



MURE DATABASE CASE STUDY

AN ANALYSIS OF

FINANCIAL MEASURES ACROSS THE EU

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1. INTRODUCTION

Financial measures are important tools that a government can use to promote the rational use of energy, and almost all the countries of the EU have included these in their programmes to achieve national targets for the reduction of CO2 emissions. Many countries have provided such incentives in one form or another since the first oil shock of the early 1970s. Financial measures are primarily the giving of grants to individuals or organisations to undertake a specific energy saving activity, but also cover the provision of loans at advantageous rate for the same purpose. They can be instigated and run by a range of organisations such as national and local governments, energy utilities, energy agencies and financial institutions.

This case study aims to provide an assessment of the range of financial measures undertaken in Europe, based on the information held in the MURE database, supplemented by examples of the potential energy savings achievable if selected measures were to be implemented throughout the EU.

The MURE database covers four separate sectors; households, transport, industry and tertiary. For the purposes of this study the industry and tertiary sectors will be considered together, as many incentives are common to both.

MURE currently contains information on 264 financial measures in the EU, some 30% of all measures in the database. Table 1 shows the breakdown of measures by sector. Due to the sectoral nature of the database there is some overlap between sectors in which the same measures may be entered, in particular in the industry and tertiary sectors.

Table 1: Number of Financial Measures by Sector

Sector	Financial Measures	Total Number of Measures
Household	88	254
Industry	80	234
Tertiary	22	136
Transport	74	268
Total	264	892

2. HOUSEHOLD SECTOR

The majority of financial measures in this sector are grants for the installation of specified types of equipment. Most schemes can be categorised in two groups;

- Grants for investing in proven technologies; insulation, controls, high efficiency heating equipment etc.
- Grants for investing in new or renewable technologies; solar energy, heat pumps, etc.

These two categories fulfil different purposes. The first group primarily aims to upgrade the energy performance of the existing stock. The latter also aims to help overcome the barriers to market acceptance of the new technologies.

Other incentive schemes include grants for energy audits, and reduced rate loans for energy saving investments. Recently some countries have also introduced grants for energy efficient domestic appliances.

2.1. Grants for Installation of Existing Technologies

The potential market for the installation of existing technologies is very large. One of the key issues for policy-makers is how to target a grant for optimum results; the aim must be to maximise its impact while avoiding subsidising those who would have implemented the measure without support. To achieve this, most grant schemes attach criteria which must be met by the applicant. Examples of targeted incentives are;

- low income of the recipient
- houses heated by undesirable means such as electricity
- specified technologies.

A number of countries have also tried less targeted schemes which cover a part of the cost of general upgrading of a building.

2.1.1. Income-dependent grants

Low-income families often live in the most inefficient housing and do not have access to funding for investment in even simple improvements such as roof insulation or draught-proofing. Improving the energy performance of these homes has both a social and an environmental benefit.

An example of a subsidy programme targeting this group comes from the UK, where the Home Energy Efficiency Scheme (HEES) aims to provide affordable warmth for those most in need.

HEES provides grants to cover the cost of basic energy efficiency measures in the homes of people living on low incomes, and those aged 60 and over. These measures include draught proofing of doors and windows, hot water tank

insulation and loft insulation. Recipients are also given professional advice on saving energy in the home.

The level of grant available depends on a household's circumstances. Those receiving any of a range of "qualifying" state benefits such as Income Support, Housing Benefit, Disability Benefit etc. receive a fixed amount which is generally sufficient to cover the full cost of the work. Those aged 60 or over who do not receive these benefits can get a grant of approximately 25% of the cost.

The scheme was introduced in 1991 and revised in 1996. The total funding for grants to date is over £420 million (630 mEuro). By 1998, 2.5 million homes had been insulated under HEES, accounting for over 10% of households in the UK

Similar schemes operate in Ireland and Denmark. In Ireland, Energy Action aims both to reduce fuel poverty and create jobs. By 1997, 4,600 homes in the Dublin area had been insulated. In Denmark pensioners who receive heating subsidies and who live in housing built before 1979 can claim up to 50% of the cost of work to improve the energy efficiency of their homes. This reduces both energy consumption and the cost of public subsidy for heating bills.

2.1.2. Grants for fuel-switching

In Sweden, the planned closure of two nuclear power plants has led to a need to reduce electricity consumption. To facilitate this reduction, various new government grants were introduced in 1997 for electrically-heated homes. These can cover up to 50% of the cost of conversion to a non-electric heating system.

A programme in Denmark targets older housing by providing grants for connecting dwellings built before 1950 to district heating systems supplied from combined heat and power plants. In the period 1993-1997 about half of the eligible dwellings (35,000) were connected to district heating with grant support. The programme will run until 2002 at a cost of 13.6 MEuro a year.

2.1.3. Specified technologies

A number of countries run programmes which offer incentives for the installation of a range of specified technologies, generally under one promotional banner. This has the advantage of a single marketing initiative to promote awareness of the grants, but as each grant is separately accounted for, its impact and cost-benefit can be accurately monitored.

In the UK, the Energy Efficiency programme of the Energy Saving Trust operates in this way. This project is jointly funded by the government and the electricity utilities, and offers fixed grants for the installation of a number of technologies including gas condensing boilers, heating controls, cavity wall insulation, compact fluorescent lighting and energy efficient refrigerators. Since the start of the programme in 1994, the utilities have spent £97.7m (150mEuro)

on the initiatives and expect to achieve a saving of 13.5GWh over the lifetime of the technologies installed, equivalent to 0.7p/kWh. The government-funded initiatives cost £20m (30mEuro) in 1997/8 and achieved an average cost-effectiveness of 1.2p/kWh. Within this figure, the grant schemes for housing technologies have been individually monitored and achieve between 0.9p/kWh for heating controls and cavity wall insulation and 1.2p/kWh for condensing boilers.

