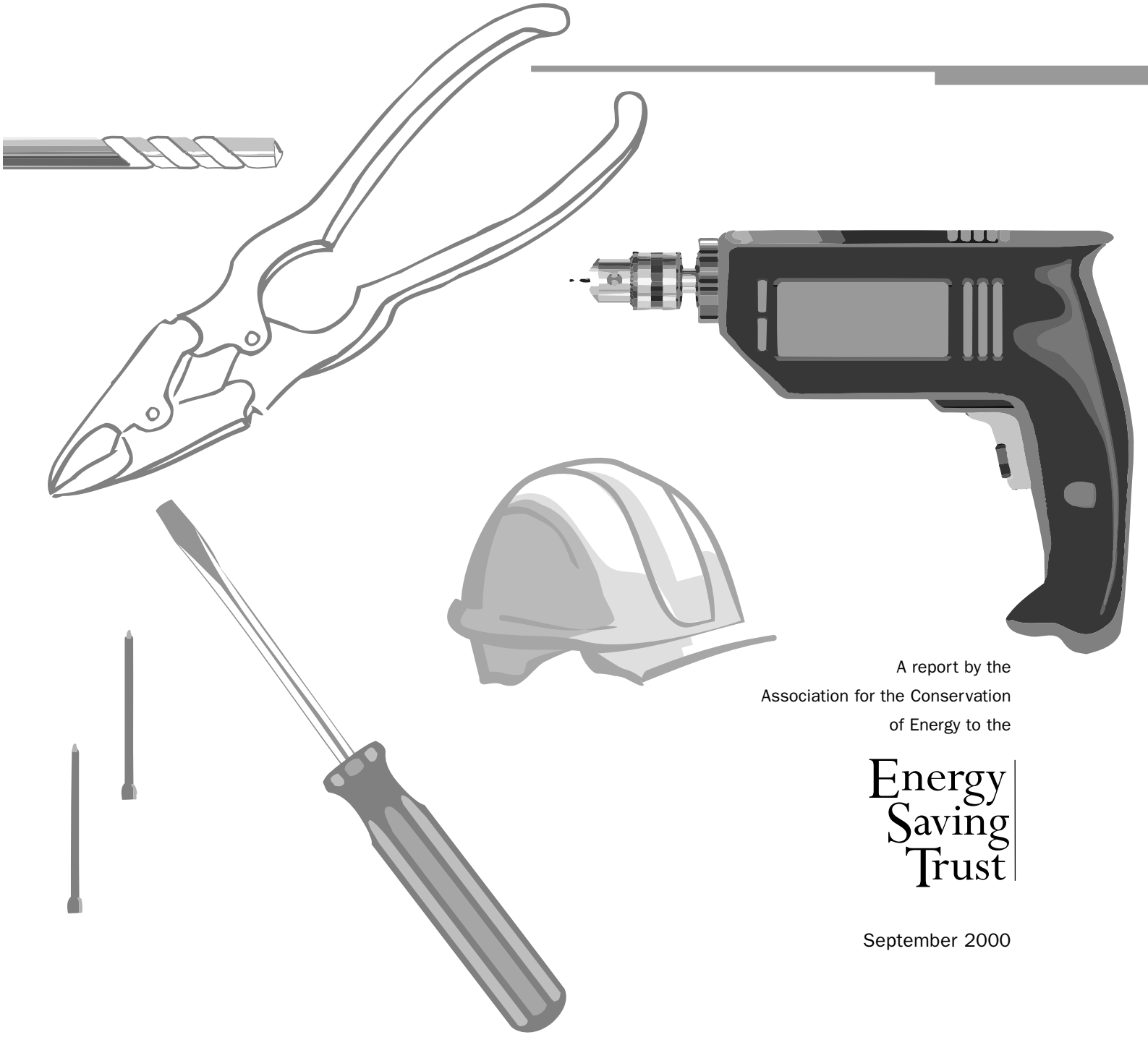
Energy efficiency and jobs:
UK issues and case studies



A report by the
Association for the Conservation
of Energy to the

Energy Saving Trust

September 2000

Acknowledgement

This report is largely based on an EC SAVE funded research project: National and Local Employment Impacts of Energy Efficiency Investment Programmes XVII/4.1031/D/97-032. Thanks are due to all of the partners in the 9 countries involved, and to the European Commission.

Copies of the SAVE reports can be obtained from the Association for the Conservation of Energy. Tel 020 7359 8000. Email info@ukace.org

Table of contents

List of tables

Executive summary

Improving energy efficiency in buildings is a particularly effective way to stimulate employment in the places where it is needed most, and to employ people who have the greatest trouble in finding jobs. In terms of direct employment, energy efficiency in buildings is a labour intensive sector, engaging many small, geographically dispersed installation companies. Furthermore, lower fuel bills mean more money to spend on non-energy items (and the labour intensity in sectors stimulated by general consumption exceeds that in the energy supply sector). Thus indirect employment is stimulated by the energy savings, for years after the work is completed. Ultimately, energy efficiency contributes to economic efficiency and growth, which creates more wealth and employment opportunities.

Despite economic growth in the l990s, joblessness remains a very real problem for several million people in the UK. This is a tragedy for those who are unable to find work, and a major drain on public finances. The problem is concentrated in particular locations, notably large cities and former industrial areas. Job losses in manufacturing have left many people, particularly men, ill equipped to benefit from the new job opportunities which are arising as the economy grows. Unemployment, poverty and poor housing are all concentrated in Britain's cities. Each of these problems can reinforce the others, in a cycle of decline. Energy efficiency improvements are an essential aspect of urban renovation, and offer a possible way to improve people's job prospects and living environment in Britain's cities.

Seven energy efficiency investment programmes were studied to identify the jobs created. Direct employment was calculated by interviewing implementing agencies, using published reports, and where necessary by extrapolation from the amount spent in each sector. The indirect employment was calculated using an input-output modelling approach. Further modelling using the same data assessed the long term impacts on the economy as a whole. The original case studies and modelling work were contributions to a European Commission SAVE funded research programme, involving 9 countries (Wade et al., 2000).

For reference and comparison, summary employment data for the seven case studies is presented in Table 1.

Programme (Years studied)	Direct employment per £m invested (person-years during programme)	Indirect employment over 15 years per £m invested (person-years)
HEES (1991-96)	24	61
Heatwise (1996)	58	Negligible
SoP (1994-98)	11	87
Fridgesavers (1997-98)	10	75
Manweb DSM (1993)	21	Not estimated
Shetland IRP (1994-97)	19	Not estimated
1995 Building Regulations (1996-97)	30	70

Table 1. Direct and indirect jobs per £1 million expenditure (including private investment).

The variation in direct employment gains is in part due to differing labour costs. For example, in the Heatwise case many of the

employees were in training, and received a relatively low wage. Variation is also introduced where data was unavailable, particularly for the estimation of employment in manufacturing. In the HEES and Heatwise case studies, which were grant funded, one could argue that government money could have been used to create an equivalent number of direct jobs in another sector. The indirect employment reported in Table 1 arises from the re-spending of money saved by households that benefit from cost effective energy efficiency improvements.

The core of the report is the discussion in the case studies, relating to how businesses and individuals responded to the new employment opportunities arising from energy efficiency programmes. The studies show the benefits of energy efficiency investment in terms of employment gains, increased training, and opportunities for people who have been in long-term unemployment. The case studies also make an assessment of the cost-effectiveness of the programmes in terms of energy savings. This cost-effectiveness varied, but was generally good. As discussed in the studies, where household energy efficiency improvements targeted the 'fuel poor', energy savings were often a secondary consideration to being able to heat one's home adequately. Therefore cost effectiveness in terms of energy savings was reduced. Where training and addressing long-term unemployment were priorities the total cost prohibited cost-effectiveness, if measured only in terms of energy savings.

Energy efficiency programmes in the UK have multiple aims, such as assisting low income families afford to heat their homes, reducing carbon dioxide emissions, and avoiding investment in new supply capacity. In general creating employment is not the aim, but this study demonstrates that investing in energy efficiency has created jobs and, where schemes were designed to include quality training, increased skill levels for the workers involved. This is a very desirable side benefit, particularly considering that many of the jobs were created in manual occupations in areas of high unemployment.

Chapter 1: How energy efficiency creates jobs

This chapter examines the reasons why investment in energy efficiency creates more employment than investment in many other sectors. It also introduces some of the issues taken into account when assessing the employment impacts of the energy efficiency investments described in the case studies in Chapter 3.

Labour intensity

Investment in any part of the economy will create a number of direct jobs, depending on the labour intensity in the sector. All sectors of the economy use a combination of labour, capital and natural resources, but in different proportions. Traditional energy supply is a natural resource intensive sector, with a high proportion of the total cost attributable to fossil fuel inputs. Wind and nuclear power are examples of capital intensive industries, where specialised equipment is the major investment cost. While service sector industries are usually the most labour intensive, the manufacture and installation of energy efficiency measures in buildings is relatively labour intensive, compared to energy supply and to many capital intensive sectors which benefit from public sector funding.

In making an assessment of the net effect of energy efficiency investment on jobs it is necessary to examine who pays for the investment, and what they might otherwise have done with the money. Where investments are government funded, net jobs will be created if labour intensity in the energy efficiency sector is higher than in the alternative sector (which might otherwise have benefited from the investment). If consumers pay, the direct impacts on employment depend on the average labour intensity across the spectrum of consumption sectors. In either case one could argue that the net effect will be unclear, and could be taken to be zero. However, the jobs created may be in sectors and locations which are more in need of stimulus than those where employment is displaced.

However, one must also take account of how consumers spend money saved on fuel bills as a result of improved energy efficiency. Assuming the investment is cost-effective for consumers, there will be a shift in their expenditure away from energy and into general consumption. This re-spending effect does create net employment, because labour intensity is higher for general consumption than in energy supply. This is discussed under ‘indirect employment’ below.

Direct employment.

For energy efficiency investments the main categories of direct employment are the following:

1. Manufacture of equipment and materials. Stimulating the demand for energy efficiency products will maintain or create employment in relevant manufacturing sectors. This employment impact tends to be difficult to quantify, as the additional demand created by individual programmes has tended to be a small percentage of manufacturers’ turnover.

2. Installation of measures. Most buildings initiatives involve the installation of specific measures, such as insulation, glazing and heating systems. Additional work is involved in deliveries, and subsequently in maintenance

operations. In the case of new buildings, this type of work may add to the cost and labour input at the construction stage.

3. Management, administration and monitoring of the investment programme. These jobs are usually in government departments or agencies, utilities, housing providers, private companies, or a combination of these.

4. Depending on the type of initiative, there may be additional work in auditing, efficiency rating, marketing or advice provision.

Most jobs will be in the first 2 categories, i.e. manual occupations. As discussed in Chapter 2, stimulating employment in manual occupations is important in tackling unemployment in the UK. Moreover, the work is spread across the country, and may even be concentrated in areas where incomes and employment levels are below average. In addition, training is required for new employees. The skills developed through this, and the ensuing work experience, will increase the employability of the people concerned: a useful effect where problems of long-term unemployment are important. Therefore, even if one argues that in some cases direct employment gains may be negated by losses elsewhere, the jobs will have attributes which make them relatively desirable.

Indirect employment

When an industry expands other businesses will benefit from the wages spent by workers, and demand for secondary goods and services which support the industry. Many studies on employment impacts consider this 'multiplier effect'. However many economists doubt that this multiplier effect really operates at the national level, arguing that money in circulation in the economy is finite at any given time, and jobs will simply be displaced elsewhere. The figure used for the multiplier effect has been revised downwards in recent years, and even abandoned by the Treasury. However the Department for Education and Employment (DfEE) does consider that the multiplier has a positive effect at the local level (DfEE, 1996). The figure used by DfEE is 0.17, suggesting that for every 100 new jobs, a further 17 will be created in the local economy. This is an important consideration given the localised nature of the unemployment problem in the UK. However, in the case studies presented in Chapter 3 we have not considered this local multiplier effect.

