive on renewables of September 2001

[2] For instance the tax planned for large industries (known as TGAP) has not been implemented

[3]Reduction of 16.3 MteCO2 in transport, 11.7 MtCO2 in buildings, 10.8 MteCO2 in industry, 16.8 MteCO2 in the energy sector and 5.9 MteCO2 for agriculture and waste

[4] The FOGIME fund relies on subordinated bonds from companies in rapid development, providing quasi-capital. The fund is managed by ADEME with ABN AMRO and CDC (Caisse des Dépôts et Consignation). The loan rate is much lower than the capital risk market value

- Support to clean vehicles and to transport management and modal shift (urban transport plans, road/rail combined transport)[1]
- Revised thermal standards for new building code; the regulation was already reinforced in June 2001 both for housing and the tertiary sectors (respectively 15 and 40% savings compared to the previous regulation). The code will be reinforced every 5 years with the new regulations tested through various labels of performance[2].
- Promotion of renewables (wind energy, small hydro, biomass, solar thermal and PV).
- General public information (a large information campaign has been launched to promote energy efficiency in 2001 with a famous French actor) (see case study).

The National Program on Energy Efficiency Enhancement led in particular to the signature of a 6 years agreement between the government and ADEME ("Contrat de Plan Etat – ADEME", known as "CPEA 2000-2006"). This agreement provides a framework for the actions of ADEME in the field of energy efficiency, with concrete and quantitative objectives conditioned to the allocation of the necessary financial means by the government. This created in particular a need for an official evaluation of the impacts of the actions undertaken by ADEME.

3. System for evaluating, monitoring and data collection on energy policies and measures and relevant scenarios

Evaluations of energy efficiency measures and programmes are carried out in different ways in France.

- First of all, there exist in depth ex post evaluations of specific measures that are usually done only once for a certain occasion; in that category can also be included the comprehensive evaluation carried out in 1997 of all energy efficiency activities undertaken between 1973 and 1993 **(Table 2**).
- A second type of evaluations is carried out on a yearly basis as a regular activity and aims at providing an overview of the general trends in energy efficiency in the country (**Table 3**); in that category, is included a yearly survey of French households, that monitor in particular their expenditures and actions in energy efficiency, as well as a quantitative assessment of energy savings by sector and end-uses, though indicators. This evaluation of energy savings rely on a regular compilation of data on unit energy consumption at a detailed level (by type of vehicles for transport, by end-use and sub-sector for households and services and by industrial branch and process in industry) (**Table 4**)
- Another yearly monitoring is done internally to ADEME, by its evaluation division, to follow the impact of all the measures undertaken by ADEME[3].
- Finally, ex- ante evaluations try to estimate, through modelling and/or expert assessment, the impact in the future of existing and/or new measures (**Table 5**).

[1] Other partners, mainly the Ministries of Transport and Research are also supporting these actions sometimes with a level of support rather big compared to ADEME funding

[2] Label HPE, VHPE "High and Very High-Energy Performance»).

[3] This evaluation is summarised every year so as to monitor the status of implementation of the CPEA (contract between ADEME and the government). It relies on a detailed data base (Lisa), that compiles for all actions supported by ADEME information on the costs and potential impact, in terms of energy and CO2 savings.

All these evaluations have been most often external evaluations (to ADEME) carried out by consultants, except the internal evaluation of ADEME actions, within the monitoring of the CPEA.

A a new law will make mandatory from 2006 an evaluation of public programmes (LOLF[1]). It is in particular required to define quantitative objectives, indicators of performance and target to be reached. Within LOLF, a systematic evaluations of energy and climate change programme is being prepared by the Ministry of Ecology (MEDD)°; the MEDD intends to start its implementation in 2005.

Table 2. Ex post in-depth evaluations of French energy efficiency programmes and measures

Programme or measures evaluated	Year	Evaluators	Reference
National energy efficiency policy and measures 1973-1993	1997	Official evaluation supported by various organisations and experts with a rapporteur	CIME[2] study (F)
Public information campaign	2002		
Audits scheme 2000-2001	2003	Gallileo Business Consulting	
Local information centres 2001-2003	2004	IDE Environnement	

Notes : (F) only available in French.

Table 3. Yearly ex post evaluations of energy efficiency trends in France

Topic evaluated	Evaluators[3]	First year	Reference
Energy/ CO2 saving by end-use/ sector	ADEME/ Enerdata	1986	Datamed [4](F)
Energy/ CO2 trends by end-use/ sector	ADEME	1992	Odyssee[5]
Energy savings in industry	ADEME/CEREN		(F)[6]
Household behaviour and investments in energy efficiency	ADEME/ Sofres	1986	(F)[7]
Indicators of monitoring of the French Programme on Climate Change of 2000	ADEME/MIES/ Enerdata	2001	

Notes : (F) only available in French

[1] Loi Organique relative aux Lois de Finances

[2] CIME ("Comité interministériel de l'évaluation ») (Committee between several ministries) « La maîtrise de l'énergie ; Rapport d'évaluation ». La Documentation Francaise, Paris : 1998

[3] The name of the consultant shown corresponds to the company that has carried the evaluation in the past years. This service is now tendered every year.

[4] Les économies d'énergie en France en 2003, ADEME/ Enerdata, Novembre 2004

[5] Report published very year on the web site of the project at www.odyssee-indicators.org (in English)

[6] CEREN « Effets explicatifs des évolutions de consommations d'énergie dans l'industrie

[7] Some results are published by ADEME in " Les chiffres clés du bâtiment- Energie et Environnement" (last edition 2003)

Table 4. Yearly monitoring of unit energy consumption in France

Sector/end-use	Evaluators[1]	First year	Reference
Households	CEREN	1980's	(F) [2]
Industry	CEREN	1980's	(F) [3]
Services	CEREN	1986	(F) [4]
Road transport modes	INSEE/ SAS	1986	(F) [5]
Cars	Secodip	1986	(F)
New cars	UTAC/ADEME	1980's	(F)

Notes : (F) only available in French

Table 5. Ex- ante evaluations of the impact of energy efficiency measures in France

Name of the study (year)	Organisation	Consultant	Target year	Reference
Third Communication	ADEME/MIES	Enerdata	2010/20	[6]
Climate Plan 2004	MEDD		2010	[7]

4. Method on evaluating energy efficiency programmes (1995 onwards); short overview for programmes

4.1. Methods used

The methods used in the evaluations vary with the type of evaluations considered. They rely on surveys, modelling and compilation of data and indicators.

I**n depth ex post evaluations**

The first type of evaluation, the in depth ex post evaluations, relies mainly on sample surveys of consumers (or more generally of actors targeted by the programme, with collection of data and possibly qualitative interviews. The impact of the programme is then assessed in different terms:

- What number of the targeted consumers has reacted to the measure (e.g. number of audits done for an audit scheme, number of contacts for local information centres)?

[1] The name of the consultant shown corresponds to the company that has carried the evaluation in the past years. This service is now tendered every year. This studies are usually sponsored by other organisations than ADEME (e.g. energy utilities).

[2] " Suivi du parc et des consommations dans le secteur résidentiel (restricted document) ; some results are available every two years in a publication of Observatoire de l'Energie " Tableaux des consommations d'énergie en France »

[3] Profit et performances énergétiques de l'industrie ; (restricted document) ; some results are available in " Tableaux des consommations d'énergie en France »

[4] Suivi du parc et des consommations dans le secteur tertiaire (restricted document) ; some results are available in " Tableaux des consommations d'énergie en France »

[5] INSEE : Comptes des transports en France

[6] MIES, Third National Communication under the UNFCC, Paris, 2001,200p

[7] Climate Plan : available in English at www.ecologie.gouv.fr/IMG/pdf/PLANCLIMATANGLAIS.pdf

- What fractions of the consumers that have reacted to the measure have really implemented an action (e.g. change of behaviour, immediate investment, intention to invest in the coming years)?

- What is the profile and characteristics of the consumers that have reacted (eg owner of their dwelling, high income)

- What type of action? (e.g. use of renewable, change of equipment…)

- What was the average cost of the investment done by the consumer?

- What is the leverage action of the public funds spent (ratio between the investment and the public cost or subsidy)?

- What were the resulting savings in terms of energy and CO2?.

Three case studies, corresponding to recent evaluations, are presented separately:
- Public information campaign of 2001
- Audits scheme 2000-2001
- Local information centres 2001-2003

In the same category of in depth ex post evaluations it is worth mentioning the official evaluation of all energy efficiency programmes and measures implemented in France between 1973 and 1995. Although, it is now old, it represents a rare example of comprehensive evaluation of the public effort of a country in the field of energy efficiency. This evaluation, known as the ""CIME" study (see Table 2), was carried out by close to 100 experts from about 25 organisations, gathered into working groups. It relied on about 20 separate studies, most of them specially undertaken for that evaluation that were synthesised in one overall report. One of the output of this evaluation was to measure the real public budget for energy efficiency, including the budget of the energy efficiency agencies, but also all the other expenditures, namely the budget spent by housing agencies and the cost for the public budget of the tax credit or tax deductions. It turned out that the total public expenditure for energy efficiency over the period 1974-1993 was 10.4 billions Euros[1], or 0.6 billions €/year. This represented on average 1% of the "energy bill "of the country (the value of the energy imports). About 40% was spent by the national energy efficiency agency. This last result was quite surprising and indicates that it may be misleading to only account the budget of the national agency to evaluate the total public expenditure of a country in energy efficiency.

Yearly evaluation of energy efficiency / CO2 trends

Most of the evaluations carried out on a yearly basis rely on indicators. Three types of indicators are considered:
- Indicators of energy/CO2 savings measured in ktoe or ktCO2
- Ratios of energy intensities or unit consumption that relate an energy consumption to an indicator of activity, either measured in monetary terms (energy intensity, for instance in toe/ M€)) or in physical terms (unit consumption, for instance consumption per car, per dwelling, per m2)
- Indicators of diffusion on the market of energy efficient technologies and equipment

[1] In Euro of 2003

The ODYSSEE project[1] favours the second approach. It now also includes indicators of diffusion.

The evaluation made by CEREN or by ADEME / ENERDATA with Datamed provides evaluation in terms of savings. In that case the approach followed consists in a decomposition of the variation of the energy consumption at a detailed level (e.g. end-use, type of vehicle) into two components or "effects"[2]: a "quantity effect" that reflects the variation of the consumption related to the change in the activity levels and a second effect, called "unit consumption effect" (or unit emission effect for CO2), that measures the impact of variations in unit energy consumption (or unit emission) on the energy consumption or CO2 emissions. The unit consumption effect is then assimilated to energy savings and the unit emission effect to CO2 savings.

The evaluation of the French Programme on Climate Change of 2000 ("PNLCC3) used indicators of diffusion, to monitor the impact of policy measures and indicators of CO2 savings to evaluate the impact of package of measures[3].

Ex-ante evaluation of the impact of energy efficiency measures

One study has been carried out in 2001 in the framework of the Third Communication of France to the UNFCC using the MEDEE model (see Table 5). It measured the impact of different scenarios, differentiated by the measures considered: with no measure, with the existing measures, and with additional measures. The " no measure case" was considered as a benchmark or a reference to measure the CO2 savings. Measures were not evaluated individually but were grouped into packages acting on the same target (eg all measures concerning new dwellings were evaluated together). Following that study, an official methodological analysis was carried out within the Planning Commission ("Commissariat Général du Plan") on how to evaluate the impact of policy measures in the field of climate change and energy efficiency[4].

4.2. Baseline (ex-ante evaluation) and relation with national scenario/model

Ex ante evaluation is generally used in forecasting exercises that model the change in energy demand in the future (2010, 2020) brought about by different scenarios of policy measures. These studies are by nature carried out at a high level of aggregation and cannot deal with detailed measures. As explained previously, they usually consider package of measures.

[1] The ODYSSEE project gathers all the EU-15 energy efficiency agencies with the support of the SAVE programme of the European Commission. Its main objective is to monitor in a comparative basis energy efficiency trends in EU countries,

[2] This methodology is usually referred to as the method of the "technico-economic effects"

[3] All measures acting on the same target (eg end-use, type of vehicle, industrial sector) were grouped together with an indicator of CO2 savings identified to measure the impacts on the emissions.

[4] P N Giraud (rapporteur), Effet de serre : modélisation et économie publique, Commissariat Général du Plan, 2002

For individual policy measures, some ex ante evaluation is sometimes provided. It is usually based on expert estimates and very seldom on detailed models or tools (e.g. "PNLCC") [1].

Baselines are usually considered in association to a model (eg MEDEE or MURE). The baseline considers either a situation in which is assumed that no measure has been implemented ("no measure case" or "frozen efficiency case"), or case that only takes into account the existing measures. With a model, it is indeed easy to adapt the definition of the baseline to the exact needs of the study.

4.3. Ex-post evaluation

Most evaluations in France have been ex post evaluations. Most of these evaluations have been carried out at a rather aggregate level through indicators, as explained above. With such an approach, it is not possible to measure the impact of individual programmes. Indeed, what is measured, through the changes in the indicators, is the resultant of the impact of several factors: the autonomous technical progress, changes in energy prices and the role of other programmes.

Only a few ex post evaluations of individual programmes exist in France. In general, they have been developed in the middle of the programme activity or at the end and not at the same time as the development of the programme.

4.4 use of indicators

The use of indicators for energy efficiency evaluations is a long tradition in France. It started in the mid eighties at ADEME with Datamed (see Table 3). As explained above, this does not really allow evaluating energy efficiency programmes but rather it contributes to measure the overall energy efficiency progress resulting from many different factors.

New indicators try to monitor the diffusion on the market of efficient equipment and technologies that are promoted through specific programmes (eg sales of label A or A+ cold appliances, of condensing boilers or of equipment using renewables[2]); this is another complementary way to evaluate the impact of programmes, with again the difficulty that part of the diffusion may not be attributed to the programmes.

4.5. Calculations on GHG emission impact for evaluated programs

A calculation of CO2 emissions is systematic in all the evaluations since the mid nineties, either in the indicators (indicators of CO2 avoided or saved), or in the in depth ex post evaluations. This is probably due to the fact that ADEME is also an agency in charge of environmental issues, and climate change in particular.

[1] Some evaluations have however been carried out at ADEME with the MURE model to simulate the impact of measures in the household sector and for cars.

[2] For instance, sales of wood boiler or solar water heaters

5. Method used for selected evaluated EE policy measures, case examples

5.1. Case for category Regulation:

No case example enclosed

5.2. Case for category Information:

Information campaign (2001)
Local energy information centres (Espaces Info Energie, EIE)
Audits ("Aides a la decision")

1. Program description

A. Name of the programme: Information campaign[1] (2001)

B. Sponsoring agency: ADEME

C. Objectives: Improve knowledge and stimulate energy efficiency.
Targeted market actors : general public above 25 years (target population of 38 M poeple). No quantitative goals available.

D. Program activities: campaign in the medias (TV, radio and press) with the message "preserve your money, preserve your planet"[2].

E. Development and operation: The programme was implemented over 4 months in 2001.

F. Administration: information activities financed and administrated by ADEME with a budget of 6 M€, of which 3.5 M€ for the campaign itself in the medias and 0.9M€ for the follow-up and the rest for accompanying measures (in particular in the local information centres)

Evaluation objectives, activities, results

A. Evaluation objectives:

The objective of the evaluations was to measure the impact of the campaign in terms of number of people that have been aware of the campaign and have understood its message. As for such a measure, the impact is not immediate and it is not possible to assess an impact in terms of energy savings.

B. Evaluation activities:

The programme in general was evaluated in 2002, using the usual method for measuring the impact of advertisement campaigns.

[1] Also known as Luchini campaign from the name of a famous French actor that appeared in the TV spot

[2] Another communication action was associated to this general campaign in association with a large retailing company ("Centres Leclerc"), in which leaflets were distributed and compact fluorescent lamps sold at a discounted price.

C. Principal results:

The evaluation revealed that 86% of the target population was reached at least once[1] , with an average rate of 3 contacts (or "exposures" to the message). The total number of contacts was estimated at 157 M. During the campaign, about 300 falls out in the medias have been counted, with most of them dealing with solutions (at 70%) and pointing out the double benefit of improving energy efficiency (ie decrease of the consumer bill and improvement of the environment) (2/3).

In addition, 84% of the people have considered the message as important[2] and 76% as credible.

The campaign generated a very significant increase of questions asked on the special call centre of ADEME[3]: with peaks up to 840 calls per week during the spot campaign on radio and TV compared to 100 in a normal week. For the month of October and November 2001 in which the TV and radios campaign took place, the number of calls reached 1850 per month compared to 500 in the previous months. In these calls, the number of questions related to energy efficiency and renewables were evenly distributed, revealing an equal interest for both solutions (respectively 46 and 48%). The majority of the calls came from individuals (at 96%), the rest coming from professionals. The TV, the national and regional newspapers and magazines contributed equally to generate these phone calls (respectively 28% for TV, 29% for the national press and 26% for the local press).

2. Program description

A. **Name of the programme**: Local energy information centres (Espaces Info Energie, EIE)

B. **Sponsoring agency**: ADEME and regional authorities

B. **Objectives**: To increase the awareness of households and assist them in their investment decisions in energy efficiency and renewables, ADEME has decided in 2000, in the framework of the PNAEE[4], to create local energy information centres. Targeted market actors are mainly the general public (households). No quantitative goals available.

D. **Program activities**: From 2001 to 2003, 160 local info centres with a total of 260 advisers (1.6 advisers per centre)[5] have been created by ADEME. These info centres provide advice to households, buildings professionals, companies and organizations, such as administrations,

[1] The percentage of the target population reached by more than once (i.e. more than 1 contact) is as follows: 2 contacts 77%, 3 contacts 68%, 4 contacts 60%, 5 contacts 54%, 6 contacts 48%, 7 contacts 43%, 87 contacts 39%, 9 contacts 36% and 10 contacts 32%

[2] The general message was "preserve your money, preserve your planet". The spots pointed out that half of the emissions and energy consumption is from individuals.

[3] This call centre enable any persons to ask question to advisers related to energy efficiency or environmental issues (cost of a local call)

[4] PNAEE: Programme National d'Amélioration de l'Efficacité Energétique (National programme for Energy Efficicncy)

[5] Numbers at the beginning of 2004 in equivalent fulltime

education, and associations. The local centres also organize different events to inform the local population.

E. **Development and operation**: The programme started in 2001. An in depth evaluation was carried out in 2004; a yearly follow-up of the programme activities is carried out annually by ADEME (number of contacts).

F. **Administration**: These centres are co financed by ADEME and local authorities (respectively 33/ 66%) and are set up for a period of 3 years. The overall budget is 15 M €/year (5 M€/year for ADEME).

Evaluation objectives, activities, results

A. Evaluation objectives:

The programme was evaluated by IDE Environment for ADEME in 2003[1] This evaluation covered a sample of 16 of the 150 Energy Information Centres (EIE) that were in activity at the moment of the evaluation

The objectives of the evaluation were the following:

- Evaluate the level of satisfaction of the consumers[2]
- Identify the impacts of the information received, in terms of actions undertaken, changes of behaviour and energy/ CO2 savings;
- Propose to ADEME a methodology of evaluation to be applied directly by the regional branches of ADEME, that supervise the EIE

In the course of the study, the evaluation was extended to assess the economic impacts of the actions in terms of amount of money spent by the consumers.

B. Evaluation activities:

To identify the sample to be surveyed in detail, a questionnaire was sent to the 150 centres. The rate of response was 85% (128 out of 150)

A classification of the EIE was then done on the basis of various criteria: profile of activity (type of consumers, area of activity), duration of activity, human resources…. From the classification, a sample of 16 EIE was selected as representative of the activity of all the centres.

The evaluation relied on different types of information:

- Data from a database that compiles information on the characteristics of the contacts received (10 810 contacts for the 16 centres since there creation).
- A qualitative evaluation through 15 individual interviews
- Two quantitative surveys: a first one by telephone with 644 consumers[1] and a second one on part of these consumers to evaluate the economic and environmental impacts (among those who had implemented an action).

[1] ADEME/ IDE Environnement: Première synthèse de l'activité de conseil des Espaces Info=>Energie, January 2004

[2] Consumers will refer here to the persons that contacted the information centres.

C. Principal results:

Since 2001, the local centres have received 80 000 contacts (of which 84% from households, 9% from organizations, 4% from buildings professionals). 70% of the demand concern buildings, 28% environment, 2% transport.

About 60% of the contacts are made by telephone, 30% by a visit to the centre and 10% by e-mail.

The dominant characteristics of a person who contacts an information centre are:

- he owns his dwelling (73%), he lives in an independent house (73%) in a rural area (67%)
- the average floor area of the dwelling is between 100 and 150 m2 (45%).

The most frequent questions concern projects related to the improvement in dwellings (41%), then new dwellings (29%), and finally the retrofitting[2] of dwellings (23%).

The demands addressed to the info centres by the different types of consumers or actors are quite different. For households, they concern mainly space heating and water heating (respectively at 63 and 60%), then energy management (25%), insulation (20%), lighting (10%) and electrical appliances (7%). For organisations, heating still arrives first but concerns only half of the demand. It is followed by the use of renewables in public buildings and infrastructures (49%) and environment (33%). For building professionals, heating and water heating are concerned by about half of the demands (53% and 50% respectively), followed by energy management in dwellings (22%), use of solar energy (18%), subsidies (13%) and insulation (12%).

After consulting the information centres, 26% of the households have decided to invest[3]; the percent of consumers implementing an action is 18% for organizations and 20% for buildings professionals.

In general 88% of all the decisions of actions related to heavy investments, with the following distribution: change of heating systems (34%), solar water heating (12%), insulation (17%), additional heating (7%), renewal of boiler (5%), solar heating (2%) and, finally, photovoltaic (1%). The lighter actions, that represented the remaining 12% of all actions undertaken, related to regulation systems for heating (5%), compact fluorescent lamps (3%), boiler maintenance (3%) and regulator for hot water (1%).

The actions, which have been implemented by the 26% of households who have invested, are the following:

	%
Installation of a new heating system	33%
Installation of a solar water heater	24%
Insulation	17%
Additional heating	8%

[1] 503 among households, 95 in organisations, 56 with professionals from the building sector

[2] By retrofitting of dwellings is meant here large investments to improve the insulation of dwellings

[3] 25% intend to search for additional information, 17% want to wait, 14% have decided to do nothing.

A new system of regulation for heating	5%
Installation of a new boiler	4%
Maintenance of the boiler	3%

The **average expenditure** for households was **7650 €/action** or **9130 €/household** (about 1.9 actions per household). By extrapolating this distribution to all the contacts received by the EIE between 2001 and May 2003 (66 300), the total investment generated by the local centres can be estimated at 110 M €, or 730 000 € by adviser[1].

The reduction of CO2 emissions is around 1.1 tons per action for households, or 1.3 tCO2 per households that made investments. This implies a total CO2 savings of about 17 ktCO2.

Conclusions

For households, the existence of the information centre has been a key element in the decision to undertake an action in 70% of the case. For the other consumers, it is around 50%.

The evaluators have pointed out several aspects in the conclusion of the study that are worth mentioning:

- There are few questions on transport issues;
- There is a need to widen the population that contacts the centres so as to increase the diffusion of the information; this could mean to have local actions of communications through local institutional networks and in local medias
- The level of satisfaction of the consumers was quite good: about half of households were very satisfied and 40% well satisfied[2].

3. Program description

A. Name of the programme: Audits ("Aides a la decision")

B. Sponsoring agency: ADEME

C. Objectives: Assist consumers though audits or studies to make decisions for investments in energy efficiency or renewables. Targeted market actors: all actors in all sectors, with a stronger focus on buildings and industry. Quantitative goals: 700 audits in industry, 35 000 buildings audited over the period 2000-2006.

D. Program activities: provision of grants for audits and light studies. In industry, financial support by ADEME is 70% for a light audit (for a cost below 2300 euros), 50% for a detailed audit or in-dept feasibility studies (for costs below 30 000 € and 75 000 € respectively).

E. Development and operation: The programme started in 1999 and will last until 2006. A yearly follow up of the number of audits and budget spent is carried out. From 2000 to 2003, ADEME has subsidised 2309 audits in industry (of which 514 in 2003) and 30 373 in buildings

[1] With the hypothesis of 26% of contacts investing following the consultation

[2] Among the reasons for being not satisfied, the most frequently mentioned were the pertinence of the answer, its comprehensiveness, and its practical aspects

(or equivalent buildings); in 2003, the budget spent was 1.7 M€ in industry and 6.1 M€ in buildings.

F. Administration: grants financed and administered by ADEME, Budget: 8.7 M€/ year (average 2002 and 2003)

Evaluation objectives, activities, results

A. Evaluation objectives:

Three objectives were put forward in the evaluation:

- Determine the percentage of actions that were recommended in the audits that were effectively implemented by the consumers;
- Evaluate the environmental impact of the audits;
- Set up a qualitative assessment of the degree of satisfaction of the beneficiaries of the audit scheme.

B. Evaluation activities:

«Gallileo Business Consulting» has carried out the evaluation for ADEME in 2003[1]. The evaluation covered the audits subsidised in buildings and in industry in 2000-2001. The evaluation was broader than just energy and included wastes and pollution. The results presented below focus on the actions related to Rational Use of Energy (RUE) in buildings and industry and to renewables.

ADEME classified the audits in 3 categories, corresponding to different rates of subsidies: light audits ("Etude simplifiée"), detailed audits (« Diagnostic ») and feasibility studies.

This evaluation covered a total of 573 audits, of which 237 for RUE in buildings (of which 159 light audits, 54 detailed audits and 24 feasibility studies), 170 audits for RUE in industry (of which 99 light audits, 51 detailed audits and 20 feasibility studies) and 68 audits on renewables (mainly wood) (of which 40 light audits and 28 feasibility studies).

The evaluation was made by telephone interviews.

C. Principal results:

The results are described in detail for RUE in buildings and RUE in industry. The number of audits for renewables was too low and was not analysed in detail in the evaluation[2].

- **RUE in buildings**

The audits in building concerned covered 237 cases, corresponding to 99 beneficiaries and a total of 679 buildings (or equivalent buildings). The majority of these audits concerned the service sector: local authorities (59%), service (31%), dwellings and associations (10%).

[1] ADEME and Gallileo Business Consulting, Evaluation de l'impact des études d'aie à la décision subventionnées par l' ADEME en 2000 et 2001, juin 2003.

[2] The rate of implementation of the recommended actions was only 39% for renewables

According to the evaluation, about 2/3 of the audits were triggered by the existence of the subsidy: 74% for "light audits", 40% for detailed audits, 36% for feasibility study.

Among the 513 recommendations made in the audits, 336 (65%) implied an investment, of which 257 (50%) with an investment above 1.5 k€.