A similar scheme operates in the Netherlands with a range of specific grants being offered by the energy utilities in conjunction with the government, under the Milieu Actie Plan 2000 programme.

2.1.4. Building upgrade schemes

Grants towards a general improvement in buildings have been tried in a few countries, with the implicit or explicit expectation that energy savings will be generated.

A specific case has been tackled in Germany with a programme for the modernisation of dwellings in the New Federal States. Under the "Aufschwung Ost" programme, a grant of 20 % or maximum 500 DM/m² (250 Euro/m²) was available for energy saving improvements of houses and apartments (e.g. insulation, renewal of heating equipment). Around 900,000 dwellings were upgraded at a programme cost of 1500 million DM (750 mEuro) between 1990 and 1992. This programme was supported by reduced rate loans for the same purpose from 1990-1996. According to an estimate of DIW et al, 1997, about 7 million tonnes/year CO₂ was saved by both programmes together. This large saving is in part due to the low standard of heating equipment in the New Federal States before the introduction of these measures.

Also in Germany, a slightly different approach has been implemented where grants are available for investment in an unspecified set of measures provided that a specified low energy standard is achieved.

During a 10 year period after the first oil shock(75-84), the Danish government used grants to reduce the energy consumption in older dwellings. The scheme was changed several times during the period, but the basic structure remained the same; a grant to pay a part of the costs (25-30%) for extra insulation, new windows etc., with an upper limit for the grant per dwelling or per square meter of living area. An interesting feature of these grants is that the cost-effectiveness was specified, at 7% savings per year for owner-occupied dwellings and 12.5% per year for tenant-occupied dwellings.

In contrast however, a scheme to upgrade the housing stock in France which from 1982 contained a specific requirement for energy saving measures, had little energy impact. A survey of the few instances in which energy use was monitored found that only 14% achieved a payback period on the investment of better than 30 years and for over 40% the payback period was greater than 90 years. The report on the scheme concluded that in reality, energy saving had not been considered as one of its main objectives.

2.2. Grants for New & Renewable Technologies

Grants for the installation of new and renewable technologies such as solar panels, photovoltaics and heat pumps are available in several countries. In the main, grants are awarded for a percentage of the installation cost, up to a maximum limit.

In Sweden, grants for about 25% of the cost of solar heating systems were available between 1991 and 1996. During that period approximately 10,000 homes used the grant to install systems with a total solar collecting area of approximately 55,000 m², receiving around 70 million SEK (8 mEuro). For a typical one or two-dwelling house the solar collecting system can cover around 20% of the total energy needed for space heating and domestic hot water. Thus the energy saved by the scheme can be estimated at 3.7 ktoe per year, worth around 30 million SEK.

Germany has a range of initiatives which support the installation of new and renewable heating technologies, such as solar panels, heat pumps and heat recovery equipment. One such programme which runs from 1996 to 1998 provides an annual grant of 2% of the investment costs (maximum of 500 DM/250 Euro) over a period of 8 years. Houses built according to a low energy house standard are supported with additional 400 DM (200 Euro) per year. The total value of grants is 1,700 mDM (850 mEuro) and the expected uptake is 80,000 homes. According to an estimate of DIW et al., the total energy savings in 1997 would be 6.1 PJ (146 ktoe) with a corresponding CO₂ reduction of 0.4 million tonnes.

In Austria the various state governments offer grants for renewable energy equipment such as thermal solar heating, heat pumps, biomass heating and photovoltaics for dwellings. The subsidies are one-off grants, often up to 30% of the investment costs and are limited by an absolute amount of between 5,000 and 30,000 ATS (350-2100 Euro) per equipment or per dwelling. Many municipalities offer additional grants for such equipment (e.g. 25% of the provincial government subsidy). Some electricity supply companies also support the introduction of heat pumps through tariff reductions.

As well as increasing the total amount of renewable energy used, these programmes aim to stimulate the market sufficiently for manufacturers to achieve economies of scale and hence reduce the relative price of these types of equipment. In the Netherlands the government has gone a stage further by setting up a voluntary agreement with the association of solar equipment manufacturers to the effect that prices will fall each year. This is supported by a decreasing grant towards the purchase of a system, such that the net cost to the householder will remain roughly constant. The aim is to have 300,000 systems installed by 2010 (c.5% of households).

2.3. Energy Audits

Grants for energy audits of housing are not a major tool in the household sector. Countries that have run successful audit programmes have supported these by a range of grants or loans to help carry out the work identified. Audit grants were introduced in France in the mid 80s and in Germany in 1991. In France, 12% of apartments were audited between 1983 and 1988, and it has been estimated that 80% of these were followed by improvement work, saving around 1.5 mtoe of energy. The social housing sector gained most from this programme, whereas in Germany it was the private rented sector. As energy prices fell, the demand for audits also decreased.

2.4. Quantitative Examples of Financial Incentives in Households

To demonstrate the potential of the MURE database, it has been used to simulate the potential impact if two measures were to be applied across the EU. The measures chosen are the UK's Heating Controls promotion run by the Energy Saving Trust, and the Home Energy Efficiency Scheme run by the Energy Action Grants Agency.

2.4.1. Heating Controls

MURE has been used to calculate the potential impact of a grant scheme to install improved heating controls in all EU countries for which sufficient data is available (i.e. excluding Greece, Ireland and Luxembourg).