An important indirect employment impact, which is specific to energy efficiency investments, arises from the re-spending of money saved on energy bills. Depending on the cost-effectiveness of the investments, and the payment method, there will be a change in household budgets resulting from the initial outlay, and subsequent savings on fuel bills. A dedicated input-output modelling approach, which considers linkages between economic sectors and domestic consumption patterns in the UK, was used to investigate this effect (Jeeninga et al, 1999). The results for this indirect 're-spending effect' are reported in each case study (where the modelling was applied). Initial effects are smaller on an annual basis than the direct employment impacts, but continue for the lifetime of the energy saving product, which may be 15 years or more.

Consideration must also be given to the displacement of jobs which might have been stimulated by alternative uses of public sector funds. Where public sector funds were used to finance the investments in a case study, this effect is estimated by the input-output modelling. The modelling approach is discussed in more detail in Appendix A.

One should also consider negative impacts on the energy supply sector. Energy supply is a less labour intensive sector than energy efficiency improvement, and therefore a shift in spending from the former to the latter will tend to create net employment. In the energy supply sector, job losses as a result of energy efficiency programmes are not a real concern. Three factors explain this. Firstly, employment in the energy supply sector is not very responsive to the number of units sold, given the fixed infrastructure involved, and the much greater influence of technological change. Secondly, company profits do not relate proportionally to units sold, due to the price control set by the regulator. Thirdly, energy consumption has risen steadily in the UK despite energy efficiency improvements, as the economy has grown.

Economic growth

Ultimately, what is needed to create and maintain high levels of employment is strong growth in the economy. Unfortunately, economic growth has all too often been at the expense of degradation of the natural environment. However, better energy efficiency can contribute to sustainable development by stimulating economic growth while reducing the environmental burdens imposed by energy supply, distribution and use.

Empirical evidence suggests that OECD countries with lower energy intensities (consumption per unit of economic output) enjoy higher rates of economic growth than their competitors. There are, of course, exceptions to the rule, as economic growth depends on a wide range of factors, but it stands to reason that an economy which makes efficient use of resources will grow more rapidly than one which is wasteful.

This assertion can be tested using macroeconomic models. Capros et al. (1999) investigated the effects of the energy efficiency programmes discussed in Chapter 3, using a model of the European Union economy, described in more detail in Appendix A. The modelling results suggest a short term boost to economic growth, and a positive impact on employment in the economy as a whole in the short and longer term.

The relevance of fuel poverty in the UK

Households are said to live in 'fuel poverty' if they need to spend more than 10% of their disposable income to heat their homes to an adequate level. Many millions of households are in this situation in the UK, and it is thought to have contributed to over 49,000 excess winter deaths in the England, Wales and Northern Ireland in 1998/99 (ONS, 2000). It is an important consideration when examining the impacts of energy efficiency programmes in the UK, as many initiatives aim to assist the fuel poor through capital investments their homes.

When calculating the energy savings resulting from such a programme some adjustment to

the potential savings needs to be made, to reflect the fact that the homes are likely to have been inadequately heated prior to the improvements. Once the improvements have been made, householders are likely to raise the room temperature to a comfortable level, rather than use less energy to achieve the same, uncomfortably low temperatures. Therefore it must be considered that 50 to 100% of the potential savings will be taken in increased comfort rather than energy savings. This effect is taken into consideration in the studies presented in Chapter 3.

The causes, and geography, of fuel poverty and unemployment overlap in the UK. By creating employment opportunities in the places where the fuel poor live one not only begins to reduce their cost of living, but also to tackle the underlying causes of poverty. As discussed in Chapter 2, many jobless people lack formal qualifications and skills, and do not live in the regions where new job opportunities are arising. The Heatwise case study in Chapter 3 demonstrates that installation of energy efficiency measures is a viable area for skills development and training for persons who have been in long-term unemployment. Creating manual employment in areas of fuel poverty has multiple benefits for local residents.

Business as usual cases

For each case study it was necessary to take into account a business as usual case. For every energy efficiency investment programme there will be a proportion of free-riders. These are individuals or households who would have made the investments themselves, but understandably make use of the available incentives such as grants if they are eligible. For the cases studied here this does not tend to be an important issue since so many of the programmes target the fuel poor. In order to qualify for assistance households normally have to be in receipt of specific social security benefits. Therefore one can assume that few are likely to have the capital necessary to make the investments themselves.

Where the programmes investigated in the case studies extend to all households and/or the commercial and industrial sector, adjustments are made to the energy saving and employment estimates to reflect the expected proportion of free-riders. In two of the case studies the aim was to avoid investment in new electricity supply capacity, and therefore the savings are in terms of load rather than energy, compared to the business as usual scenario.

Chapter 2: Why the UK needs the jobs energy efficiency creates

In February 2000 the Financial Times reported that there are now 'as many jobs looking for people as people looking for jobs'[1] in the UK. This conclusion is based on the number of people claiming unemployment benefit compared to the number of vacancies at Job Centres (which is used to estimate the total number of vacancies in the UK labour market). Some employers are facing difficulties finding staff to fill vacancies in sectors such as information technology, product development and customer support. However, joblessness remains a very real problem for millions of people in the UK. This chapter explores some of the issues behind the figures, such as 'hidden' and long-term unemployment, regional disparities in unemployment rates and the skills mismatch between those looking for work and the vacancies in expanding sectors of the economy.

The unemployment rate

Unemployment has fallen rapidly in the UK in the late 1990s, with 1.16 million people of working age claiming unemployment benefits in February 2000. This is still a large number of unemployed people, and yet it excludes approximately 2 million others who would like to work but are not eligible for unemployment benefits. This has been called 'hidden unemployment' (Beatty et al., 1997: See Appendix B).

In 1998 the Treasury reported that:
'Around 11.75%, or almost 4.25 million of working age people in the UK are still without work and wanting a job, despite the unemployed component having fallen to around 1.9 million.' (HM Treasury 1998, page 86).

1 *'Brown's jobless may be no more'. Financial Times February 17 2000.*

Thus, in simple numerical terms, there is still a pressing need to create more jobs in the UK. Investing in energy efficiency can contribute to this goal, by creating 10 to 30 direct person-years of employment per £1 million spent by consumers, utilities and/or the government. In addition approximately 70 person-years of employment in other sectors will be stimulated over 15 years per £1 million spent, as consumers save energy and money, and therefore spend less on energy supply (which has low labour intensity) and more on everything else.

Regional disparities

Between 1981 and 1996 UK manufacturing shed 1.4 million full time male jobs, with the greatest losses in large cities (Turok and Edge, 1999). In the 1980s manual employment in the UK fell by 11.1%, particularly in unskilled manual work. Conurbations and cities lost 15 to 20% of their manual jobs. While total employment has been increasing gradually, this has tended to involve predominantly part-time and female workers, employed in rural areas and smaller towns. The new jobs which have been created in cities tend to be professional and managerial positions.

Unemployment and economic inactivity among men formerly employed in industry remains a significant problem, despite economic growth and employment growth in the economy as a whole. In a recent study for the Joseph Rowntree Foundation, Turok and Edge (1999) reached the following conclusions:
'National economic growth will not rectify the situation on its own. It requires greater emphasis in policy to be given to expanding

labour demand in the cities and creating manual employment'...'Historic evidence suggests that it is unrealistic to expect people with limited formal skills to secure the non-manual jobs becoming available in cities...there is a particular need to expand employment opportunities for blue collar workers and greater effort and resources should be devoted to this important challenge by all levels of government'...'A precondition for getting more than a few of them back to work is to increase labour demand through spatial targeting of economic development towards areas where hidden unemployment and worklessness is highest' (page 52).... 'A phased programme of physical improvement to the fabric of old industrial cities would provide opportunities for short term employment and training as well as longer term economic development' (page 53).

The new interest in government circles in restricting green field development and regenerating Britain's cities is to be welcomed. However, the current pattern of job growth in rural areas and small towns at the expense of large cities makes this a challenging task. Decentralisation of work and population away from cities creates environmental problems of its own, with greater commuting distances, loss of green field land and loss of economies of scale in service provision. The potential for environmentally beneficial centralised service provision such as district heating is made impractical where population densities fall below certain levels.

In its 1997 Communication on Environment and Employment, the European Commission shares this view on the importance of urban renovation:

'Continuing and increasing efforts are to be made in order to ensure that the European financial instruments (Structural Funds, Cohesion Fund, Community Initiatives) promote economic growth, employment and sustainability simultaneously...Member states should strengthen the link between urban development, environmental protection and job creation by developing urban renovation plans which focus on areas with particular potential for environmental employment' (European Commission, 1997, page 18-19).

Improving energy efficiency in buildings would make a valuable contribution to urban renovation, and create local jobs which are accessible to those who have lost jobs in manufacturing. For example, in the case studies in Chapter 3, the Home Energy Efficiency Scheme created over 8,500 jobs over 6 years, with 90% in installation or manufacturing work.

Long term unemployment and skills disparities

Campbell et al. (1998) examined historical data on long-term unemployment in the UK and concluded that there is no relationship between overall jobs growth in an area and changes in the rate of long-term unemployment. This is to say that overall jobs growth is neither a necessary nor a sufficient condition to reduce the problem of unemployment for those who have been without a job for 6 months or more. Therefore specific actions are needed to assist this section of the population regardless of whether employment is increasing in total.

The reasons for people experiencing difficulty moving out of long-term unemployment are

complex and location specific. However, a number of common themes can be identified. These involve employers' perceptions and a discouraged attitude towards work among some of the long-term unemployed. Until recently there was also a situation whereby loss of related benefits could make families worse off in total if a low-paid job was taken. However the most important reason is that the long-term unemployed are disproportionately represented by sectors of the population which suffer discrimination and/or lack skills which are in demand in the labour market. The long-term unemployed are disproportionately male, older, from manual or manufacturing career backgrounds, from ethnic minorities or disabled. Lone parent women, persons with low levels of formal qualifications, and persons in rented rather than owner-occupied housing are also more likely than others to among the long-term unemployed.

In an assessment of the range of policy options which have been used to address the problem of long-term unemployment, Campbell et al. (1998) identify two common features of successful approaches. Firstly, training and work experience must have a strong 'market orientation', i.e. be as closely related as possible to real work conditions, and to the labour market situation participants will face upon completing the programme. Secondly, training must be in specific skills related to jobs which are available. General training and poorly focussed job creation schemes were found to be of little help.

One approach which meets these criteria is the use of 'intermediate labour markets', whereby previously unemployed persons are given employee status, paid at the going rate in a socially useful, productive company. They are simultaneously offered training and help with job searching. The focus on socially useful work is important in that the businesses can offer services which might not otherwise be made available. This minimises the risk of displacing employment in commercial enterprises. The Wise group in Scotland have pioneered this approach. Their work in providing insulation and other energy efficiency services to low income families is discussed in detail in the Heatwise case study in Chapter 3.

Chapter 3: Case studies

The Home Energy Efficiency Scheme

The Home Energy Efficiency Scheme (HEES) was a government funded grant programme overseen by the Department of the Environment, Transport and the Regions (DETR), targeting energy efficiency improvements in the low-income domestic sector. The scheme began in 1991, and received £75 million of government funding in 1999/2000. This study focuses on the period from 1991 to 1997. Over this period annual funding and eligibility criteria changed several times. The consequences of this instability in terms of employment are investigated below.

In the period in question, HEES was administered by the Energy Action Grants Agency (EAGA) and monitored by National Energy Action (NEA). Individual householders applied for grants, and the work was carried out by approved installers, who were co-ordinated and paid by EAGA (when the householder confirmed that the work had been completed). Only one of the two main measures, loft or cavity wall insulation, could be chosen. Draught proofing, hot water jackets, heating controls, efficient lighting and energy advice were additional options, up to a maximum grant per household of £315. Householders, local authorities or others could make additional contributions if necessary.