About 55% of the audits resulted in the implementation of some of the recommended actions. This rate of implementation varies from 52 and 53% for detailed and light audits to 71% for feasibility studies. In addition, in 21% of the audited buildings the implementation of actions was planned (of which 76% by the end of 2004), which may eventually raise the rate of success of the audit scheme to 71%. Among the 513 recommended actions, only 36% were actually undertaken, as in some cases alternative measures may have been proposed or not all suggested actions were selected.

About ¾ of the implemented actions implied an investment (141 investments), which means that 25% of the measures had no cost. Among the recommended investments, 36% have been implemented; the rate of implementation is lower for investments above 1.5k€ (28%).

Among the 141 investments done, 49% of them cost less than 1.5 k€, 23% concerned investments between 1.5 k€ and 7 k€, 13% between 7 and 15 k€, 7% between 15 and 30 k€, 9% more than 30 k€. **The average investment costs was 8 900 €. The average pay back time is 3.2 years.**

The average consumption gain due to investments is around 23%. The average **energy saving is 1.2 MWh/ building or 0.1 toe** (30% of the energy saved concern thermal energies (23% gas, 7% fuel) and 70% electricity)

The reduction of CO2 emissions is **0.19 tCO2/ building**.

- **RUE in industry**

The evaluation considered 170 audits in industry, of which 99 light audits", 51 detailed audits and 20 for feasibility studies.

In industry, the audits resulted in 498 recommendations of actions (average of 3 actions per audit).

Among the 170 audits surveyed, **78% of them led to an investment.**

Among the 498 recommended actions, 56% were actually undertaken, as in some cases alternative measures may have been proposed or not all suggested actions were selected. About 37% of the implemented actions implied an investment (103 investments among 279), which means that a large part of the measures had no cost.

Among the investments done, 29% of them cost less than 1.5 k€, 28% concerned investments between 1.5 k€ and 7 k€, 19% between 7 and 15 k€, 10% between 15 and 38 k€, 5% between 38 and 76 k€, 9% more than 76 k€. **The average investment costs was 36 000€. The average pay back time is 2.45 years.**

The average energy saving is 285 MWh/company or 24 toe (15% of the energy saved concern thermal energies (9% gas, 6% fuel) and 85% electricity)

The reduction of CO2 emissions is 16.5 t/ company. The total savings can be estimated at 30 kt CO2 over the period 2000-2003 (400 GWh of electricity and 6.5 ktoe of fuels).

Conclusions

The qualitative evaluation of the audits schemes revealed that the implication of an agency, such as ADEME, is an important component of success, as it is considered as a neutral body: the consumers have more confidence than if they have to rely exclusively on consulting companies. The intervention of ADEME to provide technical advice as well technical guidelines was considered as a very positive factor that has increased the rate of reaction of consumers.

Among the factors that explain the absence of reaction of the consumers, the investment cost and high payback time rank among the first.

Consumers that have asked for an audit have a higher rate of reaction (in terms of implementation of the recommended actions) than the consumers that have received an external proposal to make an audit (81% against 60%, or a rate 21% higher).

Two third of the consumers have tried to check ex post the reality of the energy savings compared to the savings estimated ex-ante in the audit. In half of the cases, the savings were correctly evaluated; they were however overestimated in the other half. The conformity of the real savings to the ex-ante estimations was better for the detailed audits and feasibility studies than for the lights audits (respectively in 60%, 53% and 43% of the cases).

The implementation of the audit was felt by 72% of the respondents as having a positive impact on the awareness of the company or organisation to energy efficiency issues.

6. Relations with international work (IEA, EU, UNFCCC)

Energy efficiency in France (annual); analysis based on the ODYSSEE Data Base from the SAVE Project ”Cross-country comparison on energy efficiency indicators.

7. Sources

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www.industrie.gouv.fr/energie/developp/econo/textes/mesures-ee.htm

DGEMP: Le programme national d'amélioration de l'efficacité énergétique
www.industrie.gouv.fr/energie/renou/textes/se_pnee.htm

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"Energy efficiency trends in France Report published very year on the web site of the project at www.odyssee-indicators.org (in English)

CEREN « Effets explicatifs des évolutions de consommations d'énergie dans l'industrie

ADEME : " Les chiffres clés du bâtiment- Energie et Environnement" (last edition 2003)

CEREN : " Suivi du parc et des consommations dans le secteur résidentiel

Observatoire de l'Energie " Tableaux des consommations d'énergie en France »

CEREN : Profit et performances énergétiques de l'industrie ;

CEREN : Suivi du parc et des consommations dans le secteur tertiaire

INSEE : Comptes des transports en France

Ex- ante evaluations of the impact of energy efficiency measures in France

MIES, Third National Communication under the UNFCC, Paris, 2001, 200p

MURE case studies at www.mure2.com

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Including case examples on:

Economic

- EE certificates
- Criteria adopted for the evaluation of primary energy savings in end-uses

Ornella Celi
Walter Grattieri
CESI
2004

Country Report Republic of Korea

Including case examples on:

Information	• Energy audits in industry
	• Energy audits in buildings
Economic	• Financial incentives for DSM
Voluntary Agreements	• Voluntary Agreements

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April 2004

1. Introduction

This is a draft of country report of Korea dealing with a summary on Korean energy efficiency policies and programmes. Since the oil crises of the 1970s, the security of energy supply and stabilisation of energy prices have been main concerns in energy policies of Korea. In its 2000 Blueprint, the MOCIE (Ministry of Commerce, Industry and Energy) said that it aimed at "implementing policies to harmonise energy, economy and environment", at a time when "the nation needs to improve energy efficiency while securing a stable supply of energy resources, thereby establishing a solid economic foundation to buffer changes in international energy market prices". The objectives of energy policies in Korea have focused on the followings: (1) maintain a stable energy supply by increasing oil stocks, raising emergency preparedness, and expanding energy infrastructure in a timely manner, through LNG and nuclear energy; and promoting energy co-operation with the countries in the Northeast Asia sub-region; (2) strengthen market mechanisms by privatising public utilities; (3) establish environmentally friendly energy systems by reforming tax system, inducing use of low-polluting energy, encouraging energy-efficient technologies, and developing new and renewable energy sources. In this country report, Chapter 2 describes major energy efficiency programmes and policies in Korea. Chapter 3 deals with the programmes for improving energy efficiency in Korea.

2. National system of energy efficiency policy measures

2.1 New Direction of Energy Efficiency Policies in Korea

The Korean government has changed existing energy efficiency policies into new one suitable to the new energy paradigm in the 21st century. Firstly, the Korean government has conducted policies to introduce competition in energy market into monopolistic system throughout reconstructing energy structure and liberalisation of energy markets. With these new trends in energy market, energy efficiency polices should also change with introducing market-oriented system into energy sector. Secondly, in order to reduce greenhouse gas emissions, the paradigm of energy policies has been shifted into energy savings and efficiency improvement in energy use, which would be more environment-friendly and effective energy efficiency policies.

2.2 Energy Efficiency Policies-Enhancement

The Rational Energy Utilisation Act, passed in December 1979 and amended several times thereafter, together with its Enforcement Ordinance enacted in November 2000, remains the legal basis for the government's energy efficiency policy. There has been no significant change in energy efficiency policies except the structure of Demand Side Management (DSM) process under restructuring electricity supply industry. The budget for DSM projects was provided by the Korea Electric Power Corporation until 2001. But now, it is provided by the Electricity Industry Fund collected from consumers' electricity surcharge since 2002.

The scope of Korean DSM programs focused on the utility-side load management and customer-side end-use energy efficiency. Load management programs are generally performed in electric power company to curtail peak demand by applying charges according to maximum demand during previous twelve months, seasonal pricing, discounts for repair adjustments and discounts for voluntary curtailment. Also, electric power company has developed DSM programs to shift peak demand such as, time-of-use rate, midnight power service, subsidies for the instalment of

ice storage cooling system, and discounts for requested load adjustment (see table 2.1). Current issues of DSM deal with the sustainable development of domestic energy efficiency and strategic reduction of greenhouse gas emission arising from the utilities' capacity instalment saving and load management. To expedite end-use energy efficiency, many programs that are energy inspections and audits, voluntary agreement, ESCO, energy efficiency standards and certifications, financial loans, and tax exemptions etc.[1], have developed to cope with the needs of end-users: industry sector, commercial and residential buildings.

Table 2.1. Types of Korean DSM Programmes, 2002

Type	Programme	Objective	Means	Acting Body
Load Management	Discount rate	Peak Clipping	Electricity Rate	KEPCO
	TOU rate	Valley Filling	Electricity Rate	KEPCO
	Midnight power service	Valley Filling	Electricity Rate	KEPCO
	Remote control for air conditioner	Peak Clipping	Subsidy	KEPCO
	Direct load control (prepared)	Peak Clipping	Subsidy	KEPCO, KEMCO
	Ice storage cooler	Peak Shifting	Subsidy, Tax exemption*	KEPCO, KEMCO*
	Vending machine	Peak Clipping	Subsidy, Tax exemption*	KEPCO, KEMCO*
Energy Efficiency	Lighting appliance	Strategic Conservation	Subsidy, Tax exemption*	KEPCO, KEMCO*
	ASD for motor	Strategic Conservation	Subsidy, Tax exemption*	KEPCO, KEMCO*
	Motor (prepared)	Strategic Conservation	Subsidy, Tax exemption	KEMCO

Note: All the programs are funded by the Ministry of Commerce, Industry and Energy (MOCIE).

For a valley filling, flatting the annual load curve, Time-of-Use (TOU) rate system has been applied since 1977. With the installation of electronic meters in 1994, customers with a demand of more than 5,000 kW have entered in the TOU rate structure and now customers more than 1,000 kW demand contract can become the participants. Along with the TOU rate, seasonal pricing has been applied to the industrial and commercial customers since 1990. Another valley filling program is the midnight power service that aims at increasing off-peak load by exploiting the advantage of low rates during midnight hours. The rate level for this option is about 25 percent compared with daytime rate. End-uses for midnight power service include the heat and hot-water storage appliances such as, boilers, hypocausts, floor heaters, space heaters, electric water heater, and electric heaters for tap water.

For peak shifting, ice storage cooling system has been encouraged since 1991. To shift the cooling loads from daytime to off-peak hours, subsidy has been given to the customers according to the capacity of installed ice storage cooling system. The objective systems are larger than 30 kW, and have storage rates of more than 40 percent. To further promotion[2], another subsidy has

[1] In Korea, these activities have been performed by KEMCO.

[2] Since 1992, new, rebuilt and expanded buildings have forced to install either ice storage cooler or gas absorption chiller according to their floor space by the standards for cooling facility in buildings.

been given to building designers who voluntarily adopt the ice storage cooling system since 1995.

Since the 1974 Arab oil embargo, energy conservation has aroused intensive interests through the world. Initially, energy conservation was generally defined as a reduction in energy use. The definition was later expanded to include improvements in energy efficiency or energy productivity.

The Korean government promulgated the Energy Utilisation Act and relevant legislation in 1979. It was established specially to promote rational use of energy resources, to improve energy efficiency of heat and equipment, and to contribute to the sound development of the national economy. More rapid growth in energy demand than in the economy during the second half of the 1980s prompted the government to amend the Energy Utilisation Rationalisation Act to promote energy conservation measures.

To drive energy conservation measures more effectively and to reduce the increasing rate of energy demand, the government established the comprehensive energy conservation program. Energy auditing is one of the major programmes, which was implemented since 1980. We will summarise the audit programmes for industry and for buildings in section 5.

3. System for evaluating, monitoring and data collection on energy policies and measures and relevant scenarios

Evaluation for energy efficiency programmes is a relatively new area for Korea. In section four and five we present a selection of Korean programmes and achievements. This will illustrate that the emphasis in evaluation is on output indicators and expected energy savings. In depth evaluations like in the USA and Europe are in the planning phase and results are not available yet.

5. Method used for selected evaluated EE policy measures, case examples

5.1. Case for category Regulation: Minimum energy performance standards

The minimum energy performance standard is implemented to prevent spreading the low efficiency products and raise the technical development propulsion of manufacturers. If the products are unimproved, at once, the system prohibits the producers and salesmen from circulating them.

Programme description

A. Name of the programme: minimum energy performance standards[1]

B. Sponsoring Agency: Korean government

C. Objectives: to prohibit the low efficiency products

The purpose of the minimum energy performance standard is to prohibit the low efficiency products from spreading and to promote the manufacturers' technical development by setting up and controlling the minimum required efficiency standard. The not-improved products can be expelled.

The target energy performance means the target value of the energy consumption efficiency to be accomplished within a designated length of time.

D. Programme activities

The regulation related to the efficiency management system consists of the law on the rationalised use of energy and enforcement ordinance, [the regulation on the operation of the efficiency management equipments & supplies] (the Ministry of Commerce, Industry and Energy notice No. 2000-101 (23. Nov. 2000)), which is enforcement regulation and base regulation about the system, or the regulation on the energy consumption efficiency grade indication of cars (the Ministry of Commerce, Industry and Energy notice No. 1998-99 (27. October 1998)).

E. Development and operation

The minimum energy performance standard programme started 1. January 2001. At that moment minimum consumption efficiency standards by product came into force. The minimum energy performance standard is usually based on the lowest value of the 5 grade of the labelling programme (see section 5.2). So over time the minimum standard will increase. For example, in case of electric refrigerator, the minimum standard was set to a new value on 1. April 2002. Table 5.1.1. holds the calculations of the values for refrigerators.

Table 5.1.1. Korean minimum energy performance standards for refrigerators

(Unit: kWh/month)

Division	Standard expression of 220V product maximum consumption electric power amount	
	From 1. Jan. 2001	From 1. Apr. 2002
Refrigerator	P≤0.067AV+30.15	P≤0.067AV+30.15
Refrigerator and freezer under the AV 500ℓ	P≤0.045AV+53.01	P≤0.045AV+53.01
Refrigerator and freezer above the AV 500ℓ	P≤0.099AV+37.24	P≤0.078AV+29.14

AV (Revised available content capacity) = freezer available content capacity × K (revised parameter) + refrigerator available content capacity

Revised parameter (K) = 0 in refrigerator case; 1.78 in freezer and refrigerator case

[1] Korea has a combined programme "Energy Efficiency Standards & labeling programme". Given the structure of the case examples and policy measures, this programme is divided into two presentations.

Offenders of this law will be subject to the fine of below twenty million won levied by the Minister of Commerce, Industry and Energy.

F. Administration: Korea Energy Management Corporation (KEMCO)

Evaluation objectives, activities, results

The programme is not evaluated yet.

5.2. Case for category Information: Energy Audits and Labelling

Energy audits are conducted for industries, buildings and transportation companies and separated into two groups such as in-depth audits and free audits. The audits are involved in identification of major factors of energy losses, recommendation of improvement measures and dissemination of updated technology. Audits for transportation companies are involved in analysis for the status of energy management, status of education for vehicle operators, and establishment of energy saving plan.
We restrict us to the energy audits for industry and for buildings
The Energy Efficiency (Rating) Labelling Program consists of energy efficiency grade indication, minimum energy performance standard and targeted energy performance standard, etc.

Programme description (1)

A. Name of the programme: Energy Audits for Industries

B. Sponsoring Agency: Korean government

C. Objectives: identify energy savings in companies and plants and advise on improvement opportunities.

The purpose of energy audits is to save energy and to drive rational energy use in industrial sector through identification of problems of industrial energy-intensive facilities and provision of improvement measures.

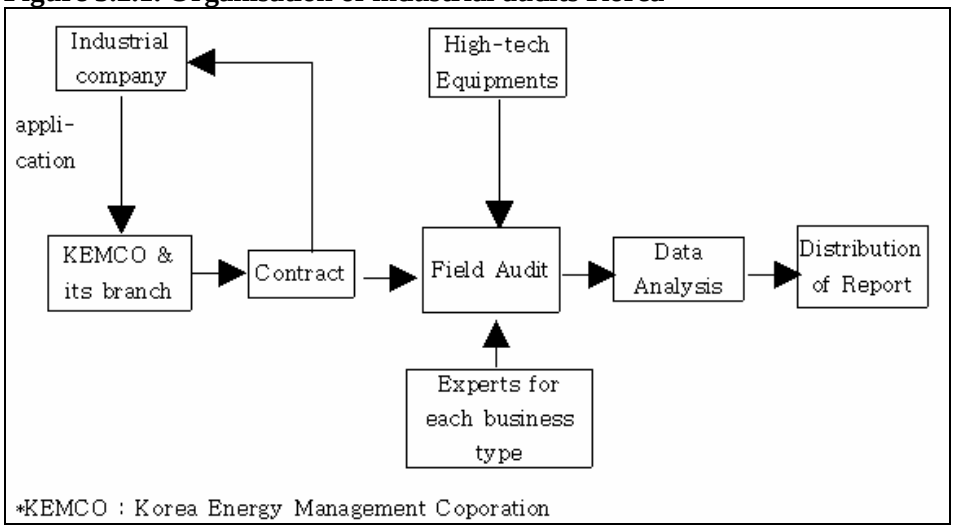
D. Programme activities

Energy audits are conducted mainly by the Korea Energy Management Corporation according to the service contract with clients or free of charge. Figure 5.2.1. summarise this process of auditing. In-depth audits (Technical service audits) are generally conducted at the request of a client that consumes over 15,000 TOE of fuel or over 40 million kWh of electricity per year. The audit is followed by technical consultation about heat recovery and facility renovation, new energy conservation measures, total energy utilisation system, and post-audit management.

Energy Audits are mainly divided into technical service audit (in-depth audit) for large-size companies and free audit for relatively small companies. Free audits are offered for small and

medium-sized industrial firms that typically use 250~1,500 TOE of fuel or 1~40 million kWh of electricity per year. The expenses are fully paid by the government.

Figure 5.2.1. Organisation of industrial audits Korea



The Energy Audits use the following methodology:

- Specialisation of audit units according to business types; Each unit has several teams considering the status of the clients;
- Dispatch of Audit Buses, thermo vision, and computer system
- Audit for small companies may take 2 days per companies
- Audit for technical service may take 3 - 13 days of field audit

E. Development and operation

The in-depth audits for energy intensive industries started in 1980. Since 1990 also free audits are conducted. On average 50-90 in dept audits and 150-300 free audits are annually realised.

F. Administration: Korea Energy Management Corporation (KEMCO)

Evaluation objectives, activities, results

A. Evaluation objectives

The evaluation includes outputs (number of companies for which an audit is conducted; the topics attention is given to in the audits) and outcomes (investments) and impacts (energy savings).

B. Evaluation activities

The information from the audits and the auditors is analysed and aggregate in annual reports on audits.

C. Principal conclusions

Energy audits were conducted for 1,657 in in-depth audits since 1980, and 3,196 in free audits since 1991 as shown in Table 5.2.1.

Table 5.2.1. Trends of audits (by type) in companies

Types	1980 -1990	1991 -1995	1996	1997	1998	1999	2000	2001	2002
In-depth audits(1)	939	259	61	62	59	55	52	73	93
Free audits(2)	-	1,496	350	250	200	150	150	300	300

Sources: (1) Report 2002 on Audit for Energy Management, p. 37, Korea Energy Management Corporation, 2003.
(2) Report 2002 on Audit for Energy Management of Small and Medium-sized Enterprises, p. 66, Korea Energy Management Corporation, 2003.

The audits include electricity and heat and for the specific facilities the focus of the audit is restricted to the 2-4 most interesting elements for energy savings. Table 5.2.2. holds the focus of the audits in the year 2002.

The outcomes of energy audits are estimated by considering the amount of investment for energy conservation and the impacts by energy savings after conducting energy audits.

It is assumed that any changes after any energy audits are effects of them. The measures that can contribute to energy savings are grouped and identified to estimate its effectiveness.

Table 5.2.2. Focus of Korean industrial audits, 2002

Category	Facility	Focus of Audits
Heat	Heat generation	1. Problems with fuel and water supply system 2. Performance teat for boilers and furnaces 3. Analysis of loss factor, and methods for improvement 4. Facility investment and feasibility for improvement
	Heat transmission	1. Problems with Heat transmission system 2. Rationalisation of Heat transmission system 3. Feasibility for heat recovery, enhancement of pipe insulation
	Heat use	1. Performance test for heat-using facilities 2. Evaluation and improvement measure for heat recovery system 3. Implementation and effect analysis 4. Investment and feasibility for energy-saving facilities
	etc.	1. Analysis for energy load and trend of plants 2. Mid/Long term energy plan 3. Problems and improvement measure for energy system
Electricity	Transmission	1. Validity of electricity supply contract 2. Evaluation of transformer

	Power	1. Power-facility capacity and operating efficiency 2. Improvement measures for load ratio 3. Evaluation of possibility for energy-saving through operational improvement
	Heat and Lighting	1. Heat-alternative possibility 2. Establishment of heat recovery plan 3. Appropriate capacity and load 4. Appropriate luminous intensity and energy-efficient lighting sources
	Etc.	1. Efficiency for electric chemical facilities 2. Feasibility for Energy-Saving devices

The estimated impacts from the audits for large industries in 2002 are an energy saving ratio of 8.8 percent, and, as a result, energy savings amounted 46.8 billion won while investment in energy conservation was 54.4 million won. Thus, the investment in energy conservation was recognised to be beneficial. Table 5.2.3. present the trend in these impact data.

Table 5.2.3 Trends impacts of energy audits for large-scale industries

Year	Number of Company	Energy use (TOE)	Energy Savings (TOE/Year)	Saving Ratio (%)	Saving Amount (million won)	Investment (million won)	Pay back Period (year)
1980	10	481,664	25,476	5.3	4,026	2,377	0.6
1985	109	859,267	45,252	5.3	9,537	12,185	1.3
1990	110	397,315	56,321	7.3	6,731	20,100	3.0
1995	55	341,654	29,384	8.6	4,495	6,744	1.4
2000	52	1,331,510	193,585	14.1	62,506	66,185	1.1
2001	73	1,193,803	119,304	10.0	40,823	40,476	1.0
2002	93	1,650,320	144,835	8.8	46,831	54,360	1.1

Source: Report 2002 on Audit for Energy Management, p. 39, Korea Energy Management Corporation, 2003.

The estimated impacts for small industries in 2002 are summarised in Table 5.2.4 and show that the investment in improvement of energy saving related to the heat use was 7.8 billion won, and the portion of chemical (20.1%) and textile (19.6%) industries is 40 percent of the total investment. An expected amount of energy saving, as a result of energy audit in heating sector, would be 21,519 toe/year, saving ratio, 10.4%, saving amount, 7.1 billion won per year. The payback periods from investment seem to be short ranging from1.1 to 1.6 years except for building sector.

The investment in improvement of energy saving related to electricity use was 3.3 billion won, and the portion of chemical (28.9%) and textile (22.9%) industries is about 52 percent of the total investment. An expected amount of energy saving from energy audit in electricity sector, would be 36,986 toe/year, saving ratio, 6.7%, saving amount, 3.3 billion won per year.

Table 5.2.4a. Impacts of energy audits for small industries, heat, 2002

Industry Type	Number of Company	Energy use (TOE)	Energy Saving (TOE/Year)	Saving Ratio (%)	Saving Amount (million won)	Invest-ment (million won)	Pay back period (year)	Cases of Improve ment
Building	28	9,386	735	7.8	304	686	3.9	109
Metal	27	32,002	3,686	11.5	1,295	1,433	1.2	97
Textiles	31	44,099	5,126	11.6	1,669	1,521	1.1	130
Food	28	33,862	2,962	8.7	1,009	1,017	1.2	106
Ceramic	8	9,786	786	8.0	337	258	1.4	18
Paper	12	25,964	3,639	14.0	956	1,299	1.3	53
Chemical	45	52,688	4,585	8.7	1,621	1,561	1.2	158
Total	179	207,787	21,519	10.4	7,192	7,775	1.6	671

Source: Report 2002 on Audit for Energy Management of Small and Medium-sized Enterprises, p. 19, Korea Energy Management Corporation, 2003.

Table 5.2.4b. Impacts of energy audits for small industries, electricity, 2002

Industry Type	Number of Company	Energy Use (TOE)	Energy Saving (TOE/Year)	Saving Ratio (%)	Saving Amount (million won)	Invest-ment (million won)	Pay back Period (year)	Cases of Improve ment
Building	25	33,836	4,184	12.4	469	1,209	2.2	100
Metal	27	204,909	12,963	6.3	948	1,527	1.3	129
Textiles	17	70,053	4,702	6.7	324	777	1.9	93
Food	19	86,203	4,690	5.4	414	474	1.6	102
Ceramic	8	49,780	2,631	5.3	190	237	1.3	35
Paper	8	35,698	2,557	7.2	274	661	1.4	38
Chemical	17	73,281	5,258	7.2	666	396	1.7	86
Total	121	553,760	36,986	6.7	3,285	5,281	1.7	583

Source: Report 2002 on Audit for Energy Management of Small and Medium-sized Enterprises, p. 20, Korea Energy Management Corporation, 2003.

Programme description (2)

G. Name of the programme: Energy Audit for public buildings, apartments and large buildings

H. Sponsoring Agency: Korean Government

I. Objectives

The programme has two principal objectives:

- To find energy-losing factors and to suggest improvement measures of energy saving through the audit for public government buildings, for apartments and large buildings
- To promote investments for energy-saving facilities and, therefore the rationalisation of energy use.

J. Programme activities

Energy audits for building are also conducted by the request of energy intensive buildings that are under the intensive supervision. The government and public buildings receive free audits under the intensive supervision.
A heat audit can be conducted for (boilers in) public buildings that consume 30-250 TOE annually and an electricity audit for (transmission facilities in) public buildings which consume below 1 million kWh annually.

K. Development and operation

The audits in the building sector started in 1980 with apartments. Since 1985 also audit for other builders are conducted. On average 15-25 audits are annually realised.

L. Administration: Korea Energy Management Corporation (KEMCO)

Evaluation objectives, activities, results

A. Evaluation objectives
The evaluation includes outputs (number of buildings for which an audit is conducted) and outcomes (investments, specified for heat and electricity technics) and impacts (energy savings).

B. Evaluation activities

The information from the audits and the auditors is analysed and aggregate in annual reports on audits.

C. Principal conclusions

Table 5.2.5 shows that the majority of audits in the 1980s is conducted in apartments and that about 1/3 of all audits is conducted in governmental buildings. In the most recent years (2000 and 2002) hotels and commercial buildings are among the major groups.

Table 5.2.5. Trends of number of audits in buildings by year and type

Year	Total	Public Building	Hospital	Hotel	Apartment	Commercial Building	Education	Others
1980	19	-	-	-	19	-	-	-
1985	16	7	4	4	1	-	-	-
1990	11	10	-	-	1	-	-	-
1995	9	7	-	1	-	-	1	-
2000	24	7	1	6	-	10	-	-
2002	24	7	1	4	-	6	5	1

Sources: Report 2002 on Audit for Energy Management, p. 107, Korea Energy Management Corporation, 2003.

