KEMA Limited

States of Jersey

Energy Efficiency Study

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Executive Summary

The States of Jersey commissioned KEMA to produce an energy efficiency report to assist in establishing their energy policy. This energy efficiency investigation breaks down into three main areas.

- Areas for Improving Domestic Energy Efficiency;
- The role of micro generation; and
- Recommending a working framework to deliver energy efficiency improvements.

As with many other islands with limited domestic energy resources, electricity and fuel oil are the primary sources of space heating. Electricity is the primary fuel used by homes in Jersey with over 296,000 MWH consumed by the domestic sector in 2005. The time of electric system peak is the winter when the major electric end uses in the domestic sector are: heating, lighting, water heating and appliances. While the island is winter peaking there are some additional loads in the summer period. In particular there are over 300 swimming pools and many of these are heated by fossil fuels.

The largest proportion of household consumption is from space and water heating which will be driven by the state of the Jersey housing stock as well as efficiency of heating technology. The report evaluates the current Jersey stock and compares likely SAP ratings for different elements of the stock based primarily on English data. The different mix of heating fuels and in particular the lower prevalence of gas fired central heating in Jersey means that some caution should be taken in the precise SAP figures, but they will provide some guidance on the types of property where EE measures could be focused.

Utilising this review of the Jersey housing stock the report considers the key improvement measures that could be implemented in Jersey. This includes an indication of the energy saved from each measure as well as the potential number of dwellings where each measure can be applied. This has been done for improvements to the housing stock, appliances and lighting and also for micro-generation.

In order for any of these measures to be implemented beyond the level that is already occurring then energy efficiency programmes will need to be introduced. To determine the type of domestic energy efficiency programmes that may be suitable for Jersey an examination has been made of the domestic energy efficiency programmes that have been successful elsewhere in the world. The investigation has focussed on five main countries. These were:

- UK – similar climate and housing stock to Jersey;
- Ireland – Small country with similar climate to Jersey;

- Ontario, Canada – running some Innovative Demand Side Management Programme including smart metering;
- New Zealand – two islands with limited interconnection; and
- Vermont, USA – One of the most aggressive states in pursuing Demand Side Management.

Based on this international best practice and the appropriate measures for Jersey the report provides recommendations for potential programmes that will deliver an improvement in energy efficiency. The programmes have been classified into:

- Building Improvements – Programmes designed to improve the energy efficiency of the current and future building stock;
- Appliance and Lighting Improvements – Programmes designed to improved the energy efficiency of the current and future stock of appliance and lighting;
- Behavioural Changes – Programmes designed to improve customers' attitudes to the use of energy and take actions to reduce their consumption.

Alongside energy reduction programmes there is the possibility of obtaining energy from renewable sources. This is considered at a small scale level with a number of different micro generation technologies. Most of these technologies are still relatively expensive in comparison to energy prices and have a relatively long payback period. However, declining technology prices as micro generation becomes more widespread and increasing energy prices may improve these figures in the future. Currently, based on UK prices the micro generation technologies that appeared the most viable were Pool Heaters, Geothermal Heat Pumps, Biomass Boilers and Small Wind Turbines.

Several international programmes are considered that promote the use of micro generation on a domestic level to consider what ideas could be introduced in Jersey. Based on the review of technologies and the review of other programmes we would propose initially that Jersey considers:

- The promotion of Solar to Heat Pools - Pool heating is a sizable end use on Jersey and this technology has one of the best paybacks; and
- Promoting renewable technology in schools.

A new body is needed to raise the awareness of energy savings measures and to co-ordinate the delivery of both the energy efficiency and/or micro generation programmes. We have termed this organisation Sustainable Energy Jersey (SEJ). A final name can be agreed once a decision on the structure and form of the body is determined. There are several different scopes outlined for the SEJ which give a number of options for its structure. These range from a low budget organisation that essentially co-ordinates existing programmes up to a larger organisation that undertakes co-ordination, promotion and enabling of energy efficiency activities directly.

Whichever scope is chosen for the organisation one of its requirements for the organisation will be to determine the priority of the objectives. Whilst those suggested are largely complimentary there will at times be conflict between the relative importance of the objectives, particularly if there are limited funds available for only a subset of proposed programmes. This potential conflict of objectives means that it is important to have the right membership of SEJ and a potential list of members is provided.

The final section suggests a budget for the period from 2007 to 2010 and the programmes that could be undertaken with this level of funding. The budget is based on a gradual ramp up of staff and programmes starting with a partially funded year of £490k in 2007 up to £1355k in 2010. An important point to note is that provision has been made for a smart metering scheme; such schemes have been viewed as important by many governments in allowing consumers to better understand and reduce their consumption.

1. Introduction

1.1 Background

Rising energy prices throughout Europe and increased recognition of the need to save Carbon has led to a renewed emphasis on the need for energy efficiency. Significant work is being undertaken in many nations to understand the technical potential for energy efficiency and the programmes that can be implemented to help achieve this potential and overcome the barriers stopping energy efficiency being widely adopted by consumers. Demonstrating its part in this process the States of Jersey have commissioned KEMA to produce an energy efficiency report to feed into its first energy policy. This energy efficiency investigation breaks down into three main areas.

- Areas for Improving Domestic Energy Efficiency – This includes an assessment of the current housing stock, areas for improvement and successful international programmes;
- Recommending a working framework to deliver energy efficiency improvements – including the costs, resources and structure of an appropriate organisation to deliver measures identified in the housing stock survey; and
- The role of micro generation- considering the possible viability of different technologies at current electricity prices and international programmes to promote micro generation.

KEMA's investigation will cover these three areas as separate sections in the report. The first two sections will build up a number of potential programmes that could be implemented in Jersey to save energy either through the improving the energy efficiency in Jersey or through the introduction of micro generation technologies on a larger scale. Some of these programmes will potentially overlap with carbon saving schemes allowing the use of either micro generation or energy efficiency measures to achieve a set amount of carbon savings. In determining recommendations an assessment is required on the applicability of programmes that have worked well internationally bearing in mind the demographic and geographic characteristics of Jersey.

The next section of our report considers the most appropriate formation of a body to oversee the implementation of some of the programmes suggested and meet the scope outlined in the tender document. This recommends objectives, membership, structure and governance of an authority based on what has worked well internationally and what is suitable for Jersey giving the recommended programmes for improving energy efficiency.

The final section in this report considers potential budget options to deliver energy efficiency programmes in Jersey.

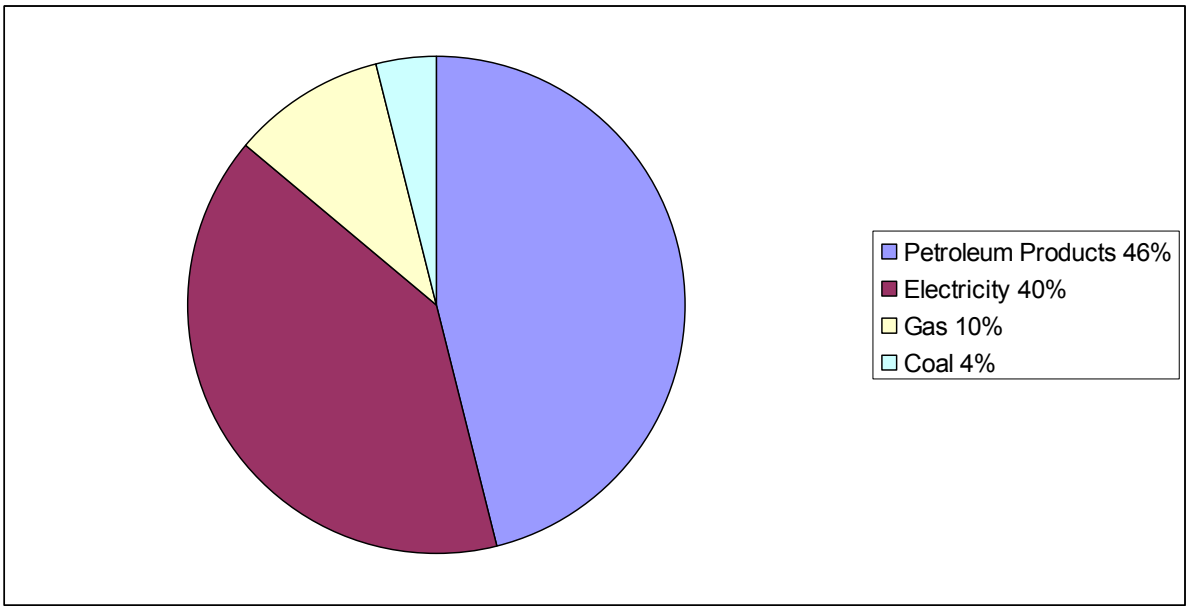
2. Areas for Improving Domestic Energy Efficiency

2.1 Domestic Energy Consumption in the Jersey

In this section we describe the current situation in Jersey. This includes the number of domestic consumers (also referred to as household demand), their level of consumption and the fuel types being used.

Household demand is a major user of energy consumption in Jersey and makes up around a 1/3rd of total energy consumption in 2005. This was consumed by 38,376 households in 2005, an increase from 35,562 from 2001. The fuel used for this divides up into the proportions shown on the Pie chart below[1].

Figure 1 Domestic Energy Consumption by Fuel Type



The relatively high use of petroleum products and electricity is notable and common for islands of Jersey's size where there is a need for space heating and where the gas network does not have full coverage and may have relatively high costs. A more detailed breakdown of household energy consumption is shown in the table below

[1] Jersey Energy Trends 2005

Table 2-1 Fuel Consumption per Household

Fuel	Total Domestic Consumption	Average per Consuming Household per Year
Electricity – All Domestic Consumers	296,200 MWh	7,720 kWh
Electricity -- Standard Tariff		6,500 kWh
Electricity Comfort Heat		9,000 kWh
Gas – All Homes	71,800 MWh	8,000 kWh
Heating Oil (kerosene)	26,600 tonnes	

Electricity consumption has grown steadily in Jersey over the past 14 years with domestic electricity consumption making up half of the total at 296,200 MWh. This is a high average figure per household of 7,720 KWh when compared to a UK average mean consumption of 5,300 kWh per household. Part of this higher average level is due to the large percentage of customers that use electricity for heating. However, even customers on the standard (single rate) tariff (who will primarily not use electricity for heating) use 6,500 KWh per annum compared with an average of 3,300 kWh in the UK[2].

This high level of average electricity consumption may partly reflect the relative size of properties, which anecdotally appear on average larger than in the UK. However, irrespective of size, for those without electric heating it could be a result of inefficient appliances, low levels of efficient lighting and behavioural aspects that mean customers do not switch off lighting and appliances when not required. Programmes to address all of these aspects are considered later in this section.

Part of the high consumption of electricity is its use as a key heating fuel. This represents a major difference between the UK and Jersey. In the UK gas is the most common fuel for household heating, whilst this is only used by a relatively small percentage of customers in Jersey. In addition, the other major difference is the large amount of heating oil used by domestic customers.

In Jersey overall heating oil consumption was 33,840 ton of oil equivalent (toe) compared to 53,030 toe for electricity. This is a high relative use of heating oil with Jersey having a consumption of ten times the UK level per head for heating oil. This level of heating oil has a negative impact on Jersey's carbon emissions, particularly when compared to the current electricity alternative which can be seen as very low carbon having been sourced from nuclear and hydro generation in France. Programmes to encourage fuel switching can be developed, but this will depend on whether Jersey has primary

[2] These figures are average consumption for 2003. In 2005 this had increased to 6,800 kWh for standard tariffs and 10,000 kWh for comfort heat.

objectives for energy savings, or carbon saving. This is considered further is section 4, which examines the most appropriate objectives for a sustainable energy body in Jersey.

2.2 Energy Characteristics of Housing Stock in Jersey

Energy used for heating is the most significant form of consumption for most households making up 73% of the domestic emissions in the UK[3]. It is therefore important to consider the composition of this housing stock in order to devise programmes that will save energy in the most efficient way. Detailed data for Jersey is not available on many of the key energy efficiency parameters of the housing stock due to the cost and time required to collect it. Following discussions with key stakeholders in Jersey, who have described the housing stock, it is considered reasonable to view the housing stock to be analogous to that of the UK at the level of detail required. As a consequence the Jersey housing stock is considered in the context of available UK and English data together with specific issues described during discussions in Jersey e.g. the level of rented property.

The factors that have the greatest correlation with energy performance of the existing stock are the age and dwelling type/size as well as ownership. The following section takes a high level look at these factors based on available Jersey data (with some assumptions) and proxies from the UK.

2.2.1 Property Age

A detailed breakdown of the age of the entire housing stock in Jersey is not available. However, a breakdown of property age does exist for the States of Jersey housing stock. Whilst this will underestimate the amount of new houses (as they do not have a proportionate share) it may provide a guide to the rest of overall stock as often some houses were sold on the market to first time buyers and some kept for social housing. It also reflects anecdotal evidence that a lot of the housing stock was built in the 1970s and 1980s. This table of age composition is shown in the table below.

[3] Communities and Local Government – Review of the Sustainability of Existing Buildiings – The Energy Efficiency of Dwellings

Table 2-2 States of Jersey - Housing Stock

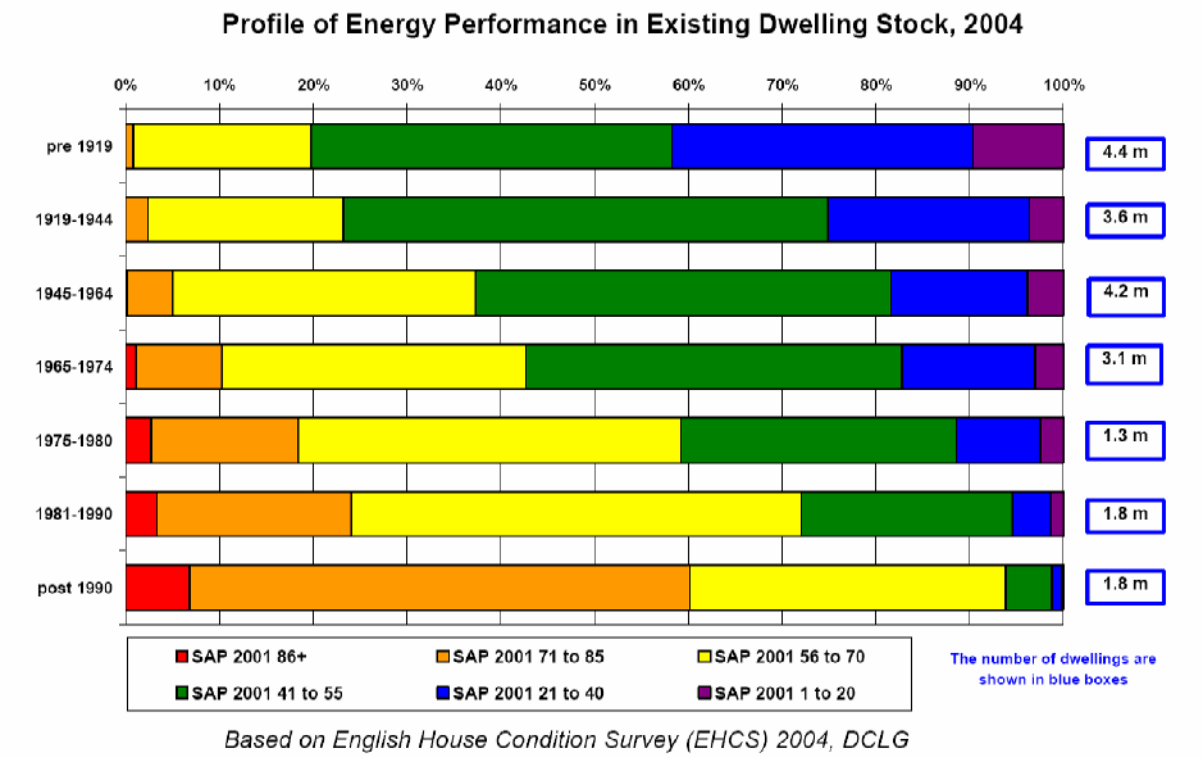
Age	% of Dwellings
1900 -1949	4%
1950-59	12%
1960-69	11%
1970-79	40%
1980-84	11%
1985-89	10%
1990-99	12%
2000	0.5%

Houses built before the mid 1980s would not have had building regulations that required any insulation. Many of them would have been built with aluminium single glazing rather than double glazing. Whilst a proportion of these properties will have been retrofitted with insulation, double glazing and draught proofing there will be a large number that are still poorly insulated.

The lower levels in insulation before the mid 1980's are demonstrated in the Standard Assessment Procedure (SAP) ratings[4] that have been calculated for England and are shown in the diagram below. It is assumed that the UK SAP ratings will be similar to the figures for Jersey, although the England levels may be slightly higher due to long running energy efficiency programmes such as the Energy Efficiency Commitment, Energy Efficiency Standards of Performance and Warm Front. The diagram shows, as may be expected, a picture of increasing SAP levels over time. A step change in SAP ratings can be seen from 1990 when new UK building regulations came in and it is expected that this increase in SAP rating will be reflected in the newer Jersey stock, albeit a couple of years later. This implies that the emphasis of programmes to improve SAP ratings should be on properties built before 1990, which is consistent with the anecdotal evidence from Jersey.

[4] The SAP ratings measure the fuel efficiency of the heating system and thermal efficiency of the building fabric

Figure 2 Energy Performance in Dwelling Stocks in England[5]



2.2.2 Type of Property

Dwelling type will also have a significant impact on the SAP ratings. The table below shows a breakdown of the Jersey housing stock in 2001 with the average SAP values from England shown for each dwelling types alongside the housing chart. These SAP values for Jersey are likely to be similar to those given in England and have been derived from Energy Use in Homes Energy Efficiency report[6]

[5] Sourced from Review of the Sustainability of Existing Buildings: The Energy Efficiency of Dwellings Initial Analysis, Department for Communities and Local Government

[6] Energy use in Homes series prepared by BRE with funding from Defra.

Table 2-3 Private Household by Type of Dwelling Occupied

Type of Dwelling	Number	% Private Households	Indicative Average SAP
Whole House or Bungalow			
Detached	10,401	29	49.3 (Bungalow 46.4)
Semi Detached	6,782	19	48.3
Terraced	3,879	11	50.4-50.9
Flat, Maisonette, Apartment			
Purpose Built	7,510	21	Low rise 60.9, High rise 52.3
Part of a Converted House	5,799	16	42.7
In a Commercial Building	1068	3	n/a
Temporary or Mobile Structure	123	-	n/a
Total	35,562	100	(UK Mean 50.6)

The highest SAP ratings are generally obtained in purpose built low rise flats. Two reasons for this are the low level of external surfaces, which reduces heat loses and the high proportion that are modern and are more likely to have efficient space and water heating systems. Flats in Jersey are almost all low rise with the only exceptions all being owned by the States of Jersey. These high rise flats already have plans for improved insulation and therefore better SAP.

Detached houses and particularly bungalows tend to have relatively poor SAP ratings. This is primarily due to the large external envelope of these properties which increases heat loss. This makes it important that these properties are well insulated.

The least efficient stock is that made up of converted flats. As an example in England 18% of converted flats had a SAP rating that was below 30, with the average rating only 42. Converted flats tend to have the lowest level of insulation with a high percentage of less efficient heating. These represent a significant opportunity for improvements in both insulation and heating systems, but may also have a higher than average level of private landlord ownership making change potentially difficult.