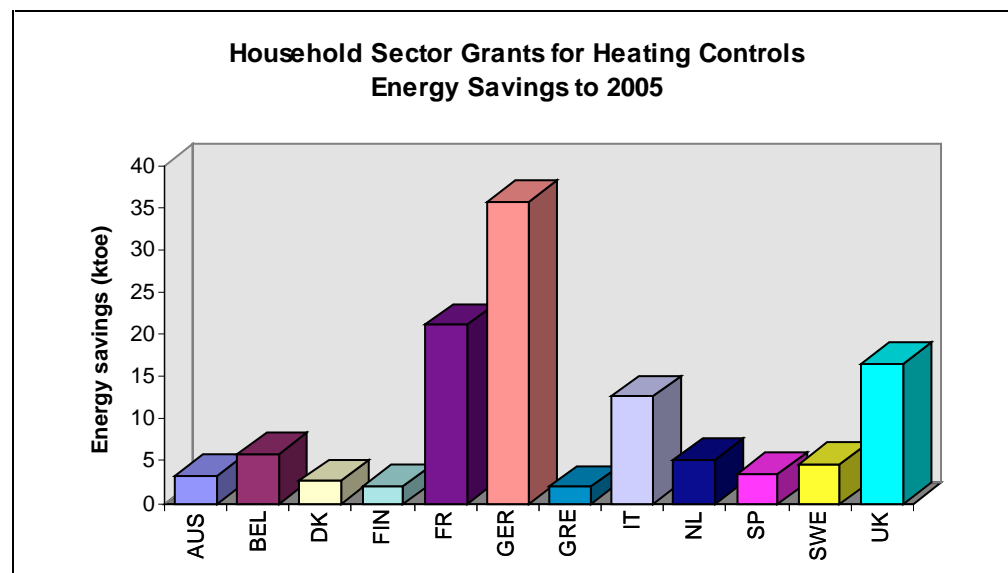
The following assumptions have been made;

- the controls have been installed as a single measure rather than as part of a package of measures
- the default values in the database for the savings achievable from improved controls have been used throughout
- the grant programme runs for 10 years from 1995
- the penetration rate achieved in the UK for this scheme (which is a small part of a larger energy efficiency scheme) of 0.1% of dwellings per year has been used.

The resulting total energy saving potential of this intervention in the 12 countries analysed is 115 ktoe. The breakdown of the results by country is shown in the table and below. The graph shows the breakdown of energy saving by country.

Table 2: Energy Savings Potential to 2005 of Heating Controls Grant Scheme

Country	Energy Saved (kTOE)	Involved Stock (thousand dwellings)	CO2 emissions saved (tonnes)
AUS	3.27	31	11
BEL	5.77	41	17
DK	2.64	24	6
FIN	2.05	23	5
FR	21.16	228	62
GER	35.79	360	105
GRE	1.95	36	5
IT	12.61	180	39
NL	5.16	61	13
SP	3.5	113	7
SWE	4.73	41	16
UK	16.52	238	47
Total	115.15	1376	333



2.4.2. Insulation

A simulation of the impact of a grant scheme similar to the UK's Home Energy Efficiency Scheme was applied to all countries of the EU, except Finland, Ireland, Luxembourg and Portugal

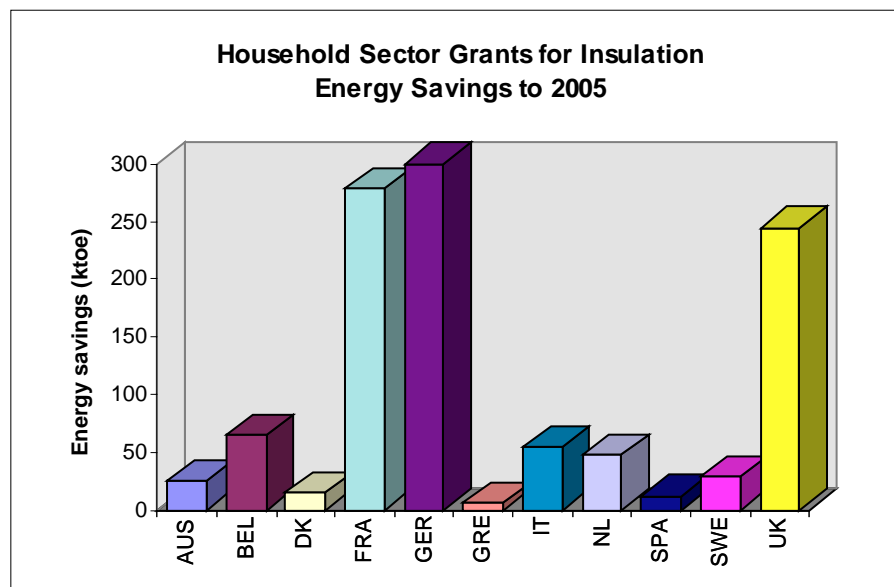
The following set up procedure was applied to all countries analysed;

- roof insulation was introduced or upgraded in old and intermediate age housing to the standard achieved by new housing
- the measure was only applied to individual housing
- the grant programme runs for 10 years from 1995
- the penetration rate achieved in the UK for this scheme of 1.6% of dwellings per year has been used
- 50% of the potential savings achieved are taken as increased comfort (based on UK survey data).

The resulting energy saving potential to 2005 is 1078 ktoe, equivalent to 3,291 tonnes of CO₂. The breakdown by country is shown in Table 2 below.

