European Energy Efficiency: Is Success Transferable?

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Synopsis

The paper presents the preliminary results of research on energy efficiency policy success stories and recent energy conservation studies in seven European countries.

Abstract

This paper presents some preliminary results from European Commission funded research on energy conservation studies and energy efficiency policy success stories in seven European countries. A selection of studies, policies and programmes, from Denmark, Finland, the Netherlands, Sweden, Switzerland, Spain, and the United Kingdom, are considered. The focus is on the domestic and industrial sectors.

Fiscal, regulatory, educational and institutional initiatives are included in a policy review. Policies are compared against the aim of reducing carbon dioxide emissions. The cost-effectiveness of the policies is also estimated. The results are not quantified: rather a series of symbols are employed to demonstrate the relative performance of policies against the defined aims. Following these assessments, the success and possible transferability of policies is considered.

Studies of energy conservation potentials in each of the countries are compared, using a classification method developed for the purpose. The comparison highlights the diversity of approaches and assumptions used in the studies. Preliminary suggestions for the reasons explaining this diversity are put forward.

The paper concludes with a discussion of the progress made and problems encountered during the review process. Suggestions are made for further research to address the barriers to policy comparison and transfer, and areas which are being considered in ongoing research are identified.

1. Introduction

Throughout the European Union there is an increasing emphasis on the use of market forces to deliver energy efficiency improvements wherever possible. The strong movements towards deregulation and liberalisation of energy markets in Western countries are an incentive for reconsidering policies that support energy conservation measures. Furthermore, as energy prices are expected to remain low, there is a recognition that, in certain cases, policy assistance to improve the functioning of the market will be necessary.

An evaluation of successful energy conservation policies in different European countries provides the opportunity to learn from a wide range of experience. A review of conservation studies gives an indication of the attention paid to different types of policies, but also of the basis for (transferred) new policy. In this respect it is also relevant to analyse the extent to which success is influenced by country-specific elements such as the economic background, dependency on imported fuels, climatic conditions, energy intensity, level of energy prices and taxes, emissions of greenhouse gases etc.

The remainder of Section 1 describes the background to the paper, and provides the reader with an outline of the main sections of the paper.

This paper presents the preliminary results of European Commission funded research on energy efficiency policy success stories in seven European countries (van Harmelen *et al* 1996). A selection of policies and programmes, judged to be successful, from Denmark, Finland, the Netherlands, Sweden, Switzerland, Spain, and the United Kingdom, are briefly characterised and compared. The paper continues by investigating a number of recent conservation studies from the above countries, to obtain insights into the research directions taken in policy preparation and design.

The analysis is based on reports written by authors participating in the project, who have provided detailed information on their own national situation.
Section 2 of the paper develops a methodology for characterising policy effectiveness, and uses this to compare the policy instruments and programmes reviewed in the national reports against the aim of reducing carbon dioxide emissions. The cost-effectiveness of the policies is also considered. Section 3 describes the results of a qualitative analysis of approaches and assumptions used in recent conservation studies executed in the countries involved. Special attention is paid to the choice of methodology in relation to the objective of the study. Section 4 is a discussion of issues raised by the preliminary assessment results. In Section 5, conclusions are drawn concerning the possibility of policy transfer from one country to another, and areas where further work would be beneficial.

2. Successful Policies and Programmes

Policy initiatives throughout Europe have been aimed at a variety of economic, social and environmental goals. These may have covered a range of market failures, market barriers and non market issues. One aim of this work has been to identify some of the most successful national policies, which may be collected together into a policy toolbox for use by the Commission and national governments when considering how to overcome specific market failures and barriers in the future. This use of a toolbox to assist a market transformation process is consistent with the Commission's present
approach to energy efficiency policy (see, for example, Bertoldi 1996).

Each of the project partners reviewed in detail five policies or programmes which had been implemented in their country. These were chosen, from an initial basic characterisation of a wide range of implemented policies, to cover a range of types of instrument which appeared to show some degree of promise. The policy choice was also intended to ensure that comparisons of similar policies, implemented in different countries, could take place. In addition, a brief review of international policy initiatives was provided by one of the project partners.

