





Homes for the 21st Century

The Costs & Benefits of Comfortable Housing for Ireland

OUTLINE OF REPORT AND CONCLUSIONS

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Foreword

The average Irish house is responsible for the annual emission of over nine tons of CO_2. Our inefficient use of energy has many costs – and yet we have proportionately more people suffering from fuel poverty than any other European country. Radical change is required, not least as a consequence of Ireland's commitment under the 1997 Kyoto Protocol.

Energy Action has been working since 1988 to alleviate the distress of fuel poverty by improving the houses of older vulnerable citizens. It has long been aware that the problems of inadequate insulation and poor heating cannot be solved by charitable efforts alone. It is one thing, however, to know the extent of the problem "on the ground", but another to place it in an objective and coherent context.

Energy Action commissioned University College Dublin's Energy Research Group and Environmental Institute to jointly investigate Irish housing and residential energy consumption, and to analyse strategies for change. This report is the result.

The authors propose a strategy, which, even by the narrowest criteria, makes good economic sense. In addition, there is also a significant value in terms of the premature deaths and illness avoided, the reduction of environmental emissions, and the increased comfort of the elderly in particular.

This report presents a case for a major upgrade of the Irish housing stock and proposes a set of measures through which such change may be achieved. For the first time, the data is available on which to base national policy in relation to this crucial aspect of Irish housing. Can we afford not to adopt these recommendations?

David McCarthy

Chairman, Energy Action Ltd

Homes for the 21st Century

the Costs and Benefits of Comfortable Housing for Ireland

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Complete report is available to download at http://www.energyaction.ie

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This report was undertaken to establish: the extent of remedial work required to bring standards of the existing housing stock up to the standards which have applied to new houses since the introduction of the '1997 Building Regulations', insofar as they are concerned with insulation and energy conservation; the costs and benefits associated with such remedial work; the outlines of a strategy to address this challenge. The key findings of the report are as follows:

- Fuel poverty in Ireland is among the highest in Europe
- Irish housing standards are amongst the lowest in Northern Europe from the point of view of thermal efficiency
- The least well off tend to live in the worst of these houses, and the share of income they devote to heating is three times higher than the expenditure share of the average household
- Excess morbidity and mortality in Ireland due to poor housing standards is amongst the highest in Europe
- Ireland will have great difficulty in meeting its agreed targets for greenhouse gas emissions, which are mainly associated with energy consumption

Costs and Benefits in Financial Terms

The costs and gains of bringing the housing stock up to 1997 energy conservation standards over a ten-year period have been evaluated to be as follows:

Category	Millions of constant (1998) Irish pounds
Benefits (in present value terms)	
Energy savings	2136
Health savings (morbidity and mortality)	912
Comfort Benefits	363
Emission reductions	310
Total value of potential savings	3721
Costs (in present value terms)	1261
Net Benefit (in present value terms)	2460

Energy and Environmental Gains

The household sector accounts for 26 per cent of total final energy consumption, and 29 per cent of carbon dioxide gas (CO_2) emissions. Carbon dioxide is the main greenhouse gas that is implicated in global warming. If household energy conservation standards were brought up to 1997 standards, there would be a saving of 7 per cent in total national energy consumption. Under the terms of the Kyoto Protocol, the Irish quota for greenhouse gas emissions – expressed in terms of tonnes of carbon dioxide equivalent – is 64.5 million tonnes, to be achieved by 2008–2012. Current emissions are about 60 million tonnes, and it is expected that with economic growth, our 'business as usual' emissions will exceed our quota by 8–10 million tonnes. The energy conservation programme would reduce greenhouse gas emissions by about 3 million tonnes, thereby reducing the 'overshoot' by over 30 per cent.

Employment Gains

Full implementation of the energy conservation programme would require 4,900 full time equivalent jobs, involving a variety of skills. The extent to which this would be a net increase in job creation depends on the extent to which those engaged would be unemployed in the absence of the programme. However, there is the potential, with training, to employ those who would otherwise be long-term unemployed. Many of these jobs will stimulate the social economy, thereby regenerating local economies and improving the quality of life of local communities.

Health Gains

Bringing household energy conservation standards up to 1997 levels would reduce the level of sickness (morbidity) and would also allow people to live longer and more comfortably.

Morbidity: We estimate that almost 3,000 cases of cardiovascular and respiratory disease would be avoided, representing about half the excess winter hospitalisation cases in Ireland, and half of the winter drugs expenditure on these two diseases would also be avoided.