Table 3: Energy Savings Potential to 2005 of Insulation Grant Scheme

Country	Energy saved (ktoe)	Stock Involved (thousand dwellings)	CO ₂ saved (tonnes)
AUS	25	368	89
BEL	65	452	202
DK	14	213	37
FRA	279	1,917	870
GER	300	2,420	935
GRE	7	249	17
IT	55	1,150	183
NL	48	686	118
SPA	12	590	18
SWE	29	260	131
UK	244	2,890	691
Total	1,078	11,195	3,291



2.5. Summary of Financial Incentives in Households

As the above examples show, financial incentives can be effective tools to improve the energy performance of housing. There are around 130 million households in the EU, of which around 70% were built before energy conservation was a serious issue in the building regulations. Whilst a large number of these will have been improved through additional insulation and glazing, there is still a huge potential market for energy saving grants.

The range of energy saving technologies in this sector is fairly limited and therefore it is relatively simple to define the aims and size of an incentive programme and estimate the cost of installation or purchase of the technology. Targeting a specific need has many advantages. If the recipient group is well defined, publicity about the measure can be effectively targeted and monitoring of results should be possible.

The cost of the incentive obviously depends on its specific aims and target market. Energy audits schemes are relatively cheap to administer, but there is no compulsion to carry out the recommendations and hence no direct impact on energy consumption. In reality, the effectiveness of such schemes is strongly dependent on the price of energy. A programme like the Home Energy Efficiency Scheme which aims to reduce fuel poverty and covers the full cost of insulation is much more ambitious, but deals with relatively cheap, no-risk technologies. On the other hand priming the market for solar heating, for example, by granting a percentage of the cost introduces more expensive technologies into a much smaller number of houses.

Most grant schemes for which the figures are available claim to have been cost-effective to the administration in terms of energy saved per Euro spent. In terms of immediate results, initial estimates suggest that low technology measures are the most cost-effective in that they reach a greater number of homes. However, this does not take into account the longer term effects of the market-priming role of grants for new technologies, or any measures carried out

as a result of increased awareness generated by the associated marketing campaigns.

The key figure affecting the energy impact of grant schemes is the penetration rate achieved. The more tightly targeted schemes may be taken up by a significant percentage of their target market, but the penetration rate relative to the whole housing stock is still generally low. Most schemes which are considered successful achieve annual penetration rates of below 1%. In the housing sector, it is therefore important that such schemes run over long periods to coincide with the relatively long-term nature of housing improvements in general.

3. INDUSTRY/TERTIARY

Industry was the main focus area of most early energy saving programmes and financial assistance has been available in many countries since the 1970s. Support programmes have needed to cover all stages of production and hence fall into the following categories;

1. support for the development of more efficient technologies through R&D programmes
2. demonstration projects to initiate a market for the new technologies
3. grants for energy audits to demonstrate the potential for investment in more efficient technologies and practices
4. incentives for investment in equipment.

As the tertiary sector has grown and awareness of the potential savings therein has increased, many financial incentives aimed at industry have expanded to include firms in this sector. Therefore the two sectors will be considered together.

3.1. Grants for Research & Development

Research into new energy saving applications and technologies provides the basis of future energy saving potential. Studies in the UK in 1980 and 1990 both showed a cost-effective energy savings potential of around 20%, despite the savings that have been achieved in the intervening years. This is due to the development of new technologies in response to the market needs and economic or environmental pressures.

Most EU countries have energy efficiency R&D programmes supported to an extent by the government or energy agency. Priority for funding of R&D in energy technologies has tended to follow energy prices, with resources being reduced during times of low prices.

3.2. Demonstration projects

The objective of a demonstration project scheme is to produce results that encourage other companies to invest in the same technology with no financial assistance. In the main they are only available for new technologies or new applications of existing technologies. The funding organisation is generally responsible for monitoring the savings made and disseminating this information to other potential users.

Large scale demonstration projects have been run by the European Commission, such as THERMIE which provides up to 40% funding. On a smaller scale, the Best Practice Programme in the UK provides funding for the monitoring of results and dissemination activities for examples of new energy technologies.

3.3. Grants for energy audits

Most of the countries of the EU have, or have previously had, a programme to support energy audits in industry and/or commerce. It has long been recognised that one of the major barriers to energy savings is a lack of knowledge of the potential among energy users. Even many large energy users do not have the resources in-house to manage energy consumption and keep up to date with the latest technological developments. Thus most of the audit schemes provide for external experts to carry out an audit and propose energy saving recommendations. None of the schemes cover the full cost of the audit, which ensures that the company has a stake in the results. In most countries the support ranges from 30%-50% of the cost, although in Belgium (Wallon region) it is possible to get 75% for a feasibility study provided that the recommended investment is carried out.

France, Luxembourg and the UK (until 1995) link the audit grants to further grant schemes for either more detailed feasibility studies or project implementation. This helps to ensure that at least some of the recommendations are actually carried out and avoids the scheme funding merely the production of reports.

In Germany, the Netherlands and the UK the grants are limited to SMEs, on the basis that larger firms have the information and resources to enable them to identify and implement energy savings without support.

In the main these grants apply to the cost of an audit, regardless of the energy type, use or technology. Two countries also have audit schemes linked to specific end uses. In Ireland there is a separate grant available of 40% of the cost of a boiler audit. In France a specific grant exists for auditing public lighting.

Audit schemes are generally seen as a cost-effective means of targeting energy savings in a wide range of companies. The use of external experts ensures that the schemes are promoted by these experts as well as by the energy agency or government department concerned, so advertising costs are relatively low compared to the other sectors.