2.1 Assessment Methodology

As part of the in-depth review of national policies, a comparative assessment was carried out. The programme assessments available to the authors of the national reports were insufficiently detailed to allow the construction of national cost-benefit curves (many of the costs and benefits involved are not translated into monetary values). Whilst some of the costs and benefits could be quantified, including these numbers in the presentation of the overall results could have resulted in an over-emphasis on these aspects of the policy's effect, when they may not be the most important. Therefore an alternative comparison method has been used, in which each option is assessed against a series of criteria, and the results are presented in symbolic rather than numeric form. This also avoids any tendency for the reader to simply sum the different assessments to produce an overall rating. This approach has been used in other studies for the Commission, and also in individual countries (see, for example, Martin and Michaelis 1992; Wade 1995).

Thus, in each of the national reports, the policies chosen for detailed analysis were assessed against a set of common criteria. These included reducing CO_2 emissions, and cost-effectiveness from a variety of perspectives. For the first of these criteria, each policy is awarded a rating: +++, ++, +, 0, -. These signify the following (based ideally

on what the policy is actually expected to achieve, relative to baseline projections, not what it theoretically could achieve):

+++	=	results in a reduction in annual national emissions of > = 5%
++	=	results in emissions reductions of < 5% but > = 1%
+	=	results in emissions reductions of < 1% but > = 0.05%
0	=	results in emissions reductions of < 0.05%
-	=	results in an increase in annual emissions

If a policy has only been applied, as a pilot phase, to a small proportion of the possible end-users (for example a domestic insulation programme which has only been implemented in one town), the above rating is calculated against emission reduction targets of an appropriate scale. This scaling of the effects is necessary to compare policies fairly: otherwise small-scale but very effective initiatives would not perform as well as larger scale yet less effective programmes. Note that the comparison of policies with differing scales of application is particularly difficult: this issue is discussed further below.

Partners were asked to assess cost-effectiveness from three perspectives: customer; utility; and total resource cost. At this point any non monetary costs and benefits will be excluded from these analyses (this issue is being considered in another part of the project).

For this criterion, it is perhaps more appropriate not to split down levels of positive effects, since information on total costs where a number of organisations or individuals contribute to the financing of a programme can be very difficult to find. Therefore, the ratings given here are:

✓	=	cost-effective
..	=	no effect
✘	=	not cost-effective

Note also that the degree to which costs and benefits are quantified may vary between countries, and thus the ratings given may not be directly comparable. A different set of symbols have been used here to indicate to the reader that the level of detail in the assessment for this criterion is different to that for the previous one.

In addition to the above criteria, the impact on primary energy demand was assessed. This was included to allow consideration of, for example, the possible energy security implications of CO_2 reducing fuel switching programmes. However, little variation from the CO_2 reduction assessments was found for the selected policies, and hence this aspect is not considered here.

2.2 Preliminary Assessment Results

Table 2.1 illustrates the results for the fiscal policies considered. Similar tables can be constructed for regulatory, educational and institutional initiatives.

The assessments provide an initial list of policies and programmes which appear to have been successful. However, the results must be treated with caution: the assessments are in many cases based on very few data, they may reflect differences in the interpretation of the criteria used, and the information available varies between countries, as assessment methods and comprehensiveness vary. Therefore the results must not be seen as directly comparable.

There are some policy approaches, for example taxes, which appear to be successful in all countries where they were assessed. Note, however, the difficulty of separating the impact of a tax policy from that of other underlying economic and social factors. All the assessments had the benefit of surveyed demand elasticity values but all admitted the difficulty of determining actual impacts relative to a business as usual pathway.