Mortality: over the life of the project, over 650 lives would be spared from premature death, representing 44 per cent of excess winter deaths in Ireland, which in turn represents 6 per cent of total winter mortality. Most of the lives saved would be amongst the lowest socio-economic groups, with the majority (87 per cent) also being over 65.

Recommendations for Action (the 'HOUSES' Strategy)

- Because the (very substantial) benefits are widely diffused across a number of areas and departmental responsibilities in government, it is highly recommended that a sub committee at cabinet level be established to mobilise the key agencies and policy actors.
- Those householders who are too poor to fund the conservation themselves will need to be grant aided.
- Particular attention will need to be given to those renting private accommodation to ensure that their needs in this regard are met, and that landlords have the right incentives to mobilise action.
- For other households, provision of high quality information on conservation status, and on costs of action, combined with access to reliable and approved installers will be necessary.
- The creation of 'carrot and stick' market incentives for households will be necessary to stimulate action, including some combination of tax credits (carrot), credit for emissions trading (carrot) – trading in greenhouse gasses is provided for in the Kyoto Protocol – and carbon taxes (stick).

Conclusion

The net benefits of implementing an effective household energy strategy are very substantial. We hope that this report will provide the stimulus to make it happen. If it does not, then our economy, our environment, our health and our comfort will be the poorer, and the costs of our inaction will be borne disproportionately by the poor and the vulnerable.

Objectives of Research

The aim of the research was to investigate different technical options to upgrade the existing housing stock of Ireland to meet the energy conservation standards of the 1997 Building Regulations, to evaluate the benefits and costs of a remedial programme, to address policy implications and to proffer recommendations designed to enable the programme to succeed.

UCD's Energy Research Group and Environmental Institute investigated the following areas:

- Energy assessment of the national housing stock
- Socio-economic profile of the national housing stock
- Energy conservation retrofitting measures
- Social cost benefit analysis and policy implications of remedial programme

Socio-economic Profile of Irish Households and the Residential Building Stock, Their Energy Consumption and Fuel Mix

A computer model of the existing national housing stock was developed as part of this study, which calculated the energy consumption of over 1,800 dwelling types. The chapter highlights a number of socio-economic issues interlinked with household energy consumption, such as fuel poverty, excess winter mortality and comfort levels in the home, which emphasises the need for an energy efficiency programme to be undertaken.

Fuel Poverty

Fuel poverty in Ireland, i.e. the inability to heat one's home to a safe and comfortable standard, owing primarily to low income and poor (energy-inefficient) housing standards, is among the highest in northern Europe (Fig. 1). The crucial interaction between low incomes and relatively high fuel expenditure but also (more importantly in Ireland's case) poor thermal efficiency in the residential sector is what makes fuel poverty so acutely felt.

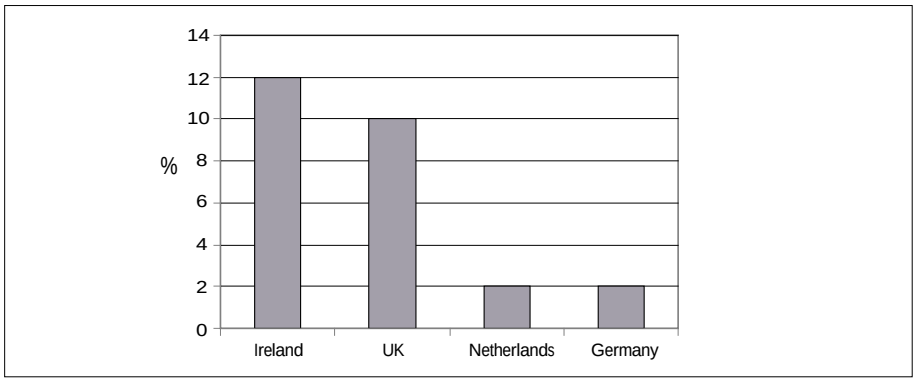

Fig. 1: Percentage of households who cannot afford to adequately heat their homes.
Source: Whyley and Callender, 1997.