2.2.3 Ownership of Dwellings

As well as housing type the ownership of property will also impact on the relative energy efficiency of property. The ownership of the different types of property in Jersey in 2001 is shown below along with an indicative SAP rating using English figures[7].

Table 2-4 SAP Levels by Tenure

Tenure	Households	Mean SAP
Owner-occupier	18,026	49.9
Social-rented	5,017	53.6 Local Authority 60.3 Registered Social Landlord
Private Rental	7,854	45.3
Tied (Staff)	1,700	n/a
Private Lodging	1,539	n/a
Lodging House	1,268	n/a
Other	149	n/a
Average		50.6

The relatively good performance of the local authority and social landlord is likely to be reflected in the figures for Jersey. In discussions with the States of Jersey housing department they already have a plan for improving the energy efficiency of the entire stock. However, this does take a number of years due to funding constraints.

The UK experience suggests that the lowest level of SAP ratings reside with private landlords. Private landlords represent 22% of the housing stocks and therefore are likely to have significant potential to improve the SAP ratings of their properties. There may however be some sensitivity in funding this with public funds, despite the potential for improvement, due to individual landlords benefiting.

2.2.4 Space and Water Heating

Heating of premises is one area where there may be a difference between Jersey and England. This needs to be further investigated as it may result in different SAP ratings between the two countries reflecting the different mechanism for heating.

In England in 2001 86% of houses had central heating as their primary heating system. 8% of dwelling have programmable heating as their primary provision, 6% have fixed heating and <1% have

[7] Energy Use in Homes: Energy Summary Report 2005

non fixed heating. However, of this 86% of dwellings with central heating 91% were gas fired and another 4% were fired by fuel oil. In Jersey whilst there is a sizeable reliance on heating oil and gas to provide central heating, many household rely on electricity for heating, which is more likely to programmable heating.

Without research on the Jersey heating stock it is not possible to estimate the proportion of households that have central heating which is likely to be different to England. Ideally this date should be collected soon as it may provide important evidence as to the types of heating used in different types of premises and provide guidance as to where funding may be needed to improve heating systems.

2.3 Measures to Improve the Jersey Housing Stock

There are a number of key measures that can be used to improve the energy efficiency of the housing stock. This includes:

- Hot Water Insulation;
- Cavity Wall Insulation;
- Loft Insulation;
- Improved Heating Controls;
- Draught Proofing;
- Solid Wall Insulation;
- A Rated Boiler; and
- Double Glazing

A summary of the potential energy, cost and Carbon that could be saved by each of these measures is shown in the table below. The calculations are based where possible on Jersey data, but this has been supplemented by UK data from DEFRA[8]. Some caution needs to be applied to these figures to reflect the fact that they are a mixture of UK data and Jersey estimates rather than all being based on actual data measured or calculated in Jersey for the purpose of this analysis. However, the table does provide a useful guide as to the scale of savings for measure.

[8] Data sourced from DEFRA's First Draft Illustrative Mix of Measures for EEC 2008-11 and the Review of the Sustainability of Existing Buildings The Energy Efficiency of Dwellings Initial Analysis

Table 2-5 Summary of Potential Carbon Savings for Key Measures in Jersey

Measures	Kwh/ Year Saving	Jersey Energy Cost Saved per Year	Jersey Cost per Unit	Jersey Carbon Saved per Year kgC/yr	Estimate Jersey Dwellings	Max Potential Carbon Savings/ yr tonnes	Cost/ Annual kg Saved
Hot water insulation	941	56	25	44	10362	457	0.57
Cavity Wall Insulation	4217	240	568	212	19650	4167	2.68
Loft Insulation (professional)	3312	189	475	167	4747	791	2.85
Loft Insulation (DIY)	2775	158	241	140	4747	662	1.73
Improved Heating Controls	1457	83	251	73	3556	261	3.42
Draught Proofing	743	42	171	37	20339	760	4.57
Solid Wall Insulation	12085	689	4676	608	5228	3177	7.69
A Rated Boiler	1951	94	329	153	17615	2694	2.15
Glazing E to C	458	26	354	23	6140	141	15.38

Each of the columns in Table 2-5 have been derived as follows

- **KWh Year Saving** - These are DEFRA calculations of the saving for each measure and are UK data. No adjustment has been made for Jersey as there is no clear scaling factor that could be applied for each measure.
- **Jersey Energy Cost Saved per Year** – This has been calculated as a two step process. First an estimate is made of the average number of units of each fuel that would be saved based on the appropriate fuel mix used for space heating and water heating in Jersey. The number of units of each fuel saved is then multiplied by energy prices in Jersey to calculate the energy costs saved for each installation of the measures.
- **Jersey Cost per Unit** - These costs are scaled up versions of the UK costs based on discussions with participants involved in energy efficiency measures in Jersey. The appliance based measures have been increased by 30% from UK costs and the other measures increased by 40%.
- **Jersey Carbon Saved per Year kgC/yr** - The calculation of Carbon saved per annum requires the breakdown derived earlier of units saved of each fuel type multiplied by the

carbon intensities of each fuel for Jersey. These carbon intensities have been calculated as 0.022kgC/KWh for electricity[9], 0.074 kgC/KWh and 0.068kgC/KWh for gas.

- **Estimated Jersey Dwellings** – This is an estimate of the number of dwellings in Jersey that could benefit from each of the measures. An explanation of how this number is derived for each potential measures is provided below.
- **Max Potential Carbon Saved per Year** – This is the amount of carbon saved per installation multiplied by the number of dwellings to which the measures could be applied.
- **Cost/Annual kg Saved** - The costs per kg Carbon saved is the cost per measure divided by the carbon saved for each measure.

Additional details on each of the measure and number of remaining beneficiaries is provided below.

2.3.1 Hot Water Insulation

Insulating Hot Water Cylinders is a low cost measure that has already been widely adopted. In Jersey 73% of households were aware that they already had an insulated hot water tank. This only leaves 27% of households where some action could be taken and this figure may be optimistic as some householder may have had insulated tanks done by builders without actually being aware of this energy efficiency improvement. Utilising this estimate of 27% households where insulation may be required and the 2005 stock of dwellings gives a maximum of 10,362 premises that could benefit from this improvement.

2.3.2 Cavity Wall Insulation

Cavity Wall Insulation (CWI) refers to an insulating layer being present in the internal cavity of an external wall. When fitted retrospectively it involves the process of injecting an insulating material (usually fibres, beads or foam) in-between the inner and outer leaves of masonry that make up an external cavity wall.

A prerequisite to CWI is the existence of a cavity wall, which is more common in post 1919 properties. This is shown in the Table below of wall construction for different age properties in England[10].

Table 2-6 External Wall Type by Property Age

Main wall Type	Pre 1919	1919-44	1945-64	1965-80	Post 1980
Cavity	14.9%	58.5%	86.2%	91.9%	97.3%
Solid	84.7%	41.1%	13.3%	5.9%	1.25

[9] Figure for average carbon intensity supplied by EDF
[10] Sourced from Energy Use in Homes: Thermal Insulation

Other	0.4%	0.4%	0.5%	2.1%	1.5%

Comparing the States of Jersey age of property figures with the percentages of properties in England that have cavity walls allows an estimate as to the stock of properties in Jersey with cavity walls.

Table 2-7 Estimate of Cavity Wall Insulation in Jersey

Year	Percentage of Stock	Estimate with Cavity Walls
1900 -1949	4%	1%
1950-59	12%	9%
1960-69	11%	9%
1970-79	40%	36%
1980-84	11%	10%
1985-89	10%	9%
1990-99	12%	11%
2000	0.5%	0.5%
		85%

Our analysis has assumed that 85% of the 2001 stock of houses could benefit from CWI, which equates to a total of 30,228 pre 2001 dwellings that could get CWI (it is assumed that houses built after this date will have appropriate insulation). In England it is estimated that approximately 35% of houses already have CWI by 2001. Applying this figure to Jersey gives a figure of approximately 19650 dwellings that could benefit from CWI.

2.3.3 Loft Installation

The subset of houses that could have loft insulation is houses with pitched roofs. This data for all houses and bungalows from the 2001 data above gives 21,062 dwellings. Whilst part of the converted houses could also have loft installation they have not been included as it is difficult to estimate how many flats in converted houses will have pitched roofs.

Having derived a figure for total number of premises with pitched roofs an estimate is needed of the number of house that will still have unconverted lofts and therefore be eligible for improved or first fit insulation. This is estimated at 98% of the premises that have pitched roofs. Over half (54%) of the homes in Jersey with a loft have it fully insulated so the calculations have therefore assumed that 46% of households with pitched roofs and unconverted lofts will be able to have loft insulation which equates to 9,494 dwellings. To avoid double counting this number has been split between lofts where the installation may be done professionally and those where a DIY approach is adopted.

2.3.4 Improved Heating Controls

Heating control should enable the user to obtain control of room temperature and temperature of stored hot water. The controls should include on/off times for heating and hot water and switch off the boiler when heating is no longer required. Thermostatic Radiator Valves will provide extra benefit of individual room temperature controls.

The Building Research Establishment had a 2001 figure that represents around 10% of UK houses did not have any controls. A similar percentage has therefore been applied to the 2001 stock of houses in Jersey to derive an approximate figure for potential in Jersey of 3,556 dwellings.

2.3.5 Draught Proofing

This would require remedial draught proofing of doors and windows and is generally done in conjunction with the installation of cavity wall or loft installation. It is hard to quantify the demand for this service and in particular how much draught proofing has already been done by customers. Draught Proofing has been defined as including single glazed windows that have been draught stripped as well as double glazed windows (as double glazing includes integral draught seals)

In Jersey in 2006 over 53% have no internal or external draught excluders. On this assumption based on the 2005 dwelling stock there would be 20339 dwellings that could benefit from improved draught proofing.

2.3.6 Solid Wall Insulation

There are two main forms of insulation that could be applied to these walls which are either some form of external wall insulation or the application of an internal dry lining. Either form of insulation is significantly more expensive (approximately ten fold) than insulating properties with CWI.

In England only 2% of solid walled dwellings are insulated.[11] Dwellings in the social sector are more likely to have solid wall insulation where 10% of Solid wall dwellings have insulation compared with only 1% in the private sector.

It is assumed that the 15% of properties that did not have Cavity Walls in 2001 would have been of solid wall construction. Applying these calculations to Jersey's 2001 stock would give 5,228 dwellings that could potentially benefit from solid wall insulation.

[11] The low level of insulation means that errors are possible within this sample.

2.3.7 A Rated Boilers

One area for improvement is the replacement of old boilers with new and more efficient boilers. Typically this measure will see the introduction of a condensing boiler that will heat water on demand. This is of relevance for the housing stock with gas and oil boilers that may be persuaded to upgrade. This analysis has assumed a total of 51% of 2005 dwellings have gas or oil boilers of which only 10% may already be efficient. This gives a figure of 17,615 dwellings that could gain from a move to 'A' rated boilers.

2.3.8 Double Glazing

In England approximately 76% of dwellings had some level of double glazing in 2001. 51% of the dwellings have the entire dwelling double glazed, whilst 34% have none or less that half of the dwelling double glazed. Jersey figures from 2006 compare favourably with England with 68% of homes have double glazing everywhere in the house, which may reflect the lower percentage of older properties in Jersey. This leaves only 32% of properties that can benefit from doubling glazing. Based on experience in the UK it is estimated that half of this 32% will have no double glazing at all. This figure of 16% of the 2005 properties (6140) has therefore been used to calculate the potential gain from double glazing[12]

2.3.9 Comfort Taking

All savings estimated in this table have been done on a gross basis and take no account for comfort taking. This comfort taking is estimate at up to 30% of potential savings for heating related measures. This will need to be considered in selection of appropriate measures required to meet any carbon targets.

2.4 Key Areas for Improving Appliance Use of Energy

As noted in the previous sections in households the major electric end uses are:

- Lighting
- Fridges
- Freezers
- Consumer electronics
- Laundry
- Miscellaneous such as towel heaters and kettles
- Air conditioning (very limited)

[12] Properties with some double glazing could also gain from further double glazing, but it is unclear how much of the property could gain from further double glazing and for simplicity these dwellings have not been included.

Table 2-8 presents the major equipment options that are appropriate for these end uses to improve efficiency.

Table 2-8 Domestic Electric Savings Options

End Use	Options
Lighting	CFL replacements for bulbs CFL replacements for fixtures Timers and controls Reduced Usage
Consumer electronics	More efficient models Standards
Laundry	More efficient models Standards
Fridges and Freezers	More efficient models Standards
Air Conditioning (very limited)	Higher SEER models

The potential savings for the key appliances are shown below. It is suggested that 93% of the current stock of premises should be able to benefits from increased CFLs and torchieres[13] as indicated in the latest Jersey social survey. The table shows the measure benefits from an individual installation and it may be possible to do multiple installations for each dwelling. On wet and cold appliances[14] it is assumed that there has been a gradual movement to more efficient appliances as part of regular replacement, but the current stock is still fairly inefficient. A level of 80% of household appliances that could be improved is therefore used. Further analysis is needed to confirm this figure.

As with the heating measures the estimates of carbon saving are based where possible on Jersey data supplemented with UK data from DEFRA. The calculations are as outlined in Section 2.3 although the saving are all based on electricity only rather than a mix of fuels. The savings made are based on a single installation of each measure per dwelling and it is likely that some of the measures such as CFLs will have multiple installations in dwellings. It should be noted that the current amount of carbon saved in Jersey will be relatively small compared to international levels due to the low carbon nature of the electricity that Jersey imports.

[13] Torchieres are upright lamps

[14] Wet appliances are dishwashers and washing machines. Cold appliances are fridges and freezers.

Table 2-9 Summary of Carbon Savings for Appliance Measures in Jersey

Measures	Kwh/ Year Saving	Jersey Energy Cost Saved per Year	Jersey Cost per Unit	Jersey Carbon Saved per Year kgC/yr	Estimate Jersey Dwellings	Max Potential Carbon Savings/ yr tonnes	Cost/ Annual kg Saved
CFL	28.7	3	3	0.6314	35689.68	23	5.35
Torchiere	50	5	26	1.1	35689.68	39	23.64
Wet Appliances	102	8	168	3.77	30701	116	44.50
Cold Appliances	34	3	34	0.748	30701	23	45.19

2.5 International Energy Efficiency Programmes

2.5.1 Objective

To determine the type of domestic energy efficiency programmes that may be suitable for Jersey a key area of investigation has been to examine what domestic energy efficiency programmes have been successful elsewhere in the world. The assessment has considered formal energy efficiency programmes as well as other initiatives and policies that have had an impact on the level of domestic energy efficiency. One deliberate omission involves programmes that are focussed on micro generation; these are examined in section 4 of this report.

All of the programmes have been assessed using four main criteria which are: an overview of the programmes; costs and benefits; numbers of customers; and barriers to successful delivery. The final section in each review then provides a view as to how applicable each programme would be for Jersey and what elements may need to change.

The investigation has focussed on five main countries. These were:

- UK – similar climate and housing stock to Jersey;
- Ireland – Small country with similar climate to Jersey;
- Ontario, Canada – running some Innovative Demand Side Management Programmes including smart metering;
- New Zealand – two islands with limited interconnection; and

- Vermont, USA – One of the most aggressive states in pursuing Demand Side Management.

In addition to programmes in these countries the investigation has included a number of relevant examples from selected other countries where it was felt these programmes may provides useful lessons of the most applicable solutions for Jersey. Appendix A provides the detailed analysis of each of these programmes. This section provides a summary of KEMA's findings in respect of these programmes.

2.5.2 Breakdown of Programmes

Whilst the Appendix has examined domestic energy efficiency programmes by country, this assessment has grouped the programmes by key characteristics. Broadly programmes can be classed as falling into one of three categories.

- **Building Improvements** – Programmes designed to improve the energy efficiency of the current and future building stock;
- **Appliance and Lighting Improvements** – Programmes designed to improved the energy efficiency of the current and future stock of appliance and lighting;
- **Behavioural Changes** – Programmes designed to improve customers' attitudes to the use of energy and take actions to reduce their consumption.

The table below indicates the focus area of each of the programmes. Some of the programmes are deliberately included more than once where they fit across more than one category. The high number of building programmes indicates that this is generally seen as an area where there is a lot of potential and can result in good carbon savings for each pound invested in the programme.

Whilst numerically there appears to be less behavioural programmes, this should not be reflected in the value given to educating customers about energy efficiency and energy use more generally. In order for a number of the buildings and appliances/lighting programmes to work it is important that domestic customers value and respond to the energy information they are given. This suggests that many of these programmes would also require some degree of behavioural change by consumers even if this only impacted on purchasing decisions in light of information from building or appliance programmes.

Table 2-10 Breakdown of Energy Efficiency Programmes

Buildings and Heating	Appliance/Lighting	Behavioural Changes
Energy Efficiency Commitment (UK)	Energy Efficiency Commitment (UK)	Commit to Save your 20% (UK)
Warm Front (UK)	Energy Labelling (Irl)	Energy Matters (UK)
Energy Performance Certificates (UK)	Power Smart at Home (Ontario)	Power Smart at Home (Ontario)
Building Regulation Part L for Existing Dwellings (UK)	Cool Savings Rebate (Ontario)	Low Income Conservation and Demand Management Programme (Ontario)
Building Regulation Part L for New Dwellings (UK)	Every Kilowatt Counts (Ontario)	CO_2 Diet Japan
House of Tomorrow (Irl)	Low Income Conservation and Demand Management Programme (Ontario)	State-wide Pricing Programme (California)
Warmer Homes Scheme (Irl)	Residential Energy Efficiency (Canada)	
Building Energy Ratings (Irl)	Residential Energy Services Retail Efficient Product (Vermont)	
Power Smart at Home (Ontario)	Existing Residential Homes (Vermont)	
Low Income Conservation and Demand Management Programme (Ontario)	Residential New Construction (Vermont)	
Residential Energy Efficiency (Canada)	Energy Efficiency of Products (NZ)	
Existing Residential Homes (Vermont)	Energy Efficient Product Retailer Assessment System (Japan)	
Residential New Construction (Vermont)		
EnergyWise Home Grants (NZ)		
Home Energy Rating Scheme (NZ)		

The following sections assess each of these categories of programmes to establish common themes and consider what programmes may be applicable for Jersey.

2.5.3 Buildings Programmes

Programmes to improve the efficiency of buildings are the most significant elements in the international programmes examined. Depending on the current stock of housing these programmes can initially achieve impressive carbon savings in relation to the cost. These programmes are sometimes targeted at older (and the least efficient) properties such as in New Zealand where houses had to be pre 1977, but more often these programmes are targeted at the fuel poor.

Most countries studied have at least one policy aimed at helping low income consumers. As an example the UK runs the Energy Efficiency commitment where 50% of the energy targets to be met by the priority group and Warm Front which is aimed at the Fuel Poor, Ontario have a Low Income Conservation and Demand Management programme, whilst Ireland has a Warm Homes scheme similar to that in the UK. As these programmes can often require a substantial outlay per household with cavity wall insulation, loft insulation and new boilers common, it is understandable that governments and Trusts are keen that they should be targeted at the fuel poor. However, the introduction of this split objectives is likely to reduce the amount of carbon that can be saved for each pound invested in a DSM Programme as there is a cost associated with targeting only a subset of customers.