Other fiscal mechanisms, such as rebates, grants, loans and so on, although effective to some extent, appear to

Table 2.1. Assessment Results for Fiscal Policies and Programmes

			Assessment against criteria		
			Cost effectiveness		
Policy	Country	CO_2 emiss. reduction	Consumer	Utility	TRC
Fiscal					
Taxes	Sweden	++			✓
	Netherlands	++	..	..	✓
	Denmark	+++			..
	Finland	+++	?	..	✓
Rebates	Spain	0			✓
Grants/	Sweden	+			-
Subsidies	Spain	0/+/++	..	..	✓
	Netherlands	+	✓	..	✓
Loans	UK	0/+	✓	..	?
	Netherlands	+	✓	..	✓
TPF	Spain	+			✓
Tariffs for CHP	Netherlands	+++	✓	✓/..	✓

have less impact than taxation. However, this may be simply because they have been implemented on a smaller scale (in terms of investment levels). This is supported by the example of Spain, where grants and subsidies have been one of the main policy instruments: in some cases here such policies appear to be as effective as taxation in other countries. The impacts of these fiscal policies, in terms of total investment levels and energy use avoided by the technologies installed, tend to be well documented.

Building regulations are also widely considered to be an effective policy instrument, in terms of their impact on energy use and CO_2 emissions. The information available tends to be based on theoretical calculations of the impact of the standards, and rarely includes actual measurements of energy consumption.

A combination of investment subsidies and a supporting tariff structure to promote the development of CHP capacity has proved to be effective in the Netherlands, and the use of regulation to support the development of CHP in Spain appears to be highly effective. Note that the subsidies in the Netherlands have been discontinued as there is now concern that increased CHP would lead to overcapacity in the electricity generation industry, and therefore that continuing subsidies for investment in own generation would have an adverse impact on the electricity sector.

Assessments of the effectiveness of educational policies differ between countries. This is due in part to the differing nature and scale of the programmes implemented, but also it reflects the difficulty in identifying the full impacts of an educational approach. Whilst specific, targeted information and advice can often be seen to have an immediate positive impact (as reflected in the assessment of the UK's Best Practice Programme, for example), the effects of more general (national media) campaigns can only be estimated, and it is likely that different experts will include differing sets of impacts and varying timescales in this estimating process.

Programmes which aim to adjust the institutional structures and cultures governing the markets for energy and

energy efficiency are almost universally judged to be effective. The nature of these programmes varies between countries, and this doubtless reflects differing decision-making and government cultures. It is perhaps in this area where particular effort should be made to transfer the knowledge gained from successful approaches from one country to another.

3. Energy Efficiency Studies

There are several reasons for reviewing the conservation studies recently conducted in the participating countries. First, we note that the introduction of a policy often is preceded by a study of its expected effectiveness. Therefore the review is a method to learn more about the (intended) energy efficiency policies in a country and the basis for policy transfer. The extent to which studies and methods correspond to national policies may give an indication of the basis for (transferred) new policy. Ongoing research may already be addressing some of the existing barriers to policy implementation. Second, many energy conservation studies aim at identifying sectoral conservation potentials, and thus indicate the scope for energy conservation in a country. Finally, a review of the methodologies used in the different countries might provide scope for transfer of methodologies that appear suited for energy conservation studies.

Transferability depends on the characteristics that countries have in common. Although not described in this paper, the characterisation of national energy contexts in terms of the energy supply mix, energy intensities by sector, energy prices and the environmental situation was an important first step to gather information explaining country differences. Together with the identification of sectoral energy conservation levels from recent studies, this provided an impression of the current situation regarding energy conservation in the participating countries.

3.1 Characterisation Methodology

The analysis has been performed in a qualitative way, by arranging the described studies into the previously defined categories described below, and thus attempting to compare methodologies and emphases between the different countries. Table 3.1 illustrates this approach for one of the countries.

- *Methodology.* *Bottom-up* approach, taking the engineer's point of view, with explicit consideration of energy technology properties for deriving conclusions on national policies, or *top-down* approach, treating energy demand (and thus implicitly energy conservation technologies and behaviour) as a function of economic production and energy prices.
- *Objective or evaluation criterion.* This characteristic was included to give an indication of the goals of the models or studies. Naturally the goal and the methodology of a study are closely related.
- *Scope.* National, regional or local (municipality).
- *Sectors.* Some studies concentrate on one sector while others include all or take an overall approach.
- *Horizon.* The distinction is between short term (<10 years), medium term (10-25 years) and long term (>25 years).
- *Energy carrier.* Some studies focus on one energy carrier, for example electricity, others include all energy carriers.
- *Options.* Options are technological possibilities to save energy. There is a difference between supply and demand options. Supply options concern an increase of efficiency of the generation of energy. Demand options are options that decrease the useful energy demand, such as insulation.
- *Instruments.* Four groups of instruments were distinguished, as for the review of policies: fiscal; regulatory; institutional and educational.