Housing Standards, Heating Equipment and Energy Spend

Irish housing standards are amongst the poorest in northern Europe as regards thermal efficiency. Overall insulation levels are poor, particularly for floor and wall insulation and draught-proofing, while the heating equipment and fuels used to heat the home tend to be inefficient. The socio-economic profile developed in this Study demonstrates how the least affluent tend to live in the worst of these houses (i.e. the oldest, and least well-insulated). Many of the individuals in these inefficient homes are elderly. These people spend up to three times more than the average household on

fuel relative to income and more than twice the average household on fuel relative to household expenditure. They are more likely to consume more expensive, dirtier and less efficient fuels, such as coal, slack and turf, which are also more environmentally damaging. Conversely, it can also be shown that high-income households, ironically, typically consume cheaper, cleaner and more efficient fuels, such as oil and gas.

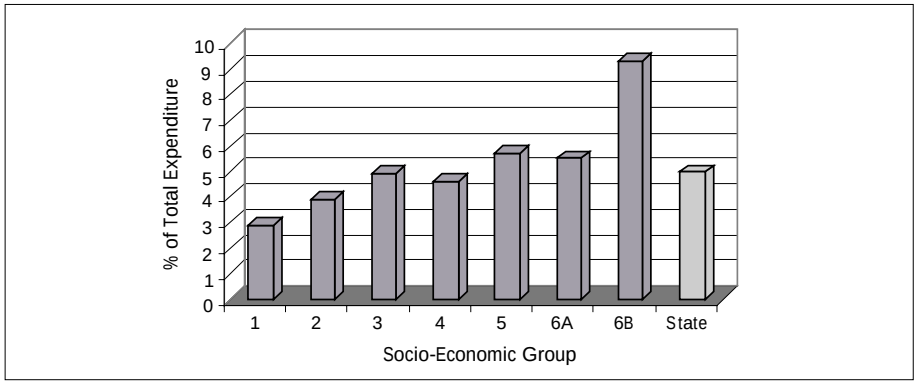

Fig. 2: Mean Energy Budget as a percentage of Household Expenditure.

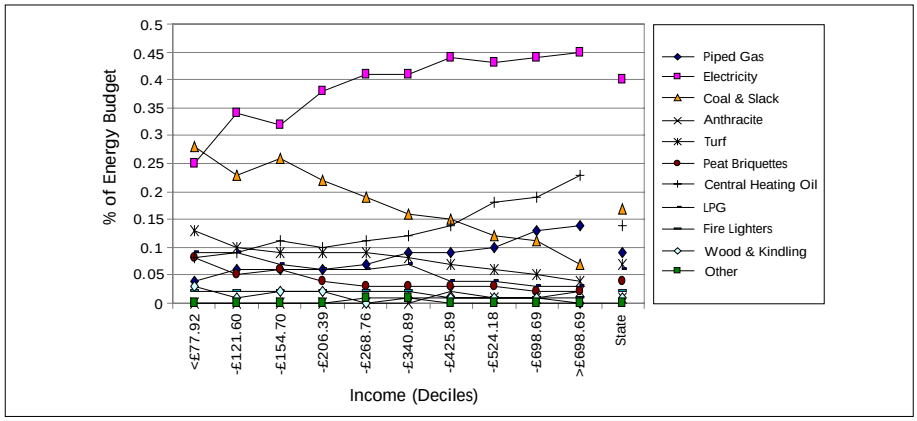

Fig. 3: Fuel Mix per Income Decile.

Energy Consumption

In addition, the chapter highlights the fact that the residential sector is the second largest consumer of energy (after transport) in this country, accounting for 26% of total final consumption and 29% of CO_2 emissions. The predominant use of energy in the residential sector is for space heating (71% of delivered energy). The fuel mix is detailed, both at the socio-economic level (see above section) and at the macro level. The latter shows that electricity, coal and slack account for the largest proportion of the average energy budget (57%).

Fuel poverty has important implications for health, comfort, energy expenditure and the environment.

Case Study Dwellings

Eight typical dwellings were selected as case studies, and methods of improving their energy efficiency were investigated. The dwellings ranged in time of construction from the 1850s to the 1980s. Dwelling forms included detached bungalow and two-storey, semidetached two-storey, terraced single and two-storey and multiple dwellings. The dwellings incorporate a wide range of construction methods, insulation characteristics and heating system types.

For each of these dwellings, measures which could be implemented to improve energy performance were identified and analysed. Implementation costs and annual savings

in fuel bills were estimated, and standards of energy efficiency in relation to current Building Regulations requirements were quantified. The results indicate the potential of particular energy-saving measures in particular dwellings, and demonstrate the challenges associated with bringing different dwelling types up to current energy-efficiency standards. The dwellings are described and results given within report.