As well as the desire to improve the existing stock of house there is an aim to improve the standards of new houses being built and ensure that upgrades are of a high quality. This appears to be achieved using a mixture of mandatory standards alongside incentives for builders who increase the energy efficiency of their dwelling above the minimum standards. The UK Part L for 2006 will increase the minimum standards for both new properties and existing dwellings and are likely to be adopted in Jersey in a couple of years. Ireland is currently running a House of Tomorrow programme which provides incentives for builders that make the energy performance of their building at least 40% above that required by the building standards. This does come at a relatively high cost with grants of up to €8,000 available for each new property. There are other lower cost and lower support programmes that do exist with actions such as having advisors review blueprint for new houses and make energy efficiency recommendations (Ontario and Vermont).

Alongside standards and incentives are the information requirements on energy efficiency of new properties that many countries are now introducing. In Europe this is driven by the European Performance of Buildings Directive, but it is also being introduced elsewhere such as New Zealand. Under the UK and Ireland programmes each house that is being sold or rented will need to have an Energy Rating (similar to appliances) along with a list of measures that could be done to improve the energy efficiency of the house. These programmes are still being introduced, but it is clear that to be

really successful it needs buyers and renters to value the information in these packs and for this to influence their purchase/rental decisions.

2.5.4 Appliance/Lighting Programmes

Lighting has traditionally been a large area for potential saving of energy and is a low cost way for consumer to save both energy and money, partly due to the long lifetime of the product. Promoting energy efficient light bulbs therefore remains a key part of many programmes. In the UK as part of the Energy Efficiency Commitment suppliers distribute energy efficiency light bulbs to their customers. In Vermont and Ontario the preference is to give rebate coupons to customers to purchase cheaper energy efficient light bulbs. This is believed to get customers into the habit of purchasing efficient lights and paying for the products means that they have a higher perceived value to the customers. The aspiration is that customers will become repeat purchasers.

Rebates are often also used in North America to try and move customers to higher energy efficient appliances, particularly for refrigeration. BC Hydro goes further and offers to pick up, recycle and pay small incentive fees to owners of old inefficient refrigerators. In the UK the EEC provides for assistance with the additional cost of highly efficient appliances over those that are not efficient. Other typical rebated goods include programmable thermostats, dimmer switches and even Seasonal LEDs in Ontario.

In addition to financial incentives customers that are better informed can also be persuaded to buy higher efficiency products. Through out Europe there are mandatory Energy Labelling laws that show the efficiency of appliances with energy consumption ranging from A to G. In Ireland there are a team of inspectors who monitor retail outlets for the correct operation of the scheme with a potential fine of up to €3,000 or a jail sentence of up to 6 months. In Japan a softer approach has been taken with retailers who promote energy efficient goods being able to display a logo and being promoted by the Energy Conservation Centre.

A final method for raising the efficiency of products is to make it mandatory (or almost mandatory) for appliances to be above a certain standard or to work with manufacturers to persuade theme to improve energy efficiency standards. The most famous example of working with manufacturers is the Top Runner Programme in Japan, where manufacturers were persuaded to raise the energy efficiency of many of their products. Achieving these reductions is a result of the power that comes from being a large nation that can put sufficient voluntary pressure on a supplier. Despite its size a more mandatory approach has been used in Europe where minimum standards have been introduced for fridges and freezers, but not for other appliances. Jersey being outside the EU is not governed by these rules, although this may be a positive options as the State would have the power to introduce even tighter standards, an option not available to individual members of the EU.

2.5.5 Behavioural Change Programmes

The final element of energy efficiency programmes is about changing customer behaviour. Education and valuing energy efficiency is a critical part of succeeding with some of the programmes outlined above such as Building Energy Rating or labelling for energy appliances. Unless consumers prescribe a value to these labels, which will require some education, it is unlikely that the programmes will be successful.

In addition to making customers aware of relative energy efficiency there is also a need to persuade customers to reduce their consumption. Ontario has on-line software that analyses a home's energy consumption and provides personalised information on potential cost saving upgrades. In the UK the Energy Savings Trust has launched the Commit to save 20% programme. This explains what actions consumers can take to reduce their energy consumption by 20%. In undertaking a mixture of these action customers can reach this target and can make a commitment to achieve it on the website. These methods should help raise both awareness and buy in from consumers of the need to save energy.

A final method for making consumers more aware of their consumption would be the introduction of smart meters. The results in California showed that when combined with an appropriate pricing tariff, customers could reduce their energy bill and also their consumption. However, there is considerable air conditioning in California so this may not be achievable to the same degree. In the UK Energywatch are key proponents of Smart Meters and have been lobbying strongly for their introduction. The current Energy Demand Reduction Pilot being run by Ofgem may give more details about the real benefit of smart metering and indicate whether they could deliver real savings in energy in the UK, which may be more comparable with Jersey.

2.6 Best Practice for Energy Efficiency Programmes

Best Practices for Energy Efficiency programmes have been reviewed in several recent studies. This section presents findings from these studies to inform the potential programme design opportunities for Jersey. The first of these studies is the best practices review that was completed for the California utilities.[15] This study reviewed a wide array of mostly North American programmes for all market sectors. The high level best practices are presented here in Table 2-11.

[15] From www.eebestpractices.com.

Table 2-11

Best Practice	Rationale
Keep Participation Simple	Easier for participants and any trade ally partners, encourages higher participation
Have Participation strategies that are multi-pronged and inclusive	Allows for more flexibility and greater participation
Keep programmes stable over time	Makes programmes predictable and easier for all participants
Use incremental costs as the basis for incentives	If incentives are used it is more economic to base them on incremental cost
Use electronic means as much as possible	More efficiency processing
Single point of contact	Easier for participants, more efficient
Make participation part of an existing transaction	Easier for participants, more efficient
Use trades as much as possible	Engages them as programme partners, reduces marketing costs
Provide training to trades	Increases knowledge of more efficient technologies
Sell the customer the benefits first, energy efficiency later	Emphasizes other attributes of efficiency
Evaluate programmes on a regular basis	Informs results and future programme design

A recent US Environmental Protection Agency white paper also provides a number of best practices for energy efficiency programmes. [16] A number of the options presented in this report are very closely related to programmes administered by utilities and the rate treatment of such programmes. However, table 2-12 presents some of the recommendations from this study that are most relevant for the climate in Jersey. The recommendations presented here are focused on overall funding, valuing the resource, and high level programme design.

[16] US Environmental Protection Agency, National Action Plan for Energy Efficiency, July 2006.

Table 2-12 Recommended Options from the US EPA Study

Options
Establish policies to establish energy efficiency as a priority resource
Integrate energy efficiency into planning
Establish the potential for long term energy savings
Establish funding requirements
Develop robust measurement and verification methods
Designate which organisation(s) is responsible for administering programmes
Provide for frequent updates to accommodate new information and technologies
Educate stakeholders on the business case for energy efficiency
Communicate the benefits of energy efficiency
Establish funding mechanisms for multi year periods
Communicate the role of building codes, appliance standards, and tax incentives
Eliminate tariff designs that discourage energy efficiency

2.7 Recommended Programmes for Jersey and Indicative Cost

A number of potential programmes for Jersey are outlined below. These have been designed based on the current (and aspirations for future) building and appliance stock in Jersey as well as international experience and best practice. The potential programmes have been split into three sectors:

- Buildings Programmes;
- Appliance Programmes; and
- Behavioural Changes Programmes.

Renewable energy programmes are considered separately in Section 3.

2.8 Buildings Programmes

2.8.1 Heating Retrofit / Weatherization Programme

This programme concept would be focused on existing homes. An audit would be conducted to assess the energy efficiency opportunities in the home which would include insulation, window upgrades, lighting upgrades, draught proofing, and water heating jackets. There are generally 3 approaches to these types of programmes:

1) the first is where the audit is conducted and the owner is provided with a list of recommendations and a list of contractors who could install the recommendations without a subsidy
2) An alternative version is for an entity (i.e. a utility or the administrator of an energy efficiency trust) to provide a loan to the owner to install the measures or subset of measures. This can also be done through a financial organisation
3) The final variation is to provide a subsidy based on payback or pence per kWh to partially or fully cover the cost of installing these measures.

As part of this programme it would also be possible to consider a fuel switching initiative (e.g. oil to electricity) as one of the measures that may reduce carbon emissions.

Cost- Will vary depending on option selected.

2.8.2 Weatherization for the Fuel Poor

This programme concept would be focused on existing homes. An audit would be conducted to assess the energy efficiency opportunities in the home which would include insulation, window upgrades, lighting upgrades, air sealing and water heating jackets. An audit will conducted and the owner/decision maker or tenant is provided with a list of recommendations and a list of contractors who could install the recommendations with a subsidy. Education can also be a key component of theses types of programmes.

Cost- High

2.8.3 Energy Certificates for Homes Sales

In this programme concept an energy rating is conducted at the time of the home sale. This provides information to the potential buyer as to the overall efficiency of the home. This could be based on the European Performance of Buildings Directive, but it is also being introduced elsewhere such as New Zealand. Under the UK and Ireland programmes each house that is being sold or rented will need to

have an Energy Rating (similar to appliances) along with a list of measures that could be done to improve the energy efficiency of the house. These programmes are still being introduced, but it is clear that to be really successful it needs buyers and renters to value the information in these packs and for this to influence their purchase/rental decisions. The best strategy may be to watch as the UK and Ireland programmes evolve and then take the best elements of those programmes.

Cost – Moderate

2.8.4 Utilising the Health and Safety Draft Law

One programme that could be implemented at low cost in Jersey is based around interpretation of the Health and Safety (Dwellings) (Jersey) Draft Law. Part 2 of this Law places a Duty on the Minister to promote health and safety conservation in dwellings. This includes promoting the conservation of energy and water supplied to dwellings. Orders that can be made include provisions with respect to lighting, heating and ventilation and to insulation. This is currently a draft that is due to go out for consultation and depending on feedback is unlikely to be implemented before the end of 2007 at the earliest.

Some thought will need to be given to the potential Order before this date. These Orders are primarily to ensure that the dwelling is suitable for habitation, rather than simply imposing energy efficiency standards. Theoretically it would be possible to have gradually rising standards of insulation, lighting and heating within the Order. However, any Order would need to be seen to be reasonable otherwise they could be challenged.

Whilst this may not be a way to create best practice in energy conservation it could, if passed, be used to insist on minimum (and rising) insulation standards that at least raise the lowest levels of efficiency.

Cost – No direct cost, but will be a cost in implementation of the Law.

2.8.5 Residential New Homes

This Programme will require that new homes be constructed to a standard at least 30 percent more energy efficient than the existing codes. These savings are based on heating, cooling, and hot water energy use and are typically achieved through a combination of building envelope upgrades, high performance windows, controlled air infiltration, upgraded heating systems, tight duct systems, and upgraded water-heating equipment.

Homes are qualified by the use of the Builder Option Packages (BOP). BOPs represent a set of construction specifications for a specific climate zone. BOPs specify performance levels for the thermal envelope, insulation, windows, orientation, HVAC system and water heating efficiency for a

specific climate zone that meet the standard. The New Construction Programme will offer technical services and financial incentives to builders while marketing the homes' benefits to buyers. Scaled incentives will be provided to homes that are qualified.

This programme would build on the House of Tomorrow concept but be intended for a wider role out, possibly at a lower level of support. Longer term – could insist on higher minimum standards or just UK standards.

Cost – Overall cost of these programmes can be modest however cost per unit particularly at start up can be rather high.

2.9 Appliance/Lighting Programme

2.9.1 Discount Vouchers for Efficient Appliances

The objective of this programme is to promote the use of higher efficiency appliances and black goods (Stereos, TVs etc) as well as compact fluorescent bulbs and fixtures. It is sugggested that this programme would provide point of purchase and / or manufacturer's coupons, providing for a price discount for qualifying lighting, appliance and selected black goods[17]. All qualifying products would need to be clearly labelled and the benefit explained. In addition this programme could be combined with a national marketing campaign to promote these products.

Cost – Moderate

2.9.2 Labelling Efficient Promotions

This programme would combine well with the lighting and appliance initiative suggested above and is targeted at retailers. The aim is to persuade retailers to give more prominence and information on energy efficient appliances to customers. Retailers that meet certain criteria in terms of promotion of efficient products and providing advice on energy consumption would be given an energy efficiency logo which would be publicised on the `Trust's' web site. Potentially the coupons issued above may only be redeemable at retailers that have this energy efficiency logo, which would be an incentive to get qualified if both schemes were to operate.

Cost – Moderate

[17] Evidence from other programmes has demonstrated that it is important that customers actually purchase these lighting systems rather than simply being given them as that provides more of a tangible value

2.10 Behavioural Change Programmes

2.10.1 Residential On-line Energy Audit

An online energy information and analysis programme allows all residential customers with computers to input their billing information and make comparisons of their usage on a monthly or annual basis. This tool will analyse what uses energy is put to and show them as a percentage of the total. It will then provide information on ways to save energy by end use through a searchable resource center. This tool would allow the user to analyse why their bill may have changed from one month to another. A home comparison also displays a comparison of the customer's home versus an average similar home.

Cost – Start up costs are moderate, on going costs relatively low.

2.10.2 Education Programme for Children

This programme would promote the involvement of young people as environmental decision-makers and provides links between school and home. This would be similar to the UK Programme Energy Matters. The programme provides not only education materials but also training and ongoing support for teachers through local Energy Educators. A central part of the programme would be the development of a network of Energy Educators. They would be trained and accredited to deliver the programme to a local audience and provide on-going support to schools.

The structure allows teachers to quickly introduce the materials into their teaching plans. The Energy Educators can deal with queries quickly. Overall it encourages teachers in further development of energy education and links with other initiatives.

Cost - Moderate

2.10.3 Critical Peak Pricing or Time of Use Pricing with Educational Materials

This programme would provide customers with time of use or critical peak pricing. It would be done in conjunction with a device to provide customers information on pricing. This could be something like a display or something like the "energy orb" used in the California Peak Pricing programme. This would require the support of, and implementation by, Jersey Electric. It also needs some form of metering which supports the provision of information to sustain such a programme e.g. half hour meter with a display and a remote communication device.

Costs – Metering costs make the costs of this type of programme high.

3. The Role of Micro Generation

3.1 Benefits of Micro Generation

There are a number of potential benefits that micro generation could bring to Jersey. These include:

- Lowering Carbon Emissions – if renewable technologies are used;
- Security of Supply – This would assist with continuing to reduce Jersey's dependence on imports and oil;
- Diversifying the supply of electricity – More diverse supply also reduces dependence on oil and imported supply; and
- Increased support of T&D system – Micro generation sited through out a T&D system can lead to reduced need to upgrade the T&D system over time.

Despite these potential benefits the take up of micro generation is still relatively low. This section explores the types of micro generation, costs and paybacks, settlement issues and programmes that have been successful internationally in encouraging the take up of micro-generation. In addition, the section considers the technical potential of micro generation for Jersey considering its current housing stock.

3.2 Analysis of Potential Micro Generation and Renewable Technologies

As an introduction to this analysis it is worthwhile considering the range of potential micro generation technologies and how suitable they may be for Jersey. A more detailed explanation is provided in Appendix B with a summary of each technology given below.

3.2.1 Solar Energy Systems

Solar energy systems use the energy from the sun to generate heat (solar thermal) or electricity (photo voltaic). Solar thermal is the most commonly installed form of solar energy currently in use today. The solar panels, or collectors, are usually fitted to the roof and collect heat from the sun's radiation. This heat is used to raise the temperature of the household water and is delivered by the heat transfer system which takes the heated water to the hot water cylinder for storage until use. Solar hot water systems can also be used on larger applications such as swimming pools. This technology is highly suitable for Jersey.

3.2.2 Photovoltaic

Photovoltaic (PV) generates electricity directly from sunlight. Although the electrical output from a single cell is small, when multiplied together a desired electrical output can be achieved. Small-scale PV modules are available as roof mounted panels, roof tiles and conservatory or atrium roof systems. This technology is suitable for Jersey, but is normally used in places where no grid connection is available due to the price.

3.2.3 Wind Turbines

Wind Turbines harness the wind to produce electrical power. The latest development in domestic wind turbine technology is roof-mounted turbines for installation on domestic dwellings. The modern designs tend to be very near silent in operation. This technology is suitable for Jersey.

3.2.4 Combined Heat and Power

Combined Heat and Power (CHP) is a highly fuel-efficient energy technology, which puts to use waste heat produced as a by-product of the electricity generation process. Two sorts of CHP are available: reciprocating engines and stirling engines. Both types of engines are fuelled by gas. Mains gas CV is weaker in Jersey than the UK which means the appliance would uses a greater volume of fuel, but as the fuel price is based on its CV then the costs are proportionate. However, there are significant issues in that not all engines will convert to the mains gas. This solution based on mains gas is not currently suitable for Jersey, but could be suitable using LPG.

3.2.5 Heat Pumps

Heat pumps are a technology to transfer heat energy from one place to another. Where heat pumps are used for heating applications, heat is removed from the source (ambient air, water, soil or bedrock) and then discharged where the heat is needed. Where cooling is required, the reverse happens and heat is removed and discharged into air, water, soil or rock.

Ground Source heat pumps tap the heat within the ground and convert it into energy. The heat is captured from within the ground by either pipes laid into trenches or down a borehole and is eventually distributed within the building through radiators or under-floor heating.

Air Source heat pumps work in the same way as ground source heat pumps except that the source of the heat is the external ambient air. Systems are often installed on an external wall, and may give rise to noise issues in high-density housing developments. As external temperature is more variable than in the ground, coefficients of performance are likely to be lower, but so too are installation costs as no trenching or ground drilling is required. These pumps have yet to become widely available for the domestic market and continue to undergo minor development work. However they are likely to

become commercially viable in the very near future. This technology is suitable in the parts of Jersey with a sandy soil.

3.2.6 Micro Hydro

Micro Hydro uses "hydro turbines" and water to generate electricity. Water flowing down rivers, for example, turns the turbine round; this movement is used to produce power. Most hydro power is produced in hilly or mountainous areas, or in river valleys. The amount of electricity that can be produced is determined by how much water is available and how fast it flows. Additionally of all renewable energy technologies, it is the most consistent at providing electricity. This technology is suitable in rural areas, provided that a water stream or high difference is present.

3.2.7 Biomass

Biomass heating usually involves the use of commercial energy crops in the form of fast-growing trees such as willow or poplar for woodchips or waste wood products such as sawdust, pallets or untreated recycled wood for pellets. These fuels are burned in either pellet stoves or larger scale boilers to provide heating and/or water heating.

This technology is very suitable for Jersey. However, for this technology to fit in the green policy of Jersey, the biomass will have to be grown on Jersey itself and not shipped from abroad by oil-fuelled ships. With a high percentage of arable land, this should be possible.

3.2.8 Fuel Cells

Fuel cells have been designed to combine hydrogen and oxygen to form electricity, heat and water. These can be used for providing heat and power to individual or multiple homes and for powering cars. They operate best on pure hydrogen, but other natural gases can be converted into power too.
Hydrogen and fuel cells are intermediate technologies, not renewable sources, they cannot contribute to renewable energy targets. However, the production of hydrogen from renewable energy sources offers the potential to create an almost zero emission energy chain, with hydrogen and fuel cells used to power everything from domestic households (providing both heat and power) to mobile phones and cars.