Data for the number of installations for 1991 to 1996, and the average cost per job are presented in Table 2.

Energy efficiency measure.	Total installations 1991 to 1997	Average cost per measure installed
Draught proofing	1,550,000	£119
Loft insulation	128,000	£219
Draught proofing plus loft insulation	447,000	

Table 2. HEES major installations and average costs 1991 - 1997.

Over three quarters of the beneficiaries of the scheme were in receipt of social security benefits. NEA estimated that each household could potentially save an average of £39 per year on fuel bills. However the scheme targeted the fuel poor who were likely to have under-heated their homes prior to the improvements. Therefore the actual energy savings may have been as little as 20% of this potential in some cases, as the householders improved their level of comfort rather than paying less for the same level of service. The Buildings Research Establishment (BRE) found that some fuel bills fell by only £9 per year in 1993. Later BRE research in 1996 suggested that this was an underestimate. We have therefore estimated an average annual energy saving of just 500 kWh, with a value of £14.75 per household per year. This is a small saving, but not an indication that the scheme was unsuccessful, since the aim was relief of fuel poverty rather than energy conservation per se.

Approximately 6% of the total cost of the scheme went towards EAGA's management requirements, totalling £23.8 million over the period 1991-1997. Installers applied for registration under the scheme and could then operate in their local area. There was usually a maximum of 3 installers working in any one area. This localised approach was beneficial in terms of the regional spread of employment opportunities, and benefited from localised knowledge of needs and opportunities.

Data for this study were taken from NEA's monitoring reports (NEA 1992 - 1997) and a National Audit Office report in 1998 (NAO, 1998). NEA staff were also interviewed for the study. The reports focus on interviews with installers, manufacturers and suppliers, and provided a wealth of information on employment issues (as employment creation was a stated aim of HEES in its early years). The NEA work particularly concentrates on the effects of increased funding in 1995/6, which stimulated the industry and employment, followed by a budget cut in the following year. This case study uses those results and figures from the NAO report to extrapolate to the employment impact over the 6 year period.

Effects of the budget increase in 1995/6 and subsequent cut

The annual budget for 1995/6 was increased by £31 million from the previous year, to £100 million. In response to this increase, 90% of approved installation firms took on new permanent employees. These new employees tended to have some experience in installation work, and were not generally involved in government job creation initiatives. Approximately 750 new jobs were created in installation firms in this year. Business confidence was high, and many installers began to expand their operations and diversify in to new activities. In particular many firms made efforts to move into cavity wall insulation, which is a big step given the training, licensing and specialised equipment required.

In the following year the budget for HEES was cut by £31 million, to its previous level. The allocation per installer, rather than the number of registered firms, was reduced. This had a significant impact on the firms' business, given that HEES typically accounted for 50-75% of their turnover. Competition became more intense and profits more marginal, though few companies actually went out of business.

Installation firms continued in their efforts to diversify their operations, and additional sources of funding (such as the Standards of Performance scheme) maintained business for many. The budget cut made diversification more difficult due to staff reductions and more restricted budgets for training and new equipment. Increasingly installers were looking for more skilled staff who could take on a range of work, with a net loss of jobs overall. NEA's interviews with installers suggest that contraction in the industry after the budget cut was associated with a loss of 1,115 jobs in installation firms. 82% of these were in manual installation work, and the remainder in surveying, management and administration. For some employees work opportunities became more transient, as quarterly budget allocations were used up before the end of the quarter, and temporary staff had to be laid off and re-hired at intervals.

Other responses to the tighter market included reductions in overtime and bonuses, shorter working hours, reduced profit margins and, in some cases, pay cuts. Some firms stepped up their training in order to maintain efforts to diversify, while more marginal companies had to cut back on training. Nevertheless, over time, the vast majority of installation firms reported that HEES had allowed them to take on and train more staff. Overall, 2000 people

benefited from training as a result of HEES, and the number of trained staff employed by installers increased by 81% by 1996.

In the manufacturing sector, producers of draught proofing materials were badly hit by the budget cut, given the large percentage of the market HEES represents. NEA interviews with manufacturing companies suggested that competition became very tight and profit margins diminished. Some job losses and a reduction in new product development were reported, while many firms responded by stepping up their sales and marketing operations.

Overall impacts on employment

Despite the negative impacts of fluctuating budgetary allocations, the HEES programme had a positive impact in creating employment in the energy conservation industry. The National Audit Office estimated in 1998 that 5000 extra jobs per year had been created by the scheme. This included 1,600 jobs in installation, and the bulk of the remainder in manufacturing, distribution and transport operations (NAO, 1998). In addition 170 staff were employed at EAGA in management, technical and clerical positions. The most reliable data for employment were available for 1996, and these were used as a basis to estimate total employment impacts over the lifetime of the scheme.

Only installation jobs and work at EAGA were included in our estimates of direct employment, as data for manufacturing and related services are more uncertain. Adjusting for changing annual expenditures, on the basis of the above figures we estimate that 8,600 direct person-years of employment were created from 1991 to 1996. The input-output modelling and the NAO report suggest that this is an under-estimate for direct effects. However there would also be some displacement of employment in other sectors which might have benefited from alternative uses of government expenditure. This displacement depends on the assumption made as to how the government would otherwise have used the funds.

Very little of this employment would have been created in the absence of the scheme, given that the focus is on low-income households who would be unlikely to be 'free-riders'. Allowing for the comfort increases discussed above, we estimate that the installations made from 1991 to 1996 will result in 10,800 GWh energy savings over 15 years. On an annual average basis this equates to 720 GWh, or an annual saving to customers of £21.24 million. The input-output modelling suggests that re-spending of money saved on fuel bills would stimulate an additional 22,000 person-years of employment over 15 years (Jeeninga et al. 1999).

Summary data

HEES 1991-1996	
Government expenditure (over 6 years)	£359 million
Average annual energy savings (15 years)	720 GWh
Value of energy savings (15 years)	£21.24 million/year
Simple payback period	17 years
Blue collar employment (over 6 years)	7,800 person-years
White collar employment (over 6 years)	840 person-years
Indirect employment (over 15 years)	22,000 person-years
Direct employment per £m invested (over 6 years)	24 person-years
Indirect employment per £m invested (over 15 years)	61 person-years

Heatwise

Heatwise was a registered HEES installer, so this case study serves as a more detailed examination of the employment impacts of one aspect of the HEES programme. However it is atypical and is of particular interest, since Heatwise operated as an 'intermediate labour market' for people who had been in long-term unemployment in Glasgow. The scheme has been in operation since 1984, and this case study focuses on activities in 1996.

Background

Heatwise started life as the Scottish Neighbourhood Energy Action Glasgow Project, a voluntary organisation established to tackle the problem of cold, damp housing in Glasgow's housing estates. The project secured funding from the then Glasgow District Council (which owned about 160,000 homes) to hire key management staff and to 'top up' insulation grants so that tenants would receive a free draught proofing and insulation service, while at the same time, work experience was provided for unemployed people who were involved in installing these measures. The project was initially developed under the Manpower Services Commission's Community Programme, a temporary job creation programme targeted at the long-term unemployed. By the end of 1995, Heatwise had draught proofed around 110,000 homes.

Heatwise expanded from its core activity of home draught proofing and insulation, and in 1987 launched a Home Energy Advice Service, advising householders on heating systems operation, dealing with fuel debt, payment methods, heat loss within the home and appliance running costs.

In 1987, the Wise Group was created as a holding company, with Heatwise as a wholly owned subsidiary. In the same year, the Heatwise model was adopted to create Landwise, established to transform neglected back courts into sustainable, functional gardens and recreational areas. In 1991, two new divisions of Landwise were established - Treewise (to establish urban wooded areas in some of Glasgow's housing states) and Wise Recycling (the sole collector of glass from Glasgow's bottle banks.) This case study looks only at Heatwise (this being the only part of the Wise Group that is geared towards energy efficiency).

In the study period the majority of Heatwise's funding came from grants (approximately 80% of the total), provided by the European Social Fund, the local council, the Glasgow Development Agency and from the Government via their Home Energy Efficiency Scheme. 15% of the income came from contracts (mostly for the local council). Other financing came from donations and from the local energy advice centre.

A comparison between Heatwise's funding in 1986 and 1996 shows that contract income has doubled during this period, with the organisation becoming less reliant on public sector funding (although this still accounted for the vast majority of the organisation's income). Surpluses, which were covenanted to the holding company to support its wider social objectives, averaged around £100,000 per annum over 1993-5.

The Heatwise approach

All Wise Group companies shared common goals, namely:

- To create an intermediate labour market, i.e. to recruit and provide training and work experience for unemployed people so they can improve their own prospects by moving into a job or further education;
- To provide good quality products and services;
- To involve and work closely with their customers (i.e. funding bodies, those receiving products and services, trainee workers, and employers or colleges that recruit their people).

The Wise Group as a whole sought to achieve its training and employment objectives by providing a one-year programme for trainee workers. It aimed to deal with the problem of long-term unemployment by creating an Intermediate Labour Market (ILM) that, with the help of partnerships, combined training, work experience and personal development. The function of the ILM was to:

- Give the long-term unemployed a period of employment in their own right;
- Keep them in contact with the habits of work;
- Improve their skills to keep them closer to the labour market;
- Prevent them from dropping into the category of being unemployable (Wise Group, 1994).

In addition to the common goals of the Wise Group, Heatwise had the specific objective of making houses warm, and the organisation aimed to make an economic and social impact as well as an environmental impact. Most of the organisation's activities were directed towards housing estates with minimum standards in insulation levels and other problems of poor housing. Thus, low-income households could benefit from increased comfort and/or reduced weekly fuel bills.

The Heatwise business policy was based on three approaches in the fields of energy saving, training and work experience:

- The traditional energy-saving approach via installation of insulation measures;
- The service-oriented advice and auditing approach via consulting and surveying;
- The promotion approach via spreading information, education and exchange of know-how.

The Group's arrangement for transitional workers was a weekly 3:1:1 ratio for work experience, training and personal development. The maximum duration of employment at the Wise Group was 52 weeks. Jobs were advertised, and each applicant went through a recruitment interview. Personal development was given a prominent place in the Wise Group concept, and each transitional worker had a supervisor who was responsible for progress in this area (giving, for example, help with interview techniques, application forms and drawing up CV's).

After an 8-week induction period, during which trainees were paid an amount equal to their benefits plus an additional £10, the workers were paid £3.60 an hour for the remaining 44 weeks of their contract. During the year, trainees received on and off-site training, working towards nationally recognised qualifications, and work experience which was

geared to improving their future prospects in the labour market. Heatwise trainee workers had access to over 30 nationally accredited training courses.

In 1996, 40% of trainees had been unemployed for more than 2 years prior to joining the scheme. 57% of trainees who left the Wise Group succeeded in finding a job in the mainstream labour market, or departed to further education (this rose to 62% in 1997). This is significantly higher than the results under Training for Work (the main government scheme for the long-term unemployed, prior to 'New Deal', which was launched in April 1998).

Achievements

- Draught proofing and loft insulation have been the core business of Heatwise since the organisation began. A total of 110,000 houses were insulated (with draught proofing, loft insulation, pipes and tank jackets) between 1983 and 1997. Additional measures were carried out on certain projects, such as external cladding of 582 units. An external cladding team was created, operating as a contractor to Heatwise, with ten full-time trainees. Energy efficiency measures were also carried out as part of the HEES scheme.
- Energy advice and auditing is an increasingly important area of Heatwise activity. Free energy advice and an information package are available.
- Promotion of energy saving awareness and dissemination activities. Energy education in schools is a relatively new activity for Heatwise. In partnership with the then Scottish Office Environmental Department, Heatwise developed in-service training for teachers and pupils. In addition, Heatwise runs a 'Young Technologist' challenge for primary schools each year. It is a science and technology based challenge with a strong emphasis on energy and the environment.
- Introduction of home security measures. In the early 1990s, Heatwise began to offer a number of security measures along with the energy efficiency measures. These are targeted at vulnerable groups, with measures including the fitting of deaf alerts and specially coated handrails in a small number of households with elderly and physically disabled inhabitants. This new element has broadened training opportunities, for example in customer advice.