A listing of a wide range of energy conservation measures was compiled. These measures are described with the aid of diagrams in a separate chapter. Measures chosen for the case studies and for the national energy-saving programme are selected from this listing.

Energy Assessment of National Dwelling Stock

A computer model of the existing national dwelling stock was developed in order to predict the savings which would result from the implementation of various energy-saving measures. Input information required by the model includes the percentage of stock represented by various dwelling forms, insulation characteristics and heating system types. Results include the total annual heating energy consumption, cost and CO_2 and other emissions of all existing dwellings. The breakdown of national consumption by fuel and end-use is also estimated. Input percentages may be adjusted year by year to project into the future, allowing different future scenarios to be compared.

Details of the model are described in the body of the report. Briefly, it involves over 1,800 dwelling types, each representing a proportion of national stock. These are run through an energy assessment procedure in turn, and national energy consumption calculated. To project on a year-by-year basis, input parameters for each year are set up as separate columns of a table, and the program loops through each in turn. Input, output and intermediate results are performed in a 'Microsoft Excel' spreadsheet file, and programming is done in 'Visual Basic for Applications'.

The energy consumption predicted by the model for 1997 was balanced against the corresponding residential energy consumption data for that year obtained from the Dept of Public Enterprise. This involved the development of a new method of accounting for the relatively low mean internal temperatures prevalent in inefficient or partially heated homes. The method takes some account of the fact that when insulation measures are implemented, internal temperatures tend to rise (i.e. previously cold dwellings become more comfortable), absorbing a proportion of potential savings in bills.

When projecting into the future, two factors which may significantly affect heating costs are energy inflation (energy prices rising faster than general inflation) and rising comfort expectations as standards of living improve. These effects are difficult to predict with any degree of certainty. The model thus allows the relevant parameters to be varied in order to investigate different future scenarios.

The model was used to investigate the potential of various energy-saving measures to achieve cost-effective savings. From these investigations a number of measures were selected for a 'ten-year programme' scenario, in which the measures are assumed to be fully implemented across the existing (1997) dwelling stock, to the extent that is technically feasible, over a period of ten years. For comparison, a reference scenario in which the measures are not implemented was also considered. The results indicate the technical potential of the set of measures considered to achieve savings in consumption, cost and emissions.

The scenarios are described in detail within the body of the report. The results are used as inputs to the cost-benefit analysis summarised below.

Social Cost-Benefit Analysis

The Social Cost-Benefit Analysis examines the economic worthiness of bringing the heating standards and energy efficiency of all houses in Ireland up to the standards specified in the 1997 Building Regulations. This Programme and the associated policy instruments form a Household Energy Strategy that we call HOUSES.

The costs consist of materials and labour, while the benefits include energy cost savings, environmental improvements, comfort gains and health (mortality and morbidity) benefits. The results show that such a programme would involve costs of £1.26 billion in present value terms, discounted to the present at an interest rate of 5 per cent (or some £230 million annually over ten years). Total discounted benefits would amount to some £3.72 billion. The overall benefit-cost ratio is a resolute 3.0. The internal rate of return is impressively high, at approximately 33%. Energy cost savings alone, at £2.1 billion would allow this Programme to pass the cost-benefit test. These benefits represent the majority (57%) of all of the benefits. These are followed by health benefits (mortality and morbidity) which account for £912 million of the total benefits (25%). Comfort benefits rank next, at £363 million (10%). Finally, emissions reductions, of £310 million (8%), account for the remaining benefits (See Fig. 4 below).