Fuel cells for domestic use are currently under development. They are therefore not yet suitable for Jersey.

3.3 Cost of Technologies and Paybacks

An estimate of the costs and benefits to customers of different forms of existing micro generation that could be implemented in Jersey is shown in table 3-1 below. Because these technologies are still

maturing, published technology characteristics may vary and in our experience prices can also vary significantly between sources. For consistency with other analysis the calculations of the model are all based on prices from DEFRA[18] and on DEFRA's view as to the Energy that may be saved by each of the different forms of micro generation. The financial benefits of each form of micro generation for Jersey are derived from the saved energy for each type of generation multiplied by the price of electricity in Jersey.

For the purposes of this analysis the displaced energy is assumed to be electricity although for some of the heating replacement technologies it could potentially be oil or gas. However, many of the implementations will be for replacement of electricity and a separate analysis could be done to compare feedback if the replacement fuel is not electricity. Avoided electricity costs have been based on either the comfort tariff or standard tariff, depending on the likely electricity tariff that will have been avoided.

Where the acquisition of these technologies will allow the user to avoid the purchase of a conventional solution this has been included in the payback calculations. This makes a significant difference to the viability of some technologies such as the pool heater as the cost is really the incremental costs over the need to purchase some alternative technology. Clearly, this may not be the case if the purchase of the conventional technology solution has already been made. However, it does represent the opportunity cost for either a new build property or one where the current sources of heat need replacement.

The baseline payback for different technologies is based on electricity prices remaining stable. In recent years there has been a significant increase in most European countries. The table demonstrates the impact that rising power prices may have in decreasing the payback period. It is also anticipated that the price of the technologies should reduce further over time making them a more viable investment merely on a payback basis. For simplicity there is currently no discount rate used in the model. Clearly if this was introduced this will have a negative impact on the payback times.

As this table indicates the most cost effective technologies based on the data from DEFRA currently include:

- Pool heaters;
- Geothermal Heat Pumps;
- Biomass Boilers;
- Small Wind Turbines.

[18] This is primarily DEFRA The first Draft Illustrative Mix of Measures for the Energy Efficiency Commitment 2008-2011 but some data such as biomass costs is based on information from DEFRA's website

Technology	Unit	Solar Thermal Hot Water Heating -- Pool Heating	Solar Thermal Hot Water Heating -- Home Heating	Solar Photovoltaic (PV) electricity generation	Wind turbines (domestic)	Ground Source Heat Pumps	Biomass heating
initial system costs	GBP	3,000	2,500	9,375	2,250	4,500	4,000
lifetime	y	20	20	25	20	20	20
annual fuel costs	GBP	0	0	0	0	0	158
annually saved energy	kWh	2,200	1,548	2,115	2,235	12,608	7,010
tariff	-	comfort heat	comfort heat	domestic elec	domestic elec	comfort heat	comfort heat
tariff price	GBP	0.076	0.076	0.091	0.091	0.076	0.076
conventional Technology	Unit	Oil-Fired Pool Heater	Electric Water Heater				Domestic House Oil Boiler
conventional technology cost	GBP	£ 2,500	£ 406			n/a cost above is incremental	£ 550.00
payback	Years	2	17	35	11	4	9
payback + 1.0% electric escalator	Years	2	16	35	10	4	8
payback + 2.5% electric escalator	Years	2	14	31	9	4	7

Table 3-1 Simple Payback for Micro Generation Technologies

3.4 Settlement and Metering Options

3.4.1 Current Position

Discussions with Jersey Electricity indicate that currently there is no micro generation that is producing electricity and spilling onto the network. If there was energy being spilt it would need to be measured and there would need to be a bilateral agreement between the customer and Jersey Electricity. The lack of any spill means there has been no immediate driver for a policy on whether this would be measured using half hourly metering or non half hourly metering.

This analysis is necessarily future looking and considers what the implications would be if the penetration of renewable generation was dramatically changed, partly due to a programme that was established to promote renewable energy. It considers the options for two key questions:

- What needs to be measured?
- How should settlement occur?

The appropriate answer to both of these questions will depend on the likely penetration of small scale renewables and how these are being supported.

3.4.2 What to Measure

Micro generation output is generally small and a large proportion may be consumed at the premise. However, particularly with some of the renewable technologies such as micro wind it may be hard to align consumption with production. Consideration therefore needs to be given as to how any export could be metered with the costs of this metering and settlement needing to be commensurate with the value of the electricity exported.

The first decision that needs to be determined is what is actually being measured. This may break down into two potential requirements. Firstly there is an enduring need for settlement metering to measure energy flowing into and out of a premise. In order to be settled the metering will need to record the energy produced by the micro generator minus the energy consumed at the premise. There are a number of different options for this calculation and they are considered in section 4.3.3.

The second metering requirement relates to any renewable benefits that may be established in Jersey and the desire for micro generators to be paid in full for these. There are two options for quantity based support either a feed-in tariff for renewable energy or a ROC scheme similar to the UK. Any renewable feed in tariff is likely to be less than the domestic tariff rate so a micro generator owner will prefer that any production is first offset against their imported units of electricity. If in the future a ROC type mechanism exists, where a certificate was issued for all of the renewable generation, then

it could make sense to install a Gross Generation meter to maximise subsidy revenue. This would record the actual output of the renewable generator, but would be additional to the metering required for settlement. The customer would need to weigh up the costs of the additional metering with any renewable benefit he may receive.

3.4.3 Options for Settlement Metering

There are four key metering and settlement options for micro generation in Jersey. These options are as follows:

i) **Interval Export Meter** - This export meter would record all export electricity flows for each HH Period and the customers would be paid at the market price (or some agreed price) for each HH for the exported electricity. This meter would not necessarily need remote communication functionality as it could be settled on a regular basis when the metering data is collected.

This approach has the advantage of ensuring the owner of the micro generator is rewarded accurately for all the energy exported onto the network. It provides an incentive to export at times of high energy prices assuming these high prices are reflected in the price the micro generator receives for its output. However, it would be an expensive option in terms of metering cost[19] and would also have a high administration and settlement costs.

It may be important that a half hour meter was used for a generator above a certain size to minimise any disturbance to settlement.

ii) **An Additional NHH Meter Recording Export** - A standard NHH meter could be installed to record all export from the premise. This standard meter would need to sit alongside the import meter and would record any export from the premises as a single advance over a period of time. The electricity would then need to be profiled to estimate when the export actually took place.

The advantage of this approach is that it provides a relatively cheap method of measuring the output in comparison with the first option. However, it requires profiles to be established for the export which can be difficult to achieve and may require different profiles for different technologies.

Both options (i) and (ii) would require an obligation on Jersey Electricity to purchase export energy and there may be some discussion on what price this export would be valued.

[19] This may be a more practical solution should smart metering be adopted in Jersey and be capable of recording both import and export meter readings.

Bilateral discussions would not be feasible if there were lots of micro-generators on the Island.

iii) Net Metering – In this option a single meter register would record the energy going into the premise minus the energy being exported by the premise.

This solution has the advantage of only requiring one meter, but it would still need to be an additional new meters as current meters in Jersey are not designed to run backwards. There are issues that the micro generation output may be occurring during low price periods and the import during high price periods and that it would distort the settlement system as it would be impossible to determine when the output occurred. These disadvantages are significant enough to preclude Net Metering being considered as an option for metering micro generation.

iv) All Export Spilt unmetered onto the Network – In this case the energy is not metered and any generation beyond current consumption is simply spilt on to the network. This is the least cost option as no additional meters would be required by the customers.

This solution would need to be reviewed if large amounts of micro generation were installed and profiles and losses were being distorted. It also essentially represents a transfer of value from the owners of micro generation to Jersey Electricity who will gain from any unrewarded spill as losses will appear lower. However, a single small transfer payment (reduction in bill) representing the likely gain to the network could be used to overcome this issue.

3.4.4 Recommended Metering and Settlement Solutions

In the short term there is no reason why three of the recommended options can not co-exist with customers choosing the option that best suits the output of their micro generator and relevant metering costs.

In the longer term it is recommended that metering requirements are re-assessed over time as both the number of micro generators and the relative costs of metering changes. Import Profiles used to settle customers' consumption will be distorted if there was large scale adoption of micro generation as the profiles now represent the difference between imported electricity and generation rather that simply the consumption of the customers. This will clearly have an impact on the accuracy of settlements, but this impact will remain small until widespread adoption occurs. A threshold number of micro generators being settled under any of these options should be established and used as the trigger for a review of metering arrangements once this number is reached.

3.5 Successful International Micro generation Programmes

This section considers the international programmes that are being run to promote the use of micro generation at the domestic level to decrease carbon emissions. The objective of this review is for the design of successful international programmes to be used in any decision over the most appropriate programmes for Jersey.

In undertaking this assessment the following countries were examined.

- UK – similar climate and housing stock to Jersey;
- Ireland – Small country with similar climate to Jersey;
- New Zealand – two islands with limited interconnection; and
- Spain – One of the most progressive with a mandatory solar programme.

In addition the analysis included a number of relevant examples from selected other countries where their programmes may provides useful lessons of the most applicable solutions for Jersey and two example programmes to educate children on energy savings and renewable energies. This section and its accompanying Appendix C contain an international survey of such programmes.

Many programmes include schemes for both micro generation and for energy efficiency. This section describes programmes which are primarily focussed on micro generation. Programmes that have been focussed mainly on energy efficiency are included as a separate piece of analysis in Appendix A.

3.5.1 Breakdown of Programmes

The programmes can be broken up into three categories,

- **Heating** –Programmes to promote technologies to generate heat for space or water;
- **Electricity** – Programmes to promote technologies to generate of electricity;
- **Heating and Electricity (both)** – Programmes designed to promote wider range of generation technologies or to promote technologies that generate heat and electricity simultaneously.

This is shown in the list below.

Table 3-2 International Micro Generation Programmes

Heating (Water or Space)	Electricity	Both
Greener Homes Scheme (Ireland)	PV Incentive Programme (USA)	Scottish Community and Householder Renewables Initiative (Scotland)

Community energy programme (UK)	Wind Incentive Programme (USA)	VAT Relief on Energy Saving Materials (UK)
Dwelling Improvement Act and Housing Promotion Subsidies (Austria)	Zero Emission Homes (USA)	Low Carbon Building programme (UK)
Solar Water Heating (New Zealand)		Spain's Building Technical Code (CTE - Código Técnico de la Edificación) (Spain)
Long Island Power Authority - Residential Energy Efficiency Rebate Programme (USA)		State Programme to Support Energy Savings and Use of Renewable Energy and Secondary Sources (Czech Republic)
		Support for solar (Belgium)
		Promotion for the Local Introduction of New Energy (Japan)
		Energy $mart Loan Fund (USA)

The low level of electricity only programmes suggests that more benefit is seen by government for heating, or heating and electricity programmes. Of the two electricity programmes one is aimed at least partly at the commercial and industrial sectors with grants of up to £50,000. This would suggest larger scale wind turbines are more commercially attractive than some of the small scale wind micro generators.

Space or water heating was promoted as a standalone use for a number of types of micro generation particularly solar, biomass and heat pumps. Heating and electricity programmes were the most common form of programme being offered internationally. However, it is not clear what the uptake is of the different element of these packages. Despite the offer of electricity and heating it may be that a significant proportion of the programme expenditure was focussed on heating rather than generation electricity, which tends to have a longer pay back.

There are some renewable schemes that are not particularly aimed at micro generation, but could result in additional revenue for small scale generators. As an example in the UK a micro generator could qualify for Renewable Obligation Certificates for their output which could be worth £40-50 MWh. However, there is some administration costs associated with obtaining this revenue, which has put some customer off entering the scheme. Alternatively some countries provide renewable feed in tariffs, which may be available to micro generation; however the value of this is likely to be low in relation to the domestic tariffs which the generation could offset.

3.5.2 Types of Support

Almost all of the programmes were voluntary initiatives with subsidies for customers that wished to install various types of micro generation. One problem with this approach is that despite the subsidies this still requires substantial investment by householders in the micro generation. This will preclude low income families from investing in these types of technologies as even with the subsidy they can be significantly more expensive than the fossil fuel equivalent.

Some of the schemes cover both renewable and Energy efficiency programmes. Complying with emissions based building standards and the House of Tomorrow programme in Ireland can be done using a mixture of both renewable and energy efficiency improvements. The House of Tomorrow programme gives preference to those that have renewable features. Normally the less prescriptive nature of the building approach will lead to a market decision to invest in small scale renewable only where it is the most efficient way to achieve CO_2 savings.

One programme in Spain is an exception to the voluntary nature of support for micro generation. Spain is the first European country to make the implementation of solar thermal energy obligatory. This programme is implemented as part of their Building Technical Codes and includes a requirement for a minimum contribution form solar power ranging from 30-70% of the annual energy requirements for the production of domestic hot water systems. This is estimated to add around 1% to the cost of the house with a payback of 5-10 years. An interesting announcement by Gordon Brown in the pre Budget speech on the 6 December 2006 was that by 2016 he wanted all new houses in the UK to be zero carbon. This would suggest some forms of renewable energy in each house.

3.5.3 Key Technologies Promoted

When studying the programmes, one source of power seem to have a particular interest on an international level,

- **Solar** - for the use of solar heating and photo voltaic

Closely follow by two others,

- **Biomass** - for the use of heating. The latter is often combined with the promotion of energy saving measurements.
- **Geothermal heat pumps** - for heating of space or water.

As seen in the earlier analysis these micro generation technologies are closest to commercial viability and with subsidies can be seen as a sensible investment by some households. It is hoped that decreasing costs associated with increased roll out will lead to them becoming more widespread

without support in many of the countries that are currently providing subsidies. The alternative for rapid roll out is the policy of compulsion adopted by Spain.

3.6 Technical Potential for Micro Generation and Renewables in Jersey

The table below provides some indication as to this technical limit based only on the stock of housing that exists in Jersey. With current electricity prices the key barriers to adoption are financial as indicated by the payback table, which for most technologies makes it hard to justify the investment or purely financial criteria.

3.6.1 Solar

In order to have Solar heating it is assumed that you will need a house (or some land with a pitched roof). Based on our earlier calculations in section 2 it was estimated that there were 21,062 houses with pitched roofs in Jersey all of which could potentially be suitable for solar water heating. In addition there may be other surfaces that could be used to place solar heating materials. However, for this exercise only those with pitched roods are considered. It is assumed that this potential applies to both solar for water heating and solar power for electricity.

In addition it is likely that all swimming pools will have sufficient space to install some solar heating.

3.6.2 Geothermal Heat Pumps

All houses with a garden could potentially install Geothermal Heat Pumps. In 2001 there were 10,401 detached houses and 6,782 semi-detached. This gives a total of 17,183 premises in 2001 that could install this technology. However, this estimate is made without investigation of the adequacy of gardens and without any knowledge of the increase in detached/semi-detached houses from the 2,814 increase in dwellings between 2001 and 2005.

3.6.3 Biomass

These sort of boilers are often more practical in multifamily homes, although there is no data on these for Jersey. Given the need to store fuel it is suggested that these would need to be houses with gardens. The same figure as for Geothermal Heat Pumps is therefore used as the theoretical maximum.

3.6.4 Wind

It is suggested that all detached and semi-detached houses would have the potential to install micro-wind. It is possible that Terraces and flats could also be included, but there could be issues of where and how to attach the micro-wind turbines. This give the same figure as used for Geothermal Heat pumps above.

Table 3-3 Potential for Micro Generation in Jersey

Technolgy	Maximum Eligible Homes	KWh saved per Home p/a	Carbon saved p/a kgC/yr	Max Potential Carbon Savings/ yr Tonnes	Tonnes of Oil Equivalent	Total Toe p/a
Solar thermal Hot Water Heating - Pool Heating	300	2,200	48	15	0.19	57
Solar thermal Hot Water Heating - Hot Water	21,062	1,548	34	717	0.13	2,804
Solar PV	21,062	2,115	47	980	0.18	3,830
Wind Micro Turbines	17,183	2,235	49	845	0.19	3,302
Ground Source Heat Pumps	17,183	12,606	277	4,765	1.08	18,626
Biomass Heating	6,000	7,010	154	925	0.60	3,617

3.7 Potential Micro Generation Programmes for Jersey

Based on the review of technologies and the review of other programmes we would propose the following initial programme options for Jersey to consider

3.7.1 Promotion of Solar to Heat Pools

Pool heating is a sizable end use on Jersey. A promotion could be developed to replace existing pool heaters at time of replacement with a solar system. The solar system would replace both electric and fossil fuel heating systems. The incentive would be designed to the incremental cost between the solar

system and the fossil system. Another option would also be to require that all new pool heaters be solar by code.

3.7.2 Green Schools

In this programme, selected schools would install small PV systems, geothermal heat pumps and wind systems along with comprehensive energy efficiency measures. Curriculum would be developed in conjunction with installations and included as part of the science programme.

Many of the benefits of this programme will be hard to quantify and may not directly accrue to the school. There is consequently little quantifiable evidence on a cost benefit basis for these programmes, particularly if these don't include energy efficiency as a major part of the projects. However, these types of renewable projects are believed to deliver a deliver a number of benefits that may have a wider benefit to Jersey including:

- Increased understanding of the range of different possibilities for generating electricity and the carbon implication of each technology;
- Increasing interest in renewable energy from students and their parents (potential purchasers);
- Increasing awareness of the use of energy and how this can be reduced; and
- Reduction in the electricity bills of the school through the use of renewable electricity.

3.7.3 Zero Emissions Homes

Over time it may also make sense to include a zero emission homes component as part of a residential new homes programme. In this type of scheme renewables are incorporated into the construction of the home enabling them to have zero emissions or a zero carbon footprint. Technologies that could be included would be: PV, geothermal heat pumps, solar hot water heating and solar roof tiles. This would involve establishing an incentive scheme for builders to encourage the development of such homes.

4. Delivering Energy Savings

4.1 Introduction

Jersey is currently considering establishing a new body to raise the awareness of energy savings measures and to co-ordinate the delivery of energy efficiency or micro generation programmes. This section addresses a number of questions to help determine the objective, structure, membership and scope of this organisation before making some recommendation as to the most appropriate solution for Jersey.

For convenience and to not prejudice how it will be set up and what it will cover we have termed this organisation Sustainable Energy Jersey (SEJ). Clearly a final name can be agreed once a decision on the structure and form of the body is determined.

4.2 Objective of SEJ

One of the key initial decisions is what should be the objectives of any authority that was formed. There is a significant difference in the objectives of the international examples. In the UK the Energy Saving Trust and Carbon Saving Trust take on quite narrow roles as other organisations can deal with related issues. However, the relatively small size of Jersey suggests that there is only likely to be one organisation that is responsible for sustainable energy issues. This may mean at times the objectives conflict and there will be competing projects for any available funds. It will be the responsibility of the members of SEJ to determine the relative importance of the different objectives and decide the best way to allocate any budget.

The suggested objectives for SEJ are listed below together with a fuller explanation of why each objective is important in subsequent sections:

- Reduction in energy Use by the sector (Tons of Oil equivalent);
- Reduction in CO_2;
- Promotion of small scale renewables;
- Assistance to Low income customers; and
- Improvement in energy efficiency of business and commercial customers

4.2.1 Reduction in Energy Use and CO_2

Many organisations and governments have targets or report progress based on reductions in $C0_2$. This is consistent with the way that Kyoto targets have been established and the EU Emissions Trading Scheme has been set up. However, this measure alone may not be applicable for Jersey due to the sources of its electricity.