In 1996, the following work was carried out:

- 186 dwellings externally clad
- 2,347 houses draught proofed
- 37 lofts insulated
- 2,893 new energy advice visits

Training and employment impacts

In 1996 the majority of jobs created in this programme were in the installation and project administration sectors, with a minority in the manufacturing sector. Table 3 shows how the permanent staff at Heatwise were split

Category of employment	Average wage	Staff employed
Managers	£22,200	10
Technicians	£16,100	22
Other white collar/non manual	£11,800	27
Skilled blue collar	£12,500	20
Semi skilled blue collar	£10,400	2
Unskilled	£5,800	3

Table 3. Permanent staff employed by Heatwise

between employment categories. The trainees themselves predominantly went on to be skilled blue collar workers, involved in installation and advice provision. A few went on to white collar jobs in project administration.

The number of permanent staff employed by Heatwise averaged 84 people over the period 1995 to 1997. Around half of these had previously been Heatwise trainees, and prior to this had been unemployed. Over the same period an average of 194 new trainees were employed by Heatwise per year.

The majority of the trainees had been unemployed long-term and were unskilled. Around 60% of trainees gained a National Vocational Qualification (NVQ) before they left the scheme, although for around half of these only the basic NVQ Level 1 was obtained (McGregor et al, 1997). Exact figures on the number of people trained since Heatwise began are not recorded, but it is estimated to be well in excess of 2000 people. It is estimated that around half of these have gone on to secure permanent employment.

Just under half of the trainees completed the training and work experience. Over 40% of those leaving did so to take up employment opportunities. 10% left early due to feelings of dissatisfaction. Two-thirds had found a job at some point after leaving Heatwise. For the Wise Group as a whole, 41% continued to be employed full time 6 months after leaving Heatwise, with 5% employed part-time. 4% were in education or training, with 44% unemployed. The remainder were unable to work. (McGregor et al, 1997). The relatively high proportion of those completing their 52 weeks can probably be attributed to the financial benefits paid to trainees (relative to other training programmes). Research showed that only 14% of trainees were no better off while being trained by Heatwise, with the remainder being better off (26% by £50 or more per week).

The highest proportion of those finding work were those that stayed with the Wise Group for longer than 12 weeks. Most encouragingly, the Wise Group placed almost as high a percentage of the formerly long-term unemployed into employment as shorter-term unemployed recruits.

Research has identified a range of positive impacts on the quality of employment:

- The quality of jobs found improved with time after completing the Wise Group programme;
- Pay also improved for those changing jobs;
- Generally, take-home pay and income gains compared to unemployment were reasonable.

Two manufacturing companies which supply materials to Heatwise were asked about the employment effects of the scheme. They reported that it was a very small part of their turnover and the employment impacts were negligible.

Due to comfort increases, energy savings were considered too small in relation to the cost of the programme to create significant indirect employment through the re-spending of money saved on energy bills.

Economic impact on households and neighbourhoods

Heatwise's services were delivered mainly in Glasgow's large peripheral housing estates where problems of unemployment and housing decay are greatest. Research conducted in 1997 found that the vast majority of householders receiving energy efficiency measures from Heatwise relied on benefits for their main source of income. Only 20% of those in homes surveyed were in employment. By improving the energy efficiency of homes, Heatwise manages to increase the comfort levels of the householders as well as reducing fuel bills, and thus increases the householders' purchasing power. Of those who had insulation installed, 68% reported savings of up to £5 per week, with 12% reporting savings of £5-£10 and 4% of £10 or over. Where the whole house had been refurbished, savings were higher, with 16% reporting savings of £10 or over. The average amounted to £7.10 per week for refurbished homes, and £4.94 for houses which were insulated (McGregor et al, 1997).

The work provided by Heatwise, in addition to other local environmental improvements provided by other sectors of the Wise Group, can also increase household stability by making the area more attractive to people who might otherwise leave. 44% of those whose dwellings had been insulated by Heatwise reported that they were more prepared to stay in their home as a consequence of the work being carried out.

Results

A total of 278 person-years of employment were directly generated in one year of Heatwise's operations. These were all in installation or administration, with less than 0.1 person year being created in the manufacturing sector. Input-output modelling suggests that the net employment gain would be positive but small for two reasons. Firstly, the programme is grant funded and therefore one should subtract the jobs which might have been created in another sector using the same funds. This will depend on the labour intensity in the reference scenario. Secondly, the energy savings are small and therefore there is not a large re-spending effect.

However, it is the type, location and training benefits afforded by the work which are of interest here. Perhaps most significantly, research has shown that around 50% of trainees were still in employment 6 months after leaving Heatwise. It is therefore possible that the total employment creation from the project is much larger, but it is impossible to make any accurate estimate of the total figure.

In addition, for the measures installed by the company in 1996, it is estimated that a total of 25 GWh of energy will be saved over 15 years. This takes account of the assumption that energy savings in low-income households will typically be 50% lower than the potential, since increased comfort rather than cash savings are likely to be the priority. In terms of cost effectiveness the energy savings do not appear attractive, as the payback period is very long. However this is to be expected since the programme has such a strong training element, and targets the fuel poor.

Heatwise's approach to the problem of unemployment and cold houses has been extensively evaluated and it is generally agreed that the organisation has been very successful in achieving its two main objectives of moving long-term unemployed people into sustainable employment and improving the energy efficiency of low-income households, to both increase comfort levels and reduce fuel bills.

Evidence for the success is found not only in the statistics of jobs created and services provided, but also in the continued and growing support the organisation receives in Glasgow and in the extension of the model to other areas. In addition, the model has proved to be replicable, with similar programmes being set up in London.

The Wise Group is currently regarded as a model for the creation of local ILMs in the UK. Research conducted by the European Academy of the Urban Environment (1997) identified the following characteristics as important lessons to be learned from the Wise experience:

- Networking and partnership building are the most important elements in the Wise Group approach, as no single funder could sustain the entire costs.
- Diversification is an important strategy - this not only offers new services to clients, but the trainees also comes into contact with a wider spectrum of transferable skills.
- The Heatwise model, like all parts of the Wise Group, can be easily transferred to other areas; franchising has taken place in, for example, Newham, East London.
- The Wise model is based on the assumption that payment at the rate for normal industrial wages values the work of the transitional workers and increases their commitment to the training programme. (86% of trainees are better off during their training than they were prior to it).

Summary data

Heatwise 1996	
Expenditure	£4.8 million
Average annual energy savings (15 years)	1.7 GWh
Value of annual energy savings (15 years)	£82,000
Simple payback period	>50 years
Blue collar employment (1 year)	194 person-years
White collar employment (1 year)	86 person-years
Average annual indirect employment (over 15 years)	Negligible
Direct employment per £m invested	58 person-years

Standards of Performance (SoP I)

After privatisation of the GB electricity industry in 1990 the electricity regulator was given a range of duties, including the promotion of energy efficiency. From 1994 in England and Wales, and 1995 in Scotland, the 14 Public Electricity Suppliers (PESs) were given an energy saving target to be achieved through the installation of energy saving measures by customers. The cost of financing these activities was covered by an annual amount equivalent to £1 per domestic or small business electricity user. The scheme was implemented by the Energy Saving Trust on behalf of the PESs.

Under Standards of performance (SoP) Phases 1 and 2 (1994-98 and 1998-2000) £150 million was raised from customers, and used to subsidise a range of insulation, heating, lighting and appliance initiatives which save energy and money, primarily for low-income households. The third phase of SoP from April 2000 to April 2002, extends the programme to gas suppliers, and raises the contribution to a nominal £1.20 per customer per fuel (gas and electricity) annually. Over £100 million will be invested by energy suppliers in energy efficiency over the 2 years. This case study focuses on the employment impacts of the first phase of SoP, from 1994 to 1998.

The initial phases of SoP were restricted to electricity consumers, as the gas regulator did not consider that it was within her powers to introduce such a levy. Therefore the energy efficiency measures only extended to houses heated by electricity, and to electrical appliances. Only 8% of the UK homes were therefore eligible for insulation measures, and within this category priority was given to low income families in receipt of certain social security benefits. During SoP1 (1994-98) over 7 million measures were installed, such as efficient lighting, cavity wall and loft insulation, double glazing, heating upgrades and efficient appliances such as fridges and kettles. For the purposes of this study only the following heating and insulation measures were considered:

- Cavity wall, floor and loft insulation
- Draught proofing
- Tank and water pipe lagging
- Efficient boilers
- Heating controls
- Double glazing

One of the largest schemes under SoP1 involved the replacement of old inefficient fridges. The employment impacts of the Fridgesavers programme is studied in more detail in the next case study.

Data on the labour required to fulfil the SoP obligations were collected from 2 PESs and from the manufacturers and installers involved. The management, monitoring and marketing work carried out by the EST was also included. These data were then used to estimate the national employment impacts for the entire scheme, implemented by 14 PESs. Local authorities and housing associations also had to dedicate time managing the scheme for their tenants. Approximately 81 person-years of employment was involved per year in this sector. However this work was not included in the employment estimates since no additional financing was available for this purpose and therefore time and financial

resources were assumed to have been diverted from other tasks.

Installation jobs

In social housing bulk contracts for a large number of houses allow economies of scale which reduce the labour input per installation. The labour inputs per installation in social housing and owner occupied premises, as estimated by installers, are presented in Table 4.

Measure	Person days labour required (installers' estimates)	
	Owner occupied	Social housing
Cavity wall insulation	0.75	0.44
Loft insulation	0.36	0.22
Draught proofing[1]	0.33 - 0.5	0.33 - 0.5
Tank and pipe lagging[1]	0.13 - 0.4	0.13 - 0.2
Heating systems	1	1
Heating controls	1	1
Double glazing	4	4
Floor insulation	1	1

Table 4. Labour in installation of energy efficiency measures under SoP 1.

1. *The lower figure is for work carried out as a secondary measure by installers contracted for insulation work in the same property.*

These estimates, and records of total installations completed under SoP1, were used to estimate person-years of employment in installation firms under the scheme. It is estimated that the equivalent of 184 full time jobs in installation firms were created for each year of the scheme. These were predominantly in semi-skilled or skilled manual work.

There was some evidence that installation firms had taken on additional manual workers to cope with the increased work load, and in several cases these were known to be previously unemployed persons. However there was some criticism from smaller firms who felt that they had actually lost business because they were not in a position to compete for the irregular, large contracts from PESs. Some customers who would have had the work done using a small local firm were lost to larger competitors who could offer subsidised rates under the SoP scheme. Nonetheless a large number of firms across the country benefited from the increased work, and the number of 'free-riders' (who would have had the work done without the subsidies) is not likely to have been large given that the scheme predominantly assists households in receipt of social security benefits, mostly living in social housing.

Jobs in manufacturing

Manufacturers of insulation materials, heaters and heating controls were asked about the likely employment impacts of the increased demand for their products stimulated by SoP. The response was that, due to over-capacity in the industries at the time, the impact would be negligible. One manufacturer estimated that a programme 20 times larger, in which all materials were produced in the UK, would be necessary for there to be a significant impact on their labour requirement. While one could argue that the additional demand could have prevented some job losses in manufacturing industry, it was considered appropriate to conclude that there were no job gains in this sector.

Employment in the PESs and EST

A further 205 jobs were supported each year in white collar occupations related to management, marketing, advice, monitoring and consultancy roles in the PESs. This

estimate was derived from interviews with two representative PESs, and scaled up to a national total. In addition the EST employed the equivalent of 5 full time employees in work related to the SoP scheme. Thus a total of 210 white collar jobs were estimated to have been created for the duration of the scheme.