In addition, the bottom-up and top-down methodologies were further characterised by the following classification.

For bottom-up approaches:

1. *Evaluation.* The term evaluation denotes a static study, focused on techno-economic aspects of options for energy conservation (micro-economic approach).
2. *Simulation.* Simulation models investigate the effects of assumed penetration values of energy conservation

options, often based on expert judgements of exogenous model parameters.

3. *Optimisation*: Energy supply models calculate the least-cost mix of energy supply technologies under (national) energy demand and price assumptions, and possibly emission constraints. When studying energy conservation, aggregated conservation potentials and their marginal costs can be included. Given the properties of optimisation models, it is only possible to study *national* cost-effectiveness of aggregated energy conservation options and potentials. No information is obtained about consumer behaviour in their markets, market penetration rates of options, and effects of policy instruments on this penetration.

For top-down models:

4. *Macro-economic*: These models do consider market barriers and consumer behaviour such as price responses in an aggregated way by means of (cross) price elasticities and income elasticities.
5. *General equilibrium*: This type of model explicitly takes into account the interactions between markets, and determines a situation of economic equilibrium through changes in relative prices.

The relation between energy and economic actors is the strong point of top-down models. However, they are not able to analyse at the level of individual efficiency technologies.

Finally, *combinations* of the model types listed above are a separate category. The studies in this category can also consist of a comprehensive analysis based on a number of models or on other studies.

Table 3.1. Example of Structured Comparison of Energy Conservation Studies

Methodology		#	Objective/ 'Evaluation crit.	Scope	Sectors	Horizon	Energy carrier	Options	Instruments
Spain									
Bottom-up	optimisation								
	simulation	1	'market segments for energy conservation'	national	all	short	-	various	fiscal
	evaluation	7	estimating conservation potentials, inventory of possibilities for energy saving	national, regional	all or sectoral (industry, households services)	short	all, elec.natural gas, biomass	various, cogeneration, boilers	fiscal or various
Top-down	equilibrium								
	macro-econ.								
Combinations		2	evaluation & pre-paration of DSM programmes/ conservation and efficiency plan	national	householdsall	short /medium term	elec., all	various	DSM, educational

3.2 Initial Comparison Results

The different national reports listed a total of over 60 studies. The first point to make is that we found a great variety in approaches and underlying assumptions. Even within one country, comparing results calculated in different studies appears to be a risky enterprise. The assumptions made regarding GDP growth and fuel prices directly affect the model results. In addition, the choice of the baseline scenario is very important because the

(cost-)effectiveness of conservation options and policies is determined in comparison to a "Business as usual" situation. These observations imply that comparison of results between different countries is even harder because of differences in the energy and environmental situations, and therefore should be made with great care. An attempt, however, is made in Section 3.3.

A comparison of the methodologies and time horizons chosen, as well as the sectors studied in the participating countries is less sensitive and gives additional information regarding the attention different countries pay to energy efficiency.

There seems to be a preference for bottom-up approaches for the study of energy conservation (see Figure 3.1). Bottom-up models and methods can incorporate more technological detail, and therefore are suitable for evaluating technological saving options and estimating conservation potentials. Evaluation approaches are frequently used in short term studies, focusing on identification and implementation of conservation options. Simulation studies are often a medium or long term preparation of policy targets and strategies. Within the bottom-up approach, there is a preference for simulation and evaluation methods. This is partly due to the fact that cost-optimisation models take an integrated approach, not specifically aimed at energy conservation.