The States of Jersey imports the majority of its electricity from France with a contract that specifies Nuclear and Hydro as the mechanisms for production. This means that the electricity purchase either has almost zero carbon content, if based strictly on the contract, or low carbon content if you base the carbon level on the overall carbon of electricity generated in France. This leads to the situation where Jersey could improve its CO_2 targets simply by persuading customers to switch from gas or oil based heating to electric heating. This may not be a long term solution, as the electricity purchased may not continue to have such a low carbon level and there may also be some concern about relying on nuclear power to meet environmental targets.

In Jersey's Energy Trends for 2005 there is an examination of Final Energy Consumption in tons of Oil equivalent. This will show a better picture of the energy consumption of Jersey and not be subject to potentially significant changes that the CO_2 figures suffer if the contract with France was to be changed. It will avoid the incentive to reduce targets by promoting programmes that simply switch fuels rather than reducing energy consumption.

4.2.2 Promotion of Small Scale Renewables

Many of the international organisations promote renewable energy and efficient forms of energy production as well as energy efficiency. Objectives such as the reduction in energy use and CO_2 can be achieved jointly by customers generating their own low/no carbon energy as well as customers using less power. There are a number of programmes such as the House of Tomorrow programme in Ireland that aim to achieve an emission reduction using both energy efficiency improvements in new build premises and small scale renewable generation.

Given the overlap of small scale renewables and energy efficiency improvements it makes sense for the promotion and co-ordination of the schemes to rest with the same body who can weigh up relative costs and benefits of investing in small scale renewable against alternative energy efficiency improvements.

4.2.3 Assistance to Low Income Customers

If taxpayers money is being used to fund energy efficiency programmes it would be desirable if this was targeted to low income customers who could not easily afford to undertake some of the potential improvements themselves. This could be a proportion of the overall funds targeted at low income customers, or a subset of the programmes that are targeted at low income customers. This is consistent with the international programmes examined in section 2, where all countries had at least one scheme primarily targeted at low income customers.

One issue for Jersey to consider is what definition should be used for low income customers. The UK definition of 10% of income being spent on fuel may results in relatively small numbers of consumers

being judged as fuel poor. The Jersey Household Expenditure states that the proportion of household income spent on energy for the 20% of customers on the lowest income was 4.1%. Whilst standard deviations are not given it is not expected that there will be large numbers above the 10% by income levels.

An alternative option for definition of the Fuel Poor in Jersey could involve looking at the amount spent on fuel after housing expenses, which are high in Jersey, are taken into account.

4.3 Scope of SEJ

The expected scope of the SEJ is outlined in the tender documents as five key activities. This section clarifies what we believe is envisaged within each activity and suggest a couple of additional areas of scope that could be considered as a role for SEJ.

i) **Provide an analysis of a range of incentives that have been effective elsewhere, in improving energy efficiency e.g. grants / loans**

This can build upon the analysis done in this report and provide full cost benefit assessment as well as potential implementation strategies either for roll out or pilots of any programmes. It is important to continue to follow programmes and technological developments elsewhere to consider what is appropriate for Jersey.

ii) **Run education campaigns to promote energy efficiency etc**

A key element in the success of energy efficiency programmes is persuading consumers of the value of reducing consumption. SEJ should utilise a number of media including internet, billboards and the local paper. In addition educational campaigns could also be introduced through school programmes that will impact on children and parents. As education is a key activity it is important that SEJ is given a high profile role at launch.

iii) **Promote unbiased advice for home owners on the most sustainable way to use energy e.g. energy audits**

SEJ should be the source of all information that households need to become energy efficient. This should include a number of guides as to how to become more energy efficient covering houses, lighting and appliances. An on-line audit would be useful for homeowners to understand their usage and spot opportunities for saving energy e.g. replacing old refrigerators. The opportunity for an energy audit by someone who is not connected to one of the fuel suppliers would also be valuable and could be subsidised.

iv) **Promote / provide training opportunities for operatives within the industry in energy efficiency / renewable**

Training operatives would overcome one of the barriers to energy efficiency being lack of skilled operatives. One limitations is that in a small country such as Jersey it may not be practical to run courses for just one type of skill e.g. Cavity wall insulation. For specialist skills SEJ could offer to subsidise courses that are run elsewhere.

v) **Use the trust's purchasing power to source energy efficiency materials / micro generation technologies cost effectively and pass these saving onto the consumer.**

This could be done for items such as CFL or insulation that may even be passed onto consumer at a subsidised cost. For example in some places in the US utilities or efficiency funds have made bulk purchases of CFLs and appliances such as fridges for installation in low income and or multifamily residences.

There are a number of other activities that could potentially fit within the remit of the SEJ. These depend on the depth envisaged for SEJ, for example:

i) Managing the Implementation of Selected Programmes

ii) Actual Implementation of Programmes

4.3.1 Assessment of Scope Options for SEJ

Delivering the different scopes outlined above gives a number of options for the structure of SEJ. These breaks down into:

i) A no (low) budget organisation that essentially co-ordinates existing programmes run by individual companies and discusses policy;

ii) A budget organisation that is responsible for coordination, promotion and enabling of energy efficiency activities runs, but may outsource many of the activities. Outsourced activity could range from commissioning specific reports to outsourcing the management and delivery of programmes;

iii) A budgeted organisation that undertakes co-ordination, promotion and enabling of energy efficiency activities. The organisation would include a number of staff that directly manage the delivery of programmes.

These are best seen in a table format.

Table 4-1 Scope Options for SEJ

	Activities	Cost (Range)	Benefit	Organisational Fit	Future Development	Risk
Option 1	Some co-ordination of existing activities by companies and policy discussions	Probably 1-2 staff with 150 K of additional expenses	One central body checking programmes are consistent	Already planned so no impact on organisations	Hard to grow as will start to conflict with companies Coordination only can leave organisation very dependent on other organisations	Some risk of being politically insignificant
Option 2	Co-ordination, Promotion and enabling of energy efficiency activities over time	Staff of 3-5 Dependent on number and type of Programmes run	More opportunities for energy savings	Start small and grow organically	Would allow for gradual growth	Some risk of not getting started fast enough to have an impact
Option 3	Co-ordination, promotion and implementation of energy efficiency activities	Staff of up to 6-8 Dependent on number and type of Programmes run	More opportunities for energy savings Better likelihood of success	Bigger staffing commitment and hiring risks. More complex contract management required.	Best chance for sustainable organisation-could start with option 2 and move to 3 over time.	Risk of growing too fast. More inherent risks in implementation.

4.4 Structure of the Organisation

Typically trusts of this nature are led by an Executive Director who reports to a Board of Directors. The Board of Directors typically includes a cross section of stakeholders. For the Board of Directors to be manageable it should not exceed 10-15 members to start. The organisation can be a non profit/ non governmental organisation, a branch of government, a contract to a firm or coalition to a government agency, or a quasi governmental agency. Examples of each of these can be found in Appendix B. Typically these types of organisations have working groups on specific topics which can also be a way to engage stakeholders.

4.5 Membership of the Board of Directors

The organisation needs to be composed of a good cross section of stakeholders. A suggested starting point is to consider a subset of the membership of the Energy Policy Steering Group. This is made up of the following key stakeholder interest:

Core officer Team for the States of Jersey

- Senior Representatives from the Environment Division
- Statistical Representative and Economic Advisor from the Chief Minister's Department
- Representative from Building Control, Planning and Building Services
- Representative from Economic Development
- Policy and Projects, Planning and Building Services
- Director of Estate Services, States of Jersey Housing Department

The Following Energy Industry Representatives

- Jersey Electricity Company
- Jersey Gas
- Fuel Supplies CI Ltd
- Jersey Energy

Representatives from Non-Governmental Organisations

- Jersey Ecology Fund
- Environment Section, Société Jersiaise
- Association of Jersey Architects

There are a few other organisations that may also wish to be involved in decisions on how energy efficiency programmes are targeted. This is likely to include

Representatives from

- Help the Aged
- Housing Charities
- Renewable Energy (Solar) Installer

One of the key decisions that need to be made is the Terms of Reference of this group and in particular the voting weights of the different members. This will be important where alternative projects compete for the same funds and different interest groups will have their own priorities as to how the available funds will be allocated.

4.6 How the Funding Should Work

The funding for the SEJ is anticipated to come from Environmental Taxes. Additional funding could also come from a charge on electric bills. For successful programme development it is important that the funding be stable over time. An annual budget should be developed along with a 5 year budget. These should be tied to a strategic plan.

4.7 International Experience with Trusts

Table 4-2 below provides a summary of some the other trusts that were reviewed.

Table 4-2 International Experience with Trusts

Name/ Country	Scope of Activities	Type of Organisation	Annual Funding	Source of Funding
Massachusetts Renewable Energy Trust US	Renewable Energy	Quasi Governmental agency with Board of Directors	Around $ 20 M	Surcharge on Electric bills
Energy Savings Trust – UK	Energy Efficiency and Renewable Energy	Independent trust with Board, Include member agencies and companies	£60 M	From both public and private sector
Efficiency Vermont US	Energy Efficiency	Contract overseen by Department of Public Service	$18 M	Surcharge on Electric bills
Carbon Trust – UK	Reducing carbon emissions	Trust run by two Executive Directors, with Board of Directors	£106 M	Grants from DEFRA, Scottish Executive, National Assembly of Wales, Northern Ireland Assembly and Climate Change Levy
Conserve Nova Scotia -Canada	Energy Efficiency	Was part of Department of Energy , was split off	$12 M	General Funding
Sustainable Energy Ireland	Energy Efficiency and Renewable Energy	Was formerly the Irish Energy Center	€17.3 M	General funding and EU
Oregon Energy Trust	Energy Efficiency and Renewable Energy	Non Profit	Around $52 M	Surcharge on Electric bills

5. Proposed Budgets for Energy Efficiency and Renewable Programmes

Proposed budgets for 2007 to 2010 are shown below. These budgets are based on both a gradual ramp up of staff and programmes.

Table 5-1 Potential Budget in £ (1000)

Jersey Budget Template				
	2007	2008	2009	2010
Direct Staff	100	250	300	300
Marketing and Outreach	100	150	200	250
admin/ IT	75	100	150	150
Programs				
Weatherization for Fuel Poor	75	150	250	250
Pool Pump Incentive	15	30	30	30
School Programme	50	75	75	75
On -line Audit with contractor arranging		50	100	100
Lighting and Appliances/ Labeling	75	150	150	150
New Homes / Zero emission homes		25	50	75
Green Schools			50	100
Smart Metering Support				100
Total	490	980	1355	1580
2007 assumes partial year of funding				

This mix of programmes should make a significant contribution towards meeting the energy policy objectives of Jersey. This includes:

(i) A reduction in the carbon used in Jersey (The exact contribution will depend on exactly how programmes are implemented and requires further knowledge of measure costs and the heating stock);
(ii) Assistance to the fuel poor; and
(iii) Improve on a long term basis the overall efficiency of the stock of housing and appliances.

Appendix A – International EE Programmes

This appendix contains a structured assessment of some of the domestic energy efficiency programmes that have been tried internationally in order to assess the most appropriate solutions for Jersey. The assessment has considered formal energy efficiency programmes as well as less formal initiatives and policies that have had an impact on the domestic energy efficiency. This includes programmes that change the efficiency of buildings, lighting, appliances and those that encourage behavioural changes in how customers use electricity. Programmes that have been focussed on micro generation are included as a separate piece of analysis in Appendix C.

In undertaking this assessment the following countries were examined.

- UK – similar climate and housing stock to Jersey;
- Ireland – Small country with similar climate to Jersey;
- Ontario – Is running some Innovative Demand Side Management Programmes including smart metering;
- New Zealand – two islands with limited interconnection; and
- Vermont – One of the most aggressive states in pursuing Demand Side Management.

In addition we have included a number of relevant examples from selected other countries where we felt these programmes may provides useful lessons of the most applicable solutions for Jersey.

UK

The following programmes and initiatives have been included from the UK

- Energy Efficiency Commitment (EEC);
- Warm Front;
- Commit to save your 20%;
- Energy Performance Certificates;
- Building Regulations for Existing Buildings;
- Building Regulations for New Buildings;
- Energy Matters and Energy Matters in London.

UK - Energy Efficiency Commitment (EEC)

Overview of the programme	This is a programme that runs from 2005-2008 which all licensed electricity and gas suppliers, with at least 50,000 customers, need to comply with. The supplier will be given an EEC target to save energy based on the number of domestic customers supplied. Each supplier needs to implement energy efficiency measures that will save the energy targets set for them by Ofgem according to a specific formula. Typical measures that suppliers can provide as part of this programmes include: • Cavity wall insulation; • Loft insulation; • Incremental cost of upgrading boilers; • Compact Fluorescent Lamps; • Insulating water tanks; • Incremental costs of upgrading appliances; and • Draught proofing. Currently discussions are taking place on what improvements will be eligible for the third round of the EEC which will run from 2008-2012. It is viewed as likely that it will include some forms of micro generation. At least 50% of the energy targets will need to be met by energy savings from the priority group (low income) customers. Prior to the EEC there were Energy Efficiency Standards of Performance programmes. These ran from 1994-2002

Benefits/Costs	The benefits to participants are subsidised or free equipment that help to reduce the consumption of energy. The first EEC from April 2002- March 2005 saved 62 Fuel Standardised (FS) lifetime discounted TWhs. The Second EEC from April 2005 to March 2008 should save 130 FS LD TWhs. The cost is passed on to domestic customers through energy supplier bills. The latest programme is estimated to cost £9 per customer per annum per fuel.
Number of Customers	Many millions of customers will benefit. Some in a small way with access to free light bulbs, whilst others will be supported with larger installations
Barriers to Success	Suppliers need to access enough priority customers to reach their targets.
Suitability for Jersey	This may be overly complicated for Jersey as there is significant administration in determining applicable measures and savings, suppliers designing programmes and obtaining the right mix of customers. The UK policy only applied to suppliers of over 50,000 customers, which is more than the number of households in Jersey. The use of a significant proportion of oil fired central heating would also mean that a large amount of domestic energy consumption was omitted unless these were also included in the scheme.

UK - Warm Front

Overview of the Programme	The programme is sponsored by DEFRA and managed by Eaga partnership. It has been running since 2000 and was originally called the Home Energy Efficiency Scheme. It was set up to assist Fuel Poor households to have adequate heating in their house. It is targeted at two types of fuel poor customers: i) Those with a young child (or pregnant) and in receipt of particular benefits; ii) Those aged over 60 and in receipt of certain benefits. A Warn Front Grant of up to £2,700 (£4,000 if oil fired central heating is recommended) can be used to provide a package of measures for customers to ensure their premises are adequately heated. This includes: **Heating Systems:** • Central heating • Gas room heaters • Electric storage heaters • Converting a solid fuel open fire to modern glass fronted fire • Time controls for electric space water and water heaters • Heating repairs and replacements **Insulation Measures:** • Loft insulation • Draught proofing • Cavity-wall insulation • Hot-water tank insulation **Other Measure:** • Energy advice • Low energy light bulbs • Hot water tank jacket

Benefits/Costs	The key benefit is that fuel poor customers are able to obtain grants that enable them to install heating or insulation measures that allow their homes to be heated to a decent level.
Number of Customers	Over a million customers had benefited from the programme by March 2005.
Barriers to Success	Can create a waiting time for a new heating system 3-6 months.
Suitability for Jersey	A similar programme could be considered for Jersey. Careful thought is needed on the design and a few international programmes of this type should be considered in designing an appropriate programme for Jersey.

UK - Commit to Save your 20%

Overview of the Programme	This Programme is run by the Energy Savings Trust and is available via their website. It was heavily promoted during Energy Saving Week from 23-29 October. The aim of the programme is that customers should commit to saving 20% of their energy as their contribution towards the UK Commitment to saving CO_2. To help customers realise this saving the website indicates how much energy (as a %) each of the measures will deliver and also shows the CO_2 saving. Ideally by selecting a number of programmes the customer will commit to measures that involve saving 20% of their energy. Example measures are: • Turn down Thermostat by 1% = 4% saving • Turn appliances off standby = 1.1% saving • Install Cavity Wall Insulation = 14.1% saving (note there is a longer list) All savings are done on the basis of an average house not calculated based on an individual's house. Once you commit to your suite of measures the Energy Saving Trust will send you an electronic postcard of a favourite place (from their selection), which can also be sent to a friend. This reminds you of what you are helping to save.
Benefits/Costs	The key benefit is that it educates people on how much energy they can save by taking various actions and it also makes them pledge to actually take these actions. This is a low cost programme as just requires a website.
Number of Customers	*Unknown.*
Barriers to Success	Not clear for how long customer will keep to their commitment particularly for the behavioural changes.

Suitability for Jersey	Easy to replicate. Should be replicated in Jersey. Could even be personalised to list all the people by Parish that have committed to save 20% of the energy. This being publicly named may make more people sign up.

UK - Energy Performance Certificate

Overview of the Programme	This is part of the UK Implementation of the EU Performance of Buildings Directive (EPBD). Article 7 of this directive requires an energy performance certificate to be issued. The Energy performance certificates will provide an A to G rating for properties to reflect their energy efficiency and carbon emissions. The criteria will be based on factors such as the annual running costs of the property (space heating, water heating and lighting) and carbon emissions. The report will also contain a list of cost effective measures to improve the energy efficiency of the premises. Sample certificates suggest that savings per measures would be indicated as well as the impact on the performance rating of the product. As from June 2007 every home that is put on sale in England and Wales will need an Energy Performance Certificate. For non marketed and 'right to buy' sales as well as all letting of existing properties it is expected to be introduced in Spring 2008.
Benefits/Costs	The benefit is that customers can make an informed decision when deciding whether to buy or rent a property. Customers will also know what actions they can take to improve the energy efficiency of their premises. The cost is the Domestic Energy Assessor producing the Energy Performance Certificate.
Number of Customers	Mandatory so will apply to all house sales and all rented properties once re-let.
Barriers to Success	Having sufficient qualified personnel to produce the Energy Performance Certificates. Public understanding of what the Energy Performance Certificates means and factoring this into the value of a property.

Suitability for Jersey	Very Suitable and it is suggested that a similar scheme is considered for Jersey. It would be sensible to witness the introduction in the UK and in Ireland first before determining when and how to introduce this to Jersey.

UK -Building Regulations Part L1 for Existing Dwellings

Overview of the Programme	This is not strictly an energy efficiency programme but should make a significant impact on the energy efficiency of the UK Housing stock. The current regulations were introduced in April 2006. The rules require that whenever works are carried out reasonable provision should be made to improve the efficiency of the thermal envelope (Walls, floor, roof, windows and doors), heating and other fixed services. Improvements are required when undertaking the following sort of work: • Extension to existing dwellings; • Change of use or change in energy status; • Alterations to dwellings (e.g. replacing external wall); • Provision, replacement or renovation of a thermal element; • Provision or replacement of controlled fittings (Doors, windows etc); • Provision or replacement of controlled services (Heating, hot water, lighting, ventilation and cooling). To demonstrate compliance with building regulations a 'Building notice' or Full Plans' application for approval needs to be sent to the local authority control department. The responsibility for demonstrating compliance rests with the person ordering the work with substantial penalties for failing to comply. There are a list of Competent person schemes to allow suitably qualified individuals to self qualify that their work complies with building regulations.
Benefits/Costs	The regulations aim to reduce CO_2 emissions is dwellings by around 2.8 million tonnes by 2010. Costs are not known but will add cost to some building project.