The business as usual case

Without the financial savings arising from the energy efficiency measures the households concerned would spend less on all forms of consumption including energy. When energy efficiency is improved in low income houses a proportion of the potential energy savings is lost as families can now afford to heat their homes to a more comfortable temperature. These adjustments are taken into account.

Since there was a requirement to design schemes so as to minimise free-ridership, added to the fact that over half the expenditure targeted low income families, it is likely that the energy savings and employment generation under SoP are genuinely additional to those which would have arisen in a business as usual case.

Indirect employment effects

The levy on consumers reduces their consumption expenditure by £1. However the energy savings greatly outweigh this cost, resulting in a stimulus to consumer expenditure. For every £1 spent by the PESs the EST estimates that lifetime energy bills were reduced by around £4. The shift in expenditure from energy, which is a relatively low labour-intensity sector, to other sectors stimulates employment in the economy. For an initial outlay of £138 million (PES plus householder expenditure) on measures it was estimated that householders will make cumulative savings through reduced fuel bills of £400 million over 15 years (EST estimate, discounted at 8% per annum). The employment impact of the resulting net increase in consumer expenditure was estimated to be 12,000 additional person-years over 15 years, or an average of 800 jobs per year (Jeeninga et al. 1999). Furthermore, since the programme is not funded by public sector grants, one does not have to consider displacement of jobs which might have been created by alternative uses of the funds.

Summary data

Standards of performance 1994 to 1998	
Total PES expenditure over 4 years[1]	£96 million
Additional private expenditure over 4 years	£42 million
Average annual energy savings (15 years)[2]	840 GWh
Value of annual energy savings (15 years)[2]	£42 million
Simple payback period	3.5 years
Blue collar employment (over 4 years)	736 person-years
White collar employment (over 4 years)	840 person-years
Average annual indirect employment (over 15 years)	12,000 person-years
Direct employment per £m invested (over 4 years)	11.4 person-years
Indirect employment per £m invested (over 15 years)	87 person-years

1 *An additional £5 million has been invested by PESs in other energy efficiency projects which do not count towards there SoP targets.*

2 *Data refers to discounted EST estimates which include all measures implemented under SoP whereas the employment data relate only to the measures discussed in the text.*

Fridgesavers

Fridgesavers was a scheme funded under the Standards of Performance (SoP) programme in which new refrigerators were supplied to low-income families at a charge of £25. This case study is provided as a detailed investigation of one aspect of the SoP programme, and considers only the period August 1997 to March 1998.

The refrigerators supplied were C-rated, which means they are considerably more efficient than those replaced, but not as efficient as A or B rated appliances (which were available, but were usually considerably more expensive). The EST estimates that recipients saved around £30 per year on their electricity bills, and therefore recovered their personal contribution in less than a year, and will save more than £400 over the product's lifetime. There are additional health and financial savings due to reduced food spoilage caused by ineffective cooling in old refrigerators. The old refrigerators were removed free of charge, and disposed of safely to prevent release of CFCs, re-sale or export to developing countries.

To qualify for the replacements the recipient had to be claiming social security benefits, and have an existing refrigerator with an ice box which was in poor condition. The refrigerators supplied were manufactured by Whirlpool or BEKO, and retailed for around £120. The scheme was administered and monitored by Lothian and Edinburgh Environmental Partnership (LEEP) on behalf of the EST and the PESs.

Data on employment were collected through interviews with LEEP, BEKO and Whirlpool and the delivery companies. Energy saving data were supplied by LEEP, who calculated that the old refrigerators consumed 645 kWh per annum on average, compared to 184 kWh per annum for their replacements. In total 50,000 refrigerators were replaced in the time frame considered by this study.

Jobs in manufacturing

The manufacture of 50,000 refrigerators requires approximately 40 person-years of labour. The factories concerned, in Turkey and Italy, reported that this was a small percentage of their output, and did not cause any direct increase in their workforce. Nonetheless it represents additional demand and should be recorded. There does not appear to be any evidence that more efficient refrigerators require greater labour input than less efficient models.

Jobs in deliveries

The delivery jobs required a driving license, but were otherwise unskilled and employed mostly men. Work was carried out by three companies: Expert Logistics, a private company part of the Iceland group (which undertook the bulk of the deliveries); Shaftesbury Resources, which normally delivers free second-hand furniture to low income families in London; and LEEP was responsible for deliveries in southern Scotland.

Expert Logistics estimated that 15 person-years of employment were generated in their delivery operations, which accounted for 90% of the total deliveries. LEEP and Shaftesbury Resources created some work experience for

previously unemployed persons, totalling approximately 3 person-years.

Jobs in administration

Expert Logistics employed 4 people to manage delivery operations. LEEP employed 6 people specifically for the management of this programme. In contrast with the delivery operations, employees in administration were predominantly women. In total 7 person-years of employment were created in this category, as not all posts were maintained for a full year.

Expenditure and energy savings

The total cost of the scheme was £6.36m, including £1.25m from householders. The remainder was funded by a levy on all domestic and small business electricity consumers. The total energy saved over 11 years was estimated to be 230.5 GWh with a value of £12.5m. This is net of a business as usual case which assumes that some of the recipients would have replaced their refrigerators with new or second hand models over the period.

Indirect employment

Jeeninga et al. (1999) estimated that the net increase in consumer spending (re-spending of the money saved on energy bill less the £1 levy on all households) would stimulate a further 475 person-years of employment over 15 years. This equates to almost 32 additional jobs. As with the SoP programme overall, one does not have to consider displacement of jobs which might have been created by alternative uses of government funds.

Summary data

Fridgesavers 1997-8	
PES expenditure	£5.1 million
Additional private expenditure	£1.25 million
Average annual energy savings (11 years)	20.9 GWh
Value of annual energy savings (11 years)	£1.14 million
Simple payback period	6 years
Blue collar employment	58 person-years
White collar employment	7 person-years
Average annual indirect employment (15 years)	475 person-years
Direct employment per £m invested	10.2 person-years
Indirect employment per £m invested (15 years)	75 person-years

Manweb Demand side management scheme

The Manweb demand side management (DSM) project was designed to evaluate the principles and techniques necessary to introduce a major DSM programme. It aimed to reduce peak demand for electricity in Holyhead on Holy Island, just off the West coast of the Island of Anglesey in North Wales. At the time, Holyhead was an economically depressed town, comprising mostly low-income households (3496 homes in all), small businesses and a number of major industrial loads. The largest single load on the island was a school, followed by the port and 3 or 4 other industrial sites. The project was an alternative to a major investment programme in electricity distribution that would otherwise have been required to cope with increasing electricity demand in the area.

The project was partly funded under the European Commission's SAVE programme, the rest of the finance coming from Manweb itself. Market research commenced in 1992, and implementation of measures began in 1993 and lasted for approximately one year. Measures included compact fluorescent lamps, insulation, lighting refurbishment for industrial and small business premises and audits followed by individual energy saving programmes for industrial organisations. The measures were either free or heavily subsidised.

The measurements in this study are made in kilovolt-amperes (kVA) rather than kilowatt hours (kWh) as the aim was peak load reduction rather than energy savings. The project achieved its aim of reducing the peak demand by 808 kVA (of which 346 kVA was load growth) and further investment in plant was deemed unnecessary. The majority of energy savings in the project were achieved in the industrial sector (57%) followed by the domestic (30%) and small business sectors (13%).

Achievements

The scheme was closely monitored in terms of energy savings from the start, as it was such an innovative programme. Marketing was carried out before implementation, based mainly on experience in the USA, to discover the best methods to achieve maximum penetration. A survey of 600 domestic customers was undertaken to establish base data on penetration of energy efficiency measures, the age and condition of the appliance stock and an audit of lighting use was carried out. Marketing was mainly by direct mailings, but also through local radio, TV and newspapers, and local schools. Post project research was also carried out to see the how much energy was being saved and whether advice and installed measures were still being used.

Measures implemented as part of the study included, for the residential sector:

- the offer of two compact fluorescent lamps (CFLs) for each household, installed in their home, at a price of £0.75 each compared with the normal retail price of £10.60;
- the offer, for electrically heated households, of loft insulation and draught proofing at a price of £30.90 compared with an average price of £160;
- free hot-water tank insulation for households using electric heating; and

- rebates of up to £50 on energy efficient appliances.

For the small business sector, measures offered were:
- a free insulation jacket for each hot water cylinder;
- two CFLs at £0.75 each; and
- a free lighting audit.

Customers in the larger industrial/commercial sector were offered:
- a free energy audit;
- subsidies on energy saving measures; and
- subsidies on power-factor correction equipment.

Both the subsidies in the industrial/commercial sector were offered so as to provide a 12-month payback on the customer's investment.

A 10% reduction in maximum daily demand was achieved of which 30% was from the residential sector, 13% from the small business sector and 57% from the industrial/commercial sector. The reduction measured at the distribution transformers was 374 kVA, with a further 88 kVA achieved after the end of the project with late implementation by one industrial consumer.

Several new developments in the area led to increased load growth during the time scale of the project – these comprise:
- expansion of the port (256 kVA)
- new motive power at an industrial site (30 kVA)
- increase in ownership of domestic appliances (40 kVA)
- expansion of the housing stock (20 kVA)

The net reduction from the implemented measures is therefore the measured decrease (374 kVA) plus the load growth (346 kVA). Including the 88 kVA implemented after the project, the total reduction was 808 kVA.

In the residential market the penetration of the CFLs reached 79%, leading to savings of 88 kVA. Water cylinder insulation saved 47 kVA with a penetration rate of 84%. Draught proofing and loft insulation were less well taken up with penetration rates of 20% and 30% respectively. All the insulation measures will, however, be sustained, whereas the return of CFLs to higher prices means that many of these will not be replaced (53% were sustained according to Manweb). The uptake of the subsidised energy efficient appliances was estimated to be negligible.

The small business market was less ready to take up measures on offer. CFLs reached only 24% penetration and water cylinders 17%. A small number of businesses (6%) undertook lighting refurbishment programmes resulting in a saving of 92 kVA (compared to 4.8 and 7.4 kVA for water cylinders and CFLs respectively).

In the industrial sector there were fewer potential consumers to involve, but those that took up the offers saved significant amounts of electricity, accounting for 57% of the total saved by PowerSAVE. 60% of the peak demand was saved by just 4 sites using power factor correction. In total this sector saved 282 kVA from power factor correction, 125 kVA through lighting programmes and 55 kVA from other measures.

The average cost per kVA saved was as follows:

- residential sector, £512;
- small businesses, £507;
- larger industrial consumers, £126.

This suggests efforts in similar schemes should be concentrated on the larger industrial customers in the future. The figure is somewhat distorted by the high level of subsidy of the CFLs. The power factor corrections proved to be particularly effective, and although no kWh savings result, it is still useful to Manweb for reducing peak demand and avoiding investment in new supply capacity.

The programme was considered a success in that it achieved its aim of avoiding investment in further plant, by saving 10% in peak demand. It did this within a smaller range of measures than anticipated, as appliance rebates and the small business sector proved to be more difficult to involve than expected.

Employment impacts

The total employment impact was small, as one might expect in a project with a total cost of less than £250,000. The following work was identified:

- A full time project manager was seconded from Manweb to oversee the activities in Holyhead, for one year;
- During the period of the project a dedicated mobile unit and a Manweb shop were used for sales and marketing. This employed 2 people for one year, involved in giving advice and advising customers on how to take up the measures that had been offered;
- NEA (National Energy Action) was responsible for draught proofing and insulation of lofts in the domestic sector. A total of 90 homes were draught-proofed and 63 homes had loft insulation installed. As NEA could not provide specific details about who carried out the work or how long it took, using average figures for such work, a total of 67 person days work was created - a little over 1/4 of a person year;
- A specialist lighting contractor worked directly for Manweb providing lighting installations and energy audits. At peak times they utilised a team of four engineers to carry out installation work;
- The Prince's Trust is a national organisation that offers young disadvantaged and unemployed people an opportunity to gain valuable work experience. The group was used for distributing the light bulbs. Although no paid jobs resulted from their involvement, the group improved their employability by being involved in the project;
- Industrial customers were offered free audits. The initial walk-around survey was undertaken by Manweb staff and took an average of 1 hour. If the customer was interested in going further, experts were brought in who carried out a 1/2 day survey.