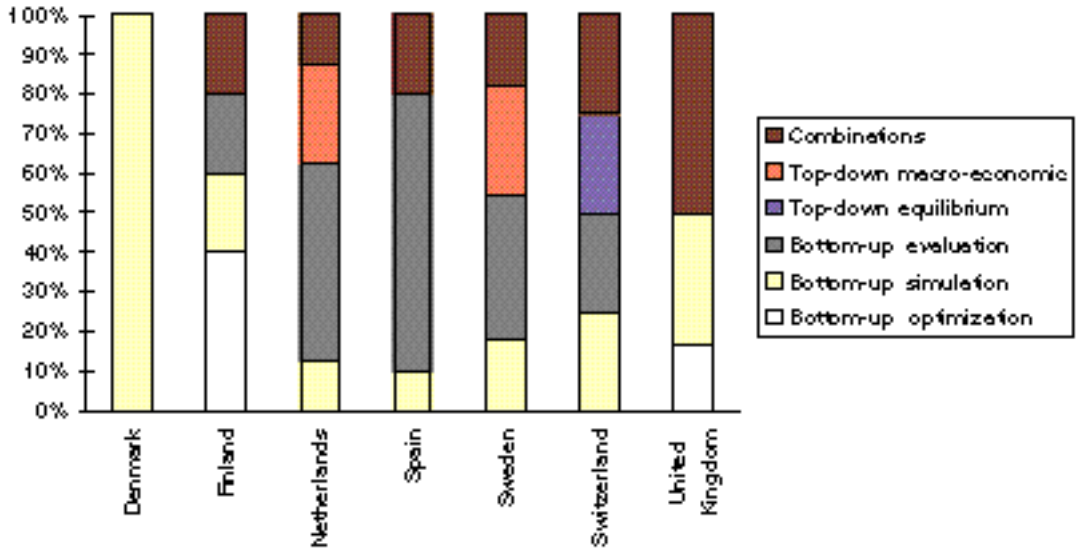

Figure 3. Methodologies Used in the Different Countries

Even if top-down macro-economic models are used, these are often combined with energy supply models. This can be explained by the technology-oriented nature of most conservation studies. The human dimensions of energy use seem to be disregarded in many studies. This may be ascribed to the fact that it is hard to represent human behaviour mathematically. Finland and Sweden do report the use of sociological and empirical methods.

In most countries there is a balance between short and long term studies. In general, the short term studies provide a framework for designing policies for implementation, while medium term studies set policy targets. In addition, studies considering policies to reduce greenhouse gases have a long term horizon. Almost all Spanish studies have a short term horizon. This could be explained by the fact that many studies investigate the role of a particular technology or energy carrier in a specific sector.

It is worth noticing that in most studies where only one energy carrier is considered, electricity is the carrier. Two factors may contribute to this focus on electricity. First, producers and distributors of electricity may have an economic interest in electricity savings, and regulation of electricity demand. Therefore they carry out energy conservation studies to support DSM programmes. Second, the prices of electricity are substantially higher than the

prices of other energy carriers. As a result there is a financial incentive to investigate saving of electricity.

3.3 Policy Instruments Studied: Some Preliminary Remarks

Studies are usually conducted to inform policy design or policy preparation. Therefore an analysis of the type of policy instruments studied should give an indication of the policies currently being considered in the different countries. A relationship exists between methodology and type of instrument studied. The different methodologies are complementary and each particularly suited for studying specific (types of) policy instruments. Financial measures such as subsidies and taxes are often analysed in top-down studies. Bottom-up approaches are used to investigate regulatory measures and fiscal measures aiming at specific technologies. Educational and DSM measures are mainly analysed in evaluation studies.

One step further is to take into account the conclusions of the studies regarding the effectiveness of different policy instruments. However, the remarks made in Section 3.2 regarding the comparability of model results do apply here.

Energy or carbon taxes are studied in all countries except Spain. In Switzerland many different studies consider fuel and CO_2 taxes, which are judged effective in the long term. Road fuel taxation is identified to be effective in Switzerland and the UK. In a Dutch study, an energy tax applied to all economic sectors has a particularly large impact on fossil fuel and electricity demand in industry. The fiscal instruments studied in Spain concern subsidies and grants. This is noteworthy because Spain is the only country where (additional) taxes to encourage conserving behaviour are not applied at all. This is coherent with the fact that partial subsidies for projects have been one of the main instruments used in Spain to promote energy efficiency over the last decade.