Number of Customers	Will apply to all customers undertaking building work.
Barriers to Success	This is a legal requirement, so providing it is enforced, it should be successful in reducing energy emissions.
Suitability for Jersey	This is already planned for introduction in Jersey possibly in 2008.

UK - Building Regulations Part L1 for Existing Dwellings

Overview of the Programme	These building regulation are being revised to meet the requirements of the EU Directive on the energy performance of buildings (EU EPBD). The previous Part L had been based upon reducing heating loss, whereas the 2006 Part L is based upon reducing energy consumption and CO_2 emissions. To comply new buildings must meet the following criteria: 1. The predicted rate of CO_2 emissions has to be less than the Target Emissions Rate (TER). The TER is expressed as a quantity of CO_2 per m^2 of floor area per year; 2. The performance of the building fabric and fixed building services is no worse than given design limits; 3. The building must have the appropriate passive control measures to limit the effects of social gains or indoor temperatures; 4. Quality of construction and commissioning has to be such that the completed building meets the TER; 5. Providing Information – Owner needs to be provided with a set of operating and maintenance instructions aimed at achieving economy in the use of fuel and power in a way that households can understand.
Benefits/Costs	For new buildings it is anticipated that it will reduce carbon emissions by 25% from 2002 standards. The 2002 standards had already reduced emissions by 15% leading to the often quoted 40% reduction since 2002. Costs not known, but there will be costs involved in the higher standards for new homes.
Number of Customers	All new buildings.
Barriers to Success	This is a legal requirement, so providing it is enforced, it should be successful in reducing energy emissions.

Suitability for Jersey	This is already planned for introduction in Jersey possibly in 2008.

UK - Energy Matters (EM) and Energy Matters in London (EMIL)

Overview of the Programme	The initial Energy Matters programme is run by the Centre for Sustainable Energy and promotes the involvement of young people as environmental decision-makers and provides links between school and home. This description comes for the Kids 4 Energy Best Practice Guide. The programme provides not only education materials but also training and ongoing support for teachers through local Energy Educators. A central part of the programme was the development of a network of Energy Educators. They were trained and accredited to deliver the programme to a local audience and provide on-going support to schools. The structure allows teachers to quickly introduce Energy Matters into their teaching plans. The Energy Educators can deal with queries quickly and encourages teachers in further development of energy education and links with other initiatives. The Energy Matters 'Home Energy Resource' has been developed to fit with the Curriculum at Key Stages 2 and 3 (ages 7-14) and to provide the local authority a link with the Home Energy Conservation Act. Students complete a Home Energy Survey and analyse the data in the classroom, before taking home recommendations for energy efficiency improvements. The Programme also helped schools to build their home school links through an activity which helps educate parents as well as pupils. Energy Matters in London built upon the initial programme with new resources introduced to widen the approach to school energy.

Benefits/Costs	An independent evaluation was completed in March 2003 the findings included: • Three quarters of parents had adopted some behavioural changes to save energy as part of their children's involvement in Energy Matters; • Nearly all pupils claimed to have taken some actions to save energy as part of the programme; • Staff in participating schools reported action to reduce energy consumption by staff and schools; • Most of the schools assessed in the evaluation had undertaken some energy saving investment; • 98% of schools have indicated that they will continue to use Energy Matters resources.
Number of Customers	• 86 Local authorities have been involved. • Teachers from 466 schools trained. • 18,000 pupils involved. • 189 schools evaluated.
Barriers to Success	School recruitment was difficult, but it was helped by the fact that the Energy Matters resources were free.
Suitability for Jersey	An education scheme for Children would be a low cost programme for Jersey that could make both children and their parents more energy aware.

Ireland

The following programmes and initiatives have been considered from Ireland

- House of Tomorrow;
- Warmer Homes;
- Building Energy Rating;
- Energy Labelling.

Ireland - House of Tomorrow

Overview of the Programme	The programme is run by Sustainable Energy Ireland and aims to accelerate the improvement in the quality of energy features in Irish housing. Developers of a cluster of at least ten houses can apply for funding of up to €8,000 per housing unit. For projects to be eligible the energy performance needs to be at least 40% better than that required under the current building regulations. Preference is also given to projects that incorporate renewable energy features. The measures that have been supported by the programme include advanced wall, ceiling, floor insulation as well as window glazing systems with well sealed construction and good ventilation control. Efficient production is also supported from condensing gas and oil boilers, solar heating systems, heat pumps and biomass boilers. The programme also provides support for installer training, technology guides, feasibility studies, research into housing performance and post graduates.
Benefits/Costs	The key benefit of the programme is that it compensates developers who are spending additional funds in building homes that are more energy efficient than required by the building standards. The programme has been going since 2001 and by October 2006 €22m had been allocated.
Number of Customers	Over 4000 homes have been supported
Barriers to Success	There is a higher cost in building energy efficient homes and the grants may not cover the full cost.

Suitability for Jersey	The main part of this project (grants) could be suitable for Jersey in encouraging developers to build more energy efficient houses. Will have limited applicability as there may not be that many developers building blocks of more than 10 units.

Ireland - Warmer Homes Scheme

Overview of the Programme	The programme is run by Sustainable Energy Ireland with funding allocated by the National Development Plan. It aims to provide energy efficiency measures to customers living in privately owned or privately rented accommodation. SEI will fund multi annual programmes that cover installation of a number of measures including attic insulation, cavity wall insulation, draught proofing, water cylinder jackets and low energy lamps. SEI has appointed organisations to deal with the management of this project. Eaga Partnership is involved in selecting organisation to install measures, quality assurance and programme reporting. Energy Action is responsible for mentoring and assisting the development of community based installer agencies that are funded through the programme.
Benefits/Costs	The benefit to the customers is that they will receive energy efficient improvements to their homes. This is targeted at low income customers.
Number of Customers	Target was to assist 18,000 customers by the end of 2006.
Barriers to Success	Only limited number of customers can be beneficiaries.
Suitability for Jersey	A similar programme could be considered for Jersey. Careful thought is needed on the design and a few international programmes of this type should be considered in designing an appropriate programme for Jersey.

Ireland - Energy Performance of Buildings Directive (Building Energy Rating)

Overview of the Programme	This programme reflects the way that Ireland is implementing the Energy Performance of Buildings Directive (EPBD). Responsibility for this is split between a number of agents including Department of the Environment, Heritage and Local Government (DEHLG), Department of Communications Marine and Natural Resources (DCMNR) and Sustainable Energy Ireland (SEI). The EU Directive contains a range of provision for improving energy performance in buildings. A key part is the requirement for a Building Energy Rating (BER) certificate which is effectively an energy label for buildings. This needs to be available at the point of sale or rental of a building or on completion of a new building. An 'Advisory Report' also needs to be produced setting out the recommendations for cost effective improvements to the performance of the building. There is no legal obligation to carry out the recommendations. There will be a phased impact of the BER in Ireland: • 1 January 2007 – Required for new dwellings; • 1 July 2008 – Required for new building other than dwellings; • 1 Jan 2009 – BER required for all existing buildings when offered for sale or rent.
Benefits/Costs	The benefits will be that purchasers and renters can make an informed decision to buy or rent being fully aware of the energy efficiency of the house. The costs are still uncertain, but it is expected to cost around €300 per building in Ireland
Number of Customers	It is expected that the Directive will impact on 170,000 transactions per year. The majority of which will be domestic premises.

Barriers to Success	Needs well trained assessors to meet the phased timelines identified above. Needs customers (renters and buyers) to value and use the information provided as part of the BER
Suitability for Jersey	This type of scheme should be suitable for Jersey and should be implemented in some form. Important to ensure that trained assessors are available and that customers know how to interpret the information. Consideration needs to be given as to how the Energy Performance of Buildings Directive is being implemented elsewhere to devise the best way to implement in Jersey.

Ireland - Energy Labelling

Overview of the Programme	This is based on EU legislation, but this section describes how it has been implemented in Ireland. Energy labelling of appliances was introduced to Ireland in 1995. The legislation currently covers washers, driers, combination washer driers, fridges, freezers, fridge freezers, dishwashers, ovens and air conditioners. Under this scheme appliances have their energy consumption rated from A (the most efficient) to G the least efficient. There are a team of 18 inspectors who monitor retail outlets for the correct operation of the energy labelling scheme. The potential sanction for non compliance is a fine of up to €3,000 or a jail sentence of up to 6 months.
Benefits/Costs	Consumers can make an informed decision on the appliances. There is a cost to suppliers and distributors in producing the labelling and ensuring it is accurate. There is a cost to retailers to ensure that all display models carry the correct energy labels.
Number of Customers	All retailers, suppliers and distributors need to comply.
Barriers to Success	Customers need to value the information about the energy efficiency of appliances.
Suitability for Jersey	Energy labelling seems a sensible policy for Jersey and some retailers are already adopting this voluntary. Whether it needs a formal programme with penalties is more debatable as it may be possible to reach agreement with the retailer to do this. Possibly a programme similar to the Energy Efficient Product Retailer Assessment System in Japan could include this requirement.

Ontario

The following programmes and initiatives have been considered from Ontario

- Power Smart at Home;
- Cool Savings Rebate;
- Every Kilowatt Counts;
- Low Income Conservation and Demand Management Programme; and
- Residential Energy Efficiency (Canada).

Ontario - Power Smart at Home

Overview of the Programme	The Programmes is run by BC Hydro to encourage the adoption of energy efficiency products in the home. BC Hydro anticipates that Power Smart programmes will save over a 1/3rd of new customer demand. It encourages building improvements, appliance improvements and behavioural change. The programme covers a number of different measures: • Lighting and window rebate – BC Hydro provides rebates for Energy STAR certified light fixtures, lamps and CFLs. Incentives are also available for the purchase of Energy STAR labelled windows based on size. • Refrigerator Buyback – BC Hydro picks up, recycles and pays small incentive fees to owners of old inefficient refrigerators • Power Smart Homes – This programme encourages developers to incorporate energy efficient design concepts and products during construction, which is generally more cost effective than retrofitting existing homes • Tips Products and Energy Analysis Software – BC Hydro offers tips and product recommendations for all types of energy consuming products that are commonly used in the home, The company also provides free online software that analyses a home's energy consumption and provides a personalised information and advice on potential cost saving upgrades.

Benefits/Costs	Figures are available for both the domestic and business Power Smart programmes. The programmes have saved consumers over $1.8 billion. Every year over 4,000 GWh of electricity is saved through Power Smart Programmes (this is both Business and Domestic) The programme costs about $81 per year for each customer.
Number of Customers	All domestic customers are eligible for bits of the programme
Barriers to Success	Getting information to consumers. Persuading customers in existing homes to undertake implementation of measures in existing homes.
Suitability for Jersey	The programme is made up a number of separate initiatives many of which are applicable in Jersey.

Ontario - Cool Savings Rebate

Overview of the Programme	The Cool Savings Rebate programme is run by the Ontario Conservation Bureau. It encourages Ontario residents with existing central air conditioning (AC) systems to improve the operating efficiency of their AC systems. It provides rebates of: • $50 for central AC system 'tune ups' • $75 towards the purchase and installation of programmable thermostats; • $500 to replace existing AC systems with ENERGY STAR qualified systems.
Benefits/Costs	Participants benefit from more efficient air conditioning which reduces electricity cost. The Conservation Fund has an annual budget of $1.5m which is to be spent across all their programmes including Cool Savings Rebate.
Number of Customers	*Unknown*
Barriers to Success	The larger incentives need customers to invest their own money.
Suitability for Jersey	Not applicable as currently not much air conditioning load in Jersey.

Ontario - Every Kilowatt Counts

Overview of the Programme	This programme aims to provide residents with conservation tips and financial incentives to save electricity. It is run by the Ontario Conservation Bureau to every one of Ontario's 4.6m residences. Rebates include: • $3 for ENERGY STAR® qualified Compact Fluorescent Light Bulbs (CFLs); • $15 for programmable thermostats ; • $15 for programmable baseboard heater thermostats; • $7 for motion sensors switches; • $3 for dimmer switches; • $5 for Seasonal LEDS (strings of 50 or more)
Benefits/Costs	The benefit to consumers is reduced prices for purchasing equipment which will make them more energy efficient. It is estimated that customers who take advantage of the entire coupon package can save up to 10% of their winter electricity bills with a target of over 80,000 MWh per annum. The programme requires the customer to actually purchase the equipment, a benefit of which is that they are more likely to value the equipment. The costs break down into rebate costs and administration. Not quantified separately, but typically the Conservation Fund spends between $10,000 and $250,000 per project
Number of Customers	Take up off the last project was nearly 250000 customers
Barriers to Success	Rebates are only offered for two months of the years (Oct 1 – Nov 30th). The Customer needs to make a purchase.
Suitability for Jersey	A similar programme could be used in Jersey but with rebates for slightly different equipment. The lower number of retailers should make it reasonably easy to set up a programme supported by most of the retailers in Jersey.

Ontario - Low Income Conservation and Demand Management Programme

Overview of the Programme	This programme aims to reduce energy consumption of low income residents by 100 MW, while saving them money. The programme has been initially available to the residents of the 5,000 housing units that undertook an energy audit in the summer of 2005 though Social Housing Services Corporation Energy. It had two main objectives: • To capture potential energy savings in Ontario's housing sector through lighting and appliance upgrades, building improvements, and consumer education aimed at promoting energy conservation, while at the same time ensuring that the broad energy needs of households in this sector are met; • To support programme partners in the creation and delivery of effective energy-management strategies as a means of improving the quality and viability of housing in the low-income sector generally.
Benefits/Costs	The benefit of the programme for participants is the lower energy costs. Costs are not known, but as stated earlier the Conservation Fund has an annual budget of $1.5m. Typically the Conservation Fund spends around $10k to $250k per project.
Number of Customers	It is intended that the programme will be expanded to include all 250,000 social housing units by the end of 2006. In 2007 the programme will be expanded to other low income householders and First Nation communities across the province. In total there are 750,000 low income units that could benefit from this programme.
Barriers to Success	Convincing low income residents to implement the measures is difficult.

Suitability for Jersey	This could be adapted for Jersey. Potentially it could be targeted first at the residents of the States of Jersey Housing stock.

Ontario - Residential Energy Efficiency Programmes

Overview of the Programme	This is a series of individual programmes that are run by the Natural Resources Canada's Office of Energy Efficiency. It includes: • EnerGuide for the Houses Retrofit Incentive Programme – Incentives and technical assistance to property owners; • EnerGuide for New Houses – For around $350 an expert advisor will review building blueprints and make upgrade recommendations that will improve efficiency. Canada Mortgage and Housing Corporation (CMHC) will offer a 10% mortgage loan insurance premium refund for CMHC insured financing to purchase EnerGuide certified homes; • R-2000 standard – This initiative includes requirements related to energy efficiency, indoor air quality and the use of environmentally responsible products and materials. R-2000 sets performance criteria but leaves the developer to choose the most effective and economic ways to build it. Builders need to be R-2000 certified. The house must operator within a specified energy budget, which is generally 30% below conventional new home standards; • ENERGY STAR for New Homes – This is just being piloted in Ontario. New homes need to be 40% more efficient than building code standards to receive an Energy Star label; • Website on Appliances - The OEE maintains a website with information on all major appliances.
Benefits/Costs	All of these programmes are designed to increase residential energy efficiency and should decrease energy bills for residential customers. No cost and benefit figures exists for the individual programmes
Number of Customers	*Unknown*

Barriers to Success	Various including additional costs for builders and customers understanding and acting on information on energy efficiency.
Suitability for Jersey	This is a collection of individual programmes many of which exist in other guises elsewhere and should be considered for Jersey. In particular EnerGuide for new houses and the Energy Star Label could be implemented relatively easily in Jersey.

Vermont

The following programmes and initiatives have been considered from Vermont

- Residential Energy Services: Retail Efficient Products;
- Existing Residential Homes; and
- Residential New Construction.

Vermont - Residential Energy Services Retail Efficient Products

Overview of the Programme	This programme is organised by Efficiency Vermont and promotes ENERGY STAR products. It provides financial incentives for purchase of a variety of energy efficiency equipment and aims to strengthen the relationship with retailers, vendors and manufacturers of energy efficient products. The 2004 Programme included: • Rebate for ENERGY STAR qualified freezers; • Lighting rebate coupons; • Commitments to a national initiative to encourage computer manufactures to use energy efficient power supplies; • Buy down offers to retailers and manufacturers.
Benefits/Costs	Customer will benefit by using more energy efficient appliances and lighting. It was estimated that 18026 MWhs were saved in 2004. Costs were: • $1m in incentives; • $4.5m in costs to participants.
Number of Customers	Customers are broken down into categories. Air Conditioning – 1,771 Cooking and laundry 4,166 Lighting 31,159 Refrigeration 1,106
Barriers to Success	Persuading customers to purchase appliances and retailers and manufacturers to take action.
Suitability for Jersey	A programme focussed on rebates for energy efficient products working with retailers could work well in Jersey. The country is too small to be able to put pressure on manufacturers to make energy efficient appliances.

Vermont - Existing Residential Homes

Overview of the Programme	Efficiency Vermont works with retailers, contractors and renovators to disseminate knowledge of energy efficient practices. The programme provides homeowners with incentives and information about energy efficient building practices, appliances and lighting products. The programme also caters to low income single-family housing; providing weatherisation (e.g. draft exclusion) assistance and installation of ENERGY STARY certified lighting and appliances.
Benefits/Costs	The programmes should improve the level of energy efficiency in existing homes. In 2004 there were 3,805 MWh saved. The costs of the programme break down into $920k paid for incentives and $565k in participant costs.
Number of Customers	In 2004 the following customers were involved: • Air Conditioning: 39 Participants • Hot Water Efficiency: 441 Participants • Hot Water Fuel Switching: 317 Participants • Lighting: 1,149 Participants • Motors: 2 Participants • Other Fuel Switching: 2 Participants • Refrigeration: 431 Participants • Space Heat Efficiency: 42 Participants • Space Heat Fuel Switching: 131 Participants • Water Conservation: 1 Participants
Barriers to Success	Customer awareness of programmes and understanding the energy efficiency benefit.
Suitability for Jersey	Incentives could work but need appliances targeted at the Jersey market.

Vermont - Residential New Construction

Overview of the Programme	This programme is aimed at builders and buyers of new houses. Efficiency Vermont provide: • Technical assistance; • Plan reviews; • On site inspections; • Performance testing; • Energy ratings; and • ENERGY STAR labelling for qualified homes. The programme was successful as in 2004 Vermont was among the top five states for market share of ENERGY STAR qualified single family and multi family homes.
Benefits/Costs	The programme saved 783 MWh in 2004. The programme cost $318k in incentives and $192k in participant costs.
Number of Customers	Customers were involved in the following activities: • Air Conditioning Efficiency: 43 • Cooking and laundry Efficiency: 454 • Hot Water Efficiency: 394 • Lighting: 468 • Other Activities: 401 • Refrigeration: 404 • Space Heat Efficiency: 448 • Ventilation: 423
Barriers to Success	Builders have to be prepared to get Efficiency Vermont involved in providing assistance and may need to make alterations that add costs to the project. Buyers of houses need to value the ENERGY STAR label.