In the UK, the Energy Management Assistance Scheme which ran from 1993-1996 cost £400,000 (600 kEuro) and is estimated to have generated savings of over £1.8million (2.7mEuro). In a similar scheme in Ireland, the Energy Audit Grant Scheme, savings equating to over £6million (nearly 5% of industry's annual energy expenditure) were realised at a cost to the government of less than £1million.

3.4. Grants for investment in equipment

The provision of grants to help with investment in energy saving equipment can be a very expensive measure. Therefore most schemes in the EU have a means of limiting their applicability. The most common way of doing this is to specify

the technologies to be supported. This can ensure that the funding is only being used to help install the most efficient type of equipment, or a technology that has a large potential but currently only a low penetration rate. Technologies can also be specified that have a large potential but are on the limits of economic viability. However, this type of programme must be continually monitored to ensure that more recent innovations are not ignored. France, Germany, Ireland, the Netherlands and the UK all have programmes to support specific types of technology.

In the Netherlands the Subsidy Scheme for Energy Saving Techniques (BSET) provides funding of up to 20% of the investment costs, (to a maximum level dependent on the technology) for the following types of investment:

- thermal solar energy installations e.g. solar boilers
- heat pumps, industrial cooling and air handling installations
- automatic control equipment
- the improved use of existing equipment
- equipment for heat recovery from warm air streams
- absorption cooling using residual heat
- gas condensers and heat buffers for existing CHP installations

These technologies are fairly broad and hence a large number of projects could be included. The list is updated at intervals, and in the 1995 revision a number of technologies were dropped, such as CHP installations, photovoltaic systems, variable speed drives and long-term cold storage.

A similar programme ran in Germany from 1978 to 1989. The Investment Subsidy Law (Investitionszulagengesetz §4a) allowed for a subsidy of 7.5 % of the investment cost for technologies predominantly in energy supply and distribution: heat recovery systems, heat pumps, solar and wind plants, heat distribution systems, heating and power stations, garbage incineration power stations, small hydro plants, peak load heating stations. The subsidy was tax free and therefore effectively higher than 7.5 %.

An analysis of the results of the German programme by Ifo showed that between 1975 and 1988 subsidies of about 3 billion DM (1.5 bnEuro) were granted for around 18,600 projects with a corresponding investment of 40 billion DM (20 bnEuro). Savings have been estimated at 320 PJ per year.

3.4.1. Loans for investment in energy efficiency

The provision of low cost loans rather than grant support is a popular tool in Germany where a number of complementary loan programmes exist. These are

run by the German Bank for Compensation (DtA) and the Credit Institute for Reconstruction (KfW).

The loans support the installation, extension and modernisation of energy efficient and environmentally friendly production plants, actions to conserve energy, use of renewable energy sources and the manufacture of environmentally friendly products. The maximum value of the loan depends on the specific programme but ranges from 1-10 million DM (0.5-5 mEuro) to cover between 50%-80% of the investment cost. Loans of 4500 Mill DM (2250 mEuro) were made to businesses from the entire ERP programme fund in 1995 of which 40% went to the New Federal States.

The credit volume for environmental projects has grown by a factor of four since 1991. It is noticeable that support is shifting in favour of smaller projects, and now 98% of all environmental loans are granted to SMEs.

3.5. Tertiary Sector Financial Incentives

Many of the incentives aimed at industrial companies are also available to organisations in the tertiary sector, such as grants for energy audits and investment. As energy is not such a significant issue for individual organisations in this sector, the uptake of these incentives has been limited.

In the UK, one initiative is available to both industry and tertiary sector organisations but is predominantly aimed at the latter. The Energy Design Advice Scheme offers advice on the energy conscious design of buildings covering both new build and refurbishment projects. The scheme offers a free one-day consultation to identify possible design options which could improve the energy and environmental performance of the building. If this first consultation identifies significant potential energy savings a grant of 50% of the cost of further consultancy is available. Between 1993 and 1996, EDAS was used in over 1200 projects and energy savings worth £17m (25 mEuro) per year were identified, equating to a reduction in CO₂ emissions in excess of 350,000 tonnes.

3.6. Quantitative Example of Financial Incentives in Industry

As the majority of financial incentives in industry apply to a broad range of sectors and/or a range of technologies, it is difficult to carry out a simulation of the impact of a specific measure across the EU. The examples given above vary enormously in terms of scale, cost to the administration, and hence the results achieved. The very large support programmes in Germany are estimated to have saved over 10% of annual industrial energy consumption. Similarly the relatively large audit scheme in Ireland saved around 5% of annual industrial energy consumption. In contrast, the UK's EMAS scheme was only aimed at SMEs and thus saved less than 0.1% of total industrial energy.

MURE has been used to assess the likely impact of a financial support programme in industry based on the following procedure;

- the technical energy saving potential was calculated in all countries for which sufficient data was available (excluding Ireland, Portugal and Sweden) for all sectors except non-ferrous metals
- a penetration rate of 50% was applied, assuming a relatively large intervention programme.