DSM programs are prepared by studies in Finland, Denmark and Spain. In Denmark, energy audits, advice on energy efficiency (for new constructions or investments), and information campaigns to influence customer behaviour are identified as successful policies for the residential and commercial sectors.

Educational instruments are proposed in Spain, Sweden, Switzerland, and the United Kingdom. In the UK, one of the studies identifies information campaigns and education to be a key part of an effective strategy in the domestic appliance sector.

Regulatory instruments are studied in the UK, the Netherlands, Switzerland and Sweden. In Switzerland it concerns building and vehicle standards that, together with a tax on gasoline and subsidies on renewables, slow the increase of electricity consumption and achieve a decrease in fossil fuel consumption. Institutional instruments are hardly mentioned. In the Netherlands bottom-up studies are carried out as a preparation for the negotiations regarding voluntary agreements.

Although the authors of the national reports have been asked to aim at a variety of recent conservation studies of importance, it must be noted that part of the observed country differences may stem from the selections made by the authors. Keeping this in mind, the following country preferences can be identified. Denmark focuses on DSM studies, which may be caused by the Danish Integrated Planning legislation. Since 1994, this legislation requires a collective integrated resource supply plan to be produced every second year. In Spain most studies are addressing (short term) market evaluations of specific technologies. Other country preferences for sectors and fuels can be ascribed to the energy intensity of the sector in question, and to the natural resources and import dependency of the countries involved.

4. Discussion

The preliminary results from the policy and study comparisons raise a series of issues which deserve further investigation.

4.1 Geographical Boundaries of the Study

As already mentioned, the basic energy and economic situation in a country will significantly influence the applicability of any given policy in that country. These differing policy drivers will, to some extent, be reflected in the commitments each nation has made to controlling emissions of CO_2. For example, Denmark's original commitment to *reduce* emissions by 20% relative to 1988 levels by the year 2005 can be contrasted with Spain's agreement to limit *growth* in emissions to 25% of 1990 levels by 2000 (CEC 1994). Such differences in focus will affect both the types of initiative needed and the programmes which will be considered acceptable in different countries.

In the review of studies, the consideration of energy taxes was noted in all participating countries other than Spain. This raises the issue of the geographical boundaries of the present work. A full investigation of the reasons why Spain is not considering taxes, and is more interested than other countries in the use of grants and loans can perhaps only be undertaken with the consideration of other southern European countries.

4.2 Theoretically Promising Areas not Reflected in Current Practice

Energy taxes are seen as a highly effective fiscal instrument, particularly for their impact on CO_2 emissions. Results of conservation studies in many countries support this conclusion. At the moment taxes are being used only in a small number of countries, but taxes are being studied in all countries except Spain, indicating that there might be a basis for transfer.

Taxes for domestic users receive mixed reactions. In the Netherlands, for example, the small user tax has met with little opposition (possibly due to comparatively low base fuel prices) but in some European Member States the situation is very different. For example, in the UK there is very strong resistance to the idea of increasing taxes on domestic energy use. Also, taxes are hardly being applied in industry, where they can pose a potential competition disadvantage with other countries. It is often argued that environmental or other taxes can only be applied "properly" in industry when applied simultaneously in all EU countries.

Thus, whilst in theory this is a very effective mechanism for reducing energy use, there are problems associated with the introduction of this type of policy across Europe. However, the success of tax policies in countries where this type of initiative is acceptable highlights the need for continued effort in this area in within the EU. Whilst opposition from some Member States remains strong, efforts should be made to enable those which do wish to use this tool to do so effectively within the framework of the developing European energy markets.

Institutional instruments, such as technology procurement and voluntary agreements, are also judged to be effective. In the studies surveyed, institutional instruments were hardly mentioned, presumably because these are not very suitable for incorporating in a model. However, research would be required to investigate the effect of differing decision-making and government cultures on the design of the programmes.

Any emphasis on the transfer of present success stories should not be at the expense of investigation of as yet untried or controversial alternatives.