According to table 5.2.6a, the amount of energy savings of improvement of het operation method is 552,416 Kgoe/year (26.7%) and 409,473 Kgoe/year in ventilation control, which is 19.8%. Electricity savings (see table 5.2.6b) throughout replacement of refrigerator would be 1,416.8 MWH/Year, which is highest.

Table 5.2.6a. Impacts of energy audits in building, heat, 2002

Classification (selected items)	Air-Ratio control	Heat Recovery	Insulation	Boiler Replace-ment	Improvement of operation	Ventilation Control	Etc.	Total
Saving (Kgoe/Year)	121,590	364,929	113,261	142,990	552,416	409,473	851,315	2,069,455
Saving (million won /Year)	57.5	152.9	172.9	54.1	263.9	196.3	1,093.6	1,780.9
Investment (million won)	25.0	290.0	555.0	350.0	39.0	455.0	92.1	1,701.2
Recovery period (Year)	0.4	1.8	3.2	6.5	0.1	2.3	-	1.7

Sources: Report 2002 on Audit for Energy Management, p. 113, Korea Energy Management Corporation, 2003. (15 buildings)

Table 5.2.6b. Impacts of energy audits for small industries, electricity, 2002

Classification	Replacement of Transformer	Efficiency of Electric Motors	Replacement of Refrigerator	Lighting	Etc.	Total
Saving (MWH/Year)	549.5	2,077.6	1,416.8	509.7	6,183.9	10,737.5
Saving (million won)	52.7	215.8	121.5	42.5	1,006.2	1,438.7
Investment (million won)	353.9	768.0	690.0	207.6	2,061.0	4,080.5
Recovery Period (Year)	6.7	3.6	5.7	4.9	-	2.8

Sources: Report 2002 on Audit for Energy Management, p. 115, Korea Energy Management Corporation, 2003. (9 buildings)

Programme description (3)

M. Name of the programme: Energy Efficiency Labelling Programme

N. Sponsoring Agency: Korean government

O. Objectives

The purpose of the Energy Efficiency Labelling Program is to save energy by enabling the consumers to easily identify the high efficiency energy saving type products and accordingly encouraging manufacturers (importers) to produce and sell the energy saving type products from the beginning stage, through indicating the energy efficiency grade from the 1st to the 5th grade, according to energy efficiency and amount used for the products, on the outside of the products. Generally speaking, the 1st grade products can save energy up to 30% to 40% compared with that of the fifth grade products.

P. Programme activities

The Energy Efficiency Labelling Program consists of energy efficiency grade indication, minimum energy performance standard and targeted energy performance standard, etc.

Energy consumption efficiency grade label consists of 1st~ 5th grade, and the closest product to the 1st grade is the best energy-saving product. The 1st grade product saves energy up to 30~40%, compared with the 5th one. Each product in the list has own grade level type. These grade levels change over time. Table 5.2.7 holds refrigerators as example.

Table 5.2.7 Korean Grade grant standard for refrigerators

R		Grade
From 1. Jan. 2001	From 1. Apr. 2002	
$R \leq 1.00$	$R \leq 1.00$	1
$1.00 < R \leq 1.20$	$1.00 < R \leq 1.20$	2
$1.20 < R \leq 1.40$	$1.20 < R \leq 1.40$	3
$1.40 < R \leq 1.60$	$1.40 < R \leq 1.60$	4
$1.60 < R \leq 2.30$	$1.60 < R \leq 1.80$	5

R(grade grant index = amount of monthly consumption electric power of the concerned model [kWh/month] / amount of targeted consumption electric power of the concerned model [kWh/month]

Q. Development and operation

The Energy-Saving Label has been proposed by The National Energy-Saving Promotion Committee¡ on May 27, 1998 and the design has finally been selected through the prize winning contest to the enhanced spreading of the energy saving products and the promotion of the rational use of energy project.

The regulation related to the efficiency management system consists of the law on the rationalised use of energy and enforcement ordinance, [the regulation on the operation of the efficiency management equipments & supplies] (the Ministry of Commerce, Industry and Energy notice No. 2000-101 (23. Nov. 2000)), which is enforcement regulation and base regulation about the system, or the regulation on the energy consumption efficiency grade indication of cars (the Ministry of Commerce, Industry and Energy notice No. 1998-99 (27. October 1998)).

In addition, the Supply Administration makes the purchasing operation standard about energy consumption products (the Supply Administration's instruction No.1106 (5. Dec. 2000)) and is preferentially purchasing the best grade (the 1st grade) products.

The items which can attach the Energy-Saving Label is the products reported to Korea Energy Management Corporation as the energy-saving products by satisfying the government suggested energy saving standards based on the MOCIE notification e-Standby Programme.
It is necessary to apply for the test of manufactured (imported) goods through the test organisation designated by the government (or the organisation being self-test authenticated). And then the designated organisation (or the organisation being self-test authenticated) reports the result to Korea Energy Management Corporation within 30 days from the date of test completion. The manufacturers (importers) receive "the examination result sheet" from the organisation and confirm the results through the Internet.

R. Administration: Korea Energy Management Corporation (KEMCO)

Evaluation objectives, activities, results

D. Evaluation objectives
In an annual report the progress in raising the values for the label thresholds and the expected energy savings should be reported.

E. Evaluation activities

The evaluation activities are restricted to the right use of the labels and the annual progress report.

F. Principal conclusions

The expected energy savings by the labelling programme is for the year 2002 164.000 Toe and 71.4 billion Won (see Table 5.2.8).

Table 5.2.8. Expected Energy-saving Effectiveness for the Energy Efficiency Labelling programme

Year(s)	Energy Savings (1,000 toe)	Savings (Billion Won)
2002	164 (electricity 124, gas 40)	71.7
1998-2002	610 (electricity 540, gas 70)	266.6

The Annual energy savings per unit (as presented in Table 5.2.9) denote the difference in the quantity of energy used between average appliances in the year when the program was implemented and the first rating items. The scale of distributed items in 2002 was computed by multiplying total sales by the share of each high-efficiency product of at least the 1st rating (at least the 2nd rating for lighting appliances). It rules out energy-saving effectiveness of the items overlapped by the certification of high energy efficiency: compact fluorescent lamps, domestic gas boilers, 26mm 36W fluorescent lamps and ballast. Energy savings are calculated only by those from ballast since ballast is a prerequisite for fluorescent lamps to work properly as lighting appliances.

The unit price of electricity in the table applies 110 Won/kWh for electric appliances and 410 Won/N/m^3 for domestic gas boilers, respectively.

Critical issues

The labelling program should be monitored and adjusted depending on the results of assessment process periodically. It is also recommended to expand the co-operation in the APEC region for better operating structure of energy efficiency standards and labelling programmes.

Table 5.2.9. Expected Energy Savings of Energy Efficiency Labelling Program (2002)

Item	Savings per unit (kWh/year, N/m^3/year)	Annual Expected Savings (2002)	
	Energy Savings (A)	Savings Rate (%)	Sales of High Efficiency Appliances (1,000) (B)
Refrigerators	204	29.8	775
Freezers	60	20.0	1,358
Air Conditions	43	7.6	1,080
Clothes Washers	14	32.6	1,193
Incandescent Bulbs	10	9.4	10,619
Ballast for Fluorescent Lamps	15	11.1	364
Compact Fluorescent Lamps	6	9.1	15,984
Domestic Gas Boilers	140 N/m^3	8.0	278
Total	-	-	31,651

Item	Accumulated Savings (1998~2002)			Reference	
	Savings (Billion Won)	Sales of Appliances (1,000) (C)	Energy Savings (1,000 toe)	Savings (Billion Won)	Standard Measure
Refrigerators	17.4	3,880	197	870	550
Freezers	8.9	4,199	62	276	60
Air Conditions	5.1	3,941	42	186	20 m^2
Clothes Washers	1.8	2,370	8	36	10kg
Incandescent Bulbs	11.7	61,278	153	673	220V 60W
Ballast for Fluorescent Lamps	0.6	9,938	37	164	Straight 40W
Compact Fluorescent Lamps	10.5	27,995	41	184	20W
Domestic Gas Boilers	16.0	482	70	277	23kW (20,000kcal/h)
Total	17.7	610	610	2666	Total

5.3. Case(s) for category Economic incentives: High Efficient Electric Inverter and Economic Incentives for DSM

Programme description (1)

A. Name of the programme: Rebate Program for High Efficient Electric Inverter

B. Sponsoring Agency: Korea Energy Management Corporation

C. Objectives: saving electric power

The aim of the program is to contribute to electric power saving through promoting usage of the high efficient electric inverters.

The program can help the consumers by offering the rebate to purchase the designated items without financial difficulties.

D. Programme activities:

The designated item should be approved as high energy efficient equipment and received "e" mark by the KEMCO.

The rebate is offered to the customers who purchase new high efficient inverters or replace the old one. The amount of the rebate is from minimum 84,000 won to maximum 50,000,000 won[87]. On average this is 167,000 per kW in saving capacity.

The program was informed through news papers such as the Hankook daily news, the Korean energy, Simin News and TV & radio.

The business briefing executions were conducted in 10 Areas 19 times (1,650 persons). A briefing session for the ESCOs was held and there are many presentation meetings for the Korea Electrical Contractors Association, the Korea Electric Engineers Association, the Korea Heat Energy Engineers association and equipment manufacturers etc.

E. Development and operation

The programme was studied in 1998 and implemented in March, 2002 as a pilot. From 2003 onwards it is implemented as a full programme.

F. Administration

The programme is managed by KEMCO.

Evaluation objectives, activities, results

[87] 10,000 Won is about 83 euro

D. Evaluation objectives

The evaluation is restricted to the expected electricity savings and the judgement on the success of the pilot programme.

General conclusions

The program was used as a pilot program to establish the basement to promote the high efficient inverters from 2003. It is facilitated for setting the minimum efficiency level for the long term. The installed 2,800 high efficient inverters will result in a reduction for the available power by about 1.4 MW and energy savings of 8 MWh.

Installed quantity (number)	Amount of total effect (MW)	Power savings (MW)	Peak Cutting (MW)	Energy Savings (MWh)
2,729	39.4	1.41	0.62	5,008

* Peak cutting (MW) = power saving capacity × average load rate (0.74) × peak agreement rate (0.59).
* Energy Savings (MWh) = power saving capacity × average load rate (0.74) × Annual operating hours (4,800)

Because an electrometer is a facility that is almost hard to change from setting up to the end of its life, it can be expected to save energy by installing high efficient electric inverters in the long term. Installation cost was not covered and the rebate was not offered to set makers and sellers. Those were main reasons why the program was not so successful.

Since the program was started from 1st of June, 2002, it was difficult to be reflected in investment budget of consumers.

Programme description (2)

A. Name of the programme: **Economic Incentives for DSM**

B. Sponsoring Agency: KEPCO (till June 2001)
Electric Industry Infrastructure Fund June, (2001 onwards)

In June 2001 the Electric Industry Infrastructure Fund was established. The source for this fund is an additional charge to customers within 6.5% of their electric utility bills (4.591% in 2002). The total amount in 2002(estimated) was 999,697 million won.

C. Objectives: Energy savings by economic incentives for DSM programmes

D. Programme activities

The DSM programmes are concentrated in the following areas:

A. Load Reduction by Adjusting Vacation/Maintenance Schedules
A company can get a subsidy where the amount of payment = Contracted average daily peak demand reduction × incentive rate (won) × days of observance (at least 3 consecutive days

during the contracted periods). The average daily peak demand reduction is billing peak demand for the month less contracted peak demand for the contracted period.
The incentive rate: Won 620/kWh (Jul. 18-Aug. 17). Won740/kWh (Aug. 19-22)

B. Voluntary Load Reduction during summer Afternoon Peak Hours
A company can get a subsidy where the amount of payment = Average load reduction (kW) for 30 minutes x incentive rate (won/kW) × times of observance. The realised average load reduction: Average load between 10-12 a.m. of a day minus average load for every 30-minute time-frame between 2-4 p.m. of the same day
The incentive rate: Won120/kW, 30minutes (July 18-August 22)

C. Remotely Controlled Air-conditioners
An organisation can get a subsidy of 200,000 won for each kW of the air-conditioner's power consumption capacity is paid as subsidy on non-reimbursement condition from the 'Electric Industry Infrastructure Fund' after installation.

D. Cool Storage System
5% of the installation costs and monetary incentive (on peak reduction, see Table) for designing the system are paid as a *subsidy* on non-reimbursement condition from the 'Electric Industry Infrastructure Fund' to promote diffusion of the cool storage system.

<Table 14> Installation subsidy

Peak reduction	First 200 kW	Next 200 kW	Over 400 kW	Remark
subsidy	480,000 won/ kW	420,000 won/kW	350,000 won/kW	no limit

There is also an *incentive on taxation* for anyone who invests in the energy conservation facility including cool storage equipment according to 'Laws on special tax exemption limit allowance Tax'. This incentive amount is a deduction of 10 percent of the total investment for installing cool storage facility from corporate or income tax. Application for tax credit should be made directly to relevant tax offices by subsidy recipients.

If needed, the identity installing cool storage system can apply for *loans* within the following limits to the financial institutes with the recommendation of Korea Energy Management Corporation or KEMCO according to rules and regulations for loaning for energy conservation facilities.

Facility	Loan limit (%)	Interest rate	Repayment	Loan limit
Gas or cool storage cooling system	up to 100% of total investment	4.75%/yr	5 year instalments with 3 year deferment	2.5 billion won per building

E. Pledged-load Reduction upon Request

This programme holds subsidy on the basic rate: peak demand of the month (kW) × basic incentive rate (Won500/kW) × contracted reduction level (%)

F. Direct Load Interruption

The amount of subsidy is on the basic rate: peak demand of the month (kW) × basic incentive rate (won680/kW) × contracted reduction level (%). This basic subsidy is applicable to only in July and August and paid regardless of implementation

E. Development and operation

F. Administration: several organisations, depending on the DSM programme

Evaluation objectives, activities, results

A. Evaluation objectives

The evaluation is restricted to the measurement of impacts in energy saving and avoided costs.

B. Evaluation activities

C. Principal conclusions

We restrict the conclusions to some of the DSM programmes and an overall one on the pricing schemes for DMS

C. Remotely Controlled Air-conditioners

- Avoided effect of investment cost: peak cut × 207,141won/kWh × present value factor (6.247/9year)
- Amount of savings: controlled level (1,55kW/unit) × controlled time (1H) × supplied quantity
- Cost saving: amount of saving (148MWh) × unit fuel cost (74.87won/kWh) × present value factor (6.247)

D. Cool Storage System

- Avoided effect of facility investment: 83,327 million won - Peak cut × avoided cost per kW (207,141won) × annuity present value factor (8.559)
- Peak shifting: 191,405MWh (midnight electric power sold for cool thermal storage)
- Fuel cost saving: shifting quantity × difference of unit fuel cost (49.89won/kWh)
  Difference of unit fuel cost: LNG Combined cycle (74.87won/kWh) - steam (24.98won/kWh)

F. Direct Load Interruption

- Total avoided cost = avoided cost per kW × electric power saving = 63,549 million won
- Avoided cost per kW: 207,141won/kW/year
- Power generation: 115,221won/kW, transmission & substation: 77,810won/kW, distribution: 14,110won/kW
- Electric power saving: 307MW/year
- Avoided cost in present value (in case of controlling cooling facilities)
  63,549 million won/year × 3.993 (5 years) = 253.751 million won

G. Pricing Scheme for DSM
The avoided costs of investment are following:

- Peak cut: 2,018MW (holiday overhaul compensation 1,230MW, voluntary power saving 788MW)
- Investment cost (electric power charge reduction): 27,303,000,000won
- Avoided cost of investment: 2,018 MW×207,141won/kW year = 418,011 Million Won
- Avoided cost per kW: 207,141won/year (LNG compound power, transmission and distribution equipment)

The impacts on of fuel saving are:

- Holiday overhaul compensation: power saving (controlled power × days×10hours)×106won/kWh
- Voluntary power saving: power saving (controlled power x frequencies × 0.5hours)×106won/kWh

Critical issues
The efficiency gain through technical improvement might not simply mean energy saving or reduction of energy consumption. The efficiency gain seems to be offset by preference of bigger appliances. There are distinct evidences of purchasing larger refrigerator, bigger TV and car, more lighting, etc in Korea.
Therefore, it is necessary, in addition to technical approach, to implement various policy options for residential sector. It would be good to use an indirect way such as price incentive, institutional infrastructure, efficiency standard, and labelling.

5.4. Case(s) for category Voluntary agreements: The Voluntary Agreement (VA) for Energy Conservation and GHG(Greenhouse Gas) Mitigation

Programme description

A. Name of the programme: The Voluntary Agreement (VA) for Energy Conservation and GHG(Greenhouse Gas) Mitigation

B. Sponsoring Agencies: MOCIE and the Ministry of Environment,

C. Objectives

D. Programme activities

The Voluntary Agreement (VA) for Energy Conservation and GHG(Greenhouse Gas) Mitigation, which was conducted between high energy consuming companies and the Korean government, was the first among the non-Annex I countries in the UNFCCC (United Nations Framework Convention on Climate Change). Due to its scarce fossil fuel resources, Korea has enforced numerous energy conservation policies, particularly since the mid-1980s, which also has contributed to the reduction of GHG emissions. To intensify its effort toward the mitigation of climate change and to use energy more efficiently, Korea became the first country to adopt VA among the non-Annex I countries, taking advantage of its experience in implementing it's 'Five-Year Energy Efficiency Program for Energy Intensive Industries and Products' (1991-2001).

A company willing to join the voluntary agreement must submit a concrete action plan within three months after submitting a letter of intent to KEMCO. The action plan must contain an operational organizational plan, targets for the improvement of energy efficiency and GHG reduction, and a detailed process design. KEMCO, the authority concerned, examines and estimates the plan, and concludes the agreement if the company satisfies qualification.

A company which joins the VA will be supported with low interest loans and tax incentives for energy conservation and GHG reduction. Technological support and PR promotion are other benefits the VA companies enjoy.

E. Development and operation

The VA was adopted in 1998 after one year of a case study and close investigation. In the first year, 15 companies including Pohang Iron & Steel Co. Ltd. (POSCO), the largest energy consumer in Korea, joined the demonstrative VA. The number of participants has increased to 212 companies in 2000 and 376 companies in 2001. The VA participants are large-scale with turnovers of as much as US$50 billion and use 77.86 million TOE annually, which is 40.4 percent of the total energy consumption or 74.2 percent of the total industrial energy use.

About 600 Companies, accounting for 70 percent of energy consumption in the Korean industrial sector, are expected to join the agreement by 2003.

F. Administration

The VA, which is co-managed by the MOCIE and the Ministry of Environment, is a co-operative program between the government and energy intensive companies. The VA is the most outstanding GHG policy measure among the Countermeasures for Climate Change Mitigation confirmed by a meeting of related ministers held under the superintendence of the Prime Minister in December 1998.

Evaluation objectives, activities, results

A. Evaluation objectives

The most important evaluation objective is to show the improved energy efficiency related to the target.

B. Evaluation activities

The evaluation was restricted to the analysis of the reports by the VA companies and to combine this information in progress reports.

C. Principal conclusions

In striving to meet the agreement requirements that the VA companies should improve their level of energy efficiency by 5.9 percent over five years and reduce 4,344 thousand TC, a considerable amount of energy was saved.

Energy consumption of about 1,636,000 TOE was curtailed in the second year of VA period (five years), which is equivalent to 1% of industrial energy use amounting to US$313 billion.

Various types of initiatives contributed to the overall achievement. Process improvement and recycle of waste heat accounted for the largest proportion, while the adoption of facilities using energy saving technologies, renewable energy, clean fuel rational operation, etc., also played important roles.

The VA is one of the major projects adhering to the international agreements of the UNFCCC. The achievement of energy savings by the VA has been closely connected to the mitigation of CO_2 emission.

1. Introduction

The Italian country report follows a common outline, giving a summary of Italian energy efficiency policies. In particular, in chapter 2 the national system of energy efficiency policies is presented, with particular reference to the new policy stated by the energy Efficiency Decrees, dated 24 April 2001, defined in the framework of the Kyoto protocol.
Chapter 3 holds information on methods defined for evaluating energy savings in the light of the new policy framework.

APPENDIX I holds a summary of the Italian Energy Efficiency Decrees (April 2001) statements.

2. National system of energy efficiency policy measures

2.1 Main actors

Responsibility for energy policy lies primarily in the Ministry of Productive Activities (formerly Ministry of Industry, Commerce and Crafts), in co-ordination with other Ministries (including the Ministry for the Environment), interministerial Committees, government organisations and independent agencies. The Interministerial Committee for Economic Planning (CIPE) co-ordinates national energy policy with economic policy. It issues deliberations which give a framework to energy policy.
Regulatory Authority for Electricity and Gas (AEEG) also has a role (given by law n.481, 1995) to guarantee the promotion of competition and efficiency in the electric energy and gas sectors and assure suitable level of quality services.
In the new energy efficiency policy, a role has been given to AEEG by two Energy Efficiency Ministerial Decrees of April 2001 (eg. defining guidelines for the implementation of the decrees and energy saving actions, ex-post evaluation and certification of energy savings, compliance check, issuing Energy Efficiency Certificates).

So the following main actors can be identified:
- Ministry of Productive Activities (formerly Ministry of Industry, Commerce and Craft)
- Ministry of the Environment
- Regulatory Authority for Electricity and Gas (AEEG)

Concerning the sharing among the state, the regions and the local authorities (see Legislative Decree of 31 March 1998 (No. 112/1998) as modified by the Legislative Decree of 29 November 1999 (No 443/1999), **the state is still responsible for the elaboration and definition of energy policy objectives and guidelines** and for action to address and co-ordinate energy planning at the regional level[1].

2.2 Policies and measures

[1] The new text of article 117 of the Constitution, introduced by the Constitutional Law of 18 October 2001 (No. 3) has inserted, among the subjects of current legislation, the production, transport and national distribution of energy: this means that the State sets the policy, the main guidelines and the general objectives by law, while the Regions concur to determine specific laws and rules for the realisation of the objectives.

In general there was in the early 1990s relatively low political attention to energy efficiency aspects and the majority of policies and measures was targeted in the residential and tertiary sector (building etc.).
Major changes are caused by three new policy drivers:

- *Kyoto*:
  - -6.5 % with reference to 1990 levels between 2008-2012
  - more than 25% via enhancement of end-use energy efficiency
- *Security of supply*
- *Potential negative impact of the liberalisation process* (e.g. gradually decreasing energy prices and raising consumption)

These resullt in a bigger role of the Public Institutions in contributing to overcome "traditional "barriers to the development of the market for energy efficiency products and services (e.g. lack of information, marketing practices to promote more energy intensive consumption habits).
In particular the situation changes increasing:

- Interest in the transport and different production sectors
- Attention to environmental aspects and GHG (greenhouse gases) reduction
- Focus on energy efficiency and energy consumption reduction

Instruments and programmes

In general Italy uses since 1995 Italy mainly traditional policy tools:

- Efficiency standards for building
- Energy labelling for appliances
- Fiscal measures

Note: The basic law on energy efficiency is Law No. 10/1991, entitled *Regulations for the implementation of the National Energy Plan with regard to the rational use of energy, energy savings and the development of renewable energy source*s. It is a framework law to introduce regulations aimed at the efficient use of energy sources in all end-use sectors including the specific reduction of energy consumption in production processes, especially in buildings and heating plants. The law provides for tax relief and the payment by local authorities of incentives to support the adoption of the most efficient technological solutions.

In June 1994 Italy signed the Framework Convention on Climate Change (FCCC) during UNCED in Rio de Janeiro. Parliament approved Italy's agreement FCCC by Law No. 65 of 15 January 1994. The *Programma Nazionale per la limitazione delle emissioni di anidride carbonica nel 2000 al valore del 1990 (National Programme for Limiting Carbon-related Emissions to 1990 levels by 200*0) was approved by the Interministerial Committee for Economic Planning (CIPE) in the session of 25 February 1994.
This National Programme describes, *inter ali*a, existing measures for energy efficiency and sets out in broad terms additional actions that Italy could take.The First Italian National Communication of January 1995 is based on the information and programmes contained in the National Programme for Limiting Carbon-related Emissions which gave high priority to energy efficiency through the following steps:

- Financial incentives in the industrial and transport sectors.
- Efficiency standards in transport, industry and residential sectors
- Voluntary government-industry agreements on energy efficiency.
- Demand reduction programmes in the residential sector

- Information dissemination and expanded product labelling and certification in the transport and residential sectors.

Since 1998 **major changes** show up in the policies.

In 1998 the National Energy Plan (NEP) includes the improvement of energy efficiency and conservation as a primary objective of general energy policy.

On February 1999 CIPE Deliberation 137/98 was published.
The deliberation gives the guidelines and actions for the containment and reduction of GHG emissions. It includes, inter alia, the following measures:
- Increasing energy efficiency in the production sector and among consumers
- Reducing GHG in the transport sector and in sectors other than the energy sector
- Reducing GHG in the generation, transport and distribution of electricity.
- Promoting international co-operation for the reduction of global emissions.

From April 2001 two **TWIN MINISTERIAL DECREES ON ENERGY EFFICIENCY** (see chapter 3 and APPENDIX I), a new energy policy framework has been defined.
In particular the following items have been stated:
- Introduction of Mandatory quantitative energy savings targets (in term of primary energy) at National Level and for single energy Distributor
- Introduction of sanctions for non-compliance
- Implementation of Energy Efficiency certificate (EEC) trading structure

These twin Decrees:
- Implement the EU Liberalisation Directives
- Are relevant to Electric Energy and Gas respectively
- Are issued by: Minister of the Environment together with Production Activities Minister

On July 2002, the State document for economic and financial planning has been established.
In order to re-establish competition in energy matters, one of the government's goal is, inter alia, "the promotion of efficient use of energy resources to diminish Italy's dependence on foreign supplies, encouraging the development of renewable resources".
All the new policies will better defined too in a new "national energy plan".

The Interministerial Committee for Economic Planning (CIPE) provided financing for the three-year research programme (2001-2003), which entails several interventions in the sector of energy and environment. Included is a project for hydrogen and fuel cells costing about 62 Millions Euro, of which 43 are to be paid by the state. Among the short to mid-term projects there is an onni-comprehensive research project for reducing air pollution, electromagnetic pollution, and energy consumption, in favour of renewable sources. To finance research activity in the energy field, the ruling assigns about 12.9 Millions Euro to the special research fund.