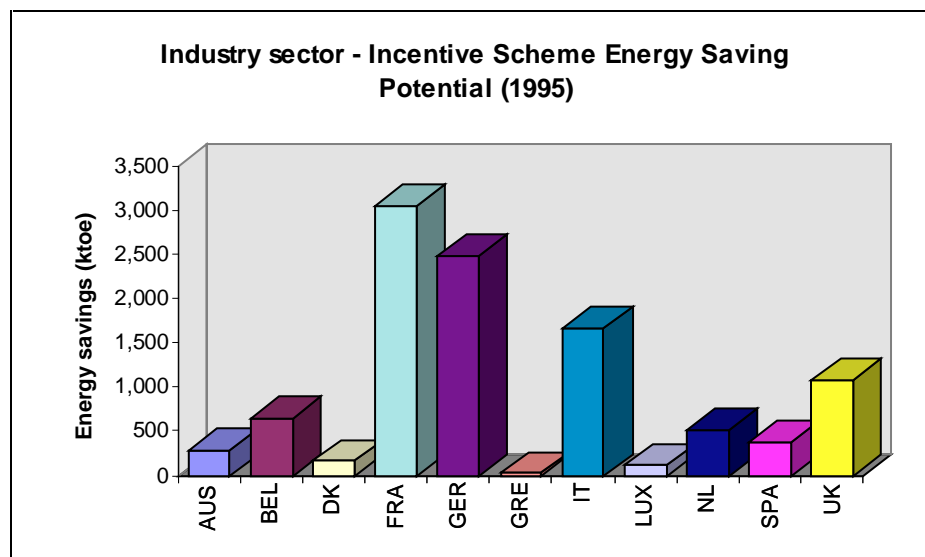
The result of this analysis are shown in the following tables.

Table 4: Industrial Energy Saving Potential by Country

Country	Energy Saving Potential (ktoe)	50% Potential (ktoe)
AUS	581	290
BEL	1,292	646
DK	326	163
FRA	6,122	3,061
GER	4,974	2,487
GRE	53	27
IT	3,356	1,678
LUX	236	118
NL	1,037	518
SPA	749	374
UK	2,159	1,079
Total	20,885	10,442

Table 5: Industrial Energy Saving Potential by Sector

Sector	Energy Saving Potential (ktoe)	50% Potential (ktoe)
Chemical	2,589	1,294
Engineering and metal industries	6,253	3,126
Food, drink and tobacco	1,660	830
Iron and steel	2,709	1,355
Non metallic minerals	3,634	1,817
Paper and board	1,986	993
Textile, leather and clothing	1,658	829
Timber and wood products	396	198
Total Industry	20,885	10,442



3.7. Summary of Financial Incentives in Industry & Tertiary Sectors

As with all the sectors, grants are most effective where there is a culture of energy or environmental awareness which pre-disposes people to consider the most energy efficient options.

Investment in energy savings in industry is almost invariably an economic decision. Studies of the impact of financial incentives in Germany have concluded that energy price was the major factor in the investment decision, and the subsidy contributed to ease the decision taking. This was particularly true for small and medium size enterprises.

This is supported by experience in the UK where it has been found that grants of any kind only support the decision to invest in energy savings which are driven by other pressures, either financial or, more recently, environmental.

Organisations operating financial incentives for energy saving in industry claim that over the lifetime of the programmes savings of between 3 and 7 times the cost of the incentive are achieved. The scale of energy savings achieved appears to be directly related to the scale of the incentive programme.

Grants for audits help to overcome a major barrier which is the lack of awareness of the potential for savings. However, these are only effective if the subsequent investment is made and in times of low energy prices, the impact of audits is limited. Grants for specific technologies have a role to play in raising awareness of a new technology and help to overcome barriers to investing in a non-traditional and therefore potentially risky technology.

Few financial incentives have been specifically designed for the tertiary sector, which tends to be covered by either industrial programmes or overall buildings programmes. However, with the rise of energy use in this sector, it may now be appropriate for authorities to look at well targeted grant support in this area.

4. TRANSPORT

The transport sector has lagged behind industry and buildings to some extent in that most programmes to tackle energy use and emissions in this sector have only been introduced in the 1990s, although research into more efficient vehicles has been supported for over 20 years. As energy use in transport has recently come to the fore for policy makers, a few innovative incentives have now been introduced aimed at transport users rather than vehicle manufacturers. However, fiscal measures remain the most popular means of trying to reduce car fuel consumption.

The three main types of financial incentive are;

1. research, development and demonstration of alternative fuel and more efficient vehicles
2. development of collective transport infrastructure
3. grants to drivers to invest in more efficient vehicles.

4.1. Support for Research, Development & Demonstration

Grants for RD&D of alternative fuel vehicles in particular are widely available across Europe with most car-producing countries supporting such programmes. The technologies supported include electric, gas, biofuel and fuel cell powered vehicles, predominantly cars and buses. Countries' own research programmes are complemented by EC-funded programmes such as ALTENER and THERMIE.

Thousands of vehicles have been involved in demonstration projects around the EU and several of the technologies supported by the research programmes have now reached the market.

4.2. Development of collective transport infrastructure

The improvement of collective transport systems is an important policy in many countries, following a period of many years when the majority of transport investment has gone into road building. However, the primary objective of such a policy is rarely energy savings. In most cases the aim is to reduce congestion or support the economic development of an area as well as reduce the environmental impact of transport.

Improvements in collective transport infrastructure includes projects such as the replacement of old buses and trains, modal transfer facilities (e.g. park & ride or freight transfer stations), cycle facilities, bus priority schemes and information systems.

In the Netherlands the government is investing around 20 billion guilders (9 billion Euro) in public transport to create an attractive alternative to the private car, both for those who have access to a car and for those who do not. A number of specific targets have been set:

- in 2010 there will be a coherent system of services capable of carrying 50 - 100% more peak-hour passengers than in 1986
- the ratio of travelling times by public transport and private car for home-to-work journeys of over five kilometres on the main commuter routes in the urban nodes will be 1.5 or less; in the four metropolitan regions this figure will be achieved by the year 2000
- the Netherlands will be integrated into the European network of high speed rail lines
- the national rail network will offer 20 - 30% quicker journeys between the main cities and the proportion of trains arriving more than five minutes late will be 2% in 2010 as against 5% in 1990.
- in situations where transport demand is low, tailor-made services will be provided.