There will have been little or no manufacturing employment generated by this level of investment. No attempt was made to investigate this further as the effect would have been impossible to separate from overall trends in manufacturing employment.

In the business as usual case work would have been created in strengthening the distribution network. However the project only delayed this work for up to 10 years, rather than making it unnecessary altogether.

Summary data

Manweb DSM scheme 1993	
Total expenditure	£243,000
Total energy saved	808 kVA
New employment	5 person-years (approx.)
Direct employment per £m invested	20.6 person-years

Shetland Integrated Resource Planning

In common with the Manweb scheme, this small, island based DSM initiative created a small, but significant amount of new employment.

The Scottish Hydro-Electric (HE) 'Island Incubator' initiative was a joint project between Shetland and Madeira, funded by the EU's SAVE programme. Its objective was to test the theory that new ideas can be developed on islands, where they have a rapid impact, before trying them out on a larger scale. In practice, the unique circumstances of the Shetland Islands mean that some of the measures which were cost-effective on the islands may not be cost effective elsewhere. The project examined complementary aspects of supply and demand-side planning. A number of scenarios were constructed to look at the influence of different supply and demand situations and new products and services that could be offered.

Shetland differs from the rest of the UK in that domestic sector demand accounts for 60% of total electricity consumption, compared to 35% in the UK as a whole. Due to the severely cold climate there is a significant demand for space heating in all sectors. Off-peak all-electric tariffs were popular because the price of electricity in Shetland was regulated in line with the mainland, and the low capital cost of electric heating installations made it an attractive option compared to the local price of other energy options (imported fuel oil, solid fuel and bottled gas - there was no mains gas supply). Demand for electricity was growing, due to around 100 new homes being built each year and buoyancy in the local economy.

Electricity generation costs in Shetland were high because of the diseconomies of scale, and distribution costs were also high because of the extreme climate and one of the lowest population densities in Europe. Given the unified, regulated tariffs for electricity, Shetland was not a profitable market for HE. Growing annual demand led to a need for new (uneconomic) investment in generating plant. By containing this growth, such extra investments could be deferred or avoided.

In the summer of 1993 it was agreed that action needed to be taken by HE to manage the growth in demand upon the Lerwick (Shetland Islands) power station. In addition, the shape of the daily load curve resulted in high cost generation in terms of fuel and maintenance, and this also needed to be addressed. A number of initiatives were introduced in 1994 aimed at managing electricity consumption.

Achievements

1. The appointment of an energy manager at Shetland Islands Council, part financed by HE.

As part of the overall programme, HE part-sponsored a new 'Energy Manager' post at the Shetland Islands Council, for a period of three years. The engineer appointed to this post was responsible for energy management throughout all Shetland Islands Council properties. It was originally anticipated that the sponsorship would be for one job, for three years. In fact, two appointments were

made - an energy manager and an energy officer. 1/3 of the funding required was supplied by Scottish Hydro-Electric, 1/3 by the European Commission, and 1/3 by the Council.

The bulk of work carried out between 1994 and 1997 was in education properties. Measures included boiler lagging, boiler controls, installation of thermostatic radiator valves, draught-proofing, ceiling insulation and installation of energy efficient lighting. Similar works were undertaken in other council properties.

The estimated energy savings resulting from the energy unit's activities over 3 years is:

1. 25 GWh per annum for 10 years.

2. The 'SaveElectric' programme: a domestic sector scheme involving audits and installations.

This initiative was designed as a demonstration project, to show how electricity bills could be reduced through investment in energy efficiency. 403 selected HE customers, all of whom were on electric storage heating tariffs, were mailed with information on energy efficiency measures. Consumption in these households varied between 30,000 and 100,000 kWh per year.

Householders were invited to take part by applying for a home energy audit. Shetland Environmental Agency (SEA) conducted these audits at a subsidised charge to the householder of £20 per audit (compared to the normal price of £80). (The fee was to dissuade those householders who had no serious interest in making improvements from taking part in the programme.) In addition, financial assistance of up to £300 (or 50% of the total cost) was offered to implement the recommendations. A 25% response rate was achieved. A telephone survey undertaken on a small sample of householders indicated this could be further increased to 40% through follow up telephone calls.

The National Home Energy Rating (NHER) scheme was used for individual energy audits. SEA is registered to undertake NHER surveys, which are accepted throughout the UK. Energy cost saving options were predicted based on the NHER model and costs were based on the charges of Shetland Heatwise, the main contractor for other energy saving works.

The energy savings resulting from this aspect of the scheme amount to 0.5 GWh per annum. However, it was estimated that under a business as usual case 20% of the initiatives would have been taken anyway, and therefore the estimate was reduced to 0.4 GWh per annum for 15 years.

3. Installation of teleswitches (designed to reduce peak load, but in fact also resulting in reduced energy consumption).

Of the electricity consumed in Shetland, a large proportion was used for space and water heating in the domestic and commercial sectors. Over the preceding 20 years, HE offered various tariffs designed to promote the use of electric storage heating. Electricity is available at two rates; normal rate for 16 hours each day, and cheap rate for the remaining 8 hours during the night. Scottish

HE was required by UK industry regulation to operate uniform electricity tariffs throughout the north of Scotland. Under the monopoly arrangements which were in place at the time, Public Electricity Suppliers (PESs) were not allowed to develop particular tariffs to suit the special circumstances of a particular area.

Until recently, all HE customers in Shetland on the older storage heating tariffs received an 8-hour charge of cheap rate electricity between approximately midnight and 8 am. The heaters and domestic hot water tank were fully charged at 8 am each morning and receive no further charge until midnight. The popularity of electric storage heating in Shetland had given rise to a daily demand profile on the electricity network which showed a pronounced peak each night at approximately 1 am during the winter heating season. This was as a result of the aggregate demand of all the storage heaters. By changing the switching arrangements, the coincident aggregate peak demand could be reduced and managed whilst also improving the quality of service.

Of the 9,100 domestic customers in Shetland, 4,000 were on old storage heating tariffs (now superseded and no longer available to new customers). In early 1994, these customers had their installations modified and a teleswitch installed so that the times they received low rate electricity for heating were spread throughout the day. The on/off signals are sent out by BBC Radio 4, on a frequency dedicated to Shetland, with local control from Lerwick Power Station. In the event of a problem on the network or in the power station, electric heating load could be interrupted for short periods in order to shed load and so avoid complete disconnection of customers. By shedding load, the idea is to give the power station time to start up an extra generator to compensate for the emergency, before re-switching the heating load once full supply is reinstated.

The teleswitching scheme was purely intended to reduce peak load, and was not aimed at energy savings as such. As expected, the new heating regime had a major impact upon the load on the power station, with a much flatter demand curve produced. However, the billing analysis also indicates a reduction in energy use of up to 15%, due to the heat being supplied throughout the day in four periods, resulting in heat always being available when needed and a lower heat differential, resulting in lower heat losses and lower heat inputs. In addition, the new arrangement allowed customers to change the heat input depending on the weather conditions.

As a result, the average domestic customer used 4,521 kWh each month between Jan and June 1994, compared to 5,210 kWh the previous year. It is estimated that the initiative would save 28.9 MWh per year over a 15 year lifetime. Moreover, it succeeded in reducing peak load from 40 MW to 33 MW.

4. Compact fluorescent lightbulb (CFL) promotion.

The benefits of CFLs in terms of reduced electricity usage and lower electricity bills are well established. Scottish Hydro-Electric considered two methods of promoting CFLs; either by spreading the cost of lamps over the customers' quarterly electricity bills, or by

offering discount vouchers. The first was considered the preferable option, but was disallowed by the Office of Electricity Regulation in the UK, and therefore the second approach was used.

"£3-off" vouchers were distributed to all franchise customers (over 10,000 homes) in Shetland with quarterly bills, for use in the Scottish Hydro-Electric shop in Lerwick. The shop sold its full stock of 772 Mazda 20W bulbs. However, the Mazda CFLs suffered from poor reliability, and 45 were returned as faulty (they were replaced by Philips CFLs as direct replacements). CFLs consume 20% of the power of equivalent incandescent light bulbs, and they have a life that is 8 times longer. It is estimated that the CFL initiative would save 38.6 MWh per year over the 10 year lifetime of the bulbs.

Industrial energy audits, heat pumps and district heating also featured, but insufficient data were available to make any estimate of energy savings or employment impacts for these.

Employment impacts

The direct employment involved in the scheme is summarised in Table 5. There are likely to have been some additional employment effects in manufacturing, and indirect employment gains as a result of re-spending of money saved on energy bills, but these impacts were not estimated here.

Initiative	Administration	Installation	Total
	(person-years)	(person-years)	(person-years)
Energy manager	6	2.5	8.5
SaveElectric	0.5	1.75	2.25
Teleswitches	0.25	2.6	2.85
CFLs	0.1	0	0.1
Total	6.85	6.85	13.7

Table 5. Jobs created in the Shetland IRP project.

Summary data

Shetland IRP 1994 - 1997	
Total expenditure over 4 years	£736,000
Average annual energy savings (15 years)	1 GWh
Value of annual energy savings (15 years)	£50,000
Simple payback period	13 years
Blue collar employment	7 person-years
White collar employment	7 person-years
Direct employment per £m invested (over 2 years)	19 person-years

The 1995 Building Regulations

The first requirement for insulation in new dwellings in UK building codes was introduced in 1965. Since then they have been updated, in 1974, 1981, 1990 and most recently in 1995. Part L of the regulations, relating to "Conservation of Fuel and Power" is once again under review in 1999/2000. The Building Research Establishment produce estimates of the additional costs and energy savings stimulated by the 1995 regulations. According to these the 1995 regulations required an additional expenditure of £68 million per year on new buildings in 1996 and 1997. This case study explains the nature of this investment and estimates the employment impacts.

Changes in the regulations

Prior to 1995 Part L of the Building Regulations merely stated that 'reasonable provision shall be made for the conservation of fuel and power'. In 1995 this was expanded to clarify the appropriate energy conservation measures and the approved means of assessing the energy efficiency of properties.

From 1995 government Standard Assessment Procedure (SAP) ratings were required for all new dwellings (and dwellings created as a result of a change of use involving building work). This rating applied to the building as a whole, and ranged from zero to 100, with higher figures indicating better energy efficiency. Location, family size or temperature preferences did not influence the rating. Rating on a continuous scale allows buyers to compare properties, and may encourage some architects and builders to go beyond the minimum requirements.

SAP ratings were provided by assessors according to a government-approved methodology, and cost approximately £30 per dwelling. Compliance could be either by minimum SAP rating, or by elemental minimum standards. The main factors taken into consideration were the insulation, the heating system, ventilation characteristics and solar gain (heat captured by windows or conservatories). A minimum performance in terms of thermal transmittance (U value) was mandated for roofs, roof lights and doors. Hot water vessels and pipe-work also had to reach minimum standards of thermal performance. Improved roof and floor insulation was required if the rating was to be less than 60 in a new building.

Costs and energy savings

The Building Research Establishment estimated that compliance with the 1995 regulations increased the cost of a new dwelling by 1 to 2%, or £450 to £650 (DOE, 1993), including £30 for the assessment itself. This investment improved the energy performance by 25 to 35% compared to the previous regulations. Thus for the purposes of this study we assume an average additional cost of £550, and a 30% reduction in energy consumption. A breakdown of the sectors in which employment was stimulated was estimated using Office for National Statistics data (ONS, 1998), DETR commissioned research on the regulations (Davis Langdon Consultancy, 1993) and interviews with construction, manufacturing and assessment companies.