Suitability for Jersey	Working with builders and developers to promote energy efficient houses is a programme that can be introduced in Jersey. Education of consumers is also important to ensure that customers ascribe value to being sold a house that is energy efficient.

New Zealand

The following programmes and initiatives have been considered from New Zealand

- Energy Efficiency of Products;
- EnergyWise Home Grants; and
- Home Energy Rating Schemes.

New Zealand - Energy Efficiency of Products

Overview of the Programme	This programme is sponsored by the Energy Efficiency Conservation Authority (EECA) and targeted at retailers and manufacturers of Consumer goods. The system establishes Minimum Energy Performance Standards, Minimum Energy Performance Labelling and Voluntary Energy Star labelling for consumer products. The programmes aim to give consumers better energy efficiency information to influence their purchase decisions. The goal is to have 20% of products displaying an ENERGY STAR label by 2007.
Benefits/Costs	The target s that by 2012 7-11PJ (A PJ = 10^{15} Joules) of energy will be saved annually. This is equivalent to 1.2 to 2 million tonnes per annum. The costs will fall on retailers and manufactures and are not specified.
Number of Customers	All customers will benefit from better information.
Barriers to Success	Customers need to value the information provided by retailer and manufacturers and purchase more efficient products. The more efficient products may have a higher initial cost.
Suitability for Jersey	Working with manufacturers would be difficult for Jersey due to its small size. Operating a programme with retailers to promote energy efficiency is a programme that should work well.

New Zealand - EnergyWise Home Grants

Overview of the Programme	The Energy Efficiency Conservation Authority operated this programme to provide financial assistance to retrofit existing home stock to energy efficient insulation levels. The programme is aimed at homes built before 1977 of which 900,000 homes exist. The aim is to retrofit 40,000 of these by 2008.
Benefits/Costs	Customer benefit from reduced energy cost due to better insulated houses. By 2012 the programme should save 0.2 to .4 PJ annually, which is equivalent to 30,000 to 60,000 tonnes of avoided CO_2 Relies on a total of $10.3m to deliver. $5.42 million of grant funding has been committed for insulation retrofits to 7-8,000 homes by June 2007.
Number of Customers	By 2006, 25,000 homes have been retrofitted
Barriers to Success	Obtaining sufficient funding.
Suitability for Jersey	A similar programme aimed at a category of home could be introduced in Jersey. Financial assistance could represent a significant cost. Thought is therefore needed as to how to target the right customers.

New Zealand - Home Energy Rating Scheme

Overview of the Programme	This programme is a rating system that is applied to residential homes. It is similar to the star rating currently used for appliances. This rating will allow owners and buyers of the property to be aware of the energy performance of their home and to make energy efficiency improvements. Households and landlords that participate in the scheme will receive information on the energy efficiency improvements they can make to their house.
Benefits/Costs	Owners and buyers will be better informed about the energy efficiency of their houses. Buyers/renters may use this information as one part of their valuation of the property. The list of potential measures may encourage landlords/buyers and new owners to undertake actions and improve the efficiency of the housing stock. $1.7m has been allocated from the 2006/07 budget. No indication is yet available as to how much the rating will cost for each property.
Number of Customers	The scheme is voluntary and open to all customers. However, the priority market is middle to high income earners and landlords who are responsible for pre-1977 houses. The Energy Efficiency Conservation Authority who runs this programme estimate this could be in the order of 250,000 houses.
Barriers to Success	Householders and landlords need to decide whether they wish to invest in these rating and take account of the recommended actions. Customers have to value the rating information.
Suitability for Jersey	Similar to the UK and Ireland schemes this type of initiatives is recommended for Jersey. If a decision is made not to introduce a mandatory scheme then some investigation should be made of the success of this voluntary programme.

Additional Programmes

The following additional programmes and initiatives have been considered

- CO_2 Diet (Japan);
- California State-wide Pricing Programme (US); and
- Energy Efficient Product Retailer Assessment System.

ECO 2 Programme - CO_2 Diet (Japan)

Overview of the Programme	This is part of the ECO2 Support programme and is run by TEPCO a large Japanese Utility. The programme provides information on what customers can do to mitigate climate changes in the monthly energy usage statement for customers and on the company website. The back of the electricity consumption notice contains a CO_2 check sheet that allows the customer to calculate CO_2 emissions. A key part of the programme is the CO_2 Diet. TEPCO invites members of the community to join the CO_2 Diet where they make life style changes at home to cut emissions and make a declaration to this effect. The CO_2 diet gives simple but useful information to save energy. It provides a number of tools for participants to raise their awareness namely: 1) CO_2 Household Account – once users input the amount of different types of energy used then a graph showing CO_2 emissions will be produced; 2) Eco Style Planning – Simulates the CO_2 emissions and monetary savings from energy saving in the kitchen and living room; 3) Introduction to Eco-housework – Provides advice from professionals on performing housework in a more eco friendly way. As part of this campaign to prevent global warming, TEPCO will donate young trees to elementary schools based on the number of people that participate.
Benefits/Costs	Provides advice to participants as to how to save energy and therefore saves both money and carbon. Carbon saving is equivalent to a reduction of 25,000 tones of CO_2. Costs are not quantified, but will be low as no financial incentives are required as part of the programme.

Number of Customers	In 2006 TEPCO reported that 300,000 people have made this CO_2 declaration. TEPCO also run an employee CO_2 diet and in 2005 over 13,000 employees took part.
Barriers to Success	Customers need to deliver their pledged energy savings.
Suitability for Jersey	A similar information based programme could be used in Jersey.

State-wide Pricing Programme

Overview of the Programme	The State-wide Pricing Pilot Programme was implemented across the entire state of California and was sponsored by the California Public Utilities Commission and the California Energy Commission. The aim of the project was to evaluate the potential peak load demand reduction benefits of time based rates. This included improved system reliability, reduced power purchases and protecting the environment. All Customers involved received a free advanced digital electric meter designed to facilitate energy information and management. Website portals were established for enrolled customers through their utility websites to check their usage online, using a password-protected login. Residential and commercial customers are given a free Honeywell programmable thermostat. Adjustments to thermostats are encouraged by providing tips on pre-cooling and pre-settings. Some of the customers were placed on a Critical Peak Pricing tariff. Under this tariff a maximum of 90 hours per year anytime during the noon- 6 p.m peak for Commercial and Industrial customers and a maximum of 15 days per year for residential customers could be declared as a "super peak" time where prices were set as high as 75 cents per kWh to deter or encourage usage shifting. Customers were informed the day before when these peak periods would apply. In return for these high peak periods customers benefited from lower off-peak rates.

Benefits/Costs	Customer benefits included new meters, a programmable thermostat, reduced bills and more information about how to lower their electricity use and therefore electricity bills. Sending dynamic rates to customers achieved average peak load reductions ranging from 12-40% of baseline peak usage. The degree or reduction depended on the tariff rate, weather, customer appliance holdings and the availability and use of demand response controls. It was found that residential and small to medium C&I customers preferred dynamic rates to the existing inverted rates that exist in California. The cost of this pilot programme was approximately $20m.
Number of Customers	A total of 2,500 customers were enrolled across residential and commercial customers. It was designed as an "opt-out" programme in order to gain a good sample of different types of customers. There were a number of enrolment requirements including: 1. The bill payer must occupy the home for residential customers (to avoid renting/owner complications over electricity decisions); 2. Customers can not be planning to move locations within the next six months; and 3. Customers are required to provide a land-based phone number where they could be reached for notifications of a "Shift & Save" event (where super peak prices would be in effect if a CAL ISO emergency was declared).
Barriers to Success	Costs of introducing such a programme. Need for suppliers to offer tariff that reward customers for moving their energy demand.

Suitability for Jersey	This scheme could be considered for Jersey as the metering and tariff produced both lower energy consumption and peak load reduction. However, this was at a high cost per customer and further investigation is needed into the likely results for Jersey's customers. A number of demand reduction pilot programmes have been proposed in the UK in a DTI/DEFRA programme. The evidence from these programmes should be published and should also be considered by Jersey to assess whether this type of programme is applicable.

Energy Efficient Product Retailer Assessment System

Overview of the Programme	This programme if run by the Energy Conservation Centre in Japan and encourages retailers to promote energy efficient products. It provides an assessment system for appliance retailers who are the contact point with customers. The assessment is targeted at large home appliance retailers who meet the following two criteria: • A floor space of at least 1,000 square meters • At least 50% of sales coming from home appliances. Stores that actively promote energy efficient products or provide appropriate energy conservation information will be able to be recognised at top retailers and are authorised to carry a special logo. Top 'energy efficient product promotion stores' are selected each year and publicised along with their rankings.
Benefits/Costs	Large stores have an incentive to provide advice on energy efficiency in order to be publicised as energy efficient. This should benefit the end customer if it leads to them buying more efficient product. Costs are not specified but should be relatively low as there are no financial incentives.
Number of Customers	*Unknown*.
Barriers to Success	Customers need to value the energy efficiency logo and look at the publicity by the Energy Conservation Centre for which sites to visit.
Suitability for Jersey	Working with the small number of retailers in Jersey would be a sensible policy. Some of the criteria would need to be relaxed as only looking at stores above 1,000 square meters could miss out on some of the opportunities.

Appendix B –Analysis of Potential Micro Generation Technologies

This appendix contains a survey of potential technologies for domestic micro generation. Each technology is explained including an assessment in regard to the suitability for Jersey.
The information derived from the website of the UK Department of Trade and Industry, www.dti.gov.uk and of the website of Micropower, http://www.micropower.co.uk.
The following technologies are assessed:

- Solar Thermal Hot Water Heating
- Solar Photovoltaic (PV) electricity generation
- Wind turbines (domestic)
- Micro-Combined Heat and Power (CHP)
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Micro-hydro
- Biomass heating
- Fuel-cells

Solar Thermal Hot Water Heating

How it works	Solar thermal is the most commonly installed form of solar energy currently in use today. There are three main components for domestic hot water systems: Solar panels, a heat transfer system, and a hot water cylinder. The solar panels, or collectors, are usually fitted to the roof and collect heat from the sun's radiation. This heat is used to raise the temperature of the household water and is delivered by the heat transfer system which takes the heated water to the hot water cylinder for storage until use. Solar hot water systems can also be used on larger applications such as swimming pools.
Suitability for Jersey/Guernsey	This technology is highly suitable for Jersey.
Maintenance	A yearly check by the householder and a more detailed check by a professional installer every 3-5 years should be sufficient (consult your system supplier for exact maintenance requirements).
Output in electricity per year	Thermal output only
Lifetime of the product	20 years (15 years for older systems)
Efficiencies of the technology	Solar water heating can typically provide almost all hot water requirements during the summer months and about 50% year round.
Quantities installed elsewhere	At the end of 2005, around 80,000 solar thermal installations existed in the UK.
Other points to note	The solar system would typically save approximately 400kg of CO_2 per year, depending on the fuel replaced. The performance of a solar thermal system is best when the solar collectors are installed on a southeast to southwest facing roof receiving direct sunlight for the main part of the day.

Solar Photovoltaic (PV) Electricity Generation

How it works	Photovoltaic or PV generates electricity from sunlight. Small-scale PV modules are available as roof mounted panels, roof tiles and conservatory or atrium roof systems. A typical PV cell consists of two or more thin layers of semi-conducting material, which is most commonly silicon. The electrical charge is generated when the silicon is exposed to light and is conducted away by metal contacts as direct current (DC). Although the electrical output from a single cell is small, when multiplied together a desired electrical output can be achieved. Therefore, PV cells are connected together and encapsulated, usually behind glass, to form a module or panel and any number of modules can be connected together.
Suitability for Jersey/Guernsey	This technology is suitable for Jersey, but is normally used in places where no grid connection is available due to the price.
Maintenance	Not known
Output in electricity per year	1-3 kW is a typical power output for a domestic installation although this is very flexible and depends on the number of PV modules installed.
Lifetime of the product	25 years
Efficiencies of the technology	A typical 1.5 - 2 kWp system will produce enough electricity to supply almost half of an average family's annual supply, assuming that the heating is fuelled by gas and that the house has no energy efficiency savings. The performance of a PV system will depend upon the size of the system, the type of PV cell used and the nature of the installation.
Quantities installed elsewhere	It is estimated that by the end of 2004 around 8,164 kilowatt peak (kWp) of PV was installed in total in the UK

Other points to note	The PV system generates no greenhouse gases and save approximately 325kg of CO_2 per year or about 8 tonnes over system's lifetime – for each kWp. Solar tiles, which can be integrated into a roof, maybe worth considering if major roof repairs are intended to be carried out.

Wind Turbines (domestic)

How it works	Wind Turbines harness the wind to produce electrical power. The latest development in domestic wind turbine technology is roof-mounted turbines for installation on domestic dwellings. These mini-wind turbines give a nominal output of 1kW and are designed to generate energy from low wind speeds. They are typically mounted on the gable end of buildings although in some cases can be attached to the building side-walls. These modern designs tend to be very near silent in operation.
Suitability for Jersey/Guernsey	This technology is suitable for Jersey, but is expensive.
Maintenance	Some parts need replacing during lifetime
Output in electricity per year	1kW up to 6 kW
Lifetime of the product	20 years
Efficiencies of the technology	The efficiency of a domestic system will depend on factors such as location and surrounding environment and the electricity output is usually between 2.5 and 6 KWs, but can be as low as 1kW.
Quantities installed elsewhere	It is estimated that there are around 650 – 700 small scale installations in the UK.
Other points to note	Roof mounted turbines of 1kW usually will reduce an average annual electricity bill by up to 1/3 or around 3.2MW per annum. This would save approximately 500kg or half a tonne of CO_2 per year.

Micro-Combined Heat and Power (CHP)

How it works	CHP is a highly fuel-efficient energy technology, which puts to use waste heat produced as a by-product of the electricity generation process. **Reciprocating Engines** The electrical output of this type of micro-combined heat and power (microCHP) units typically start at about 5 kW offering around 10-12kW of thermal output. **Stirling Engines** These are external combustion engines with a sealed system using an inert working fluid, usually helium or hydrogen. They range in size from ½ kW upwards and are now available on the market with the leading brands being Microgen and Whisper Tech who are currently penetrating the home heating markets.
Suitability for Jersey/Guernsey	Gas in Jersey has a low caloric value and no engines are currently made which are compatible with Jersey gas.
Maintenance	Required and can be a significant cost
Output in electricity per year	Not known
Lifetime of the product	10-15 years
Efficiencies of the technology	Not known
Quantities installed elsewhere	Micro-CHP systems in the UK are currently being developed and some are undergoing field trials within households.
Other points to note	Most new CHP schemes use natural gas, but a significant proportion burn alternative, including renewable, fuels. Annual CO2 savings: 5 tonnes

Ground Source Heat Pumps

How it works	A heat pump moves heat energy from one place to another and changes the temperature from lower to higher. An example of a commonly known heat pump is a domestic refrigerator. Where heat pumps are used for heating applications, heat is removed from the source (ambient air, water, soil or bedrock) and then discharged where the heat is needed. Where cooling is required, the reverse happens and heat is removed and discharged into air, water, soil or rock. The most common form of heat pump used within domestic dwellings and are eligible for government funding under the clear-skies programme, are ground source heat pumps In the UK, the earth that lies a few metres below our feet, keeps a constant temperature of about 11-12C throughout the year. The ground has a high thermal mass which allows it to store heat from the sun during the summer. Ground Source heat pumps tap the heat within the ground and convert it into energy. The heat pump operates under similar principles to a refrigerator. The heat is captured from within the ground by either pipes laid into trenches or down a borehole and is eventually distributed within the building through radiators or under-floor heating.
Suitability for Jersey/Guernsey	This technology is suitable in the parts of Jersey with a sandy soil.
Maintenance	Not known
Output in electricity per year	A typical system will provide 95 - 100% of a household's heating requirements.
Lifetime of the product	20 years
Efficiencies of the technology	The performance of Ground Source Heat Pumps is commonly measured by the coefficient of performance (CoP) which is the ratio of units of heat output for each unit of electricity used to power the heat pump. Typical CoPs range from 2.5 to 4, with the higher end of the range being for under-floor heating as it works at a lower temperature than radiators.

Quantities installed elsewhere	The total number of existing installation in the UK is estimated at 5 megawatt thermal (MWth) made up of around 600 - 700 units.
Other points to note	Heat pumps require electricity to work, although this can be provided by complimentary renewable energy sources.

Air Source Heat Pumps

How it works	These systems have yet to become widely available for the domestic market and continue to undergo minor development work. However they are likely to become commercially viable in the very near future. They work in the same way as ground source heat pumps except that the source of the heat is the external ambient air. As external temperature is more variable than in the ground, coefficients of performance are likely to be lower, but so too are installation costs as no trenching or ground drilling is required.
Suitability for Jersey/Guernsey	*Unknown*
Maintenance	*Unknown*
Output in electricity per year	*Unknown*
Lifetime of the product	*Unknown*
Efficiencies of the technology	*Unknown*
Quantities installed elsewhere	*Unknown*
Other points to note	*Unknown*

Micro-hydro

How it works	Water is used by "hydro turbines" to generate electricity. Water flowing down rivers, for example, turns the turbine round; this movement is used to produce power. Most hydro power is produced in hilly or mountainous areas, or in river valleys. The amount of electricity that can be produced is determined by how much water is available and how fast it flows. Additionally of all renewable energy technologies, it is the most consistent at providing electricity.
Suitability for Jersey/Guernsey	This technology is suitable in rural areas, provided that a waterstream or high difference is present.
Installation cost	*Unknown*
Maintenance	*Unknown*
Output in electricity per year	*Unknown*
Lifetime of the product	*Unknown*
Efficiencies of the technology	The performance and size of micro-hydro schemes is very site specific with plant ranging from a few hundred watts to 100kW, with the higher range used for commercial schemes.
Quantities installed elsewhere	A total installed capacity of around 100 megawatt (MW) is currently operating in the UK at about 120 small hydro sites, each with installed capacity of <5MW.
Other points to note	

Biomass Heating

How it works	Biomass heating usually involves the use of commercial energy crops in the form of fast-growing trees such as willow or poplar for woodchips or waste wood products such as sawdust, pallets or untreated recycled wood for pellets. These fuels are burned in either pellet stoves or larger scale boilers to provide heating and/or water heating. Man has been producing energy from biomass for centuries, and in many parts of the world it is still the principle source of heat. However, modern technologies are far more efficient than open fires and an increasing range of fuels are now being utilised. Biomass is often called 'bioenergy' or 'biofuels'. These biofuels are produced from organic materials, either directly from plants or indirectly from industrial, commercial, domestic or agricultural products.
Suitability for Jersey/Guernsey	This technology is very suitable for Jersey. However, for this technology to fit in the green policy of Jersey, the biomass will have to be grown on Jersey itself and not shipped from abroad by oil-fuelled ships. With a high percentage of arable land, this should be possible.
Maintenance	*Unknown*
Output in electricity per year	The stand-alone stoves provide space heating for a room, and can sometimes be fitted with a back-burner to provide water heating. These systems have a typical output of 6-12 kW and are fuelled by logs or pellets. Boilers that are connected to a central heating and hot water system are larger with an output of more than 15kW. These systems can usually be fuelled by logs, chips and pellets.
Lifetime of the product	25 years
Efficiencies of the technology	The performance of biomass heating for a domestic property depends upon the chosen system, usually either a space heating only, or a central heating and hot water system.