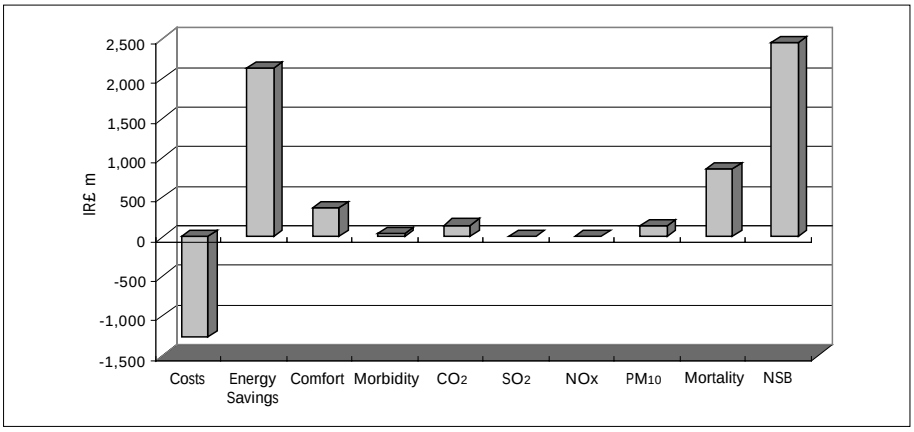

Fig. 4: Costs, Benefits and NSB. (Net Social Benefit, discounted at 5%)

The payback period for the project is seven years (Fig. 5).

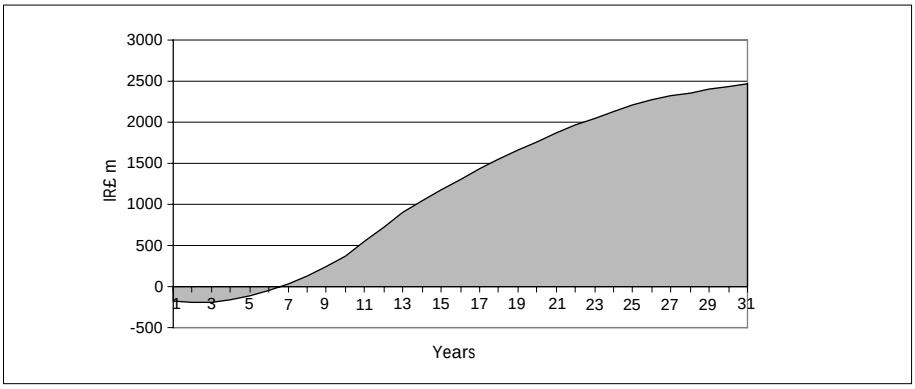

Fig. 5: Net Social Benefit and the Payback Period. (Discounted at 5%)

Policy Implications of a Household Energy Strategy (HOUSES)

Why does the market for energy conservation fail?

As the Cost-Benefit Analysis demonstrates, the Programme has the potential to be hugely beneficial both to the individual and to wider society. However, history has shown that the potential gains of energy conservation are not taken up. There are a number of reasons for this: households are unlikely to take into account all the benefits to themselves and to wider society of such measures; they may have to borrow funds at an interest rate that would make the investment prohibitive; they may not be aware of such energy-saving measures; the transactions costs of installing such measures may render the investment unwise. Moreover, the households which would benefit most from the installation of more energy-efficient technologies are: least likely to make such a long-term investment; are more likely to have to borrow funds; are more likely to have more pressing priorities for extra funds; are likely to find it more difficult to obtain such funds; are less likely to be aware of energy conservation opportunities; are less likely to live in their own house.

There may also be policy constraints. Until this Study, the full benefits of residential energy conservation were not fully quantified; investment costs are high; economic considerations in the past (i.e. the 1980s) were not conducive to investment in energy conservation; policy responsibility is spread across about 10 departments and agencies, thus there is no one institutionally or politically positioned to 'champion' such a programme. Finally, many of those who would benefit most are poor, relatively old, and whose views as a group are not effectively represented.

Physical Impacts of HOUSES

HOUSES would have a number of physical outputs, which we present below. These are of particular importance for the policy process.

Energy

The gain in energy savings is substantial (7% of total energy consumption) as can be seen in Table 1. At the moment, with energy cheap, there is little policy or public concern about energy consumption, but this will change with the next crisis. The implementation of the HOUSES programme would ensure that when we are next faced with escalating prices and/or rationing, every household in Ireland will be in a position to make the most of the energy they can procure.

Category	Impact	Primary National Policy Responsibility (1999)
Energy Saving	0.6 million tonnes of oil equivalent. Represents a saving of 24% of residential energy, or 7% of total final consumption of energy (1997)	*Department of Public Enterprise* has responsibility for oil, coal, gas, peat, electricity, transport, telecommunications and aviation. The Sustainable Energy section is dedicated to energy conservation and the Renewable Energy Division to renewable energy. *The Irish Energy Centre* promotes and supports energy conservation and renewable energy activities. *The Energy Advisory Board* advises the Minister for Public Enterprise on matters of national policy in relation to energy efficiency, renewable energy and related research. The *Department of Environment and Local Government* has responsibility for development and planning policy, housing policy and finance, housing construction and grants, including building regulations. The Energy Agencies, established by the Local Authorities, support the development of sustainable energy iniatives.