On 18 April 2002 the Parliament Commission approved and published a document entitled *Situation and perspectives in the Energy Sector*. This document indicates three strategic paths, including the increase of energy efficiency in end uses, taking into account that a mix of energy efficiency and renewable energy sources allows for the costs incurred by the reduction of greenhouse gas emissions to be minimised.

On June 2001, the Ministry of the Environment enacted a Legislative Decree providing the list of selected programmes and related funding according to Decree No. 337/2000.
The total amount addressed to supportive actions and programmes for GHG emissions reduction is worth € 25 million for national programmes and € 17.5 million for international co-operation programmes regarding Kyoto mechanisms. For the former, selected programmes relate to demonstration projects in the fields of cogeneration plants in the production and civil sectors; improvement in energy efficiency in the industrial, residential, tertiary and transport sectors and development of engines at low or zero emission.

4. System for evaluating, monitoring and data collection on energy policies and measures and relevant scenarios

Evaluating methods have been defined within the new 2001 policy measure (that is: Legislative provisions for the promotion of energy savings and renewable sources in the Italian Electricity and Gas distribution sector) implemented by the **Two twin Ministerial Decrees on Energy Efficiency in April 2001** (for details see APPENDIX I).

Main Actors:

- Electricity and gas Distributors and ESCOs (Energy Service Companies)
- Italian Regions and autonomous provinces
- End users (domestic, industrial and tertiary sectors) involved by the Distributors in energy saving measures implementation
- Installers, wholesalers, Associations etc. involved by the Distributors in energy saving measures implementation
- Regulatory Authority for Electricity and Gas (AEEG)

4.1. Methods used

Evaluation of energy savings

Three evaluation approaches have been defined:
a) default approach (no on-field measurement)
b) engineering approach (some on-field measurements required)
c) energy monitoring plan approach

Criteria for project verification and certification:
- Project must comply with guidelines for the design, implementation and evaluation of project (issued by AEEG after consultation with interested parties)
- Reporting documentation is prepared according to a reporting format
- Recording additional documentation is needed for (random) on-site audits and inspections
- Regulatory Authority for Electricity and Gas (AEEG), following verification, certifies the energy savings achieved by issuing energy efficiency certificates

For details see APPENDIX II, where also examples relevant to energy efficiency program evaluations are reported together with indicators and baselines considered in the energy savings estimation.

The definition of rules and criteria for the implementation of the Ministerial Decrees and energy saving actions is going on: in 2002, with Deliberation No234/2002, AEEG has approved 8

technical files for the evaluation of primary energy savings relevant to 8 different measures mentioned in the Decree (art. n5 comma 1) and a consultation document –dated 16 January 2003- has been circulated by AEEG with proposals for evaluation methods relevant to other 10 measures.

4.2 Baseline (ex ante evaluation) and relation with national scenario/model

Some baseline definition criteria have been defined and as a consequence baselines have been introduced for different energy saving programs where default evaluation approach is applied; some other are under development. See also APPENDIX II.

4.3 Ex post evaluation

Ex-post evaluations can be considered in those projects where no ex-ante evaluation procedure can be applied (e.g. programs where energy consumption is a function of working and use conditions of apparata). In these cases parameters for energy savings evaluations can be defined (see engineering approach or energy monitoring plan approach).

4.4 Use of indicators

See APPENDIX II.

5. Method used for selected evaluated EE policy measures, case examples

5.1. Example of criteria adopted for the evaluation of primary energy savings in end-uses

Introduction

Method used for selected evaluated energy efficiency policies or measures (case examples)
A procedure is described aimed at evaluating the primary energy savings in indoor heating in buildings heated by the use of non-renewable sources. The energy savings is attained by insulation of solid wall and roofings
The considered building sectors are:

- Residential,
- Services: offices,
  commerce,
  educational,
  hospital

It must be remarked that a procedure is described instead of a case study in strict terms. This follows from some delays occurred in implementing the national legislation which was expected to foster the Energy Savings projects (see par. 0). In the lack of experimental data, measures and estimates, the savings evaluation herein described follows from the synthesis of knowledge gained by already performed engineering studies and computer simulations, in the light of the national standards and regulation in force in the heating sector.

Though this approach may result too strictly related to Italian perspectives and too theoretical and abstract, it deserves to be considered as a meaningful example of rational way of carrying on an *ex-ante* energy savings evaluation, bound to be actually and widely adopted to verify and certify compliance to law obligations, as below described.

Background

Primary energy savings target

Italian legislation is at present a fundamental driver in fostering energy efficiency projects in Italy. Twins Ministerial Decrees[1] were issued in Italy on April 2001. They stated mandatory quantitative targets of primary energy savings at the national level (against the "business as usual" scenario). These targets must be fulfilled by obligation-bound actors through measures on electricity and gas end-uses, according to the following table:

Year	Target (Mtoe/year)	
	Electricity	Gas
2002	0.1	0.1
2003	0.5	0.4
2004	0.9	0.7
2005	1.2	1.0
2006	1.6	1.3

Eligible Energy Saving projects

The following criteria hold for the possible eligible projects:

- only demand-side actions are eligible (i.e. energy savings obtained from the electricity generation and transmission are not eligible)
- and illustrative list of project was specified by the Twins Decrees; it considers 14 classes of projects with more than 35 sub-classes; among the others:
  - use of high efficiency electric devices/motors,
  - substitution with electric energy where convenient
  - containment of electricity leaking (stand-by)
  - increasing efficiency of lighting systems
  - power factor regulation in final uses
  - improving the combustion efficiency
  - building insulation

The present example belongs to the last class.

Obligation-bound actors

The identified obligation-bound actors are the Electricity and Gas Distributors with a threshold of 100.000 customers as at 31.12.2001:

- gas: 22 distributors, serving about 60% of total customers
- electricity: 8 distributors, serving about 98% of total customers

The project must be implemented by:

- distributors (directly or via controlled companies)
- ESCOs (still to be developed)

Need of an evaluation procedure

In order to make possible an *ex-ante* evaluation of the energy savings, the National Regulatory Authority for Electricity and Gas promoted the establishment of "standard" procedures, based on conservative and conventional (though realistic) assessments, which give the gross primary energy savings attainable for a single building as a function of few and well characterised

[1] I.e. issued jointly by the Ministry of Productive Activities and the Ministry of Environment

parameters.The procedure for energy saving evaluation in indoor heating consequent from building insulation is described in detail in the following chapters.

Procedure for savings energy

Two procedures were developed to evaluate the yearly gross specific savings (RSL) of primary energy per m^2 of insulated surface (wall and/or roofings): an extensive one and a simplified one, which was definitely adopted. The values of energy savings derived from the simplified procedure are to be considered for the final evaluation of the projects specifically referring to wall/roofings insulation. The logical steps to quantify these savings, from the detailed to the simplified procedure, are described in the following sections.

Detailed procedure

(1) Evaluation of the energy savings

The procedure is aimed at evaluating the yearly specific savings of primary energy resulting by the application of insulating material to the building walls or roofings. The detailed procedure considers the yearly savings RSL (toe/m²/year) of specific[1] energy needs for heating, assuming a reference situation as a base for the calculations; thus, this value is adjusted by some correction factors which keep into account the difference between the reference situation and the actual one. The evaluation is ruled by the following formula:

$$RSL = \Delta EH_0 \cdot K1 \cdot K2 \cdot K3 \cdot K4 \qquad [toe/m^2/year] \qquad \textbf{(1)}$$

where:

- ΔEH_0 (MWh/m²/year) is the yearly savings of energy needs for heating per m² of insulated surface in the reference situation.
- K1 (-) is a variable correction factor, depending on the specific climatic zone[2]
- K2 (toe/MWh) is a variable correction factor, depending on the specific existing heating plant and used energy source
- K3 (-) is a variable correction factor depending on the kind of not continuous operation of the heating plant (depending itself on the specific purpose of use - building sector - considered)
- K4 (-) is a variable correction factor depending on the kind and the thickness of the specific adopted insulating material

EH_0 is evaluated as:

$$\Delta EH_0 = 24 \cdot 10^{-6} \cdot \Delta K_p \cdot DD^* \qquad [MWh/m^2/year] \qquad \textbf{(2)}$$

where:

DD* is a value of degree days . The arbitrary reference value adopted herein, equal to **1667 dd**, is an average over the above climatic zones)

ΔK_P (W/m²K) is connected to the variation of the average thermal transmittance, in the reference situation, before and after the intervention of insulation; it is a function of the difference of thermal transmittance of the walls before/after the intervention and of the difference of thermal transmittance of the *thermal bridges* before/after the intervention; the assumed reference value is ΔK_p = **0.5 W/m²K**.

With the adopted reference values we obtain:

$$\Delta EH_0 = 0.02 \quad MWh/m^2/year \qquad \textbf{(3)}$$

The criteria for determining the single variable correction factors K1, K2, K3, K4, used for the evaluation of the gross specific savings of primary energy are described below.

[1] Specific = per m^2 of insulated surface

[2] A climatic zone is a conventional cluster of municipalities sharing a value of degree-days (e.g. averaged over the years) within a given range. Italian regulations consider 6 climatic zones.

(2) Variable correction factors

- K1 variable correction factor, depending on the specific climatic zone – nondimensional

  It is related to:
  - Degrees days of the considered place (Climatic zones – see footnote 2)
  - Number of days for heating[1]
  - Contribution of solar radiation[1] evaluated as a function of the average solar radiation in the considered place

The Tab. 1 shows the K1 values adopted as a function of the climatic zones; the A and B zones are merged since the A zone involves a very small number of municipalities. A further dependence on the kind of intervention (insulation of wall/roofings or insulation of a floor on an arcade) is kept into account as well.

	K1 (nondimensional)	
Climatic zone	**Walls/roofings**	**Floor on arcade**
A, B	**0.36**	**0.47**
C	**0.60**	**0.71**
D	**0.95**	**1.06**
E	**1.42**	**1.51**
F	**2.01**	**2.11**

Tab. 1 – Considered climatic zones (parameter K1)

- K2 variable correction factor, depending on the specific existing heating plant and used energy source – toe/MWh –

  Is related to:
  - Emission efficiency of the existing heat generation plant, related to the heat losses through exhaust gases
  - Distribution efficiency, related to the insulation of the circuits distributing the heat into the building
  - Regulation efficiency, related to the presence of thermostats driven by indoor temperature, herein assumed as either good or moderate
  - Heat generator efficiency:
    - *Conventional heaters*: according to [1]
    - *Heat pumps*: evaluated form experimental data or from price list data, averaged on the different market products and suitably corrected with conservative factors.

  The K2 parameter combines also the conversion factors from used energy (electric energy or energy produced by the direct use of fuel) and primary energy (toe) according to the existing regulations.[2]

  The K2 values are shown in **Tab. 2** as a function of the different typologies of heat generators. Each typology are further characterised according to the conditions of its regulation systems (good for relatively new devices, moderate for relatively old ones)

Heat generators	regulation	K2 (toe/MWh)
Traditional oil/gas heater	**good**	**0.114**
	moderate	**0.118**
High efficiency oil/gas heater	**good**	**0.107**

[1] In Italy these quantities have been specified by national laws and regulations

[2] In Italy, the above mentioned twin Decrees 24.4.01

Heat generators	regulation	K2 (toe/MWh)
	moderate	**0.110**
Condensing gas heater	**good**	**0.098**
	moderate	**0.101**
Electric heat pump air-air	**good**	**0.096**
	moderate	**0.099**
Electric heat pump air-water	**good**	**0.083**
	moderate	**0.086**
Split or multisplit electric heat pumps		**0.089**

Tab. 2 – Considered typologies of heat generators(parameter K2)

- K3 variable correction factor depending on the kind of not continuous operation of the heating plant (depending itself on the specific purpose of use - building sector - considered) – nondimensional value –

  Is related to:
  - Hours/day and days/week when the heating plant is working; these values are defined by law and depend on the purpose of use of the building; in case of continuative use of the plant, which is typical of hospital structures, a value of 1 is assumed for K3
  - Degrees days of the place (see footnote 1) (connected to the climatic zone)
  - Thermal physics characteristics of the building (heat losses and thermal mass of the building) (see footnote 1)

  The building sectors considered for wall insulation in this procedure were classified through three main categories:
  – residence (excluding holiday houses)
  – offices, commercial distribution, educational
  – hospitals

  This approach, though somehow rough, tends to merge those sectors which shows similar ways of operation (timing, working days/weeks) of their thermal plants

A further aspect is evidenced, tied to the thermal physic characteristics and having impact on how intermittent is the running of heating plant: the already available insulating level before the intervention. This level is very strictly connected with the adopted building techniques. A sub-classification with two sub-categories is then adopted for each building sector. The considered sub-categories are:

- good insulating level: building with masonry load bearing structure o compliant with up-to-date national legislation on the matter
- poor insulating level: building with steel / reinforced concrete load bearing structure or non compliant with up-to-date national legislation on the matter

A last sub-sub-classification is adopted in the frame the above mentioned previous one, which keeps into account how the application of the insulating material (on either the internal or the external side of the walls) influences the intermittence of the plant operation..

The values of K3 adopted for the buildings used with purpose of residence, of office/commerce/educational and of hospitals are shown in Tab. 3. As before pointed out, we assumed K3=1 for hospital buildings.

K3 (nondimensional)									
Climatic zone	Residences				Offices, commerce, educational				Hospitals
	Masonry load bearing or compliant with legislation		Steel / reinforced concrete load bearing or non compliant with legislation		Masonry load bearing or compliant with legislation		Steel / reinforced concrete load bearing or non compliant with legislation		
	Insulation external side	Insulation internal side	Insulation external side	Insulation Internal Side	Insulation external side	Insulation internal side	Insulation external side	Insulation internal side	
A, B	0.63	0.44	0.54	0.42	0.60	0.40	0.50	0.38	1
C	0.71	0.58	0.64	0.50	0.67	0.53	0.60	0.45	1
D	0.78	0.72	0.74	0.58	0.75	0.67	0.70	0.51	1
E	0.85	0.81	0.82	0.73	0.77	0.72	0.73	0.61	1
F	0.90	0.87	0.88	0.81	0.78	0.75	0.75	0.64	1

Tab. 3 - Variable correction factor depending on the kind of not continuous operation (parameter K3)

- K4 variable correction factor depending on the kind and the thickness of the specific adopted insulating material – nondimensional value -

  It expresses the effect of increasing the building insulation; it is related to:
  - The thermal transmittance K of the considered structure components (wall/roofings) before the interventions
  - Kind and thickness of the use insulating material.

  The values of K4 for the kinds and thickness of used insulating materials are shown in Tab. 4.

	K4 (nondimensional)									
K (W/m²K) structure component before intervention (class – see Tab. 14)	**Insulating material class A**			**Insulating material class B**			**Insulating material class C**			
	3 cm	**5 cm**	**7 cm**	**3 cm**	**5 cm**	**7 cm**	**5 cm**	**7 cm**	**9 cm**	**12cm**
0.80	0.69	0.89	1.02	0.56	0.75	0.89	0.49	0.61	0.71	0.83
1.00	0.97	1.22	1.37	0.80	1.05	1.22	0.71	0.88	1.00	1.14
1.20	1.27	1.57	1.74	1.07	1.37	1.56	0.96	1.16	1.31	1.48
1.4	1.59	1.92	2.11	1.35	1.70	1.92	1.23	1.46	1.63	1.82
1.7	2.09	2.47	2.68	1.81	2.22	2.47	1.65	1.94	2.14	2.36
2.0	2.61	3.03	3.26	2.29	2.76	3.03	2.11	2.43	2.67	2.91

Tab. 4 – Kinds and thickness of the considered insulating materials (parameter K4)

As for the used insulating materials, three classes were identified as a function of their average thermal conductivity:

- class A: λ=0.032 W/m°K
- class B: λ=0.045 W/m°K
- class C: λ=0.090 W/m°K

It should be noticed that this procedure does not consider the effects of reduction of heat losses from the thermal bridges; they can be taken into account by summing 0.3 to the K4 values of Tab. 4

Supplementary conditions may be required on minimum values of the thermal resistance of the adopted insulating material, such as those involved by the present procedure and shown in Tab. 5.

Climatic zone	Minimum accepted thermal resistance [m² K/W]
A, B	**0.9**
C	**1.0**
D	**1.1**
E	**1.2**
F	**1.3**

Tab. 5 - Minimum accepted values for thermal resistance

According to it, the values of thermal resistance *R* of the used insulating material are obtained from the relevant technical records reporting the thermal conductivity λ and the thickness *d*. The obtained $R = d / \lambda$ *(m² K/W)* must be greater of the minimum values shown in Tab. 5

Simplified procedure

56.1.1 (2)Variable correction factors

A simplified procedure has been developed, where definite values were assigned to the variable correction factors, according to the below remarks.

- **K1** (Climatic zone): the values for wall/roofings are adopted also in the case of floor on arcade (see Tab. 1). It follows that:

	K1
Climatic zone	Walls/ roofings
A, B	**0.36**
C	**0.60**
D	**0.95**
E	**1.42**
F	**2.01**

Tab. 6 – Values of K1 adopted in the simplified procedure

- **K2** (kind of thermal plant): a weighted average value is used, with a variable weight according to the considered purposes of use of the building. The average value was determined assuming a reasonable distribution of the typologies of thermal plants for each building sector (Tab. 7)

Heat generators	**Residential**	**Offices, commerce, educational**	**Hospitals**
Traditional oil/gas heater	80%	50%	50%
High efficiency oil/gas heater	15%	20%	20%
Condensing gas heater		5%	5%
Electric heat pump air-air		10%	10%
Electric heat pump air-water		5%	10%
Split or multisplit electric heat pumps	5%	10%	5%
Weighted average value for K2	0.114	0.108	0.107

Tab. 7 - Adopted distributions to evaluate the weighted average value of K2 for each purpose of use

- **K3** (intermittence of operation): an average value is used, depending only on the climatic zone and the purpose of use of the building (Tab. 8)

K3			
Climatic zone	**Residential**	**Offices, commerce, educational**	**Hospitals**
A/B	0.509	0.471	1.000
C	0.608	0.563	1.000
D	0.707	0.657	1.000
E	0.803	0.708	1.000
F	0.866	0.731	1.000

Tab. 8 – Average values of K3 for climatic zone and purpose of use

Adopted in the simplified procedure

K4 (wall insulation before and after the intervention): the evaluation of K4 was simplified by assuming a fixed average value for the thermal resistance of the insulating material used for the intervention. This average value is slightly greater than the minimum accepted thermal resistance shown in Tab. 5: in fact, for a given climatic zone it follows from this minimum acceptable value, increased of 0.22 m²K/W (corresponding to a supplementary insulation equivalent to 1 cm of polystyrene). On the basis of these remarks, the values of K4 shown in Tab. 9 are obtained as a function of the climatic zone and of the thermal transmittance K of the structure before the intervention.

	K4					
	K of the structure before the intervention [W/m²K] (class – see Tab. 14)					
Climatic zone	**0.8**	**1.0**	**1.2**	**1.4**	**1.7**	**2.0**
A, B	0.75	1.05	1.37	1.70	2.22	2.76
C	0.79	1.10	1.43	1.77	2.30	2.84
D	0.83	1.14	1.48	1.82	2.36	2.91
E	0.86	1.18	1.52	1.87	2.42	2.97
F	0.89	1.22	1.56	1.92	2.47	3.03

Tab. 9 – Value of the parameter K4 evaluated as a function on the climatic zones
and of the characteristics of the wall pre-existing to the intervention

56.1.2 Energy savings evaluation

The simplified procedure for the evaluation of the specific primary energy savings for unit (m^2) of insulated surface is described by the following equation:

$$RSL = \Delta EH_0 \cdot K1 \cdot K2_{weighted,\ averaged} \cdot K3 \cdot K4_{weighted,\ averaged} \qquad [toe / m^2 / year] \qquad \textbf{(4)}$$

where the values of the parameters are those of Tab. 6, Tab. 7, Tab. 8 and Tab. 9.

The results of this evaluations are synthesised in the below Tab. 10, Tab. 11 and Tab. 12. Each table is relevant to a purpose of use (building sector), with climatic zone and thermal transmittance K assumed as independent variables.

	Gross specific savings of primary energy (RSL) for the residential sector (Toe 10^{-3}/m² /year)					
	K of the structure before the EE measure [W/m²K]					
Climatic zone	0.8	1.0	1.2	1.4	1.7	2.0
A, B	0.31	0.43	0.56	0.70	0.91	1.13
C	0.66	0.91	1.18	1.47	1.91	2.36
D	1.26	1.74	2.25	2.78	3.60	4.44
E	2.22	3.05	3.93	4.84	6.24	7.67
F	3.51	4.81	6.18	7.58	9.75	11.96

Tab. 10 - Gross specific savings of primary energy for the residential sector

	Gross specific savings of primary energy (RSL) for the offices, commercial and educational sectors (Toe 10^{-3}/m² /year)					
	K of the structure before the EE measure [W/m²K]					
Climatic zone	0.8	1.0	1.2	1.4	1.7	2.0
A, B	0.27	0.38	0.49	0.61	0.80	0.99
C	0.58	0.80	1.04	1.29	1.67	2.07
D	1.11	1.53	1.98	2.45	3.17	3.90
E	1.85	2.55	3.28	4.04	5.21	6.41
F	2.81	3.85	4.94	6.07	7.80	9.57

Tab. 11 - Gross specific savings of primary energy for the offices, commercial and educational sectors

	Gross specific savings of primary energy (RSL) for the hospital sector (Toe 10^{-3}/m² /year)					
	K of the structure before the EE measure [W/m²K]					
Climatic zone	0.8	1.0	1.2	1.4	1.7	2.0
A, B	0.57	0.80	1.05	1.30	1.70	2.10
C	1.02	1.42	1.84	2.28	2.97	3.67
D	1.68	2.33	3.01	3.72	4.81	5.93
E	2.61	3.59	4.63	5.70	7.35	9.04
F	3.83	5.25	6.74	8.28	10.64	13.06

Tab. 12 - Gross specific savings of primary energy for the hospital sector

These last three tables are merged into the Tab. 13, where the numerical values are rounded to the first meaningful figure after the decimal point.

Physical reference unit:	Unit of insulated surface
Gross specific savings of primary energy which can be obtained for a single building: **(S = surface of insulated walls/roofings)**	**RTL = RSL x S (toe 10^{-3}/year/building)**
Gross specific savings of primary energy per unit of insulated surface (RSL):	**Building sector:** **residential**
	RSL (toe 10^{-3}/year/m^2 of insulated surface)

	K [1] of the structure before the EE measure (W/ m^2/ K)					
Climatic zone[2]	***0,7÷0,9***	***0,9÷1,1***	***1,1÷1,3***	***1,3÷1,6***	***1,6÷1,8***	***>1,8***
A, B	0,3	0,4	0,6	0,7	0,9	1,1
C	0,7	0,9	1,2	1,5	1,9	2,4
D	1,3	1,7	2,3	2,8	3,6	4,4
E	2,2	3,1	3,9	4,8	6,2	7,7
F	3,5	4,8	6,2	7,6	9,8	12,0
Gross specific savings of primary energy per unit of insulated surface (RSL):	**Building sector: <u>offices, educational, commerce</u>**					
	RSL (toe 10^{-3}/year/m^2 of insulated surface)					
	K of the structure before the EE measure (W/ m^2/ K)					
Climatic zone	***0,7÷0,9***	***0,9÷1,1***	***1,1÷1,3***	***1,3÷1,6***	***1,6÷1,8***	***>1,8***
A, B	0,3	0,4	0,5	0,6	0,8	1,0
C	0,6	0,8	1,0	1,3	1,7	2,1
D	1,1	1,5	2,0	2,5	3,2	3,9
E	1,9	2,6	3,3	4,0	5,2	6,4
F	2,8	3,9	4,9	6,1	7,8	9,6
Gross specific savings of primary energy per unit of insulated surface (RSL):	**Building sector: <u>hospitals</u>**					
	RSL (toe 10^{-3}/year/m^2 of insulated surface)					
	K of the structure before the EE measure (W/ m^2/ K)					
Climatic zone	***0,7÷0,9***	***0,9÷1,1***	***1,1÷1,3***	***1,3÷1,6***	***1,6÷1,8***	***>1,8***
A, B	0,6	0,8	1,1	1,3	1,7	2,1
C	1,0	1,4	1,8	2,3	3,0	3,7
D	1,7	2,3	3,0	3,7	4,8	5,9
E	2,6	3,6	4,6	5,7	7,4	9,0
F	3,8	5,3	6,7	8,3	10,6	13,1

Tab. 13 – Procedure for energy savings evaluation

To make the use of Tab. 13 simpler as for the evaluation of the K thermal transmittance before the intervention of insulation, the correspondence between values of K and some of the most widespread structures (wall or roofing) assumed as a reference for the existing building is pointed out in Tab. 14.

Class	K wall (W/m^2 K)	Typology of structures
0.8	0.7÷0.9	Homogeneous hollow brick wall with a 3 cm insulating panel (12 cm) Concrete hollow block wall with a 3 cm insulating panel Horizontal brick-concrete roofings with a 3 cm insulating panel Sloping brick-concrete roofings + not insulated tile-concrete garret floor
1.0	0.9÷1.1	Installed concrete wall + 3 cm insulating panel Cavity wall made of hollow brick without insulation **Concrete cavity wall + 3 cm insulating panel** Cavity wall made of brick-concrete without insulation Light panel with 4 cm insulating panel

[1] Thermal Transmittance of the structure before the EE measure.

[2] A climatic zone is a conventional cluster of municipalities sharing a value of degree-day (e.g. averaged over the year) within a given range. Italian regulations consider 6 climatic zones.

1.2	1.1÷1.3	Lightened concrete wall (20 cm) Cavity wall made of hollow or solid brick without insulation Sloping roof tiling + brick-concrete garret floor without insulation
1.4	1.3÷1.6	Solid concrete wall (35 cm) without insulation Natural rock (50 cm) without insulation Horizontal brick-concrete roofings without insulation Wood slab with air space
1.7	1.6÷1.8	Solid concrete wall (25 cm) without insulation
2.0	> 1.8	Monolithic wall (12 cm) without insulation Concrete wall without insulation Concrete hollow block wall (30 cm) without insulation Concrete cavity wall without insulation

Tab. 14 – Correspondence between building typology and thermal transmission value

The primary energy savings relevant to *thermal bridges* insulation can be evaluated in a simplified way as well by a 10% increasing of the savings of Tab. 13. In this procedure this evaluation is formally accepted only for external and continuous[1] insulations.

Evaluation of the gross savings of primary per building unit

The gross specific savings of primary energy RTL relevant to the insulation of walls and roofings of a building is given by:

$$RTL = RSL \cdot S \qquad [toe / year] \qquad \textbf{(5)}$$

where S is the surface in m^2 of insulated walls and/or roofings for the specified building.