In order to achieve these targets, public transport operators and local authorities have to consider a number of issues such as speed, reliability, cleanliness, security, information services and reducing waiting times. The government is also encouraging further expansion of the integrated fare and ticket system which already covers local and regional transport and Dutch railways.

As this example demonstrates, a large number of organisations are involved in the provision of public transport. In many countries transport planning is carried out at a local level. Therefore, additional support from national government can be dependent on the local plan meeting certain environmental criteria but need not be prescriptive about the means of achieving these targets. In 1993 the UK government changed its mechanism for financing local transport works. Funding is now dependent on the submission of an integrated package of measures which meet a range of criteria including:

- contribution to easing of urban traffic congestion
- overall impact on the environment
- contribution to road safety
- benefits to cyclists and pedestrians
- consistency with plans of other relevant transport suppliers (e.g. local bus operators, Railtrack, Department of Transport)
- inclusion of complementary demand management measures (e.g. parking supply and pricing, traffic management).

An analysis of local authority bids for transport funding in 1996/7 showed that the Department of Transport was increasingly rejecting those which increase traffic capacity.

On the freight side, one of the major barriers to using rail or waterways is the high cost of handling and transfer facilities. To alleviate this, grants are provided by some governments to build or improve such facilities and thus enable a reduction in the volume of goods sent by road. The UK Freight Facilities Grant provides up to 50% of such investments where there is a worthwhile benefit to the environment through the removal of lorry traffic from sensitive stretches of road. Since 1975, 217 rail schemes have benefited from the grant at a cost of some £100 million (150 mEuro). It is estimated that 3 million lorry journeys a year have been removed from British roads, and that around 12% of rail traffic in 1994 was carried on services which have benefited from the grant.

4.3. Grants to drivers to invest in more efficient vehicles

Whilst the RD&D programmes have shown that alternative fuel vehicles are technically feasible, and work by the car manufacturers has led to a range of more efficient vehicles on the market, the trend among purchasers is still towards bigger, petrol-engine cars. To try to stimulate the market for more efficient vehicles, a few countries have introduced incentives aimed at car buyers.

In Italy the government has established a grant scheme to promote the replacement of old vehicles, thus improving the efficiency of the vehicle stock. Vehicle owners are eligible for a grant when they scrap an old vehicle (ten years or more) and purchase a new one. The grant varies with the fuel performance of the vehicle up to a maximum of 700 Euro/vehicle, and increases to 1,750 Euro for electric vehicles. The results of the measure's first evaluation have proved it to be highly effective:

- more than one million vehicles have been scrapped to obtain the incentive
- the sale of vehicles in comparison to the previous year has increased by around 30%
- the average age of Italian vehicles has reduced from 14.2 years to 13.5 years.

As a spin-off benefit, the Government has also earned around 500 MEuro, from new registration taxes (less the cost of the incentives) and there has been a positive effect on the Italian car producers.

In Austria, a number of incentives have been introduced to increase the number of electric vehicles on the roads. Subsidies of up to 20,000 ATS (1,400 Euro) have been available for the purchase of an electric vehicle (varying by Province). This was supported by an exemption from vehicle and insurance tax, and until January 1997, a reduction in VAT. Some insurance companies also offered reduced premiums on electric vehicles. The Viennese electric utility sells electricity for electric vehicles at a reduced tariff. At some other "filling stations" the "fuel" is free of charge.

4.4. Quantitative Example of Financial Incentives in Transport

To demonstrate the potential of the MURE database, it has been used to simulate the potential impact if the Italian scheme to replace old vehicles with new ones were to be applied across the EU, (excluding Belgium, Ireland and Luxembourg, for which sufficient data was not available).

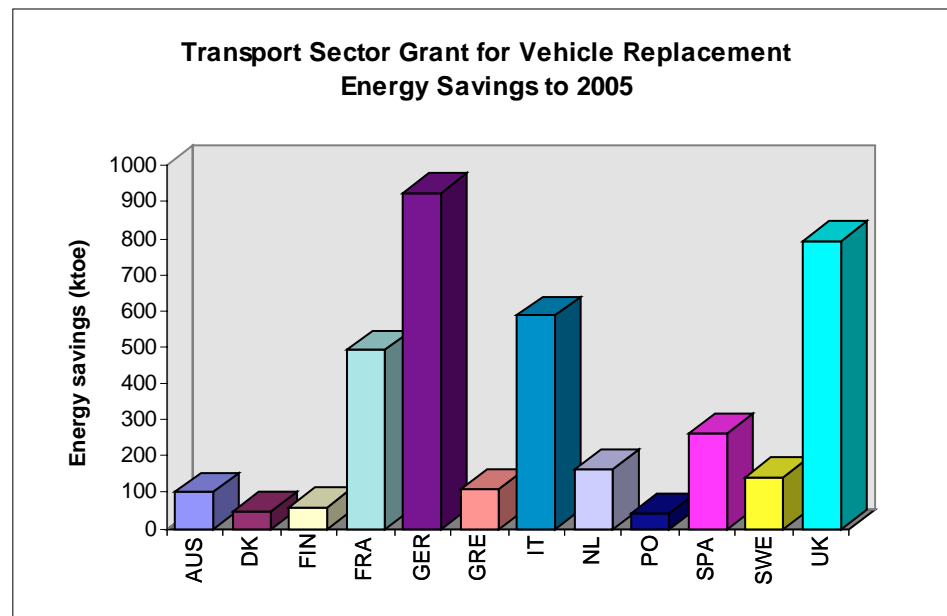
The following assumptions and parameters have been used;

- the grant is available for the replacement of all petrol and diesel vehicles over 10 years old
- the average efficiency of new vehicles is 25% better than vehicles over 10 years old (based on UK data)
- the grant scheme runs for 10 years to 2005
- the annual penetration rate of the scheme is 1.7% of the vehicle stock, leading to a replacement of 18% of vehicles over the 10 years (based on the initial results of the Italian scheme).