Table 1: Impact of HOUSES on Energy Saving.

Health

The gain in health is also substantial. Ireland has thousands of relatively poor older people, often living alone, whose houses and flats are so cold that many die prematurely, and thousands of others struggle on in discomfort and distress. HOUSES

would allow hundreds of mainly older people, numbering over 650 over the life of the project, to live longer, in comfort, and thousands more to avoid cold induced or exacerbated sickness (Table 2).

Category	Impact	Primary National Policy Responsibility (1999)
Health	Over 650 lives spared from premature death, comprising a reduction of 6% in total winter mortality. Over 2000 cases of cardiovascular and respiratory disease avoided. Savings of 5% of total winter drugs expenditure for cardiovascular and respiratory disease.	Department of Health and Children has responsibility for health promotion, childcare, mental health and services for the elderly, medical services, food safety and environmental health, community health. The National Council on Ageing and Older People advises the Minister on all aspects of the welfare of the elderly.

Table 2: Impact of HOUSES on Health.

Environment

The environmental gain is very significant in terms of contributing to our legal obligations in regard to both greenhouse gasses, and acidification pressures. In regard to climate change, under the terms of the Kyoto Protocol, a quota for European Union greenhouse-gas emissions has been agreed, to be achieved between 2008–2012. This EU envelope has been allocated amongst the Member States, and Ireland's quota is 64 million tonnes of CO_2 equivalent emissions. We are at present emitting 60 Million tonnes, and with economic growth, it is clear that, with a business as usual scenario, we will exceed the Kyoto quota by at least 8 million tonnes. HOUSES will reduce emissions by about 3 million tonnes, making up over one third of the 'overshoot'.

In regard to acidification [which is triggered by emissions of sulphur dioxide (SO_2) and nitrogen oxide (NOx)], Ireland is a signatory to the Long-Range Transboundary Air Pollution (LRTAP) Convention (1983). This was followed by: the Helsinki Protocol (1987) which required countries to cut SO_2 emissions by at least 30% from 1980 levels, the Sofia Protocol (1991) which required NOx emissions to return to 1987 levels by 1994, and now the Oslo protocol, which is based on minimising control costs for achieving carrying capacity limits. The Irish quotas for SO_2 and NOx under the Oslo Protocol are not yet agreed, but will require a substantial reduction in existing levels of emissions. In the case of SO_2, this could be in the range 37 to 66 thousand tonnes. It is clear that HOUSES would make a very substantial contribution to meeting the very demanding quotas we are facing in regard to greenhouse gases and acidification precursors (Table 3).

Category	Impact	Primary National Policy Responsibility (1999)
Environment	1. *Greenhouse gasses:* reduction of almost 3 million tonnes of CO_2 per annum (2.6 tonnes/household) comprising 9 per cent of national total emissions of CO_2, and 5% of total greenhouse gas emissions in 1996 (60 million tonnes). Under the Kyoto Protocol, Ireland has an annual quota of 64 million tonnes, which under 'business as usual' it is likely to exceed by 8 million tonnes. HOUSES would reduce the overshoot by 36 per cent.	*Department of Environment and Local Government.* Has responsibility for environmental policy, negotiations and implementation of climate change and acidification agreements, air quality. *ENFO* (Environment Information Service) promotes knowledge and care of the environment via query-answering service, information leaflets, reference library and computer database.
	2. *Acidification* (SO_2): Reduction of 16,000 tonnes of SO_2 – which compares with a current (1997) emission level of 147, 000 tonnes (11% of total), and a likely annual quota in the range 66-37 thousand tonnes. *Acidification* (NOx): Reduction of 6,600 tonnes per annum, comprising 6% of total current (1997) emissions 116 thousand tonnes). Likely NOx quota will be 58,000 Tonnes of NOx by 2010; HOUSES would reduce the NOx overshoot by over 11%.	Ditto

Table 3: Impact of HOUSES on Environment.

Employment

HOUSES would require almost 5,000 full-time jobs, as can be seen in Table 4.