Economics

There is the intention on part of the National Bodies who oversee the implementation and the application of the Twin Ministerial Decrees to valorise the saved primary energy. Such an approach is bound to create a rational base for identifying an economic value for the specific energy efficiency measures. At the moment, no final decision has been taken yet, though authoritative opinions were expressed in favour of values of the saved toe ranging between **100 and 200 Euro/toe**, regardless of the kind of performed energy efficiency measure,

[1] That is, the insulating material must cover the external side of the structure without solution of continuity.

APPENDIX I

SUMMARY OF ITALIAN NEW ENERGY EFFICIENCY POLICY FRAMEWORK

A new policy framework have been defined in Italy in the last few years, following different policy drivers with particular reference to Kyoto targets and security of supply, taking also into account potential negative impact of the liberalisation process (consisting in gradual decreasing of energy prices and raising consumption). In particular two Decrees on energy saving have been issued.
In the followings the main contents of the Decrees are schematically summarised.

- ***TWO TWIN MINISTERIAL DECREES ON ENERGY EFFICIENCY:***

- Relevant to Electric Energy and Gas respectively
- Ministers: Environment together with Production Activities Minister
- Date: 24 April 2001

The Decrees define:

- **MANDATORY QUANTITATIVE NATIONAL ENERGY SAVING TARGETS**
  in terms of primary energy

year	EL. ENERGY	GAS
▪ 2002	0,10 Mtoe/y	0,10 Mtoe/y
▪ 2003	0,50 Mtoe/y	0,40 Mtoe/y
▪ 2004	0,90 Mtoe/y	0,70 Mtoe/y
▪ 2005	1,20 Mtoe/y	1,00 Mtoe/y
▪ 2006	1,60 Mtoe/y	1,30 Mtoe/y

- **DISTRIBUTORS' TARGETS**

- Threshold: 100.000 customers as at 31.12.2001
- Apportionment on the basis of the quantity of electricity/gas distributed to final customers compared to the national ones, in previous year
- Savings must be at least 50% via reduction of electricity and gas consumption for electricity and gas distributors respectively
- Specific Regional targets can be added by Regional Administrations

Targets have to be achieved through the implementation of ENERGY SAVING PROJECTS .

❑ ELIGIBLE PROJECTS

- Only Demand-side actions
- Projects started in 2001, if part of a voluntary agreement and subjected to AEEG's approval
- The Decrees give an illustrative list of eligible kinds of project :
    - substitution of existing systems and apparata with more efficient ones
    - implementation of new systems at high efficiency level
    - domestic, tertiary and industrial sectors involved

  (Note: supply-side projects are not eligible .. but the illustrative list includes CHP and micro CHP as well small PV plants)

  14 classes of projects with more than 35 subclasses are defined

- Maximum lifetime of projects: 5 years

❑ PROJECT IMPLEMENTATION AND VERIFICATION

Energy saving projects can be implemented by:
- Distributors (directly or via controlled companies or ESCOs)
- ESCOs

There is no project pre-approval, but:

- Projects must comply with the GUIDELINES for the design, implementation and evaluation of projects to be issued by Regulatory Authority for Electricity and Gas (AEEG), after consultation with interested parties (regions, utilities, environmental NGOs, consumers associations etc.)

- AEEG verifies the compliance of the projects →ex-post evaluation and certification of energy savings (*in toe)*

A consultation document have been released by AEEG in April 2002 for the implementation of the Decree.

❑ ENERGY EFFICIENCY CERTIFICATES (EECs)

- Following verification on a project by project basis AEEG CERTIFIES THE ENERGY SAVINGS ACHIEVED BY ISSUING ENERGY EFFICIENCY CERTIFICATES (EECS) → *EECs are issued ex-post and on an annual basis*
- The value of EEC is equal to the certified reduction of energy consumption
- EECs are released to Electricity/Gas Distributors or ESCOs
- EECs are tradable
    - via bilateral contracts
    - in a specific EEC market

❑ COMPLIANCE CONTROL AND SANCTIONS

- AEEG makes an annual compliance control with the distributors' obligation
- SANCTIONS for non-compliance:
    - proportional and in any case greater than investments needed to compensate the non-compliance
    - to be paid in 2004 for 2003 targets and in 2005 for 2002 ones→ 2003 first year without possibility to compensate under compliance

❑ COST RECOVERY MECHANISM

Costs born by distributors to carry out projects in the framework of the two Decrees:

- can be recovered via electricity and gas TARIFFS
- net of any contribution from other sources
- criteria and mechanism to be defined by AEEG
- these criteria have to take into account, inter alia, any net profits variations (+or-) resulting from projects implementation

APPENDIX II

CASE NOMINATION FORM

Name of Program: see attached TABLE "- ITALY- POLICY MEASURE: EE CERTIFICATES"			
Program Sponsor: Energy Distributors/ESCOs			
Country(s):		**Region(s):**	
Program Start Date (mo/yr):2001		**Program End Date (mo/yr):2006**	
Market Actors Targeted: mark with x as appropriate			
End Users X Large:	Small:	Supply Side (specify, e.g. installation contractors):	
Residential: X	Commercial: X	Industrial:	
Technologies Targeted (e.g. lighting, HVAC)			
See attached table			
Policy Measures Employed: Indicate with an 'x'. See Framework outline Sec. 1.3 for definitions			
	Economic Incentives: rebates, loans,	**X**	Information: training, labeling, EE certificates
	Energy Audits		Regulation: codes, standards
	Voluntary Agreements		Gov. by Example/Other
Status of Documentation			
Full Evaluation (eg. complete, if not complete, when expected): **Not yet evaluated and balanced data available.** Language:		Is evaluation public domain or released for use in this project? (Y/N) *Standardized evaluation methods defined within the project and published on 234/02 Regulatory Authority for Electricity and Gas. Deliberation*.	
Other Documents Available – List:			
Critical Evaluation Issues Addressed: Indicate with an 'x'. See Issues.doc for definitions.			
A. Evaluation Planning			
	Evaluation in Policy Dev't/Management		Tracking Systems
	Resource allocation over time/function		Resource allocation over prog. portfolio
	Precision v. policy requirements		Other: Specify:
B. General Evaluation methods			
	Program Theory Statements		Specification of effects indicators
	Baseline Development/Net Effects		Energy Savings Estimates
	Emissions Reduction Estimates		Other: Specify:
C. Special methodological topics			
	Sales and Market Tracking		Characterizing the supply side
	Cost effectiveness of impact methods		Allocating effects to multiple programs
	Short term predictive indicators		Other: Specify:

POLICY MEASURE: EE CERTIFICATES (category: Information)

PROGRAMS AND STANDARDISED EVALUATION methods

(Delibera dell'Autorità n.234/02 del 28 gennaio 2003;

Documento di consultazione del 4 Aprile 2002)

Sector	***Program***	***Physical unit***	***Indicator (*): Specific Primary Energy Savings [SprE]*** *[tep/year] /physical unit*	***Baseline***	***Notes***
Domestic LIGHTING	Substitution of incandescent lamps with integrated **CFLs**	**Lamp**	14.6×10^{-3}	Weighted average (on typical domestic power and use) Yearly consumption of incandescent lamp	
SANITARY WATER	Substitution of electrical Water Heater with **NATURAL GAS WATER HEATER (**power vented and electronic lighting)	Water heater	0.107	Average yearly energy consumption	
HEATING and sanitary water production	New installation of **4 stars BOILER** supplied by natural gas	Heated Apartment	$(11 – 105) \times 10^{-3}$ F (kind of use-heating or heating + sanitary water, climatic zone)	3 stars boilers (reference technology) 20 ° C heated house	Savings: -Use: heat.+SW >heat. -Zones: A+B<C< D<E<F
SANITARY WATER	Substitution of natural gas water heater (unvented and pilot light) with **NATURAL GAS WATER HEATER (**power vented and electronic lighting)	Water heater	0.063	Average yearly energy consumption	
BUILDING THERMAL INSULATION	Substitution of simple glass with **DOUBLE GLASS:** *heating*	Unit glass surface (m^2)	$2—27 \times 10^{-3}$ F (building use – dwelling, offices, schools commercial, hospitals- and climatic zone)	20 ° C heated house with Single glass installed	Savings: Use:dwelling<office <hospital. -Zones: A+B<C< D<E<F
BUILDING THERMAL INSULATION	**WALL** and cover insulation: *heating*	Unit wall surface (m^2)	$0.3—13 \times 10^{-3}$ F (building use – dwelling, office, school commercial, hospital-Climatic zone and thermal transmittance k before measure	20 ° C heated house with existing wall thermal transmittance value ($W/m^2/°K$) f(wall material and insulation)	Savings: - Use::office<dwelling<hospital. -Zones: A+B<C< D<E<F -> K before measure >

Sector	*Program*	*Physical unit*	*Indicator (*): Specific Primary Energy Savings [SprE]* *[tep/year] /physical unit*	*Baseline*	*Notes*
					savings
ELECTRICITY PRODUCTION	Use of **PHOTOVOLTAIC PLANTS** with electric power lower than 20 kW	Photovoltaic plant	0.22 x 10-3 kW p x H eq. x k1	Yearly electric energy not taken from the net produced by photovoltaic plant	KW p = peak kW Heq = h/year F(Solar Band)) K1 = F(module inclination :>70°:k1= 0.7 < 70° k1 = 1)
SANITARY WATER *(renewable sources)*	Use of **SOLAR COLLECTORS** for sanitary water production	Unit surface. of Installed collector (m^2)	60—270 x 10^{-3} F (kind of collector-plane or vacuum sealed And integrated/substituted plant – electric, gas/gas oil boiler)	Yearly thermal energy not taken from Electric and natural gas/gas-oil boilers produce with solar colectors	Savings: -Vacuum sealed > plane -El. Boiler> gas/gas oil

Country Report The Netherlands

Including case examples on:

Regulation	• Energy Performance Standard (EPS) for houses
Economic	• Energy premium scheme households • Energy Investment Reduction (EIA and EINP)
Voluntary Agreements	• Voluntary Agreements on Industrial energy Conservation 1990-2000

Hans Goumans
Harry Vreuls
SenterNovem

2004

1. Introduction

The Netherlands Government has been active in the field of energy conservation since the first oil shock. Various measures have been taken and the emphasis changed several times. This report presents in section 2the national system of energy policies since the midst 1990. During this period several programmes are evaluated and also attention has been given to monitoring and scenarios to improve the target setting of the energy policies (see section 3). In section 4 we deal with the methods on evaluating and include the increased relationship between energy savings and emission reductions. This is followed in section five with the selected evaluation cases on regulation, economic incentives and voluntary agreement. This report also holds a list of background documents, most of them in Dutch.

2. National system of Energy Efficiency Policies and Measures

In 1995 the Dutch Government published the third policy paper on energy, stating ambitions for the short term and the long term. The goals for the year 2020 were: 33 % improvement in energy efficiency and a share of renewable energy of 10 %. The Ministry of Economic Affairs was responsible for the implementation of the measures and developed sector oriented and technological programmes. Most of these programmes were carried out by energy agencies.
The short term goal, for the year 2000, focuses on a mean improvement of the energy efficiency of 1.7 % per year and is a continuation of the policy formulated in the policy paper on energy conservation of 1993. This policy consisted of three main areas: voluntary agreements for the industry, rules for energy in the environmental permit for SME's and technology programmes. For the build environment the development of an energy standard was the body of the policy.

Around the year 2000 some major changes occurred with respect of energy policy. The first important one was the European action for liberalisation of the energy market, starting with electricity. The second point is related to the international developments regarding climate change (Kyoto).
Accompanying the liberalisation of the energy market, an Ecotax on electricity was introduced in The Netherlands. This fiscal measure was used to stimulate the introduction of renewable energy.
Because in this period the voluntary agreements with the industry were at the end of the duration, the industry decided to develop additional the Benchmark Covenant Energy Efficiency. This is now in action until about 2012.
Due to the stronger relation with environmental topics, some programmes have been transferred from the Ministry of Economic Affairs to other Ministries. In relation to the liberalisation of the energy market, the Ministry of Economic Affairs decided to chance the focus of programmes from dedicated technology development to general programmes. So a more market orientation was introduced.

3. System for evaluating, monitoring and data collection on energy policies and measures and relevant

The general approach for the evaluation of energy efficiency measures in The Netherlands is related to the way policy measures are transferred into well defined programmes. Evaluation is mostly done at the programme level after a running period of 4 years.
In most cases the evaluations have been carried out by external consultants. The results were used to get an up-date of the programme and as input for the policy process.

On the level of policy papers the Government used internal evaluation, supported by scenario studies carried out by research institutes and governmental agencies. Data collection was general performed by Statistics Netherlands (CBS).
In the last few years a "general protocol for energy conservation" has been developed. With this methodology, adopted by most institutes, reliable figures for overall energy conservation in The Netherlands have been derived.

As the energy policy became more and more interrelated with the Climate Change policy, energy policy measures are also evaluated within that framework, e.g. the progress of the Netherlands climate change policy: an assessment at the 2002 evaluation moment.

4. Method on evaluating energy efficiency programmes/policies/ measures (1995 onwards)

4. 1 Method used

The Ministry of Economic Affairs uses for the evaluation of programmes an internal guideline dating from 1994. This guideline describes the procedure, starting with the writing of a Terms of Reference for external consultants to subscribe for a contract for a particular evaluation. Also procedures for an advisory committee are given.
In general the evaluation focuses on three main questions:

- To what extent are the goals set out in the program met?
- How was the performance of the agency carrying out the program?
- What was the market response to the program?

The consultant starts the process with studying relevant documents, including progress reports and cost statements. Secondly interviews are performed with a selection of the stakeholders and contractors under the program. Sometimes a workshop is being held in order to discuss the results from the evaluation.

In the recent years the Dutch Ministry of Finance has developed a new format for the yearly departmental working programmes (in Dutch known as VBTB). This format is based on the description of policy measures in terms of performance indicators. Per policy measure it has to be made clear what the target is for a certain period, how this target will be reached and what the costs will be.

In addition a system for progress reports is introduced. Taken together, this system will result in a more clear view on the results of policy measures on an aggregated level. In line with this methodology, the Ministry of Economic Affairs has revised the guideline for evaluations. By the end of the year 2003 the Ministry of Housing, Spatial Planning and Environment introduced a Manual for evaluating Climate Change Policies that is also relevant for energy policy measures.

4.2 Baseline (ex ante evaluation) and relation with national scenario/model

Ex ante evaluation and the use of scenarios is mostly used in policy papers, which have by nature a high level of aggregation. Examples of reports are:

- Sectoral CO_2 emissions in The Netherlands up to 2010 Update of the Reference Projection for Policy-making on Indicative Targets P.G.M. Boonekamp B.W. Daniels A.W.N. van Dril P. Kroon J.R. Ybema R.A. van den Wijngaart, RIVM ECN-C--04-029, March 2004
- Reference Projections Energy and Emissions 2005-2020, A.W.N. van Dril and H.E. Elzenga ECN and RIVM, 2002
- Additional energy saving, a more detail research: background documentation to the Energy savings Memorandum 1998, Kroon, P. and others, ECN-C--98-093 November 1998 (in Dutch)
- The Netherlands' Climate Policy Implementation Plan researched, Beeldman, M., Oude Lohuis, J. Annema, J.A. and van den Wijngaart, R.A. September 1999 (in Dutch)
- Option document on GHG emission reduction, Inventory related to Netherlands' Climate Policy Implementation Plan, Beeldman, M. and others, October 1998 (in Dutch)

For concrete measures laid down in executable programmes this methodology is seldom used. The Voluntary Agreements had a general target for improving the energy efficiency of 20% in a ten years time period and the introduction of Energy Performance Standard in the Building should result in energy savings for new houses up to 30%.

4.3 Ex post evaluation

With the guideline from 1994 the Ministry of Economic Affairs introduced a systematic planning for ex post evaluation of programmes. Moreover, a general policy has been developed to evaluate Governmental policy measures on a systematic basis. Ministries have to present a list of measures to be evaluated each year. Also the Governmental Audit Authority evaluates various policy measures and reports to the Parliament (see section 7 sources).

4.4 Use of indicators

Most indicators used in energy conservation or technical programmes are related to improved technical performance and price reduction. Sometimes newly installed amounts of megawatts or number of units is used, e.g. in the programmes for wind energy or solar heating.

The program dealing with the Voluntary Agreements with the industry uses the calculation of an Energy Efficiency Index for each participant.

Recently discussion has started on the development of additional indicators like market shares and environmental performance.

4.5 Calculations on GHG emission impact for evaluated programmes

On the level of individual programmes calculations of CHG emissions are not performed. However, on the level of general policy development one can notice more focus on CHG emissions and in these policy documents energy related emissions of CHG are discussed. In a recent evaluation of Climate policy by the Governmental Audit Authority the body of the report was based on energy policy measures.
Also in the reports mentioned ahead in section 4.2 CHG emissions are calculated for energy savings. Also the (Third) National Communications on climate change policies reports on this matter.

In 2004 an action started for a national list of default CO2 emission factors for fuels that should be used for reporting in environmental reports and monitoring reports in LTA from 2005 onwards. That report will be available at the website www.greenhousegases.nl

5. Method used for selected evaluated EE policy measures, case examples

5.1 Case for category Regulation: Energy Performance Standard (EPS) for houses

Programme description

A. Name of the programme: Energy Performance Standard (EPS) for houses

B. Sponsoring Agency: Ministry of Housing and the Ministry of Economic Affairs

C. Objectives

At the end of 1995 an Energy Performance Standard (EPS) was introduced in the Dutch Building Decree. The objective of this legal instrument was to reduce the energy use in new houses, but give freedom to architects, developers and house owners on how they prefer to reach a performance level. From 15. December 1995 all new houses should have an energy performance of 1.4 or lower. By 1. January 1998 the maximum level was set to 1.2 and by the year 2000 to 1.0. The level of 1.0 should result in a 28 % reduction of the energy using compared to a similar house with a performance of 1.4.

D. Programme activities

During the 1970's and 1980's the Dutch policy for energy savings in houses was implemented by increasing the insulation rates for roofs, wall, glass etc. for existing and for new houses. In the 1990's this changed for new construction to an integrated approach: no longer the insulation measures as such, but the performance of the new build house in total. This standard leaves the

choice of energy-saving measures to the market, but the existing insulation requirements were retained as basic requirements.

To determine what the performance for a house would be, two different types of calculation schemes were developed. One for calculating the 'energy budget' for a type of house and another to prove (on paper) that the performance was at or below the legal standard. In these calculations not only the energy use related to space heating, cooling and ventilation and lighting is included, but also the water heating system. This should give an additional stimulus for domestic solar hot water systems.
During this process several standard types of houses were agreed on. One type was chosen for indicating the expected energy savings: a standard one family house. This type is used to calculate (ex-ante) the energy savings referring to new houses build before 1995. The EPS 1.2 (or lower) for building permits after 1 January 1998 should result in an energy saving of about 15%, referring to houses build before 1995. The EPS-related energy use related to gas use should then be about 1,200 m3. The EPS 1.0 (or lower), by 1 January 2000 should result in 28% energy savings. The EPS-related energy use would be about 1,000 m^3 gas. This assumption was used in models for scenarios on energy use and the policy impact.

Additional to this legal instrument the instrument of demonstration and information was used. Prior to an update of the EPS the practical application of measures to reach this new threshold was demonstrated in several projects and information on the results distributed using leaflets, reports and conferences. Also information for architects, local authorities, builders etc was produced in a variety of products: software tools, handbooks, toolkits etc. Also a kind of voluntary agreement on sustainable building with housing corporations was used to support the introduction of new build housed with lower EPS value than the legal threshold.

E. Development and operation

The programme ran from 1995 to 2000.

F. Administration

Novem together with SBR supported the Ministries during the preparation and implementation.

Evaluation objectives, activities, results

A. Evaluation objectives

There has been no formal evaluation conducted, but since 1994 several surveys were conducted, mainly:

- To get information on the distribution of the EPS values of new build houses;
- To prove that also in praxis new houses with a lower EPS value use less energy;
- To show that over time the energy use of the yearly new build houses decrease with the changing EPS values in the Building Decreed.

B. Evaluation activities

Ad the end 1994 Novem researched the situation for energy saving measures in designed houses. This was just before the introduction of the **EPS** in December 1995. A substantial part of the houses, as designed in 1995 by architects, had at that moment already more insulation measures and/or measures on a higher level then the legal one.

In the period 1998-2004 Novem (now SenterNovem) commissioned several surveys and studies on the Energy Performance Standard.
The first one (in 1998) was targeted to houses that became available for household to live in by the year 1997. It showed several important issues, two of these are:

- The building process of houses started for 46% of the houses already before the EPS was included in the Building Decree by the end of 1995;
- Houses build under the EPS legal system show a variety of values: a little over half holds the minimum standard of 1.4; 30% holds the standard of 1.2 (that became the new minimum level by 1.1.1998);

Two years later (in 1999) this survey was repeated for houses available for households to live in by the year 1998. For these houses 92% a building permit was under the EPS system of 1.4; none was with a building permit on the standard of 1.2. About 42% of the houses held an EPS value of 1.4 and 29% a value of 1.2-1.4. So almost 30% of the houses hold values below 1.2 (but about 3% a value of 1.0 that became the new minimum level by 1.1.2000).

In 2003 the survey was repeated again for houses available for households to live in by the year 2000 and 2001. This survey showed that still less then 1% of all new build housed had an EPS value of 0.8 or lower and that by 2001 the number of houses that met the new threshold of 1.o (or lower) is less than a quarter.

Table 5.1a Distribution of EPS classes in new build houses in the period 1997-2001

<table>
<tr><td>EPS class \ year</td><td>1997</td><td>1998</td><td>2000</td><td>2001</td></tr>
<tr><td>>1.4</td><td>52 %</td><td>42 %</td><td rowspan="2">89.9 %</td><td rowspan="2">76.6 %</td></tr>
<tr><td>>1.2 – 1.4</td><td>18 %</td><td>29%</td></tr>
<tr><td>>1.0 – 1.2</td><td rowspan="3">30 %</td><td>26 %</td><td></td><td></td></tr>
<tr><td>>0.8 – 1.0</td><td rowspan="2">3 %</td><td>9.6 %</td><td>22.6 %</td></tr>
<tr><td><= 0.8</td><td>0.5 %</td><td>0.7 %</td></tr>
</table>

In each survey also information on the **energy use** was collected. In the first study (buildings 1997) an attempt was made to relate the calculated energy use, based on the EPS of a dwelling, and the real energy use. This research concluded:

- The EPS is not intended to calculate real individual energy uses, but just to calculate the difference between the energy budget (for a specific type of house) and the calculated energy use (assuming a standardised family situation and use of appliances);
- Although the EPS should not be related on an individual level, on a country level the expected energy savings could be referred to the realised saving to investigate whether the expected energy savings (15% by EPS 1.2) were realised;
- The impact of behaviour and the penetration of new appliances in real life should be included in the analyses. The energy use data for just one year is too small for a good analysis.

Using the information from the survey mentioned ahead, it was clear that a representative survey on real energy uses, related to the introduction of the EPS could not be done. So the research for the houses 1998 concentrated on two items:

a. An indication of the real energy use, relate tot the EPS for a smaller number of dwellings;

b. A research layout for a structural monitor of energy use in new houses at a country level.

As real energy uses for two our three years are needed to have at least some trust in the results, the survey on the energy use had to be for houses build before 1997. But for these houses no EPS calculations are available, and it would be much too expensive to inspect houses is sample for all relevant variables for the EPS. So it was decided to use demonstration project for the survey. For these projects building information (and in several cases also EPS calculations) were available. Three projects with 474 houses were selected to be included in the survey. For about 45% of the 474 houses in three demonstration projects the needed information could be collected. The non-response by households on the questionnaire was 49%; missing energy use data causes so only 6% of drops out.
The average gas use was over 1997 and 1998 almost the same: 1,291 m^3 and 1,251 m^3 (these are adjusted numbers for the influence of the outdoor temperature using the degree day's method). Most of the houses had an EPS level around 1.2.
The use of gas showed a great variation: the lowest value was 422 m3 and the highest 3.048 m3. As showed in table 5.1b, the use differs over the type of houses, but the standard deviation within each type is interesting.

Table 5.1b: gas use in 1998 of new build houses with an EPS level of around 1.2

	Gas use 1998 (in m^3)				
	Average	Modus	Standard deviation	Minimum	Maximum
Semi-detached house	1.709	1.622	411	943	3.048
End houses	1.479	1.160	749	532	2.931
One family houses	1.179	1.110	390	422	2.292
Multi family houses	1.002	932	221	658	1.434
Total	1.331	1.217	496	422	3.048

Only a small portion of the electricity use in included in the EPS calculations (lightning, ventilation and boiler pump). In the survey it was not possible to find out these specific uses. But the general electricity use gives some indications, but more important is that the added gas and electricity use gives the real total energy use of a new house. The average electricity use was almost the same in 1997 as in 1998: 2,996 and 2,967 kWh. (3.000 kWh is equal to 852 m3 gas). As showed in the figure the spread of electricity use in much higher then the gas use. Although also here the variation over the type of houses is evident, the differences between the lowest and the highest users are great.

Table 5.1b: Electricity use in 1998 of new build houses with an EPS level of around 1.2

	Electricity use 1998 (in kWh)				
	Average	modus	Standard deviation	Minimum	maximum
Semi-detached houses	3.956	3.696	1.412	1.844	7.583
End houses	3.008	2.815	1.252	1.299	6.125
One family houses	2.816	2.675	1.091	1.007	6.904
Multifamily houses	2.575	2.465	948	1.427	4.563
Total	3.107	2.939	1.281	1.007	7.583

General conclusions on the energy use were:

- The real average gas use in new houses with a EPS of about 1.2, is in line with the calculated gas use of a standard one family house, but the variation in the gas use is high;
- Each type of houses has a interesting variation in the annual use of gas;

- The variation in the electricity use is much higher than that of in the gas;
- The variation in the electricity use is heavy correlated with the kind of appliances in a household (special with high electricity using appliances like waterbed and cloth driers);
- In about half of the houses the people do additional ventilation, this differs not for houses with or without a controlled ventilation system;
- Also houses with a heat water solar boiler system show a greater variation in gas as well as in electricity use.

In the survey for new build houses 2002 and 2002 more information on the energy uses for several EPS groups was researched. Also attention was given to the gas use for space heating and for warm water. A special study was commissioned to research this gas use and the influence of behavioural elements.
As presented in Table 5.1c, the gas use is lower in houses that have a lower EPS value and the distribution of the gas use is smaller for the houses with a lower EPS value. But there are upcoming questions whether the assumptions in the formulas could be still the same with the lower thresholds of the EPC Values. Especially as the gas use for warm water production becomes an increasing part of the total use. Table 5.1d illustrates this for three types of houses. E.g. for a standard home with an EPS values of 0.8 or lower the gas use for space heating is about twice that for warm water production while for an EPS value 1.0-1.2 the space heating counts for 70% of the gas use.