Employment impacts

Davis Langdon Consultancy (1993) undertook

detailed analysis of the various different methods of complying with Part L of the 1995 Building Regulations, separating out the cost of labour from the cost of materials. On average, their estimates show that 40% of the extra cost (excluding the cost of the SAP rating) would be incurred by additional labour, and 60% by additional materials. For an average additional cost of £520 per dwelling (i.e. £550 less £30 for the SAP rating), £220 was spent on labour and £300 on materials. With construction and installation jobs costing an average of £20,800 (gross) per annum, this should result in 1 person-year of employment created for every 95 dwellings built. Construction companies were not able to confirm this estimate, but it appears reasonable.

In the manufacturing sector there was no direct evidence of increased demand or labour requirements after the introduction of the regulations. Therefore an estimate was again derived from the average expenditure. According to the Davis Langdon estimates an additional £300 per dwelling was spent on materials, and this is estimated to generate 1 person-year of employment in manufacturing per 200 new dwellings.

The one area where it is directly possible to identify significant job creation is in the provision of SAP ratings. Before the 1995 Regulations, only a very small number of new dwellings had SAP ratings (estimated at <1%). These properties were generally owned by Housing Associations, who were keen to provide their tenants with information on the running costs of their dwellings, and a few private sector companies who used the SAP ratings as a marketing tool (e.g. Admiral Homes). The National House Builders Council took on 7 staff as full-time energy raters as a direct result of the 1995 Building Regulations (Stacey 1998, pers. comm.). They estimate that 1 rater was needed per 1,000 properties assessed each year. Each received training in how to conduct an energy rating and needed a background in construction.

There will also have been some employment generation in the field of software development for carrying out the SAP ratings, although it is very difficult to separate this from other IT recruitment in the field.

Data for rates of new housing construction in 1996 and 1997, and compliance with the 1995 regulations, were used to estimate the total employment impact over this period. Compliance is based on the date of approval, not of construction, so regulations take a few years to reach 100% compliance. Table 6 presents construction and compliance data, and Table 7 presents estimates of employment impacts.

	1996			1997		
	Houses completed	Compliant with 1995 Reg's (%)	Houses compliant	Houses completed	Compliant with 1995 Reg's (%)	Houses compliant
Private sector	178,300	30	53,490	177,900	70	124,530
Public sector	800	20	160	300	60	180
Total	179,100	—	53,650	178,200	—	124,710

Table 6. New houses completed in Britain 1996 to 1997.

Person-years		
Sector	1996	1997
SAP ratings	54	125
Construction	565	1,313
Manufacturing	268	624
Total	887	2,062

Table 7. Estimates of additional labour requirements in 1996/7

Total additional investment at £550 per compliant dwelling amounted to just under £100 million over the 2 years.

Thus, in 1997, we estimate that almost 125,000 new houses were built which complied with the 1995 regulations, and this stimulated over 2000 person-years of employment, with 94% of the jobs in manual sector occupations.

Energy savings and indirect employment

Energy savings are assumed to be 25 - 35% based on the previous building regulations. We have therefore taken an average of 30%. Energy use in homes built between 1990 and 1995 averages at 71.5 GJ (0.02 GWh) per annum (Shorrock, pers. comm., 1998). Space and water heating account for 82% of energy use in homes (DTI, 1997), and therefore accounted for 58.6 GJ per annum in homes built between 1990 and 1995, The 1995 Building Regulations will have resulted in a 30% saving, i.e.17.6 GJ per annum for each dwelling.

Although many measures will in fact have longer useful lifetimes, we have assumed an average lifetime of 15 years, making the total energy savings:

- 1996:
  53,650 x 17.6 x 15 GJ
  = 14.163 million GJ (3,933 GWh)
- 1997:
  124,710 x 17.6 x 15 GJ
  = 32.923 million GJ (9,143 GWh)

This has a total value of £320 million, or £1,800 per dwelling over 15 years. Re-spending of this money can be expected to stimulate further indirect employment. Jeeninga et al (1999) estimate that 7000 additional person-years of employment would be stimulated, or 467 jobs for 15 years. Given that this is private expenditure one does not need to consider displacement of direct jobs which might have arisen from alternative uses of government funds.

Summary data

Building regulations 1996-1997	
Total expenditure (over 2 years)	£98.8 million
Average annual energy savings (15 years)	872 GWh
Value of annual energy savings (15 years)	£21.3 million
Simple payback period	5 years
Blue collar employment (over 2 years)	2768 person-years
White collar employment (over 2 years)	180 person-years
Average annual indirect employment (over 15 years)	7000 person-years
Direct employment per £m invested (over 2 years)	29.8 person-years
Indirect employment per £m invested (over 15 years)	70 person-years

Summary of case study findings

Table 8 summarises the cost, energy saving and employment data for the 7 case studies, for purposes of comparison. In terms of direct employment per unit of expenditure, the Heatwise scheme appears the most successful. However, indirect employment gains are negligible, and the programme is not a cost-effective means of saving energy. The strength of this type of scheme is that it can provide training and operate as an 'intermediate labour market' for people who have been in long-term unemployment. Furthermore it assists low-income families to be able to afford to heat their homes. The Home Energy Efficiency Scheme also assists low-income families, and is more cost effective in terms of energy savings. These two programmes create significant amounts of direct employment, in places and skills groups which suffer high unemployment. However one must note that similar direct employment gains might be possible with alternative uses of government funds in labour intensive sectors or job creation programmes.

The Standards of Performance and Fridgesavers schemes created a smaller number of direct jobs than the other case studies. In the case of SoP this in part reflects difficulties in calculating employment stimulated in the manufacturing sector, which was excluded. In the case of Fridgesavers some manufacturing employment is included, but installation work (which accounts for a high proportion of direct employment in many case studies) is not necessary for refrigerators. The investments are funded by a levy on electricity consumers rather than from public funds. Therefore the net employment gain is likely to be greater than in the grant funded schemes, where funds might otherwise have created jobs elsewhere.

The Manweb and Shetlands demand side management schemes were small, localised programmes which created some employment as a side effect of delaying the need for investment in new electricity supply infrastructure. In terms of total (direct plus indirect) additional employment per unit of expenditure, the 1995 Building Regulations are the most effective of the programmes. Furthermore the cost to the public sector is negligible, cost effectiveness in terms of energy savings is high, and over 90% of the additional jobs are in manual occupations.

	HEES 1991-1996	Heatwise 1996	SoP 1994 - 1998	Fridgesavers 1997-8	Manweb DSM	Shetland IRP	Building regs 1995
Total expenditure	£359 million over 6 years	£4.8 million	£138 million over 4 years	£6.35 million	£243,000	£736,000 over 4 years	£98.8 million over 2 years
Average annual energy savings	720 GWh/year over 15 years	1.7 GWh/year over 15 years	840 GWh/year over 15 years	20.9 GWh/year over 11 years	N/A	1 GWh/year over 15 years	872 GWh/year over 15 years
Value of energy savings	£21.24 million/year over 15 years	£82,000/year over 15 years	£42 million/year over 15 years	£1.14 million/year over 11 years	N/A	£50,000/year over 15 years	£21.3 million/year over 15 years
Simple payback period	17 years	>50 years	3.5 years	6 years	N/A	13 years	5 years
Blue collar employment	7,800 person-years over 6 years	194 person-years	736 person-years over 4 years	58 person-years	Approx. 5 person-years in total	7 person-years	2,768 person-years over 2 years
White collar employment	840 person-years over 6 years	86 person-years	840 person-years over 4 years	7 person-years	See above	7 person-years	180 person-years over 15 years
Indirect employment	22,000 person-years over 15 years	Negligible	12,000 person-years over 15 years	475 person-years over 15 years	Not estimated	Not estimated	7,000 person-years over 15 years
Direct employment per £m invested	24 person-years	58 person-years	11.4 person-years	10.2 person-years	20.6 person-years	19 person-years	29.8 person-years
Indirect employment per £m invested	61 person-years over 15 years	Negligible	87 person-years over 15 years	75 person-years over 15 years	Not estimated	Not estimated	70 person-years over 15 years

Table 8. Summary data for the case studies.

Chapter 4: Conclusion

There are three main reasons why energy efficiency has positive effects in terms of job creation:

• Manufacturing and installing energy efficiency measures is a labour intensive sector compared to energy supply, and to many sectors in which the government chooses to invest public sector funds. This effect accounts for direct employment gains of 10 to 30 person-years of employment per £1 million spent, and almost 60 person-years where job creation and training are made a priority.

• If the energy savings are cost effective, the result is that consumers divert expenditure from energy into the more labour intensive general consumption sector. This effect typically generates an additional 70 person-years of employment in the wider economy per £1 million spent, over the lifetime of the energy saving investment.

• Work in manufacturing and installing energy efficiency measures is accessible to people who suffer the highest rates of unemployment in the UK, given that it is manual labour, and the work is dispersed across the country. Indeed, where programmes aim to assist the fuel poor the work is concentrated in areas where unemployment tends to be highest.

These effects are demonstrated in the 7 case studies presented here.

• In the Standards of Performance and Fridgesavers programmes, approximately 10 person-years of direct employment were created per £1 million of total investment. The Home Energy Efficiency Scheme and two small demand side management schemes generated approximately 20 person-years of additional employment per £1 million invested. The 1995 Building Regulations generated 30 additional person-years of employment per £1 million of total investment. Heatwise created almost 60 person-years of employment per £1 million invested, mainly for trainees who had previously been in long-term unemployment. However this is the one case in which it could be argued that no net employment resulted, since public sector funds could possibly have been used to create a similar number of jobs in other ways, and indirect job gains were negligible. There were however substantial lifestyle gains for programme beneficiaries.

• Indirect employment gains of approximately 70 person-years over 15 years were estimated for four of the seven schemes, per £1 million spent. This effect relates to the re-spending of money saved by householders who benefit from cost-effective energy savings. It does not include the 'multiplier effect' whereby local businesses benefit from the demand stimulus created by re-spending of wages and demand for secondary inputs and services. This effect is not quantified, but can be expected to contribute to re-vitalising the economies of areas where energy efficiency investments create jobs.

• In the Home Energy Efficiency Scheme, Fridgesavers and Building Regulations case studies approximately 90% of the employment was in blue collar occupations. In the remaining studies approximately 50 to 70% of new jobs were in this category. The Building Regulations applied to all new homes, and

therefore additional work was spread across the country. The small demand side management schemes created jobs in remote and/or depressed areas. The remaining case studies mainly aimed to assist the fuel poor, and therefore the work was concentrated in areas of poorer housing, lower incomes and higher rates of unemployment. The Home Energy Efficiency Scheme and Heatwise, in particular, created conditions whereby employment benefited the people and places most in need of the work.

Saving energy, cutting carbon dioxide emissions and assisting people to keep warm are quite rightly the main aims of energy efficiency initiatives. Job creation and training can be made part of the process, or will arise as a beneficial side-effect.

References

Beatty C., Fothergill S., Gore T. and Herrington A. (1997) The Real level of unemployment. Centre for Regional Economic and Social research, Sheffield Hallam University, March 1997.

Campbell M., Sanderson I. and Walton F. (1998) Local responses to long-term unemployment. YPS for Joseph Rowntree Foundation Work and Opportunity Series No. 6.

Capros P., Paroussos L. and Stroublos N. (1999) Energy saving investment and employment. Analysis through the GEM-E3 model. A contribution to the SAVE Employment Project XVII/4.1031/D/97-032.

Davis Langdon Consultancy (1993) Part L Conservation of Fuel and Power, Primary and Secondary Construction Costs.

DfEE (1996) The impact of redundancies on local labour markets and the post redundancy experience. Research Studies RS23, Department for Education and Employment, HMSO, London.

DOE (1993) Draft Compliance Cost assessment; Proposed revisions to the requirements of the building regulations for the conservation of fuel and power. Department of the Environment, 26 January 1993.