4.3 Quality and Availability of Information

National cost benefit curves for policy actions cannot be constructed as insufficient information is available. The lack of information about costs of programmes, and investment levels they produce, also limits the comparisons which can be made between the assessments. A tax policy which costs the government relatively little to administer but results in large flows of money from consumers to government is perhaps inherently more likely to produce greater results than one which involves far smaller financial transfers. The impacts of such differences can not be deduced from the information available.

The measurement of cost effectiveness also raises an issue about the definition of total resource costs. All partners were asked to include only quantified costs, and therefore to exclude environmental externalities. However, it is

possible that in some countries a greater range of costs and benefits (other than environmental externalities) are quantified than in others. This may account for the generally more favourable results from some countries and the more cautious assessments from others.

Several authors report that availability of data on realised conservation measures and technical conservation options is a problem. The data available may be of not very recent date, indicating the need for statistical surveys. A related problem, experienced in assessing policy effectiveness was the confidentiality of the results of evaluations carried out by private companies and utilities.

The feasibility of improving the level of information available, and the time and expense which would be involved in such an exercise require careful thought. Alternative methods of comparing policies may be possible, and this issue is considered in the concluding section of this paper.

4.4 Methodologies and Assumptions

As mentioned previously, the comparability of study results is, even within a country, a delicate matter. The assumptions and the choice of a baseline scenario greatly affect the results. The goal of the study also plays a role. Studies differ in their stated aims, and therefore calculate different variables and reach different conclusions. For cross-national comparisons, there is an additional difficulty in the differing national contexts and cultures. An important observation is that for almost every study, specific national approaches and models have been used. It is remarkable that the international conservation model MURE has not been mentioned once. Such a diversity of tools hampers comparison of studies, results and experiences and thus transfer of knowledge.

Similar remarks apply to the comparative policy assessment. The quality of initial assessments on which the national authors have based their work will vary within and between countries. It is at times difficult to ascertain whether the impacts described for a policy are relative to a business-as-usual scenario or are simply a measure of the difference in energy use before and after the policy implementation. This reinforces the need to treat these assessments as preliminary only.

One aspect of the policy assessment methodology used in this study which requires further thought is the comparison of policies implemented on differing geographical or financial scales. Whilst adjusting target reductions to suit the scale of the policy allows a rough consistency to be introduced into the comparison process, the application of a local or small scale programme on a larger level is unlikely to result in a directly comparable scaling up of effects, and therefore alternative comparison methods need to be sought.

5. Conclusions

The most obvious finding from the work to date is that the information which is presently collected and reported is insufficient to guide policy transfer. Also, the study of policies, when carried out using varying baselines, assumptions and methodologies, does not assist the process. However, the range of promising policies identified by the work should provide scope for action in all Member States, allowing the particulars of national situations to be accounted for without the opportunity for improvement being lost, and therefore the issue deserves further study.

The comparative process would be improved by the application of common techniques and methodologies across all countries. In the next phase of the present project, a single energy conservation model (REDUCE, see de Kruijk *et al* 1997 for more details) will be used to assess policy options. Future work is being considered, which would include a consideration of the policy assessment methodologies developed in individual countries, and the possibility of their application on a wider scale.

In addition to considering the standardisation of existing types of comparative data, alternative approaches could be developed. Reducing policies to short summaries may be necessary to facilitate the development of an overview. However, the most productive type of information to transfer between countries may be much more

detailed and qualitative. For example, descriptions of the implementation of specific policies and programmes which have, in the opinion of their implementers, met their own set of objectives, may be of more use to the policy maker.

This study, like much other recent work, has highlighted the lack of understanding which energy researchers and policy makers have about human behaviour. The modelling process referred to above will begin to integrate a closer consideration of the human aspects of energy conservation polices, based on the results of a survey of industrial energy users which was undertaken as part of the initial phase of the project. Whilst this will hopefully lead to some progress, much further work remains to be done, both to collect new information and to incorporate the knowledge and understanding already existing in disciplines, such as anthropology, which are less traditionally associated with the study of energy policy.

These developments, and others (such as geographical expansion of the present study or further investigation of the role energy policy studies can play in setting the context for international policy comparisons), will all benefit from continued research co-operation on a European level.

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