Table 5.1c: average gas use of new build houses 2000/2001 for EPS classes

	Gas use (in m³)				
	Reference use	Average	Standard deviation	Minimum	Maximum
EPS <= 0.8	719	959	364	262	2.072
EPS 0.8 – 1.0	1.329	1.173	406	327	2.488
EPS 1.0 – 1.2	1.714	1.421	709	407	4.740

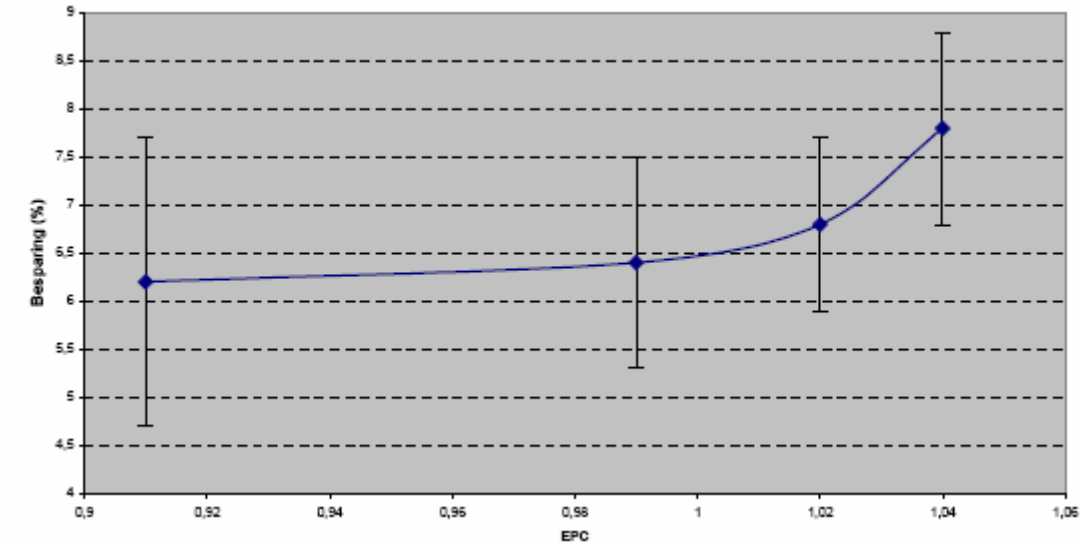
Table 5.1d: Examples of gas use in new build houses 2000/2001 specified for space heating and warm water for some EPS classes

	Gas use (in m³)		
	Total	Space heating	Warm water production
Despatched houses			
EPS <= 0.8	1.232	1.019	213
EPS 0.8 – 1.0	1.329	1.102	338
EPS 1.0 – 1.2	1.714	1.575	443
Semi-dispatched houses			
EPS <= 0.8	1.050	754	296
EPS 0.8 – 1.0	1.302	957	355
EPS 1.0 – 1.2	1.408	999	409
Houses in a line			
EPS <= 0.8	840	560	280
EPS 0.8 – 1.0	1.043	700	343
EPS 1.0 – 1.2	1.139	765	374

C. Principal conclusions

As shown in figure 5.1a the impact of the EPS on the energy use seems to become smaller and is likely to reach an asymptote of 6%. This is a preliminary conclusion, given the uncertainties that are also included in the figure.

Figure5.1a. Savings in gas use (%) and change of EPS value by 0.1 point



Source: Uitzinger, 2004, page 9

General conclusions

The monitoring studies in combination with additional analysis generated useful information on the impacts of the regulation policy, but no comprehensive evaluation was conducted.

The three studies concentrated too much on specific items for the energy use that it is hard to conclude on a more detailed level on the impact of the building decreed on the energy use. In general the energy use decreases, but with the lowering of the EPS values results with a decreasing additional impact. There are indications that the gas use for warm water systems are becoming the dominant factor and the EPS calculations is less targeted to this and also the assumptions on standard behaviour are to be questioned more and more.

5.2. Case for category Information:

No case examples enclosed.

5.3. Case for category Economic incentives:

1. **Energy Premium Scheme households**
2. **Energy Investment Reduction (EIA and EINP)**

Program Description (1)

A. Name of the programme

The Dutch name of the program is "Energie Prestatie Regeling - Onderdeel huishoudelijke apparaten" and can be translated as "Energy Premium Scheme households"

B. Sponsoring Agency

The Ministry of Economic Affairs of The Netherlands is responsible for the program. The management of the program is done by the Energy Agency Novem.

C. Program Objectives

The aim of the program is to realise a significant reduction in electricity consumption in households and SME's by increasing the purchase and usage of energy efficient appliances, by giving a rebate with money from the energy tax.
As a result also the emission of carbon dioxide should be reduced.

D. Program Activities:

The main target of the program as of 1998 is to stimulate the purchase of energy efficient household appliances by means of labelling and subsidy. Per appliance the rebate varied from 45 to 205 Euro.
The program was introduced via an extensive communication campaign. Advertisements were made on TV, national newspapers and local media.
In the policy document of 1996 a quantitative (mean general) goal of 1.7 % energy conservation per year was formulated.

E. Development and operation

The Dutch Government issued a policy document on Energy Conservation in 1994. In this document the goal for energy conservation in households for the year 2000 was defined as 30% on usage of natural gas and 25% electricity consumption. This policy document was updated in 1996 and published as the Third Policy Note on Energy Conservation.
The general target was formulated as an energy conservation rate of 1.7 % per year. For the household sector special measures were formulated, like a tax on energy and rebate on appliances. The measures for appliances are possible by law enforcement since 1986. The Netherlands has followed the EC Directive 94/2 for labelling.
The program in its present form started in 1996 and is stopped in December 2003
The policy theory consists of the following items:

- Stimulating consumers by a rebate will enhance market penetration.
- Normal retail prices will fall due to a growing production.
- In the end production of not energy efficient appliances will decline, due to a fall in sales.

The program is monitored and evaluated on a yearly basis, the results being used for calculation of the new budget and new appliances to be added to the list of allowable appliances.
The main change in the program has been made by the introduction of the EC-label for appliances.

F. Administration

The program is managed by Novem, an agency from the Ministry of Economic Affairs. The agency is responsible for the financing of the communication campaign to be carried out under the program and also for monitoring and reporting the results to the Ministry and to the market. In addition Novem plays an important role in organising the yearly update of list of appliances which will receive a label. The energy distribution companies handle the rebate after the purchase of an appliance.
In the year 2000 the available budget for rebate was 66.71 million Euros and for 2001 this was 96.21 Euro. Operational costs were 15.3 and 26.6 million Euro in respectively 2000 and 2001.

Evaluation Objectives, Activities and Results

A. Evaluation objectives

In The Netherlands most policy measures are evaluated once in every 4 years. In this case a short evaluation is made every year, based on the monitoring results, in order to establish the new budgets.

An important reason for the development of the program was the general recognised notion that limited availability of fossil fuels combined with an increase in energy consumption had to be coped with and that energy conservation was one of the most promising options. Later in time also the upcoming discussions on climate change contributed to the necessity to continue to the aim of energy conservation. Therefore it was important to monitor the results of the program. The evaluation for a four-year period was concentrated on the questions:

- What was the effect of the program on energy conservation in relation to the target?
- What was the efficiency of the program and what was the quality of the monitoring?
- How did the users (households, manufacturers and retailers) look upon the programme? What suggestions are there to improve the program?

In addition to evaluation in The Netherlands, information was also delivered to an evaluation study carried out by the University of Oxford as a project for the EC.

B. Evaluation activities

Data collection was performed by gathering data from retailer-organisations and energy distribution companies. Amounts of purchases per type of appliances were gathered.

C. Principal Results

Estimated energy savings

Based on market data, the decrease in the average energy consumption per type of appliance is determined. The following table gives the results for the recent years:

	1999		**2000**		**2001**	
Appliance	All	Only A-label	All	Only A-label	All	Only A-label
Refrigerator (year)	319	230	294	242	272	248
Freezer (year)	309	230	270	225	250	224
Washer (cycle)	1,08	0,99	1,04	0,99	1,00	0,99
Dishwasher (cycle)	1,33	1,19	1,26	1,16	1,22	1,15

From this table it can be concluded that in the year 2001 the market for these household appliances consists mainly of the A-labelled products. However, despite this high usage of energy efficient appliances the energy consumption for the household sector has increased with 3% for the year 2001.

Emission reduction

Based on the acquired data the cumulative net reductions in carbon dioxide emission have been calculated. The table below shows these results in 1000 tonnes per year.

	CO2 reduction (1000 ton)	
Appliance	2001	2002
Cold appliances	6,9	14,4
Washing machines	9,0	17,2
Dishwashers	2,6	5,3
Dryers	0,4	0,6
LCD monitor	-	0,4

Market effects
Due to the program the market for household appliances is in the year 2001 dominated by the energy efficient appliances. The table below gives the development in market shares in percentages for various A-labelled appliances in the period from 1996 to 2001.

	1996	1997	1998	1999	2000	2001
Appliance						
Refrigerators	7	10	14	26	55	67
Freezers	3	13	18	29	55	69
Washing machines	0	3	19	40	71	88
Dishwashers				27	55	73

Conclusions

Methodological lessons

- Evaluation planning

Because in The Netherlands most programmes are, as a rule, evaluated once every 4 years and that this evaluation is performed by an independent consultant, sponsoring agencies are stimulated to improve their performance. In general this results in a reasonable ratio of costs of administration to market results.
On an aggregated level the Ministry involved used results for evaluations to report tot the Parliament and also for making changes in the program.

- General evaluation methodology

With respect to the estimation of energy savings and the reduction of emissions the evaluation made clear that the program is very effective, both in terms of costs and of saved energy.

- With respect to special methodological topics this program evaluation made clear that the selection procedure with which it is decided to give a certain appliance an A-label and thereby the option for the purchaser to get a rebate has been effective. It can be concluded that the co-operation between the energy agency and the market parties, accompanied by input from research institutes, was very effective in preparing a draft list of appliances for decision making by the Government.
- Also it was important to include in the program a facility to be able to validate the data on the labels by independent research. It was found that in a number of cases the manufacturer was to optimistic and independent measurements classified the appliance as much as a whole class lower. This means that both calculations for energy savings and emissions can be too high. In general the data on purchase of appliances proved to be rather good.
- Information on acceptance of the program by consumers could not be quantified.

Programme Description (2) Energy Investment Reduction (EIA and EINP)

A. Name of the programme

The Dutch name of the program is "Energie investerings aftrek" and is translated as Energy Investment Reduction.

B. Sponsoring Agency

The Ministry of Economic Affairs of The Netherlands is responsible for the program. The management of the program is done by the Energy Agency Senter.

C. Programme Objectives

The aim of the program is to stimulate both the profit and the non-profit sector to invest in energy efficient equipment and technology. The main target areas are industrial companies participating in Voluntary Agreements, SME's and activities in the non-profit sector as well as natural persons.
The program stimulates the investment in energy efficient equipment and renewable energy equipment. The Government yearly publishes a list of equipment for which compensation is allowed. The basic approach for inclusion is, that equipment performance is better then the standard available equipment. Also included are e.g. turbines for the production of wind-energy and heat pumps.
There are no specific targets for energy saving in the program; this is not possible because of the broad scope of the program. However, based on calculations on the return on investment make clear, that industrial equipment on the list has a minimum saving of 0.25 Nm^3 natural gas per dollar invested. For equipment used in the build environment this value is 50% lower, due to longer economic lifetime.
The program is controlled solely by financial rules. Besides maximum percentage compensation per project, there is an upper limit to the total project costs as well as to the amount of money refunded per year per fiscal unit or person.
In addition there is a maximum budget for the entire program per year.

D. Programme Activities

The part of the program for industrial companies is determined by the fiscal rules. This results in an upper limit to the investments, which are allowed to be compensated with fiscal measures. Depending on the project costs a percentage of the investment can be subtracted from the companies' financial results before tax is calculated. In this way the amount of tax to be paid is lower. Because of the yearly limit to the program budget the number of projects is also limited. The table below gives an indication of the relation between investments and the tax compensation (million dollars):

Year	1997	1998	1999	2000
Total investment	474	722	646	745
Tax compensation	62	82	115	165

The second part of the program is meant for the non-profit sector (including natural persons) and is based on project subsidy, because in these cases tax reduction is not possible. Subsidy is allowed for investments in energy efficient equipment based on the same list as for the industry. Project size must exceed a certain minimum investment and the percentage of subsidy is lower for higher investments. In addition there is an upper limit to the total amount of subsidy per company (or natural person) per year. The table below gives an overview of the total investments in relation to the subsidy (million dollars):

Year	1997	1998	1999	2000
Total investment	56	98	114	152
Subsidy	7.5	13.7	18	23.6

E. Development and operation

The Dutch Government noticed in 1995 that there was a gap between the results of the RD&D programmes and the market penetration of energy efficient technologies. In the Third White Paper on Energy Policy (December 1995), new Governmental activities for the period 1996 to 1998 were described and the option of fiscal stimulation of energy conservation and renewable energy was mentioned. This resulted in measures taken by the Ministry of Finance to allow fiscal compensation.

The policy theory consists of the following items:

- Market penetration of energy efficient appliances is enhanced by fiscal (or subsidy) compensation.
- Enhanced market penetration will result in decline of retail prices.

As of January 1997 the program Energy Investment Compensation started for industries. The subsidy program for the non-profit sector started in June 1997.

After 4 years of operation the program has been evaluated. So program results form the years 1997 till 2000 have been analysed in 2001.

The most significant change in the program has been made with respect to the percentages used for compensation. In part this is caused by a general redesign of the tax system and also in relation to the change in policy towards a more generic approach in programmes.

For the industry this has resulted in a fixed maximum value of 55% of the total investment to be used for tax compensation. For the non-profit sector a fixed maximum value of 18.5% for subsidy has been introduced.

F. Administration

For the fiscal part of the program projects have to be submitted to a special office of the tax administration. This office checks the eligibility of the project and registers the company details and the required budget. This task has to do with the role of the Ministry of Finance in the budget control.

Eligible projects are then processed by the Energy Agency Senter, which performs a technical and administrative control of the project. Based on this assessment a statement is issued indicating the allowable project costs. This statement has to be used by the company to apply for tax reduction.

In case of the non-profit sector projects claiming for subsidy are completely handled by the Agency Senter.

It is important to notice that energy consultants play a role in this program. Especially in case of SME's and the non-profit sector consultants are often involved in project definition and submission.

Evaluation Objectives, activities and results

A. Evaluation objectives

1. Policy / regulatory context

   In The Netherlands most policy measures are evaluated once in every 4 years

2. Key Research questions

An important reason for the development of the program came from the introduction of the Ecotax in The Netherlands. It was decided that a part of the tax had to be used for the stimulation of energy conservation. Therefore it is interesting to investigate the effectiveness of the investment compensations.
The evaluation was concentrated on three questions:

- What was the effect of the program on energy savings?
- What was the efficiency of the program?
- How was the program looked upon by the users?

B. Evaluation activities

Data collection

Data with respect to administrative aspects like numbers of projects, amount of money involved were collected directly from the agency responsible for the management of the program.
In order to get information from the market the methodology of interviewing representative users of the programme.
Due to the reason that this program has a generic nature energy savings and emission reductions have to be estimated by using mean values and general assumptions.
An important factor came from the general criterion used for the inclusion of equipment in the list of allowable technologies. The factor for energy saving expressed in Nm^3 natural gas per dollar was used to calculate gross energy savings per year. The CO_2 emission coefficient for natural gas is then used to make an estimate of the emission reduction.

C. Principal Results

Estimated energy savings

The table below gives the calculated energy savings due to the program in the various years. Data are in million Nm^3 natural gas.

Year	1997	1998	1999	2000
Industry	260	513	547	
Non-profit			44	46

Emission reduction

Based on the data in the table above a gross estimate of the reduction of the emission of CO_2 is made. Data in the table below are in 1000 tonnes per year.

Year	1997	1998	1999	2000
Industry	460	909	969	
Non-profit			78	80

Market effects

The evaluation made clear; as a result form the interviews, that the program had a relative high number of free riders. It was found, that about halve of projects could be characterised as such.
It was observed that the principal decision for companies to invest in equipment was made on the basis of economic considerations. The aspect of energy conservation was only partly involved. It is interesting to note the list of equipment published by the Government was considered in terms of viable information for the companies.

Conclusions

- Evaluation planning

Because in The Netherlands most programmes are, as a rule, evaluated once every 4 years and that this evaluation is performed by an independent consultant stimulates sponsoring agencies to improve their performance. In general this results in a reasonable ratio of costs of administration to market results.
On an aggregated level the Ministry involved used results for evaluations to report tot the Parliament and also for making changes in the program.

- General evaluation methodology

With respect to the estimation of energy savings and the reduction of emissions the evaluation made clear that the way in which this generic measure is implemented only first order estimates are possible.
Also it was found that the program was not effective in keeping out free riders.

With respect to special methodological topics this program evaluation made clear that it is useful to compare data on the cost effectiveness of emission reduction form various measures. Compared to a program where cost effectiveness is a key selection criterion, this generic program is less effective.

5.4. Case for category Voluntary Agreements: Voluntary Agreements on Industrial Energy Conservation 1990 – 2000

Programme Description

A. Name of the program

The Dutch name of the program is "Meerjaren Afspraken Energiebesparing" and is translated as "Voluntary Agreements on Industrial Energy Conservation 1990 - 2000"

B. Sponsoring Agency

The Ministry of Economic Affairs of The Netherlands is responsible for the program. The management of the program is done by the Energy Agency Novem.

C. Programme Objectives

The aim of the program is to realise a net industrial energy conservation of 20% in the year 2000, compared to the reference year 1989
For the year 1999 an additional target is the preparation of the second covenant period of 10 years.

D. Programme Activities

The main targets of the program are, homogeneous, industry sectors. The most important ones being the food industry, base metal, ceramics & glass industry, chemicals & oil and gas, small industries and the remaining industry. In a later phase of the program the non-industrial sectors were included. The total number of targeted sectors was 36.
Further it was necessary for the program in order to be effective to include activities towards the technical research institutes, consultants and the various competent authorities.

The target of the program was to realise an over all energy conservation of 20% compared to the reference year 1989. This target can be reached by means of process optimisation, renewable energy, transport and efficient electricity and steam production and consumption.
In the initial policy document a quantitative goal of 20% energy conservation compared to the reference year 1989 was formulated, this means an uncorrected amount of 240 PJ to be saved in comparison to the final consumption of 1989.

E. Development and operation

The Dutch Government issued a policy document in 1990 entitled "Nota Energiebesparing" or in English "Energy Conservation Paper", in which the policy and its theory was described. In the period before 1990 already various subsidy programs were run by the Ministry, mostly orientated at a special sector or technical development. Results of these activities, as well as the upcoming climate change discussion, were used to formulate the policy and its goals.
The policy theory consists of the following items:

- Companies have the best knowledge of where energy conservation can be done
- A set of rules for the Voluntary Agreement, determined by discussion between Government and industry, is necessary to structure and guide the agreement
- An upper limit is set for the pay back period for projects
- In case of non compliance legal measures can be taken
- Monitoring of energy conservation is an absolute requirement

The program started in 1990.
The has been evaluated in 1997 for the program period of 1990 - 1196 and in 2001 for the period 1997 - 2000
The main change in the program has been made after the first 10 year period. For industrial companies having energy consumption greater the 0.5 PJ per year is was decided to carry on the energy conservation activities in the form of a Benchmarking Covenant. The remaining companies had the option to participate in the second 10 year period of the Voluntary Agreement. In case a company does participate in any of the covenants, the company has to fulfil the standard legal requirements, e.g. as set in environmental legislation.

F. Administration

The program is managed by Novem, an agency form the Ministry of Economic Affairs. The agency is responsible for the financing of the projects to be carried out under the program and also for reporting the results to the Ministry and to the market. Also Novem does the monitoring of the energy efficiency progress.
In the period form 1990 till 1995 governmental investments, via Novem, in projects, mostly RD&D, were about 135.5 million Euros. For the development of Combined Heat and Power about 91.8 million Euros was used. Staffing costs for Novem in this period have been about 16.4 million Euros. In total this is 135.5 million Euros. After 1997 there has been at first an increase in the budget, followed by a strong decrease.

Evaluation Objectives, Activities and Results

Evaluation objectives

In The Netherlands most policy measures are evaluated once in every 4 years. In the case of this program the first evaluation handled a 7-year period.

An important reason for the development of the program was the general recognised notion that limited availability of fossil fuels combined with an increase in energy consumption had to be coped with and that energy conservation was one of the most promising options. Later in time also the upcoming discussions on climate change contributed to the necessity to conserve energy. Therefore it was important to keep track of the results of the program.
The evaluation was thus concentrated on the questions:

- What was the effect of the program on energy conservation in relation to the target?
- What was the efficiency of the program and what was the quality of the monitoring?
- How was the program looked upon by the users, what suggestions are there to improve the program?

The second evaluation looked in addition to the action taken to prepare the second 10 year period

Evaluation activities

Data collection
Data with respect to administrative aspects like numbers of projects, amount of money involved were collected directly from the agency responsible for the management of the program.
Data on energy conservation was derived from the monitoring results from the monitoring part carried out by the agency. In addition these data were compared with data form the Central Bureau for Statistics and literature sources.
In order to get information from the market the methodology of interviewing representative users of the program was used.
The baseline data for the program have been obtained form the Central Bureau for Statistics and literature sources and are presented for the various sectors in the Governmental policy document. Based on these data targets for the year 2000 for all sectors thought to participate in the program have been set.
In order to monitor the results a method for the calculation of the Energy Efficiency has been developed by Novem. This Energy Efficiency Indicator (EEI) was calculated for each participating company, resulting in a sector EEI. This EEI is the compared to the target. The methodology also contained general agreed correction factors, which were used to compensate for structural effects.
An important aspect is the fact that the monitoring results had to be agreed upon by the companies or industrial organisation before publications.
In order to calculate general results for CO_2 reduction caused by the program a coefficient of 73 ton CO_2 per GJ saved energy was used in the evaluation studies.

Principal Results

Estimated energy savings
In the table below the results in percentage energy savings for 1998 are given in relation to the year 2000 targets.

Sector	Target 2000	Result 1998
Food	20	16.1
Ceramics	21	19
Chemicals	17	17.7
SME industry	17	11.7
Remaining industry	19	16.2

In total the energy conservation has been 15.9 PJ in 1996, 27.0 PJ in 1997 and 34.6 PJ in 1998.

Emission reduction
Based on the data on average energy savings in the period 1989 - 1995 a gross estimate of the reduction of the emission of CO_2 is made, using a mean emission coefficient of 73 ton / PJ saved energy. This results in 1161 ton in 1996, 1971 ton in 1997 and 2526 ton in 1998. The mean costs could roughly be estimated as lying between 86.4 and 112.7 Euro per ton, thus being rather effective as a mean value for the industry as a whole.

Market effects
The evaluation made clear; as a result form the interviews, that the program had a relative low number of free riders. It was found, that about one third of the saved energy could be directly linked to the program.

Conclusions

Evaluation planning
Because in The Netherlands most programmes are, as a rule, evaluated once every 4 years and that this evaluation is performed by an independent consultant stimulates sponsoring agencies to improve their performance. In general this results in a reasonable ratio of costs of administration to market results.
On an aggregated level the Ministry involved uses results for evaluations to report tot the Parliament and also for making changes in the program.

General evaluation methodology
With respect to the estimation of energy savings and the reduction of emissions the evaluation made clear that the program is very effective, both in terms of costs and of saved energy.
Also it was found that the program was effective in keeping out free riders.

With respect to special methodological topics this program evaluation made clear that it is useful to compare data on the cost effectiveness of emission reduction form various policy measures and data sources. Compared to a program where cost effectiveness is a not key selection criterion, the program is shown to be very effective.
Earlier evaluation had comments on the effectiveness of the program, because it is almost not possible to discriminate between projects due do the program and projects that would have been realised without the program.
Also this evaluation had some comments on the definition of the EEI, where some of the data used by the industry to calculate the EEI are difficult to verify.

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Country Report Sweden

Including case examples on:

Information	• Information centres in local regions • Information and education programme 1998-2002
Voluntary Agreements	• Eco-energy
Combination of policy measures	• STEM programmes

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1. Introduction

Energy efficiency has been an important issue on the Swedish Government energy policy -- agenda. Several measures have been applied and developed and over time evaluation methods for energy efficiency measures has developed. This report, describing the policy programmes and measures of energy efficiency and the evaluation of these, follows a common outline for the country studies. In chapter 2 the national system of energy efficiency policies is presented. In this chapter we present the major characteristics since 1990: the main actors, the budgets and budget changes over the years, and major policy changes in the programmes and policy framework. In chapter 3 we deal with the national system for evaluation, monitoring and data collections as well as relevant scenarios. In this chapter we present an overview of all relevant evaluations since 1990. Chapter 4 holds information on methods used in evaluations conducted. This is followed with selected evaluation case examples for categories of policy measures in chapter 5 (and in attachments of case studies). At the end relevant sources are included.

2. National system of energy efficiency policy measures

In 1988 the Swedish Government established a programme for energy efficiency. The programme, which was managed by the Department of Energy Efficiency at NUTEK, was focused on technology procurement. However, to stimulate market penetration technology procurements were combined with additional measures such as demonstrations, information, labelling, education, incentives, and voluntary agreements. Different combinations were used for different technologies as can be seen in Table 1.

The total budget of the Swedish energy efficiency programme in 1991-1997 was SEK 950 million (US$ 115 million according to the 1999 exchange rate) (Lund, 1996). Between 1991 and 1995, approximately SEK 700 million (US$ 85 million) was contracted to initiate and perform approximately 25 technology procurements and related market activities. The internal evaluation of the programmes was budgeted to SEK 32 million (approx. 3% of the total budget) of which approximately SEK 12 million was used by 1995 (approx. 2% of the actual programme cost at that time) (RRV, 1996).

In 1998 a new energy policy programme was introduced. This program, which not only was focused on energy savings or energy efficiency but also included energy supply, was divided into a short-term programme and a long-term programme. The sort-term programme, which ended in 2002, included for example “Measures to decrease electricity use” (subsidies to convert to district heating, to convert form electricity heating, and to decrease load in building sector) and “Measures to improve energy efficiency”. The long-term programme, which runs out in 2004, is focused on research, development and demonstration measures. In this report we only include the evaluation of Measures to improve energy efficiency, which included

- information and education,
- information centres in local region
- technology procurement
- testing and certification

Table 1. Swedish energy efficiency programme 1989-1991, 1991-1997; technology procurement and the combination of measures (market activities) used to stimulate commercialisation, market penetration and energy efficiency. The table is based on data from Suvilehto and Överholm (1998[j].