European Academy of the Urban Environment (1997) Job Creation in the environmental sector; Local employment initiatives in Europe. European Academy of the Urban Environment, Berlin.

European Commission (1997) Communication from the Commission on Environment and Employment (Building a Sustainable Europe). COM(97)592 Final, Brussels 18 November 1997.

HM Treasury (1998) New ambitions for Britain: Financial statement and budget report. HC 620, London. The Stationery Office.

Jeening H, Weber C., Mäenpää I., Rivero Garcia F, Wiltshire J., Wade J., and Scrase I. (1999) Employment impacts of energy conservation schemes in the residential sector. A contribution to the SAVE Employment Project XVII/4.1031/D/97-032.

McGregor A., Ferguson Z., Fitzpatrick I., McConnachie M and Richmond K. (1997) Bridging the Jobs Gap; An evaluation of the Wise Group and the intermediate labour market. The Joseph Rowntree Foundation, York.

NAO (1998) The Home Energy efficiency Scheme, Report by the Comptroller and Auditor general, National Audit Office. HMSO, London.

NEA (National Energy Action) (1992) HEES: The First Fifteen Months, Newcastle-upon-Tyne, UK.
NEA (1994) HEES: Barriers to Access, Newcastle-upon-Tyne, UK.
NEA (1995) The Impact of Change, Newcastle-upon-Tyne, UK.
NEA (1996) Opportunities Los: A report on the Home Energy Efficiency Scheme 1995/6, Newcastle-upon-Tyne.
NEA (1997) Cold comfort: A report on the Home Energy Efficiency Scheme 1996/7, Newcastle-upon-Tyne.
ONS (1998) Economic Trends No. 537 August edition. Office for National Statistics. The Stationery Office, London.
ONS (2000) Excess winter mortality by standard region of usual residence, 1988/9 to 1998/99. Pers comm. David Dix, Mortality Statistics Section, Office for National Statistics, London.
Shorrock, L. (1998) pers. comm. Building Research Establishment.
Stacey, J. (1998) pers.comm. National Home Builders Council.
Wade J., Scrase I. and Wiltshire V. (2000) National and Local Employment Impacts of Energy Efficiency Investment Programmes: Results and task reports A contribution to the SAVE Employment Project XVII/4.1031/D/97-032.
The Wise Group (1994) Intermediate Labour Markets. Wise Group, Glasgow.

Appendix A: Input-output and macroeconomic modelling.

Input-output modelling

Jeeninga et al. (1999) used the case study data to investigate indirect employment effects using a dedicated input-output (I/O) model. A description of the methodology follows.

I/O modelling allows one to trace the economic impacts of investment decisions to all the economic sectors affected. The models are static, in that co-efficients relating economic sectors are fixed in national statistical tables, and no dynamic relationship between demand, prices and quantities is made. This contrasts with general equilibrium modelling (which investigates macroeconomic effects, described below), in which all these variables are allowed to vary so that an equilibrium situation can be achieved. Since unemployment itself is a non-equilibrium situation, static I/O modelling can have certain advantages over macro-economic modelling when considering employment impacts.

In this study, conventional I/O modelling was enhanced by also considering consumer behaviour. Households are distinguished by age, income, education level, number of adults and number of children. Their consumption patterns are then modelled for broad expenditure categories such as food, clothes, home, leisure, transport and health. These expenditure categories are subdivided into 16 groups. It is also assumed that a proportion of household income goes into savings. The combination of national I/O tables and national consumption functions allows estimation of the indirect employment impacts of changes in consumer expenditure which result from energy efficiency programmes.

The impacts on employment resulting from energy efficiency programmes in the consumer sector can be divided into 4 categories:

1. Direct purchase effects. Employment is created in the sector manufacturing the energy efficiency device or measure, and in installation. These impacts are quantified directly in the case studies, where information was available.

2. Indirect purchase effects. The manufacturer will demand more goods from other sectors such as raw materials or components, thus stimulating further employment. This information was not generally available and is not quantified in this report.

3. Energy saving effect. Energy savings lead to direct and indirect job losses in the energy supply industries. Additionally, spending on energy efficiency devices, and subsequent reductions in energy bills, affect the household budget and spending in all other sectors, with consequent employment impacts. This household budget effect tends to create more employment than the losses in the energy supply industry, due to differing labour intensities in energy supply and general consumer-spending sectors. Where energy bill savings lead to increased household expenditure some of this spending will be on energy consuming appliances: this rebound effect is taken into account. Data from the I/O modelling for employment resulting from the energy saving effect are reported in this study.

4. Government budget effect. If programmes are supported by government expenditure this will affect their available budget and spending in other sectors. Similarly, programmes may affect the available public sector budget due to changes in unemployment benefit payments, and sales-tax receipts on energy. This will affect employment levels as labour intensity varies across economic sectors. These results are discussed in this study.

In order to calculate these effects a reference scenario must be created. This is the same as the policy intervention scenario in respect of all assumptions concerning key variables such as future energy prices, GDP growth and changes in labour productivity. The intervention scenarios are then investigated using data from the case studies on initial costs, maintenance costs, government outlay and energy cost savings. A base year of 1995 was chosen, with costs and savings over the lifetime of investments discounted to this base year. Employment impacts are then evaluated for years 2000 and 2010.

The payment method for energy savings investments affects the employment impacts, since different sectors will experience cash injections or withdrawals as a result, and labour intensity varies across these sectors. Energy savings investment can be financed in 4 ways (or a combination of them). These are:

1. General consumption budget. Households pay for the investment from their disposable income. This will increase economic activity (and employment) in the sectors producing and installing the energy saving device or materials, and reduce economic activity across all other sectors of consumer spending.

2. Loan financing. Assuming a bank loan is taken, this will transfer economic activity from the service sector to the domestic sector. As the loan and interest are repaid the transfer is reversed.

3. Subsidies. Provision of government subsidies will reduce government spending in other sectors, and increase spending in the household sector. For modelling purposes, an assumption has to be made as to how the government would otherwise use the money. Here, in general, it is assumed it would be spent within the government sector itself. This is a conservative assumption in that the government sector is very labour intensive, so employment gains from investment elsewhere will not be exaggerated.

4. Savings. Households can use savings, thus withdrawing funds from the service sector (banks) and injecting it into the household sector. It is then assumed that the household sector spending is reduced over the period of rebuilding savings to their former level, and because of the lost interest payments on the withdrawn savings.

The choice of methods of financing programmes was found to have a very significant effect on employment impacts. For example the government sector is labour intensive, so subsidies tend to transfer economic activity to less labour intensive sectors, causing a reduction in total

employment. However, in almost all cases the energy savings effect more than compensates for any loss of employment, as money is transferred out of the energy supply sector, which has very low labour intensity.

Macro-economic modelling

Capros et al (1999) used the case study data to investigate the wider economic impact of energy efficiency programmes. The case study data were used as a starting point, but the level of investment was scaled up in order that macroeconomic effects would be discernible in the model. A description of the modelling and key findings for the UK are presented below.

General equilibrium modelling was used to compare theoretical situations where the EU economy is enjoying general equilibrium growth, with and without diversion of funds into energy saving schemes. The GEM-E3 model allows dynamic economic (and employment) effects to be investigated on an EU-wide basis, unlike I/O modelling which looks at impacts within one country and affords a less dynamic, but more 'real world' perspective.

The model includes all EU member states, and considers 18 production sectors and 13 household consumption categories. Government expenditure is differentiated by financing method and policy types, such as carbon taxes. Trade relations between EU member states, and between the EU and the rest of the world, are also modelled dynamically (e.g. terms of trade automatically adjust to correct changes in national current accounts).

It is assumed that energy efficiency schemes result in an increase in expenditure on durable goods (e.g. appliances, insulation materials) but lower expenditure on energy. These changes affect expenditure across all consumption categories. Government funding causes an increase in public sector borrowing, and taxes have to be raised to repay the deficit. (This contrasts with the I/O modelling which assumes that any public funding is from a re-allocation of existing funds, reducing spending within the government sector and boosting spending in the residential sector). It is assumed that the government raises a carbon tax at the exact level necessary to repay the public borrowing over a period of 15 years.

For the UK study the total expenditure was scaled up 8 times, to £3.2 billion, spent over 5 years. This was necessary as the model is insensitive at the scale of the actual expenditures. The sectors benefiting from the expenditure, and the source of financing were the same as those in the case studies. The model predicted that during the investment period 12,600 additional jobs would be created in the UK, and in the long run employment would remain higher than in a business as usual case. Moreover the investment programme has a positive short term effect on GDP, and is neutral in terms of economic growth in the long run. Empirical evidence also suggests that countries with lower energy intensity (energy consumption per unit of GDP) enjoy higher rates of economic growth than their competitors.

Appendix B: The 'real' rate of unemployment

The official rate of unemployment in the UK in February 2000 was 6%, representing 1.16 million people of working age who are claiming unemployment benefits. In comparison with other EU countries this is a relatively low rate. However recent Research Council-funded research on the 'real level of unemployment' (Beatty et al, 1997) suggests that in 1997 there were a further 2 million people who were able and willing to work, but were excluded from the unemployment figures. The rate of 'hidden unemployment' has changed little since then. The authors define real unemployment as those who might reasonably be expected to have been in employment in a fully employed economy'

The data were calculated for 1997, when the official claimant count was 1.84 million. The additional 'hidden unemployed' were overwhelmingly those receiving long-term sickness benefits. In 1981 574,000 people received long-term sickness benefits, compared to 1,809,000 in 1995. This increase occurred at time when indicators of general health in the population showed a steady improvement. The authors of the report conclude that many of these people should actually be counted as unemployed rather than unable to work. In the past, mechanisms within the benefit system have made it in the financial interest of many jobless people to move from unemployment to sickness related benefits, and some have been actively encouraged to do so by the benefits agencies. Striking similarities in the geography of unemployment and long-term sickness in the UK appear to confirm the suspicion that the latter is a manifestation of the former. By examining the rate of long-term sickness in an area of full employment (the South east of England in 1991) the authors were able to estimate how many of those receiving long-term sickness benefits in 1997 were actually among the 'hidden unemployed'. The results are presented in Table 9, alongside three other categories of 'hidden unemployment'.

	MALE	FEMALE	TOTAL
CLAIMANT COUNT	1,407,000	429,000	1,837,000
HIDDEN UNEMPLOYED			
Extra LFS unemployed[1]	60,000	270,000	340,000
Government schemes[2]	260,000	150,000	400,000
Excess 'early retired'[3]	80,000	30,000	100,000
Excess 'permanently sick'	820,000	450,000	1.260,000
'REAL' UNEMPLOYMENT	2,620,000	1,330,000	3,950,000

Table 9. Alternative measures of unemployment, Great Britain, January 1997 (Beatty et al, 1997).

1 *Based on the quarterly Labour Force Survey, in which a sample of people are asked whether they are jobless and actively seeking work.*

2 *Persons on government employment schemes typically receive £10 per week in addition to normal benefits, and tend to consider themselves unemployed.*

3 *Persons for whom early retirement is a premature, enforced state due to the lack of job opportunities.*

Under these calculations the 'real' rate of unemployment was 14.2% in 1997, compared to the official rate of 7.1%. HM Treasury (1998) has acknowledged the scale of this unrecorded joblessness (see page 10).

These figures show that, despite appearances, unemployment remains a very real problem for millions of people in Britain. While this can be a tragedy for the unemployed, paradoxically it may help to explain the 'economic miracle' of the late 1990s in Britain. When unemployment falls below the 'non-inflationary rate' (about

8% in the UK) economic growth is expected to lead to wage pressure and cause inflation. Part of the reason for the recent steady economic growth without inflation may be that the real rate of unemployment has been considerably above this non-inflationary rate.

Published by:

Energy Saving Trust

21 Dartmouth Street

London SW1H 9BP

Tel: 020 7222 0101

Fax: 020 7654 2444

Web site: http://www.est.org.uk