Category	Impact	Primary National Policy Responsibility (1999)
Employment and Income support	Require 4,900 full-time equivalent jobs, involving a range of skills.	*Department of Enterprise, Trade and Employment*, with responsibility for labour market policy, unemployment policy, European Social Fund policy and operations, labour relations and consumer affairs. *FAS*, with responsibility for operation of training and employment programmes, provision of a recruitment service, support to co-operative and community based enterprise. Priority to long term unemployed and early school leavers. *Department of Social, Community and Family Affairs* has responsibility for voluntary and community services, employment support services, fuel allowance, medical review and assessment.

Table 4: Impact of HOUSES on Employment.

Policy Recommendations for a Household Energy Strategy (HOUSES)

Policies to close the gap between the positive social benefit of the installation of energy-efficiency measures and the negative private benefit of such measures must endeavour to:

1. Narrow the information gap
2. Reduce the opportunity cost of investing funds in energy conservation measures
3. Make such funds more widely available, especially to those who cannot afford to take action themselves
4. Reduce the transactions cost of such investments
5. Make private benefits reflect more closely the social benefits of such measures
6. Provide an incentive for landlords to invest in energy conservation measures

The HOUSES Strategy

This research provides the necessary strategic information. The Government is in a position to embark on new investment programmes, provided that the returns justify the costs, and they do. In addition, many private households likewise have sufficient disposable income and capacity to borrow funds to undertake new investments. A household energy conservation strategy is required to support those who cannot afford to take action, and to mobilise the market to achieve the potential for residential energy conservation. The precise mix of instruments and modalities to be used will depend on a variety of administrative, political, sectoral and financial considerations and realities which transcend our brief. However, any strategy should have the following elements:

(i) Financial grant and associated support for those who are too deprived financially and perhaps not well placed logistically (e.g., old, living alone, with poor market information and lack of confidence to undertake new ventures) to be able to undertake the investment. It may be that some of the £76.5 million provided annually at present to households as fuel subsidies could be used to finance such grant support, but we were unable to investigate the specifics of such support and within this study so cannot provide recommendations in this regard.

Acting on this will require that the target households be divided into two groups: those whose income and life circumstances make it unlikely that they will undertake and finance retrofitting conservation investment themselves, and those who can afford and have the capacities to make such investments.

(ii) ***Political and Institutional leadership*** at national level: for progress to be made, it is highly recommended that the Taoiseach get involved, perhaps by setting a Cabinet level sub-committee to ensure that interdepartmental stasis does not inhibit progress. It is one of the paradoxes of institutional rivalry that where there are multiple benefits across sectors, no one agency can capture a sufficient portion of them to make the effort to run with the programme. Unless this institutional issue is tackled, nothing much is likely to happen.

(iii) ***An incentives package*** comprising carrots and sticks for those who can afford to take action. There are a number of options: a tax on carbon dioxide would make fossil fuels more expensive for householders, and provide an incentive to invest in conservation. If a tax exemption were given to those making investments in conservation, this would re-enforce the incentive effects of such a tax. A tax break for investment in conservation would provide a carrot.

Under the Kyoto Protocol, emissions trading is allowed, whereby quotas to emit greenhouse gasses are allocated, such that the total allocation does not exceed the Irish quota. Quota holders can then trade, so that if, for example, they wish to expand and emit more than their quota, they enter the market place and buy the additional greenhouse gas emission quota needed, just as expanding dairy farmers buy milk quota today. It could be envisaged that emitters of greenhouse gasses could approach householders and pay them to reduce emissions via energy conservation, and then use that 'quota' for their own purposes.

There are a variety of instruments available to create the right mix of incentive effects (see below). Careful choice of instrument mix to meet objectives is important: Some experience in European countries with policy instruments is analysed in Convery (1999).

(iv) ***High quality information,*** supported by technical investigations and monitoring, is a prerequisite for all instruments, but it must be timely and accurate. A mechanism for assuring the quality and credibility of conservation work undertaken is an important underpinning for both householders and tax payers. If greenhouse gas emission reductions are being purchased via conservation, then national, EU and global auditors will need to know that the reduction claimed has been achieved. Requiring that credible information on energy rating be provided when houses are being sold could be considered. This would allow prospective purchasers to reflect such information in their bid price.

(v) ***Keep the programmes as simple as possible, minimise the transactions costs, and achieve economies of scale.*** There are administrative insights from other domestic energy conservation programmes, relating to the importance of keeping programmes simple, and as 'hassle free' as possible for the implementers, and the need to capture economies of scale. There are substantial fixed costs in getting a successful programme implemented, and volume is the key to reducing unit costs.