Technology procurement programmes	Procurement start	Market introduction	Market activities	Active buyers' group	Information–media	Information– brochure	Information–telephone	Labelling	Voluntary standards	Voluntary agreements	Exhibitions	Education	Subsidies/rebates	National campaign	Regional campaign	Demonstration	Result 1988
Buildings																	
Combined refrigerator-freezers	1990	1992		x	x	x	x	x			x		x	x	x		C
HF lighting system	1991	1992		x	x	x			x	x	x	x	x	x	x		C
Energy-efficient windows	1991	1995		x	x	x	x	x	x		x	x	x	x	x		C
Monitors	1991	-			x	x		x	x					x			C
Washing machines & dryers: central utility rooms	1992	1994		x	x	x	x		x		x		x	x	x		C
Heat pumps	1993	1995			x	x	x	x	x		x		x	x	x		C
Radiator control systems for single-family houses	1994	1996			x	x	x				x		x		x		C
Washing machines & dryers: apartments	1994	1996		x	x	x	x	x			x		x		x		I
Air-handling unit	1994	1996		x	x	x			x	x	x	x					I
Detached houses year 2000	1994	1997			x	x	x					x			x		I
Ventilation filters	1995	1997		x	x	x					x	x	x				C
Water heaters for single-family houses	1996	1997			x	x	x						x		x		C
Refrigerated display cabinets (food retailers)	1996	1998			x	x			x		x		x			x	I
Home lighting	1996	1998			x	x	x				x			x			I
Industry																	
Mine ventilation fans	1992	1994			x	x										x	I
Load & energy management systems	1994	1994		x	x	x							x				C
Energy-efficient factory doors	1994	1996			x	x				x			x				C
Traffic																	
Traffic lights (LED)	-	-		x	x											x	C
Electric cars	1994	1996		x	x	x					x		x				C

Comment: Result 1998: (I) demonstrates that the product has been introduced on to the market and (C) that the product has been commercialised and has penetrated the market (i.e. more units sold than included in the technology procurement programme).

The Information and education programme was focused on the development of publication, a web-site, conferences and seminars and a limited number of education programmes co-ordinated with the voluntary agreement programme targeting the Industry (EKO energy). The information centres in local regions were directed towards the public involved information of energy prices and energy related investments in households. Also the Testing and certification programme was focused on information to the households of energy efficient equipment. The technology procurement programme initiated more than 20 processes including LED traffic light, dishwashers, and stoves with integrated micro and ventilations systems for smaller households.

The total funding of the total programme was 9100 MSEK of which 450 MSEK was for Measures to improve energy efficiency. No budget has explicitly been dedicated for internal or external evaluations.

The policy programmes of 1991-1997 and 1998-2004 were coordinated by the Swedish Energy Agency (STEM, as of 1998 including the activities of Department of Energy Efficiency at NUTEK). The programmes and the policy measures developed by the Swedish Energy Agency included several actors active in the energy efficiency system such as product developers, suppliers, salesmen, consumers, architects, builders, energy companies, local authorities, and organisations.

In order to achieve energy efficiency in the industry, the Swedish energy agency has applied *voluntary agreements*. The Swedish programme, called the EKO-Energi, has been developed as contracts between the government (STEM/NUTEK) and companies. The programme started in 1994 and until 1999 contracts were signed with approximately 30 firms, involving about 80 plants or sites. The contracts were constructed around ideas similar to ISO 14001 standard (Helby, 2000). The contracts, which worked mostly as an add-on to certification, promoted an emphasis on energy efficiency within the certification process. The contract offered participating firms: free energy audit by an external auditor, help to certify according to ISO 14001 or EMAS standards, education concerning energy-efficient procurement, contacts with the energy authority, and use of the EKO-Energi label for promotion purposes. In return, the firms had to: formulate an environmental policy, have long-range energy savings goals, firmly establish energy savings as a goal at all levels of the organisation, establish a plan of action concerning energy efficiency measures accomplish a verifiable increase in energy efficiency, and conduct procurement according to standards based on life cycle cost. As in the ISO 14001 standard, the key issue was the internal organisation and decision process of the firm, not control by the authorities. Moreover, the contract text allowed for high degree of freedom for firms to implement in the way most appropriate to them.

The Swedish government has also promoted improved energy efficiency through *research and development (R&D) programmes*. In general, public R&D investments in energy efficiency have been limited, and in 1997, the OECD countries spent less than 8% of their national energy R&D budgets on energy efficiency (IEA, 1998). However, historically in Sweden (1975-1993) research on energy use has been approximately 30% of the total governmental energy research budget (IVA, 1992). The research programmes have mainly resulted in improved awareness of energy efficiency. But they have also affected the introduction of some energy-efficient technologies in the industry (IVA, 1992).

In parallel to the policy programmes described above, Sweden has applied building standards. These standards, which were introduced in 1960 and revised in 1975, 1980, 1988, and 1998, include standards of energy efficiency. These building codes have proved to be an effective measure that has accelerated energy efficiency (NUTEK, 1995b).

3. System for evaluating, monitoring and data collection on energy policy measures and relevant scenarios

Several evaluations of the Swedish measures for energy efficiency have been performed over the years. Most of them have been in more general terms describing the up-date of the programme and the individual measures. Only a few evaluations have assessed the effect caused by different measures. The evaluations have been internal as well as external evaluations. All evaluations are presented in Table 2; the evaluations are referred to in the text by the Roman numerals given in the table.

Table 2. Evaluations of Swedish energy efficiency programmes. DEE = Department of energy efficiency; I=internal; E=external; (S) only available in Swedish.

	Evaluation year	**Evaluators**	**E/I**	**Reference**
Energy efficiency programme 1991-1997				
I	1990	”Five independent experts”	E	STEV, 1990 (S)
II	1992	Swedish National Audit Office	**E**	RRV, 1992 (S)
III	1992	DEE, NUTEK	I	NUTEK, 1993a (S)
IVa	1993	DEE, NUTEK	I	NUTEK, 1993b (S)
IVb	1993	SIPU	**E***	NUTEK, 1993 c (S)
IVc	1993	Defence Research Establishment	**E***	NUTEK, 1993d (S)
Va	1994	DEE, NUTEK	I	NUTEK, 1994a (S)
Vb	1994	SIPU	E*	NUTEK, 1994b (S)
VI	1994-97	SIPU	E*	NUTEK, 1997 (S)
VII	1994-98	Eureka Research AB	E*	NUTEK, 1998 (S)
VIII	1995	ÅF-group	**E**	The Ministry of Industry, 1995 (S)
IX	1996	Swedish National Audit Office	**E**	RRV, 1996 (S)
X	1997	Lund P. et al.	E	Lund, 1996 (S)
Energy efficiency programme 1998-2002				
XI	1999	Sycon Energikonsult	E*	STEM ER 3: 1999 (S)
XII	2000	Sycon Energikonsult	E*	STEM ER 14:2000 (S)
XIII	1999	COWI 1999	E	Regereingskansliet, 1999 (S)
XIV	2000	COWI 2000	E	Regereingskansliet, 2000 (S)
XV	2000	KM Miljöteknik 2000	E	Regereingskansliet, 2000 (S)
XVI	2000	Grufman Reje Management	E*	STEM, 2000 (S)
XVII	2001	STEM	I	STEM, ER 4:2001 (S)
XVIII	2001	Eureka marknadsfakta	E*	STEM, 2001 (S)
XIV	2002	ÅF-Energikonsult	E	Regereingskansliet, 2002 (S)
XX	2002	J&W	E	Regereingskansliet, 2002 (S)
XXI	2003	STEM	I	STEM, 2003 (S)

***Commissioned by STEM/the Department of Energy Efficiency at NUTEK**

For the energy efficiency programmes of 1988-1997 no system for evaluating the energy efficiency programmes was available. Methods were developed continuously with the programme. For the energy efficiency programme of 1998-2004 a strategy for the follow-up process was presented in year 2000 (Näringsdepartementet, 2000 DS 2000:14). The strategy describes the data to collect and the way of assessing different types of measures, see Appendix 1. The framework has been used to some extent in recent evaluations.

Since the early 1990s data for evaluations has been collected by the Swedish Energy Agency. Moreover, structured follow-op activities have been developed. The data collection and follow-up activities intend to include:

- Interviews before and after activities, measuring number of consumers reached, and increase in knowledge.
- Complementing interviews to control the results of the fist interviews.
- Collection of sale statistics and cost development
- Interviews with salesmen to get cost data development (for some activities)
- Calculated energy saved based on sales statistics

Additional data collected include number of persons visiting exhibitions, number of persons visiting the homepage, distribution of information sheets and booklets, etc.

4. Method on evaluating energy efficiency programmes (1995 onwards); short overview for programmes

4.1 Methods used

As mentioned, the Swedish energy efficiency programmes have been presented in more general describing reports as well as in evaluation reports that have assessed the effect caused by different measures. The evaluation reports have all used different methods for evaluation. The evaluations from the beginning of the 1990s focused in general terms on the practice of the technology procurement programmes (since the Swedish programmes were some of the first of their kind). Subsequent evaluations also emphasised the practice of the programmes, but included more precise and direct analysis of specific programmes. The evaluations of the effect of the programme developed contemporaneously with the programme and, over time, methods for the evaluation by indicators were developed. In year 2000 an evaluation strategy was published, including evaluation plans for energy efficiency measures of the Energy policy programme of 1998. In this strategy indicators for evaluation were presented (see Appendix 1). In Table 3 we summarize the focus and structure of the evaluations of the Swedish energy efficiency programmes.

4.2 Baseline (ex ante evaluation) and relation with national scenario/model

Baselines have in general not been developed for the energy efficiency programmes. Only a few evaluations have used baselines for individual measures (measures for HF ballasts). A need for the development of baselines has been expressed in the evaluation strategy published in year 2000 (DS 2000:14).

Table 3. Focus and structure of the evaluations of Swedish market transformation programme.

Evaluation	Category of Policy measures						Baseline	Indicators			Savings	CHG emissions
	Regulation	Audits	Information	Incentive	Voluntary Agreements	Others		Technology	Market	Behaviour		
Energy efficiency programme 1991-1997												
I			X	X		X						
II			X	X		X						
III			X	X		X		X				
IVa			X	X		X		X	X		X	
IVb			X	X		X				X		
IVc			X	X		X				X		
Va			X	X		X		X	X			
Vb			X	X		X	(X)		X	X		
VI			X	X		X	(X)			X		
VII			X	X		X				X		
VIII			X	X		X						
IX			X	X		X						
X			X	X		X		X	X	X	X	
*Energy efficiency programme 1998-2002**												
XI												
XII			X			X						
XIII			X			X						
XIV			X			X						
XV			X			X						
XVI			X			X						
XVII			X			X						
XVIII			X			X				X		
XIV			X			X						
XX			X			X						
XXI			X			X		X				

** The evaluations of the Swedish Energy efficiency programme 1998-2002*are all based on indicators presented by STE, see Section 3 data collection and follow-up activities.*

4.3 Ex post evaluation

All evaluations of the Swedish energy efficiency programmes have been ex post evaluations. However, the evaluations have not been thoughtfully planned from the start of the programmes, but have rather been developed contemporaneously with the programmes. Thus, for the first programmes in the 1990s, pre-programme levels of market transformation indicators were only estimated for indicators that described energy efficiency. Over the years, pre-programme levels have also come to describe indicators of actors' behaviour.

4.4 Use of indicators

The use of indicators has developed over time. At first the indicators used were few and described only improved technology performance and price reduction (III). Over the years, indicators were developed to describe sales data, market share, changes in manufacturers' assortment, and change in knowledge, attitudes and behaviour of important actors (IV, V, V, VII, X). In 1996 a more comprehensive evaluation with respect to use of indicators was published, including additional indicators describing the introduction of informal standards and spin-off effects. Moreover, this evaluation discussed the influence of external effects (economic recession, learning processes in organisations, etc.) and international effects (effects on technology change in other countries, export markets, price reduction, etc.).

The strategy for the evaluation of energy programmes published in 2000 was based on the use of indicators (see Appendix 1). Such indicators included technology performance, sales data, actor's knowledge, and change in behaviour. These indicators were used to some extend in the process of monitoring the outputs, outcome and impact of the programmes.

4.5 Calculations on GHG emission impact for evaluated programmes

None of the evaluations include calculations on GHG emission reduction. Only a few reports (IVa, Va, X,) have estimated gross energy savings. These calculations are based on theoretical efficiency improvements, statistical figures of occupancy (Hedenström et al., 1992) or estimated utilisation data, and sales data. These estimated savings are not adjusted to external parameters. The evaluation strategy presented by the Government in year 2000 express a need for the development of methods to report CO_2 reductions.

In this project the evaluation of the following programmes will be described in detail:

- Information programme: Information and education 1998-2002
- Information programme: Municipal information centres on energy issues
- Voluntary agreement: Swedish voluntary agreements: EKO-energi
- Combined measures: Energy efficiency programme 1989-1997

The methods are to be find in the case studies,

5. Method used for selected evaluated EE policy measures, case examples

5.1. Case for category Regulation:

No case example enclosed

5.2. Case for category Information: Information and education 1998-2002 Municipal Energy information centres

Programme description (1)

A. Name of the programme: Information and education 1998-2002

B. Sponsoring Agency: The Swedish Energy Agency, STEM

C. Objectives

The overall objective was to improve knowledge and stimulate energy efficiency. Targeted market actors included local authorities, industries, organisations, architects, builders, energy companies, suppliers, salesmen, public at large etc. No quantitative goals were developed.

D. Programme activities

A number of smaller information and education projects, seminars, exhibitions, campaigns, EU-coordinating, information sheets, booklets, website development etc.

E. Development and operation

The programme started in 1998. A follow-up of the programme was planned annually.

F. Administration

Internal and external information activities financed and/or administrated by STEM was given 65 MSEK over 5 years (approximately EUR 7 Million). This also included cost of monitoring and evaluating the results of the programme. However, such costs have not been specified. (For 2003 Information and education was given an additional 34 MSEK).

Evaluation objectives, activities, results

A. Evaluation objectives

The energy programme in general was evaluated in 1999, 2000, 2002 and 2003 (COWI, 1999; COWI, 2000; KM, 2000; ÅF, 2002; J&W, 2002, STEM 2003). One additional evaluation report focused on the Information and education measure was performed by Grufman Reje in 2000 (Grufman Reje, 2000). This evaluation was focused on two campaigns; one on energy efficient lightning and one on energy efficient refrigerators and freezers. In 2001 STEM summarised all the initial evaluations (STEM, 2001).

The objective of the evaluations of the Information and education measure has not been clear; the goal has been described in vague words to improve knowledge and stimulate energy efficiency. Several evaluations identity difficulties of evaluating information measures due to problems such as:

- Difficult to separate the effect of the information measures

- Some effects will only me visible after many of years
- It is not possible to separate the effect of the programme and a development without the programme

Some evaluators identify the possibility to measure the indirect effects of the instruments, such as consumers increase in interest for energy efficient technology.

B. Evaluation activities

Each year STEM makes a follow-op of the activities, with a focus on the campaigns on energy efficient lighting, energy efficient refrigerators and freezers (including EU-labelling), efficient heating (including heat pumps). The follow-up activities include:

- Interviews before and after activities, measuring number of consumers reached, and increase in knowledge.
- Complementing interviews to control the results of the fist interviews.
- Collection of sale statistics and cost development
- Interviews with salesmen to get cost data development (for some activities)
- Calculated energy saved based on sales statistics

Additional data collected include number of persons visiting exhibitions, number of persons visiting the homepage, distribution of information sheets and booklets, etc.

In the final evaluation of 2003 the Swedish Energy agency presented the following results:

- Type and number of activities (e.g. reports 0; booklets 4; websites 3 etc.)
- Distribution of publications
- Number of persons visiting the homepage
- Seminars and conferences
- Description of press activities

Additional to the follow-up process and evaluation by STEM, the program has been evaluated and described in the following evaluations:

A. COWI, 1999, Utvärdering av det första verksamhetsåret inom 1997 års energipolitiska program, Näringsdepartementet
COWI criticise the non existing goal of saved energy and identify the difficulties of evaluating information programs. They describe the information activities of the programme, and for the campaigns they present the data of the STEM follow-up reports. No systematic evaluation of the different activities has been done. COWI comment that the increase in sales does not have to lead to decrease in energy use in total.

B. COWI, 2000, Utvärdering av 1997 års energipolitiska program 1998-1999, Näringsdepartementet
This report is a follow-up of COWI 1999. The report present data form the STEM follow-up reports. COWI criticise STEM and say that STEM has to do more detailed analysis of savings that describe the savings due to the information activities.

C. KM, 2000, Utvärdering av 1997års energipolitiska program, Näringsdepartementet
This report presents the data given by STEM. These results are then commented in terms of an increase in knowledge and changed behaviour. KM also comments the fact that the increase in sale does not have to lead to decrease in energy use in total.

D. Grufman Reje (2000)
The report focuses on two campaigns. The goal of the evaluation is to estimate and evaluate the effects of the measures. Two methods were used: the Model of information process and the Effect analysis.

The Model of information process (a chain analysis), includes 5 steps: 1) the resources used 2) the process of the measures applied 3) the physical effect of the measures 4) the socioeconomic mechanisms applied 5) and the total results. For each step the information measure is given a value, see Table below.

Step	Good	Bad
resources used	Enough resources and good design	Not enough resources and bad design
process	Good organisation	Less good organisation
physical effect of information measures	Enough	Not enough
socioeconomic mechanisms	Well known and used within the project	Not known and used less efficient within the project
total results	As presented in the goal	Not reached the goal

The *Effect analysis* differed for the evaluation of the different campaigns. For the campaign on energy efficient lighting the total sales was calculated and recalculated to the number of lamps installed. This was compared to the numbers of lamps of the goal set by STEM (3 per household). The calculations of energy savings were based on assumptions regarding savings and use. For the campaigns of energy efficient freezers the total sales of refrigerators and freezers in the different groups A-G was calculated. The increase in sale of refrigerators and freezers in each group was registered. The increase in efficiency was calculated by comparing the calculated energy use in 1999 with an estimated reference case for 1999 (in which the energy use in 1999 was calculated based on product pattern (group A-G) that was the case in 1997).

The evaluations were based on interviews, statistical data and former evaluation reports. The report is very condensed and it is not possible to find the data (interview results) used to make the conclusions presented.

D. STEM 2001
This report summarises the results of the STEM follow-up reports and the former evaluation reports. The report say that the program meats the goal, i.e. to “improve knowledge and stimulate energy efficiency”. How much it has improved knowledge is however not possible to say.

E. J&W 2002
This report summarises the results of former evaluations.

F. ÅF 2002
This report focuses of the difficulties of evaluating the program.

C. Principal conclusions

The Grufman Reje (2000) report says that both the campaigns show good results. The lamps increased from app 0, 5 per household to 2, 8 per household. The unofficial goal set by STEM was 3 lamps per household. The energy savings was calculated to 0.5TWh per year. The campaign on energy efficient refrigerators and freezers was also efficient. The number of units sold in class A and B increased from 30% to 70% and the units in group D-F sold was almost non-existent. The energy savings were calculated to 0.013 TWh per year.

The STEM report 2001 say that the program meats the goal, i.e. to "improve knowledge and stimulate energy efficiency". How much it has improved knowledge is however not possible to say.

General conclusions

The information gathered by STEM is relevant and of considerable importance for the evaluation of the program. The data given, based on interviews, indicate the market effect of the policy instrument in terms of changes in knowledge and behaviour (and cost development of products). The complementing interviews increase the value of the data. Furthermore, the sale statistic data is of importance.

All the evaluation reports are based on the data developed by STEM. Only one evaluation report includes any actual evaluation process (presenting a method and using this to evaluate the activities). The other evaluation reports are very general and discuss the difficulties of evaluating information measures and present the results of other reports. This as such describes the difficulties of evaluating information activities.

Several aspects are missing in the evaluations:

- no baseline has been estimated
- no calculations of emission reductions have been done
- no estimate on the effect of the separate activities has been done

Programme description (2)

A. Name of the programme): Municipal Energy information centres on energy issues

B. Sponsoring Agency The Swedish Energy Agency, STEM

C. Objectives

Improve knowledge and stimulate energy efficiency. Targeted market actors include municipal authorities, local energy companies, local industries and organisations, local public at large etc. No quantitative goals are available.

D. Programme activities

Consumers, industry, organisations etc. are given information and support for energy efficiency including information support, seminars, conferences, education etc.

E. Development and operation

The programme started in 1998. Municipal can apply for funding for the development of municipal information centres on energy issues.

F. Administration

The funding for Municipal information centres on energy issues administrated was 219 MSEK over 5 years (approximately EUR 24 Million). (For 2003 the programme was given an additional 90 MSEK).

Evaluation objectives, activities, results

A. Evaluation objectives

Each year the municipal information centres have to report their activities to STEM, in form of a questionnaire developed by STEM. The results of these questionnaires have been summarized for 1998, 1999 and 2000 by Sycon (STEM, 1999; STEM 2000; STEM 2001).

The energy programme in total was evaluated 1999, 2000, 2002 and 2003(COWI, 1999; COWI, 2000; KM, 2000; ÅF, 2002; J&W, 2002; STEM 2003). The evaluation report by Grufman Reje (2000) includes a focused evaluation on the municipal information centres. The goal of this evaluation was to estimate and evaluate the effects of the activity. On behalf of STEM a consultant company (Eureka Marknadsfakta AB) did an evaluation in 2001. STEM summarised the results of the evaluations in 2001 (STEM 2001, ER 4:2001)

B. Evaluation activities

A. the Sycon evaluations
The reports by Sycon summarise the results of the questionnaire answered by the Information centres. The annual follow-up process/questionnaire by STEM includes questions about the organisations model, networking, activities performed, estimated effects, and support from STEM etc. In the Sycon report the authors further criticise the questionnaire developed by STEM and says that the outcome of this 1) do not provide data to evaluate changes in knowledge, awareness and behaviour 2) do not deliver data for evaluating the quality of the information or the effect of the information. The questionnaire was changed for the evaluation of 1999; however, the evaluation was still focused and based on the employees of the information centres only. Due to this critique the questionnaire to the information centres was complemented with an evaluation of the consumers in year 2000 performed by Eureka Marknadsfakta AB on behalf of STEM (see below)

B. COWI, 1999, Utvärdering av det första verksamhetsåret inom 1997 års energipolitiska program

The report includes some general information about the development of the information centres, based on the Sycon report. COWI criticise the evaluation forms developed by STEM and it was pointed out that the questionnaires should be more quantitative. COWI also points out the need of qualitative interviews in order to analyse the effect of these information activities on the energy savings estimated. COWI identify the need for evaluation methods!

C. COWI, 2000, Utvärdering av 1997 års energipolitiska program 1998-1999
COWI once more criticise the evaluation form by STEM that is used to evaluate the program. According to COWI, these evaluations, which are base on data provided by the municipals and the people active at the information centres, present the process in a subjective way. COWI would like to see a more quantitative analysis in order to calculate cost/benefit and a qualitative objective analysis.

D. KM, 2000, Utvärdering av 1997års energipolitiska program, Näringsdepartementet
This report summarises the results of SYCON. They also stress the result of COWI 1999 and ask for qualitative analyses to evaluate the effect of these information activities on energy saving.

E. Grufman Reje Management (2000)
The evaluation by Grufman Reje Management (2000) is based on two methods: the Model of information process and the Effect analysis.

A. Model of information process (a chain analysis), including 5 steps: 1) resources used 2) process 3) physical effect 4) socioeconomic mechanisms 5) total results. For each step the information measure is given a value, see Table below.

Step	Good	Bad
resources used	Enough resources and good design	Not enough resources and bad design
process	Good organisation	Less good organisation
physical effect of information measures	Enough	Not enough
socioeconomic mechanisms	Well known and used within the project	Not known and used less efficient within the project
total results	As presented in the goal	Not reached the goal

B. A statistical analysis is used to measure the energy used in terms of electricity use per person (U), electricity price (EP), average income (AI), climate (T) and information (I).

$$\ln (U) = ß_0 + ß_1 \ln AI + ß_2 \ln EP + ß_3 T + ß_4 T^2 + ß5_1 I2 + ß_6 I3 + \varepsilon$$

The analysis is based on interviews, statistical data and former evaluation reports.

E. Eureka Marknadsfakta AB, 2001
On behalf of STEM a consultant company (Eureka Marknadsfakta AB) did an evaluation of the outcome of the project in terms of knowledge and changes in behaviour. The evaluation was based on a questionnaire sent to 429 households and smaller industries. Some of these had not had any contact with the municipal information centres, others did not answer, and some did not

want to fill in the questionnaires. In all 224 questionnaires could be used for the evaluation. The questionnaires included questions regarding contacts with the municipal information centres, type of information received, changed behaviour, the information affect on the changed behaviour, plans to do changes, assumed savings etc

F. J&W 2002
This report summarise results form other evaluations.

G. ÅF 2002
This report focuses of the difficulties of evaluating the program.

H. STEM 2003
The report present the number of municipals in which energy information centres is to be found. The report also summarise the results of the questionnaire from 2002. The summary describe

- The education of the informers (educated at Universities or not)
- The employment form of the informers
- Number of municipal energy information centres without STEM support
- Activities ad the information centre (telephone information, seminars etc.)
- What type of information asked for
- Support to the informers
- Websites at the municipal energy information centres

Principal Results

The questionnaire has only resulted in indicators of, for example, development of organisation of model, development of work process at the information centres, need of support at the information centres etc. No market effects, in terms of changes in knowledge and behaviour, or increase in sale have been estimated. No baseline estimations, no calculations on energy savings and no calculations of emission reductions have been done.

The evaluation report of Grufman Reje Management present the value of the information process in terms of resources, process (observations through interviews), the physical effect (observations trough interviews), the socioeconomic mechanisms, and the goal achievement. The statistical analysis in this evaluation further illustrates that it is not possible to show any effect of the information program on the use of electricity!

The results of the evaluation of Eureka Marknadsfakta AB, 2001show that:

- 57% of the 224 responders have been affected by the information and changed their behaviour. 22% of the 224 responders have been affected by the information and changed their behaviour I part.
- 53% say that they know how large their saving will be.
- 40% of the saving will be in the size of 2000-4000 kWh per year

C. Principal conclusions

The evaluation of the Municipal information centres is weak. STEM has developed a questionnaire for the evaluation of the activity, which, however, only describes the activities in

view of the people active at the Municipal information centres. The complementing evaluation including consumers included in year 2001, however, showed some information of market effects, i.e. consumers changes in knowledge and behaviour due to the Municipal information centres. The qualitative analysis of Grufman Reje Management (2000) is very difficult to understand, and the quantitative statistical method is even harder to understand. The result of the evaluation is however of great importance since it claims that the activity has no effect on the use of electricity.