The resulting total energy saving potential of this intervention in the 12 countries analysed is 3721 ktoe, equivalent to CO₂ savings of 9340 tonnes. The breakdown of the results by country is shown in the table and below. The graph shows the breakdown of energy saving by country. It is worth noting that these figures only relate to the energy use of the vehicles. They do not take into account any related increase in the energy use of the vehicle manufacturing industry (for reference, the vehicle manufacturing industries of France, Germany, Italy and the UK together used 7,300 ktoe of energy in 1995).

Table 6: Energy and Emissions Savings Potential to 2005 of Vehicle Replacement Grant Scheme

Country	Energy Saved (ktoe)	Emissions Saved (tonnes)					
		CO2	NOx	SOx	CO	VOC	PM
AUS	100	298.52	1.48	0.19	17.94	2.44	0.33
DK	49.0	12.91	0.05	0.02	0.06	0.02	0.03
FIN	57	167.51	0.92	0.05	12.47	1.66	0.1
FRA	492	1343.58	6.3	0.87	81.46	11.12	1.58
GER	927	1915.98	11.96	0.79	117.4	15.6	1.48
GRE	108	314.63	1.77	0.03	27.4	3.62	0.07
IT	586	1720.57	8.46	0.52	140.46	18.8	0.96
NL	162	56.53	0.2	0.09	0.27	0.07	0.16
PO	42	122.65	0.61	0.04	9.8	1.31	0.07
SPA	262	774.33	3.59	0.37	56.66	7.66	0.67
SWE	143	282.07	1.43	0.06	24.65	3.29	0.11
UK	793	2331.13	11.88	0.77	181.06	24.23	1.42
Total	3721	9340.41	48.65	3.8	669.63	89.82	6.98



4.5. Summary of Financial Incentives in Transport

There are two main approaches to reducing energy consumption in transport;

- increase the proportion of journeys by public or non-powered transport
- increase the efficiency of private transport journeys.

Financial incentives are in place in most countries of the EU to support both of these approaches. The first approach covers the development of infrastructure and public transport vehicles and involves a wide range of individual projects, most of which need to be tailored to local circumstances. Thus, funding of this type of work needs to be assessed on a case-by-case basis. The number of incentives granted for infrastructure work will be relatively few, but most grants will be substantial amounts. However, as most of this work is in the public domain, support for energy and environmentally friendly schemes can often be directed through existing financing arrangements. As most such projects aim to improve the environment, reduce congestion, aid economic development or improve safety, there is little data available yet on the marginal cost of these measures related to energy saving.

Incentives to increase the efficiency of private transport include both grants for RD&D of new technologies and grants to promote the replacement of vehicles with highly efficient ones. The former category is well developed and has resulted in significant increases in efficiency of new vehicles in the last 20 years. The latter is a more recent development and is potentially an important tool as there are an estimated 175 million vehicles in the EU. The Italian government has seen benefits from this programme, although the true costs and net energy savings would need to be assessed in a life-cycle analysis. However widespread application of this type of tool in non-producing countries would be expensive.

While there are major cultural and infrastructure barriers to the introduction of alternative fuels such as electricity and gas, the impact of financial incentives to drivers to promote these will be limited. Although there is a role for these incentives in priming the market and demonstrating the technologies, provision of the necessary infrastructure must come first.

5. SUMMARY

Financial incentives are one of the main tools used by national and regional administrations to promote energy conservation. In all sectors, a range of incentives are provided to work on each stage of the energy efficiency improvement process;

- development of new technologies
- demonstration of new technologies
- market penetration of new technologies
- increased penetration of existing technologies.

There is a long history of measures in the Household and Industry sectors, where many incentives were introduced at the time of the first oil crisis. In the Transport sector, although research and development of new vehicle technologies has been going on for many years, most of the support programmes for infrastructure improvement were only introduced when the environment became a policy issue in the 1990s. Only in a few countries has the Tertiary sector been addressed with specific measures. Given the increasing energy use of this sector, it is to be hoped that more measures will be considered in the future.

The majority of financial incentives have a direct impact on energy consumption, especially when a grant is given to assist with the purchase of a piece of equipment. From the limited information available regarding the results of these incentives, it appears that;

- well-targeted measures are more cost-effective than loosely-defined ones
- the total energy saved as a result of a measure is roughly proportional to the cost to the administration - saturation point does not appear to have been reached in any measures considered
- supporting new or developing technologies is less cost-effective than providing grants for the installation of proven technologies.

One of the additional benefits of a grant programme which has not been quantified, is the fact that marketing of the initiative raises awareness of energy saving and can lead to energy saving actions outside the scope of the programme.

Whilst this study has not investigated all measures in all countries, it is clear that the impact of the measures depends to an extent on the existence of an energy-conscious culture in a country. A grant programme alone will not have the same impact as a package of measures including information campaigns, legislation and fiscal measures.