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The Costs & Benefits of Comfortable Housing for Ireland

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The authors propose a strategy, which, even by the narrowest criteria, makes good economic sense. In addition, there is also a significant value in terms of the premature deaths and illness avoided, the reduction of environmental emissions, and the increased comfort of the elderly in particular.

A number of possible instruments which could form part of HOUSES are listed in Table 5.

Instrument	Key Features
1. Taxes and charges	Taxes on energy make it more attractive to invest in retrofit conservation measures. Ensuring that tax incentives, e.g. VAT rates, do not discriminate against conservation versus consumption, as is the case presently.
2. Tradable permits and offsets	Emissions trading is provided for in the Kyoto protocol, whereby compliance with the greenhouse emission quotas can be achieved in part by purchasing from others who have quota to spare. A price is likely to emerge for greenhouse gas emissions which reflects the scarcity value of the environment at the quota which has been established. Once such a market is in place, perhaps by 2005, it is possible that households – who emit an average of 2.6 tonnes of carbon dioxide per annum – will be able to sell the carbon reduction which follows on investing in conservation. A company which needed to earn emission credits may be able to do so by investing in household energy conservation.
3. Subsidies, including direct investment, grants and tax reliefs	Energy in many jurisdictions is subsidised, by some combination of direct subsidy, limitations to market access, and tax provisions, which can bias decisions in favour of consumption and against conservation. Conservation can also be subsidised via some combination of tax and grant provisions, to encourage provision of the social benefits it yields.
4. Voluntary Agreements or Approaches	Three main categories: *unilateral agreement* by one or more firms to meet certain targets, e.g. the ESB has agreed to limit emissions of NOx to 42,000 tonnes annually; a multi-firm agreement by a number of firms to achieve a collective target, e.g. energy-using firms in the Netherlands and Denmark; an 'opting in' of firms to meet certain standards, e.g. the EMAS system of the EU.
5. Information	'Adequate' information is regarded as a pre-requisite for effective market performance; therefore, filling an 'information gap' for consumers or producers could be regarded as a market based instrument. Performance information on house energy conservation at the point of sale would provide prospective purchasers with relevant information and give some purchase premium to relatively well-insulated houses.
6. Institutional Development	Where, as in the Irish case, household energy conservation is not really 'owned' and led by any one agency, there is a case for a Cabinet Sub-committee at strategic level, designation of a lead agency, and cross-departmental co-ordination.
7. R&D	Research and its application is a means of generating choices which heretofore did not exist. It can be mobilised to engender innovation. This study is an example of research identifying and opening up choices. There is scope for more detailed research at every level. In this country, there is a dearth of research in the area of best practice/optimal techniques and materials' usage. Defensive considerations also need to be assessed, i.e. ensuring that any energy-efficiency measures implemented do not impair the durability of the building fabric, nor threaten indoor air quality, etc.
8. Regulation	Regulation (or command and control) provides minimum insulation standards to be met in new houses. These standards should reflect greater appreciation of foreseeable future considerations and higher costs of retrofit measures. This policy instrument could also be mobilised to require retrofit whenever a house changes hands via sale and to require for provision of information on the energy efficiency of the building (energy rating).

Table 5: Possible Instruments for Use in a Household Energy Strategy.

Conclusion

The net benefits of implementing an effective household energy strategy are very substantial. We hope that this report will provide the stimulus to make it happen. If it does not, then our economy, our environment, our health and our comfort will be the poorer, and the costs of our inaction will be borne disproportionately by the poor and the vulnerable.

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The Costs & Benefits of Comfortable Housing for Ireland

Energy Action has been working since 1988 to alleviate the distress of fuel poverty by improving the houses of older vulnerable citizens. It has long been aware that the problems of inadequate insulation and poor heating cannot be solved by charitable efforts alone. It is one thing, however, to know the extent of the problem "on the ground"; but another to place it in an objective and coherent context.

Energy Action commissioned University College Dublin's Energy Research Group and Environmental Institute to jointly investigate Irish housing and residential energy consumption, and to analyse strategies for change. This report is the result.

The authors propose a strategy, which, even by the narrowest criteria, makes good economic sense. In addition, there is also a significant value in terms of the premature deaths and illness avoided, the reduction of environmental emissions, and the increased comfort of the elderly in particular.