General conclusions

Several aspects are missing in the evaluations:

- no baseline has been estimated
- no calculations of the savings of emission reductions have been done

5.3. Case(s) for category Economic incentives

No case example enclosed

5.4. Case(s) for category Voluntary agreements EKO-energi

Programme description

G. Name of the programme): EKO-energi

H. Sponsoring Agency The Swedish Energy Agency, STEM/NUTEK

I. Objectives

The objective of the programme was to improve efficient energy use, reduce the use of fossil fuels, and reduce CO_2 emissions and to improve the awareness of environmental and energy issues to improve the use of environmental standards such as ISO 14001 or EMAS in individual firms.

J. Programme activities

To sign contracts with the industry that offered the participating firms free energy audit by an external auditor, help to certify according to ISO 14001 or EMAS standards, education concerning energy-efficient procurement, contacts with the energy authority, and use of the EKO-Energi label for promotion purposes. In return, the firms had to: formulate an environmental policy, have long-range energy savings goals, firmly establish energy savings as a goal at all levels of the organisation, establish a plan of action concerning energy efficiency measures accomplish a verifiable increase in energy efficiency, and conduct procurement according to standards based on life cycle cost.

K. Development and operation

The programme runs from 1994-2002

L. Administration

The programme is administrated by STEM, Budget: 30 MSEK

The Swedish voluntary agreement programme, called the EKO-Energi, was developed as contracts between the government (STEM/NUTEK) and companies. The programme started in 1994 and contracts were open for signature from 1994 to 1999. In total, contracts have been signed with approximately 48 firms. The contracts were constructed around ideas similar to ISO 14001 standard. The contracts, which worked mostly as an add-on to certification, promoted an emphasis on energy efficiency within the certification process. The contract offered participating firms: free energy audit by an external auditor, help to certify according to ISO 14001 or EMAS standards, education concerning energy-efficient procurement, contacts with the energy authority, and use of the EKO-Energi label for promotion purposes. In return, the firms had to: formulate an environmental policy, have long-range energy savings goals, firmly establish energy savings as a goal at all levels of the organisation, establish a plan of action concerning energy efficiency measures accomplish a verifiable increase in energy efficiency, and conduct procurement according to standards based on life cycle cost. As in the ISO 14001 standard, the key issue was the internal organisation and decision process of the firm, not control by the authorities. Moreover, the contract text allowed for high degree of freedom for firms to implement in the way most appropriate to them.

Evaluation objectives, activities, results

A. Evaluation objectives

The programme has only been evaluated once, by Linden & Carlsson-Kanyama (2000). The objective of this evaluation was to show the barriers and incentives for effecting energy efficiency in firms. Additional evaluation criteria - given by STEM/or set by the evaluators- was to evaluate the energy audits, the training programmes, the changes in behaviour and the actions taken in the firms participating. The evaluation report focuses of the processes within the firms and not on the effect of the measures.

A final report of the EKO Energi programme has been published by STEM, 2002. This report describes the programmes and summarise the process in the view of the firms. No results in terms of energy efficiency are presented.

B. Evaluation activities

The evaluation method used in Linden & Carlsson-Kanyama (2000) is based on a survey divided into four categories

1. Analysis of goals of the firms
2. The follow up of the contracts etc
3. Studies of barriers, incitements, implementation, and results
4. Evaluation and valuing of the programme

The evaluation is based on interviews and written materials such as, information materials, contracts and reports. The report describes the design and development of the EKO-energi programme in general terms and by fragments of the interviews.

C. Principal conclusions

The evaluation does not show any effects on energy efficiency. The results of the evaluation illustrate the pros and cons of the project in the eyes of the firms.

Additional studies of EKO-Energi

The EKO-Energi programme has been in focus in other studies – for example Helby (2000). This report show that the most significant results of the EKO-Energi programme were in the stimulation of dissemination of knowledge and values of energy efficiency inside firms. This through the educational activities, the knowledge building through the energy audits, and the decentralisation of responsibility introduced. The programme further initiated the development of procurement procedures, and the introduction of life-cycle cost in the procurement procedures in participating firms. Moreover, case studies of some programmes have identified the adoption of formal policies allowing energy efficiency investments to have longer pay-back than other investments. This is probably due to recognition of energy-efficiency investments as strategic investments.

EKO-Energi has also affected the investments in energy-efficiency equipment and processes (Helby, 1999). In the s*hort term* the programme leads to supplementary investments aimed at increasing the energy efficiency of existing equipment and processes. This as a result of the firms improved attention on energy-efficiency options and a relaxation of pay-back criteria. Moreover, the programme is expected to improve *long term* technical change due to the programmes organisational effects and the continual improvement effort required by EMAS and ISO 14001.

As a label, EKO-Energi was at best a very modest success (Helby, 1999). No significant use of the label for marketing purposes has been observed. Firms emphasised their ISO 14001 or EMAS activities and/or their activities to improve energy efficiency, but not their participation in the EKO-Energi programme. The yearly EKO-Energi award event was the only aspect of the labelling that demonstrated some marketing value, as it provided good press coverage for some of the participating firms.

5.5 Case for category "Combinations of policy measures": Energy efficiency programme 1989-1997[88]

Programme description

G. Name of the programme: Energy efficiency programme 1989-1997

[88] The text of this chapter is from Neij, L., 2001, Methods of evaluating market transformation programmes: experience in Sweden, Energy Policy, Vol. 29, pp. 67-79.

H. Sponsoring Agency The Swedish Energy Agency, NUTEK

I. Objectives

Originally, the programme was focused on efficient electricity use, but in 1990 the programme was revised to cover energy efficiency in general. The purpose of the programme was defined to stimulate efficient energy use, to exploit long-term prospects for efficient energy use, to strengthen the flexibility in energy use, etc.

J. Programme activities

To stimulate market penetration of energy efficient technologies through technology procurements combined with additional measures such as demonstrations, information, labelling, education, incentives, and voluntary agreements. (Technology procurement was also applied as an instrument in the Energy programme of 1997. However, at that time technology procurement was not strategically combined with other policy measures designed for the different technologies).

K. Development and operation

The programme ran from 1989 to 1997.

L. Administration

In 1988 the Swedish Government decided to establish a new programme for energy efficiency. The programme ran between 1989 and 1997 and included market transformation supportive policy measures for approximately 25 technologies. To stimulate market penetration technology procurements was combined with additional measures such as demonstrations, information, labelling, education, incentives, and voluntary agreements, see Table 1 (page 3). (For detailed information on the different market activities, see Suvilehto and Överholm (1998[j]).

Swedish market transformation programmes have been focused on technology introduction and commercialisation, rather than on market enlargement. The design of each programme has been based on the characteristics of the technology, actors concerned, and the market needs and conditions; the programme design processes have been focused on technical evaluations, behavioural surveys, market surveys, and estimates of energy-saving potential.

The Department of Energy Efficiency at NUTEK has been the co-ordinator, designer and financial supporter of the Swedish market transformation programmes. A key task has been to co-ordinate the technology procurement process, i.e., co-ordinating the participating actors. This includes directing many small and fragmented end-users, in the residential, service, and industrial sectors, which separately have insufficient demand and competence to initiate a technology procurement process. Moreover, it includes co-ordination of other participating actors, for example manufacturers, wholesalers, retailers, consultants, building contractors, property owners, etc.

The total budget of the Swedish market transformation programmes in 1991-1998 was SEK 950 million (US$ 115 million according to the 1999 exchange rate) (Lund, 1996). Between 1991 and

1995, approximately SEK 700 million (US$ 85 million) was contracted to initiate and perform approximately 25 technology procurements and related market activities. The internal evaluation of the programmes was budgeted to SEK 32 million (approx. 3% of the total budget) of which approximately SEK 12 million had been used by 1995 (approx. 2% of the actual programme cost at that time) (RRV, 1996).

Evaluation objectives, activities, results

D. Evaluation objectives

Since the early 1990s, the programmes have been evaluated by NUTEK and by external evaluators, see Table 5.7.1. (The evaluations will be referred to by the Roman numerals given in Table 5.7.1 The objective of the programme evaluations, defined in each evaluation report, has in general been to investigate whether a programme has been successful or not, and to provide information in order to improve the programmes.

Table 5.7.1. Evaluators of Swedish market transformation programmes.

Evaluation	Evaluation year	Evaluators	Reference
I	1990	”Five independent experts”	STEV, 1990
II	1992	Swedish National Audit Office	RRV, 1992
III	1992	Dept. of Energy Efficiency, NUTEK	NUTEK, 1993a
IVa	1993	Dept. of Energy Efficiency, NUTEK	NUTEK, 1993b
IVb	1993	SIPU*	NUTEK, 1993 c
IVc	1993	Defence Research Establishment*	NUTEK, 1993d
Va	1994	Dept. of Energy Efficiency, NUTEK	NUTEK, 1994a
Vb	1994	SIPU*	NUTEK, 1994b
VI	1994-97	SIPU*	NUTEK, 1997
VII	1994-98	Eureka Research AB*	NUTEK, 1998
VIII	1995	ÅF-group	The Ministry of Industry, 1995
IX	1996	Swedish National Audit Office	RRV, 1996
X	1997	Lund P. et al.	Lund, 1996

* Commissioned by the Department of Energy Efficiency at NUTEK

E. Evaluation activities

The evaluations have described the direction and procedure of the programmes and analysed the results of the programmes and, to a small extent, also analysed the outline of the programmes. - The focus and structure of evaluations of Swedish market transformation programmes are presented in Table 5.7.2. The first evaluations of Swedish market transformation programmes focused only on the direction and procedure of the programmes (I, II). Since the Swedish market transformation programmes were some of the first of their kind, the direction and procedure of the programmes were described and discussed. Subsequent evaluations also emphasised the direction and procedure of the programmes, but included more precise and direct analysis of specific programmes (III, IVa, Va, VIII, IX) and the cost of specific programmes (IVa, Va, VIII, IX). The results of the programmes have been evaluated in several reports, in the internal NUTEK reports and in two external reports (VIII, X). The outline of the programmes has, however, only been evaluated in one report (VIII), which included evaluations of calculated potentials and the choice of target technologies for technology procurement.

Table 3. Focus and structure of the evaluations of Swedish market transformation programme.

Evaluation	I	II	III	IVa[1]	IVb[2]	IVc[3]	Va[4]	Vb[5]	VI[6]	VII[7]	VIII	IX	X[8]
Focus of evaluation													
- direction & procedure	X	X	X	X			X				X	X	X
- programme outline											X		
- market transform. effects			X	X	X	X	X	X	X	X	X		X
Indicators of MT													
- changes in actors' behaviour					X	X		X	X	X			X
- market development				X			X	X					X
- technology development			X	(X)			X						X
Baseline calculation								X	X				
Savings achieved				X									X

Comments:
(1) Programmes included: HF electronic ballasts, low-energy lamps, energy-efficient windows.
(2) Programmes included: Energy-efficient lighting (including HF electronic ballast), energy-efficient windows, washing machines & dryers in central utility rooms, office equipment (including monitors), ventilation, and energy services.
(3) An evaluation report on competence building and diffusion. Programmes included: office equipment, energy-efficient windows, washing machines & dryers in central utility rooms, voluntary standards.
(4) Programmes included: HF electronic ballasts, office equipment, combined refrigerator-freezers. Programmes included for analysis of technology development only: mine ventilation, washing machines & dryers in central utility rooms, energy-efficient windows, etc.
(5) Programmes included: HF electronic ballasts.
(6) Pre-programme and progress evaluation for washing machines & dryers in central utility rooms, electric cars, air-handling units, heat pumps, mine ventilation fans, load and energy management systems, energy-efficient windows, office equipment, voluntary agreements, monitors, radiator control systems for single-family houses, washing machines & dryers in apartments, energy efficient lighting. Baseline calculations included for, e.g. energy-efficient windows and washing machines & dryers in central utility rooms.
(7) Evaluation of energy-efficient labelling and energy-efficient lamps.
(8) The report is based on the evaluation of five programmes (including combined refrigerator-freezers, HF electronic ballasts, monitors, heat pumps, and energy-efficient windows) and an overall analysis of all programmes.

The evaluations of programme results developed contemporaneously with the programmes and, over time, methods for the evaluation of market transformation were developed. Market transformation effects caused by a programme were first evaluated by the Department of Energy Efficiency at NUTEK, in 1992 (III), 1993 (IV) and 1994 (V). These relatively early evaluations were based on indicators of technology and market development for the most mature programmes. In 1993 and 1994, the main reports were supplemented with reports from external evaluators, contracted by the Department of Energy Efficiency at NUTEK, to evaluate the changes in actors' behaviour and competence (IVb, IVc, and Vb). Evaluations of changes in actors' knowledge, attitudes and behaviour were also conducted in later years (1994-1998), by evaluators commissioned by the Department of Energy Efficiency at NUTEK (VI, VII).

The most comprehensive evaluation with respect to market transformation was published in 1996 (X) and was performed by a research team in Finland on behalf of the Department of Analysis at NUTEK. This report contained a market transformation evaluation that included an analysis of cause, effect and objective, an economic analysis (techno-economic analysis and macro-economic analysis), a diffusion analysis, and an international comparison analysis. The evaluation was based on production statistics, market surveys, interviews, and questionnaires. However, most of the data used and presented were based on former evaluation reports.

Evaluations that have systematically analysed market transformation effects as a result of Swedish market transformation programmes have used indicators to monitor changes in market

transformation. First, the indicators used were few and described only improved technology performance and price reduction (III). Over the years, indicators were developed to describe sales data, market share, changes in manufacturers' assortment, and change in knowledge, attitudes and behaviour of important actors (IV, V, V, VII, X). The evaluation from 1996 (X) included additional indicators describing the introduction of informal standards and spin-off effects. Moreover, this evaluation discussed the influence of external effects (economic recession, learning processes in organisations, etc.) and international effects (effects on technology change in other countries, export markets, price reduction, etc.). In accordance with the evaluation model, the indicators developed describe changes in actors' behaviour, market development, and technology development.

The evaluations of the Swedish market transformation programmes have, however, not been thoughtfully planned from the start of the programmes, but have rather been developed contemporaneously with the programmes. Thus, for the first programmes, pre-programme levels of market transformation indicators were only estimated for indicators that described energy efficiency (see, for example, report IVa). Over the years, pre-programme levels have also come to describe indicators of actors' behaviour (VI, VII). Evaluations IVb, Vb and VI have described the changes in actors' attitudes and behaviour, the increase in diffusion of energy-efficient technologies, and the contribution to the market transformation caused by the programmes of Department of Energy Efficiency at NUTEK. The evaluations were performed using a method called effect-chain analysis, a method based on standardised telephone interviews and deep interviews with important actors. Statistical methods were used to evaluate relations such as (1) how achievement creates knowledge, (2) how knowledge changes attitudes, (3) how attitudes direct behaviour, and (4) how behaviour affects the prospects for further diffusion of the technology. Pre-programme evaluations as well as progress evaluations were performed.

The indicators used to monitor market transformation effects have only been used to a limited extent to analyse the impact of market transformation. Only a few reports (IVa, Va, X) have estimated gross energy savings: based on theoretical efficiency improvements, statistical figures of occupancy (Hedenström et al., 1992), and sales data. (Sales data has been described as very difficult and troublesome to collect (Suvilehto et al., 1997). These estimated savings were, however, based on estimated utilisation data, and were not adjusted to external parameters.

In 1996 the Department of Energy Efficiency calculated the total approximate cost of the market transformation programmes completed at that time. The calculated cost of the programme for combined refrigerator-freezers was approximately SEK 5 million, the calculated cost of the programme of HF electronic ballasts approximately SEK 24 million, the calculated cost of the programme for energy-efficient windows approximately SEK 10 million, and the calculated cost of the programme for washing machines and dryers in central utility rooms approximately SEK 6 million (STEM, 1999). These costs included only the cost to NUTEK and not the costs to manufacturers, property owners, end-users, etc

F. Principal conclusions

The indicators developed for the analysis of market transformation were successfully used to analyse market transformation of new energy technologies. The results indicate that the Swedish market transformation programmes have succeeded in establishing changes in the market. Firstly, Swedish market transformation programmes have increased the *awareness* among several different actors, from producers to users of energy-efficient technologies (X).

Secondly, the programmes have resulted in the introduction of several energy efficient products to the market (V, VIII, X). The technology procurement programmes have also brought about technology improvements additional to increased energy efficiency. For example, the procurement of combined refrigerators/freezers provided products with reduced CFCs, and the procurement of HF electronic ballasts provided non-flickering lighting systems, operational reliability, and a built-in intelligence for occupancy control. In fact, the evaluations show that the arguments used by purchasers when buying the new products often is based on attributes such as improved reliability, improved design, and improved comfort rather than on improved energy efficiency (NUTEK, 1993c; NUTEK, 1994b, NUTEK 1997). According to several evaluations, the introduction of most new technologies must, however, be considered a pre-introduction since the technologies would probably have been introduced onto the market even without the programme, but several years later. For example, the pre-introduction has been calculated to be 5-7 years for HF electronic ballasts and 3-4 years for refrigerators/freezers (X). Thirdly, the market transformation programmes have caused commercialisation and market penetration of energy-efficient technologies, see Table 1. The evaluations show that market penetration differs considerably between technologies. Some technologies have attained a smaller market share. In 1995, 5 years after initiation of the technology procurement programme, the market share of energy-efficient combined refrigerators/freezers was 16.5% of new sales (STEM, 1999). Other technologies have reached a larger market share. In 1995, only 3 years after the technology procurement programme, the market share of HF electronic ballasts was 60-70% of new installations (X). Some, technologies, such as energy-efficient air-handling units, have not attained any significant degree of market penetration. The reason for the failure has been described by Suviletho and Överholm to be due to the limited use of the procured technology (only one size of air-handling unit was chosen) and too limited a number of market support programmes (Suvilehto and Överholm, 1998)

Moreover, the evaluations imply a potential for market transformation and energy savings in addition to those measured in the evaluations. This is due to the fact that the results indicate an increased awareness of the existence of energy-efficient products, changes in manufacturers' commitment to the market (e.g. development and marketing of improved energy-efficient technologies by manufacturers other than those originally participating in technology procurement programmes), changes in customer acceptance and behaviour, price reductions, non-energy benefits, spin-off effects of the programmes (e.g. technology improvements being transferred to other technologies and technology improvements making the introduction of other technologies possible), introduction of informal standards, etc.

General conclusions

The evaluations of the Swedish market transformation programmes have focused on different aspects and have had different structures. Not all of them have included the evaluation of market transformation effects. The evaluations that have evaluated market transformation effects have developed and improved over the years.

The evaluations of the Swedish market transformation programmes have some limitations; the evaluations have not included specification for baseline estimates, programme goal definitions, or impact analysis. However, within the process the use of indicators to evaluate market transformation effects was developed. The indicators used, which have been consistent with the

indicators suggested in the literature, have proven to be useful to illustrate market transformation effects. All the same, the evaluation of the impact of the market transformation effects, including elimination of market barriers, reduction of transaction costs, or achieved energy savings, has been minimal. No analysis of specific changes in market barriers and transaction costs has been developed. The energy savings actually estimated have been based on estimated utilisation data. These estimated data could be improved by using spot tests to verify the calculated savings. Moreover, market effects and energy savings should be estimated and presented with a discussion of the uncertainty i.e. comments on biases, unmeasured assumptions, and statistical uncertainty. The estimates of market effects and energy savings should be based on a defined baseline and be adjusted for external parameters. Furthermore, none of the evaluation reports has estimated the cost efficiency or cost-benefit of the Swedish market transformation programme.

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APPENDIX A. EVALUATION STRATEGY FOR ENERGY EFFICIENCY IN SWEDEN

In year 2000 an evaluation strategy for the evaluation of the energy policy programme of 1997 was presented by the Government. The strategy is divided into different policy areas and we will here present the evaluation strategies for measures of energy efficiency.

A: Evaluation of procurement measures

Data for the following parameters/indicators are to be collected:

- Administrational cost
- Total cost
- Cost paid by STEM
- Number of units sold with subsidy
- Number of units sold without subsidy
- Market share of the product
- Improved technology performance

The data will be used:

1. To analyse the impact of the measures by calculating a reference cases and to perform an Effect-change-analysis (Effektkedjeanalys). This Effect-change-analysis is an analysis of several stages, the stages are described as:

- Actors initiating a technology procurement programme
- Actors engaging in a technology procurement programme
- Spontaneous diffusion with subsidies from STEM
- Spontaneous diffusion outside the targeted
- Visible market shares

2. To evaluate the goal achievement of the programme, e.g. by analysing how many of the programmes have reached step 3 and 4 in the Effect-change.

3. To evaluate the effect of the measure by analysing if the measure has accelerated development and market enlargement of the product considered.

4. To evaluate the efficiency of the measures.

The methods used should be interviews and data collection including sales statistics.

A: Evaluation of information measures and testing & labelling measures

Data for the following parameters/indicators are to be collected:

- Administrational cost
- Total cost
- Number of information measures
- Number of energy advisors
- Number of www sites
- Number of follow-ups
- Number of provided products

- Market share of the products
- Number of labelled units

The data will be used:

- to analyse the impact of the measures used by analysing the change in actors' knowledge and behaviour.

- to evaluate the goal achievement by evaluating the change in actors' knowledge and behaviour and to analyse the share of labelled products on the market.

- to evaluate the effect of the measures by evaluating the change in actors' knowledge and behaviour.

- to evaluate the efficiency of the measures used by evaluating the cost and the results of the measures.

Appendix A: Experts participating in the IEA DSM Agreement, Task 1, Subtask 9, Evaluation guidebook

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Appendix B: Overview of the International Energy Agency (IEA) and the IEA Demand-Side Management Programme

The International Energy Agency

The International Energy Agency (IEA), established in 1974, is an intergovernmental body committed to advancing security of energy supply, economic growth, and environmental sustainability. The policy goals of the IEA include:

- diversity, efficiency, and flexibility within the energy sector,
- the ability to respond promptly and flexibly to energy emergencies,
- environmentally-sustainable provision and use of energy
- development and use of more environmentally-acceptable energy sources,
- improved energy-efficiency,
- research, development and market deployment of new and improved energy technologies, and
- undistorted energy prices
- free and open trade
- cooperation among all energy market participants.

To achieve those goals, the IEA carries out a comprehensive program of energy cooperation and serves as an energy forum for its 26 member counties.

Based in Paris, the IEA is an autonomous entity linked with the Organization for Economic Cooperation and Development (OECD). The main decision-making body is the Governing Board, composed of senior energy officials from each Member Country. A Secretariat, with a staff of energy experts drawn from Member countries and headed by an Executive Director, supports the work of the Governing Board and subordinate bodies.

As part of its program, the IEA provides a framework for more than 40 international collaborative energy research, development and demonstration projects, known as Implementing Agreements, of which the DSM Programme is one. These operate under the IEA's Energy Technolgy Collaboration Programme which is guided by the Committee on Energy Research and Technology (CERT). In addition, five Working Parties (in Energy Efficiency, End Use, Fossil Fuels, Renewable Energy and Fusion Power) monitor the various collaborative energy agreements, identify new areas for cooperation and advise the CERT on policy matters.

IEA Demand Side Management Programme

The Demand-Side Management (DSM) Programme, which was initiated in 1993, deals with a variety of strategies to reduce energy demand. The following 17 member countries and the European Commission have been working to identify and promote opportunities for DSM:

Australia	Italy
Austria	Japan
Belgium	Korea The Netherlands
Canada	Norway
Denmark	Spain
Finland	Sweden
France	United States
Greece	United Kingdom

Programme Vision: In order to create more reliable and more sustainable energy systems and markets, demand side measures should be the first considered and actively incorporated into energy policies and business strategies.

Programme Mission: To deliver to our stakeholders useful information and effective guidance for crafting and implementing DSM policies and measures, as well as technologies and applications that facilitate energy system operations or needed market transformations.

The Programme's work is organised into two clusters:

- The load shape cluster, and
- The load level cluster.

The 'load shape" cluster includes Tasks that seek to impact the shape of the load curve over very short (minutes-hours-day) to longer (days-week-season) time periods. The "load level" cluster includes Tasks that seek to shift the load curve to lower demand levels or shift loads from one energy system to another.

A total of 15 projects or "Tasks" have been initiated since the beginning of the DSM Programme. The overall program is monitored by an Executive Committee consisting of representatives from each contracting party to the Implementing Agreement. The leadership and management of the individual Tasks are the responsibility of Operating Agents. These Tasks and their respective Operating Agents are:

Task 1 International Database on Demand-Side Management &
Evaluation Guidebook on the Impact of DSM and EE for Kyoto's GHG Targets
Harry Vreuls, SenterNovem, the Netherlands

Task 2 Communications Technologies for Demand-Side Management - *Completed*
Richard Formby, EA Technology, United Kingdom

Task 3 Cooperative Procurement of Innovative Technologies for Demand-Side Management – *Completed*
Dr. Hans Westling, Promandat AB, Sweden

Task 4 Development of Improved Methods for Integrating Demand-Side Management into Resource Planning - *Completed*
Grayson Heffner, EPRI, United States

Task 5 Techniques for Implementation of Demand-Side Management Technology in the Marketplace - *Completed*
Juan Comas, FECSA, Spain

Task 6 DSM and Energy Efficiency in Changing Electricity Business Environments – *Completed*
David Crossley, Energy Futures, Australia Pty. Ltd., Australia

Task 7 International Collaboration on Market Transformation- *Completed*
Verney Ryan, BRE, United Kingdom

Task 8 Demand-Side Bidding in a Competitive Electricity Market - *Completed*
Linda Hull, EA Technology Ltd, United Kingdom

Task 9 The Role of Municipalities in a Liberalised System- *Completed*
Martin Cahn, Energie Cites, France

Task 10 Performance Contracting- *Completed*
Dr. Hans Westling, Promandat AB, Sweden

Task 11 Time of Use Pricing and Energy Use for Demand Management Delivery
Richard Formby, EA Technology Ltd, United Kingdom

Task 12 Energy Standards
Frank Pool, New Zealand

Task 13 Demand Response Resources
Ross Malme, Retx, United States

Task 14 White Certificates
Antonio Capozza, CESI, Italy

Task 15 Network Driven DSM
David Crossley, Energy Futures Australia Pty Ltd, Australia

For additional information, see the DSM website: http://dsm.iea.org