	For a typical domestic system with a total annual heat load of 30,000 kilowatt hours (kWh), a 9kW biomass system could deliver the heat required.
Quantities installed elsewhere	It is estimated that the existing number of domestic wood burning installations produce around 2.38 terawatt hours (TWh)/year in the UK.
Other points to note	Biomass systems do emit carbon dioxide. However, as the biomass fuel is cultivated, it absorbs the exact same amount of carbon dioxide as is released when burnt. There will however be carbon emissions associated with, for example, any fertiliser used in production of the biomass fuels. As such, bioenergy systems are considered to be broadly carbon neutral and will almost always save more than 95% of the carbon from fossil fuels displaced.

Fuel-cells

How it works	Fuel cells have been designed to combine hydrogen and oxygen to form electricity, heat and water. These can be used for providing heat and power to individual or multiple homes and for powering cars. They operate best on pure hydrogen, but other natural gases can be converted into power too. Hydrogen and fuel cells are intermediate technologies, not renewable sources, they cannot contribute to renewable energy targets. However, the production of hydrogen from renewable energy sources offers the potential to create an almost zero emission energy chain, with hydrogen and fuel cells used to power everything from domestic households (providing both heat and power) to mobile phones and cars.
Suitability for Jersey/Guernsey	This technology is not yet suitable for Jersey.
Maintenance Cost	*Unknown*
Output in electricity per year	*Unknown*
Lifetime of the product	1 year for the hydrogen cells.
Efficiencies of the technology	*Unknown*
Quantities installed elsewhere	Fuel-cell technology is an emerging global industry, with North America, Japan and the UK playing leading roles. Areas such as Teesside, with its long history of petrochemical innovation, are pioneering the initial development of the necessary technology and infrastructure to produce large-scale hydrogen fuel cells and help speed the creation of a hydrogen economy.
Other points to note	

Appendix C International Micro Generation programmes

This appendix contains a structured assessment of some of the domestic micro generation programmes that have been tried internationally in order to assess the most appropriate solutions for Jersey.

The programmes are sorted in three categories, namely programmes to promote:

- Heating (of space or water);
- Electricity; and
- Both heating and electricity.

Many programmes include schemes for micro generation as well as energy efficiency. Programmes that have been focussed predominantly on energy efficiency are included as a separate piece of analysis in Appendix A.

In undertaking this assessment the following countries were examined:

- UK – similar climate and housing stock to Jersey;
- Ireland – Small country with similar climate to Jersey;
- New Zealand – two islands with limited interconnection; and
- Spain – One of the most progressive with a mandatory solar programme.

In addition we have included a number of relevant examples from selected other countries where we felt these programmes provided useful lessons of the most applicable solutions for Jersey and two example programmes to educate children en teenagers on energy savings and renewable energies.

Summary Table of Micro Generation Programmes

HEATING	ELECTRICITY	BOTH
Greener Homes Scheme (Ireland)	PV Incentive Program (USA)	Scottish Community and Householder Renewables Initiative (Scotland)
Community energy programme (UK)	Wind Incentive Program (USA)	VAT Relief on Energy Saving Materials (UK)
Dwelling Improvement Act and Housing Promotion Subsidies (Austria)		Low Carbon Building programme (UK)
Solar Water Heating (New Zealand)		Spain's Building Technical Code (CTE - Código Técnico de la Edificación) (Spain)
Long Island Power Authority - Residential Energy Efficiency Rebate Program (USA		State Programme to Support Energy Savings and Use of Renewable Energy and Secondary Sources (Czech Republic)
		Support for solar (Belgium)
)		Promotion for the Local Introduction of New Energy (Japan)
		Energy $mart Loan Fund (USA)

Programmes for Heating

Greener Homes Scheme

Country	Ireland
Technology supported	• Wood chip or pellet stoves or boilers • Solar heating (hot water or space) • Heat Pumps (Horizontal or vertical ground collector)
Overview of the programme	This programme is run by Sustainable Energy Ireland (SEI) and provides grants to homeowners that install eligible products of the types listed above. All eligible products will have a SEI Product ID as part of the Registered Product list. The level of the grants will depend on the technology used as detailed below. Applicants are also expected to use installers who have registered with SEI, which helps to keep some control on quality. All of the renewable energy systems are new technologies which have yet to become established in Ireland. The provision of these grants should help with the faster uptake of these programmes.
Benefits/Costs	The benefits will depend on the type of technology with the following grants available: • Wood Chip or Pellet Stove €1,100 • Wood Chip or Pellet Stove with Integral Boiler - €1,800 • Wood Chip or Pellet Boiler - €4,200 • Heat Pump – Horizontal Ground Collector €4,300 • Heat Pump – Vertical Ground Collector - €6,500 • Heat Pump – Air Source €4,000 • Solar Thermal Space/Hot water heating - €300 per m^2 A total of €27m has been made available as part of this scheme.
Number of customers	The programmes only started in March 2006 and by the end of June there was over 3,500 grants approved

Community Energy Programme

Country	UK
Technology supported	• Renewable CHP
Overview of the programme	The community energy programme has broken new ground to make community heating more efficient by supporting a large number of small, innovative projects, using renewable fuels such as biomass and lead the way for developing even more innovative solutions to cutting carbon emissions in the future.
Benefits/Costs	*Unknown*
Number of customers	*Unknown*

Dwelling Improvement Act and Housing Promotion Subsidies

Country	Austria
Technology supported	• Bioenergy • Solar thermal
Overview of the programme	The redesign of existing subsidy schemes for construction of housing (responsibility of provinces) has been one of the most successful policy measures to promote renewable energy use by households. In the province of Salzburg in 2003 more than 50% of newly constructed dwellings were heated with biomass and solar. Some have excluded new houses from subsidies that do not use renewable energy for heating.
Benefits/Costs	*Unknown*
Number of customers	*Unknown*

Solar Water Heating

Country	New Zealand
Technology supported	• Solar water heating
Overview of the programme	To encourage the growth and proliferation of solar water heating technology in New Zealand: • Provides buyers with greater certainty of product and service quality through standards, accreditation procedures and training. • Provides incentives for solar water heating uptake to expand the current market and encourage new buyers. • Changing the perception of solar water heating through information and marketing programs.
Benefits/Costs	By 2102: .5PJ annually of additional solar thermal energy, lower prices of solar water heaters, 80,000 tonnes of CO_2 avoided.
Number of customers	*Unknown*

Long Island Power Authority - Residential Energy Efficiency Rebate Program

Country	USA
Technology supported	Geothermal Heat Pumps
Overview of the programme	Financial aid to install geothermal heat pumps for heating and air conditioning.
Benefits/Costs	Examples of grants provided: • Split Central Air Conditioner: $300 or $400, depending on efficiency rating • Air Source Heat Pump: $300 or $400, depending on efficiency rating • Geothermal Heat Pump: $150/ton - $800/ton, varies by efficiency rating and whether the unit is a replacement or a new installation • Clothes Washer: $15 - $50, varies by efficiency rating
Number of customers	*Unknown*

House of Tomorrow

Country	Ireland
Technology supported	Efficient production from e.g. • Condensing gas and oil boilers • Solar heating systems • Heat pumps • Biomass boilers
Overview of the programme	The programme provides funding to housing developers of superior energy performing housing units. These houses must be in cluster of at least ten. For projects to be considered the energy performance needs to be at least 40% better than that required under the current building regulations. Preference is also given to projects that incorporate renewable energy features. Available funding is up to €8,000 per housing unit. The featured that have been supported by the programme include advanced wall, ceiling, floor insulation as well as window glazing systems with well sealed construction and good ventilation control. As well as the house having a reduced loss of energy there is also efficient production from condensing gas and oil boilers, solar heating systems, heat pumps and biomass boilers. The programme also provides support for installer training, technology guides, feasibility studies, research into housing performance and postgraduate studentships.
Benefits/Costs	*Unknown* €22m has been allocated by October 2006
Number of customers	Over 4,000 energy efficient houses have been supported by loans.

Programmes for Electricity

PV Incentive Program

Country	USA
Technology supported	Photovoltaics
Overview of the programme	The New York State Energy Research and Development Authority (NYSERDA) provides incentives of $4 to $4.50 per watt (DC) to eligible installers for the installation of approved, grid-connected photovoltaic (PV) systems. The maximum capacity of an eligible system was raised from 15 kilowatts (kW) to 50 kW in June 2004. Incentives are only available to eligible installers, and incentives must be passed on to customers. Installer eligibility will be determined and maintained based on factors such as acceptance of all program terms and conditions, training, installation experience, track record related to utility interconnections, overall performance, monitoring, customer references, customer satisfaction, and commitment to become certified through a national certification program. All incentives are capped at 60% of the total installed cost for all systems. PV systems must be sized to meet specific site energy needs (local load or demand) and may not exceed 110% of the demonstrated energy demand for the site, taking into account any other on-site electrical power generation systems. PV incentives are available for many end-uses (building or non-building) and sectors, including the residential, commercial, industrial, agricultural, institutional, educational and non-for-profit facilities, and government sectors.
Benefits/Costs	The programme budget is $15.9 million (2002-2006)
Number of customers	*Unknown*

Wind Incentive Program

Country	USA
Technology supported	Wind
Overview of the programme	The Wind Incentive Program is designed to encourage the development of a network of eligible installers who will install end-use wind turbines for all sectors. These include, but are not limited to, the residential, commercial, industrial, agricultural, institutional, educational, not-for-profit and government sectors. Awards of up to $100,000 per installation will be paid to eligible installers who meet the requirements for education, training, experience, insurance and other criteria. The installers, in turn, pass through incentives directly to the owners of the wind systems. Incentives are based on a percentage of the installed cost, ranging from 50% of costs for systems of 500 watts (W) to 10 kilowatts (kW), to 15% for systems larger than 80 kW. Larger incentives of up to 70% of costs are available for commercial farms, and for school applications where the study of wind energy is incorporated into the curriculum.
Benefits/Costs	*Unknown*
Number of customers	*Unknown*

Programmes for Both Heating and Electricity

Scottish Community and Householder Renewables Initiative (SCHRI)

Country	Scotland
Technology supported	SCHRI supports a range of renewable energy technologies including: • Micro hydro-electric • Micro wind • Solar water heating • Solar space heating • Automated wood fuel heating systems (boilers and room heaters/stoves) • Heat pumps (ground, air and water source) • Connections to the Lerwick District Heating Network *(applies to heat exchanger only. Radiators/internal heat distribution system not eligible for grant)
Overview of the programme	SCHRI is a one-stop shop offering grants, advice and project support to assist the development of new community and household renewable schemes in Scotland.
Benefits/Costs	Funding for householders is set at 30% of the installed cost of a renewable measure up to £4,000. Householders can also apply for separate grants for two different technologies.
Number of customers	The programmes only started in March 2006 and by the end of June there was over 3,500 grants approved.

VAT Relief on Energy Saving Materials

Country	UK
Technology supported	• Central heating and hot water system controls • Draught Stripping • Insulation • Solar Panels • Wind turbines • Water turbines • Air Source Heat Pumps • Micro-CHP • Wood fuelled boilers
Overview of the programme	• The programme allows a reduced rate of VAT of 5% (as against 17.5%) to be charged for energy efficient equipment fitted to existing buildings. This reduced rate applies to all technology described above.
Benefits/Costs	*Unknown*
Number of customers	*Unknown*

Low Carbon Building Programme

Country	UK (except the Channel Islands and the Isle of Man)
Technology supported	• Solar photovoltaics • Wind turbines • Small hydro • Solar thermal hot water • Ground/water/air source heat pumps • Bio-energy • Renewable CHP • MicroCHP (Combined heat and power) • Fuel cells
Overview of the programme	It offers grants towards the cost of installing domestic micro generation technologies and larger scale distributed generation installations for public buildings and businesses, provided energy conservation standards are also met. Grants are normally in the 10 to 50% range, according to the applicant and the technology, and are considered on a first-come-first-served basis. It replaced two earlier schemes, the 'Major Photovoltaics Demonstration programme', which assisted with photovoltaic installations, and the 'Clear Skies' programme, which aided other micro generation installations.
Benefits/Costs	Initial Government funding of £30 million was announced, to be made available over the first three years from the start of the programme. £6.5 million of this is allocated for domestic installations, £4 million for community installations and £18 for others, while £1.5 was reallocated to fund the remainder of earlier programmes. A further £50 million was announced in the April 2006 budget.
Number of customers	*Unknown*

Spain's Building Technical Code (CTE - Código Técnico de la Edificación)

Country	Spain
Technology supported	Efficient production from e.g. • PV systems • Solar heating systems
Overview of the programme	Spain's new Building Technical Code establishes minimum requirements for energy efficient buildings. In March 2006, the Spanish Council of Ministers approved a new construction standard through Royal Decree 314/2006 of 17 March 2006. This updates the old one dating from the 1970s and partially transposes the EU Directive 2002/91/CE on Energetic Efficiency in Buildings. The new standard, called the Building Technical Code (CTE - Código Técnico de la Edificación), establishes new quality, security, energy efficiency and habitability requirements for new or renovated buildings, thus creating a legislative framework that harmonises Spanish building standards with those of the European Union. This standard should also promote technological innovation and development. In particular, the standard includes the following basic requirements for energy efficiency of buildings: • Minimum contribution from solar powered systems. A minimum percentage ranging from 30% up to 70% of the annual energy requirements for the production of Domestic Hot Water (DHW) demand will be met with solar thermal energy. The percentage will depend on geographical location and the specific demand of the building for domestic hot water. • Minimum contribution from photovoltaic systems to the total electric energy consumption. In certain buildings, photovoltaic systems will be introduced to transform solar energy into electric energy for personal or community use. • Limitation of the general energy demand of a building. Buildings will be designed taking into consideration insulation, air permeability, exposure to solar radiation, and the local climatologic conditions, and using the necessary materials and techniques to limit the gain and loss of energy. • Performance of the thermal facilities. The thermal facilities of a

	building (heating, ventilating, air-conditioning, etc…) will have a minimum energy efficiency target, established by current legislation. • Energy efficiency of the lighting facilities. The lighting facilities of buildings will be appropriate to meet the lighting requirements of users and at the same time will be energy-efficient. To this end, they will have a control system that will optimise the use of natural light and adapt their use depending on the occupancy of the area.
Benefits/Costs	It has also been estimated that for each household (4 people, 100 meter squared) one or two meter squared of photovoltaic panels will be needed, which will involve an additional cost of 600 to 2,000 euros approximately 1% of the total cost of the house). This initial cost will be paid off in 5-10 years. After that period, each family could save up to 80 euros per year. The Spanish Institute for Energy Diversification and Saving (I.D.A.E.) has calculated that with the implementation of these new energy requirements introduced by the CTE, each building will reduce energy consumption by between 30% and 40%. Moreover, the CO_2 emissions associated with energy production and consumption will be reduced by 40% to 55%.
Number of customers	It is expected that the estimated 400,000 households to be built annually will be equipped with such facilities.

State Programme to Support Energy Savings and Use of Renewable Energy and Secondary Sources

Country	Czech Republic
Technology supported	All technologies simultaneously
Overview of the programme	The State Programme to Support Energy Saving and Use of Renewable and Secondary Sources set up by the Ministry of Industry and Trade in co-operation with other ministries was established in 1991. It is revised each year. The programme for 2000 included energy-saving measures in production, distribution and consumption of energy; wider use of renewable and secondary sources of energy; development of co-generation of heat and electricity; counselling; implementation of low-energy technologies; and educational and promotional activities. The programme is executed by the Czech Energy Agency (CEA) and other ministries. The State Environment Fund is an important participant. Currently it provides the following incentives for renewables: • Obligation for distribution companies to purchase electricity and heat generated from renewables based on regulated buy-back tariffs. • Exemption from excise taxes for biodiesel fuel (methanol from rape seed). • Reduced import duties on renewable energy equipment. • Five-year tax relief (income and property) for investment in renewables (small hydropower plants restricted to capacities > 1 MW). • Reduced VAT rate (5% instead of 22%) for small facilities (hydropower: 0.1 MW; wind: 0.075 MW; and all solar and biomass units). • Exemption from property tax for five years for the conversion of building heating systems from solid fuel to renewable energy. • Reduced VAT rate of 5% paid by final consumers of biomass heat, provided that it is a part of district heating system. • Direct investment incentives for non-profits, municipalities and individual end-users.
Number of customers	*Unknown*

Support for Solar

Country	Belgium
Technology supported	• Solar photovoltaics • Solar thermal
Overview of the programme	Grants for PV panels amounted to 65% of the total investment cost. This programme had a budget of € 1 million in 2002, which has been exhausted. Additionally, most of the municipality provide grants of between € 250 and € 750. For solar heating systems, a grant of € 625 was available and most of the municipality provided between €250 and €750.
Number of customers	*Unknown*

Promotion for the Local Introduction of New Energy

Country	Japan
Technology supported	• Solar photovoltaics • Offshore wind • Onshore wind • Solar thermal • Hydrogen (from Renewables) • Waste (organic) • Bioenergy
Overview of the programme	To promote new energy sources, NEDO subsidises renewable energy projects at the local level. Public entities and NGOs are eligible for a subsidy to promote PV, biomass, waste and wind power generation, fuel cells, solar thermal, natural gas co-generation, waste thermal, waste fuel production, biomass thermal use, clean energy vehicles and water-source heat pumps. The subsidy rate is up to 50% of the cost for installation, deployment, promotion of public awareness and related activities.
Benefits/Costs	Program budget: • 7.6 billion yen in 2005 (33.3 million British pounds) • 5.2 billion yen in 2006 (22.8 million British pounds)

Energy $mart Loan Fund

Country	USA
Technology supported	• Solar Water Heat • Solar Space Heat • Photovoltaics • Landfill Gas • Wind • Biomass • Geothermal Heat Pumps
Overview of the programme	The New York Energy $mart Loan Fund, administered by the New York State Energy Research and Development Authority (NYSERDA), provides reduced-interest rate loans through participating lenders to finance renovation or construction projects that improve a facility's energy efficiency or incorporate renewable energy systems. Any commercial, industrial, retail, agricultural, non-profit, residential, or multifamily facility that is an electric distribution customer of one of the State's six investor-owned utilities is eligible for this interest rate reduction program. For grid-connected photovoltaic and wind turbine systems, a customer must first be approved to receive incentives through NYSERDA's Powernaturally program. Once a customer has been approved to receive these incentives, they may then apply to the Loan Fund for a low-interest loan for their out-of-pocket expenses.
Benefits/Costs	The programme allows for customers to lend money at 4.0% below the average bank rate for a period of ten years. The loans are capped at $20,000 for residential construction, $1 million for multifamily new construction and all other non-residential, $2.5 million ($5,000/unit) for existing multi-family construction, plus an additional maximum of $2,500,000 for projects that include advanced meters.

Educational Programmes

Renewable Energy Sources in Schools

Country	Austria
Target group	Students, teachers
Overview of the programme	The main objective of the project was to establish a strategy for further integration of renewable energy sources in school buildings, combined with well targeted information activities for schools. The ESV supported the project with a variety of different activities, such as competent advice on technical matters, provision with high quality information material, or helping in identifying financial sources, as well as small financial contributions for meetings or site-visits. More specifically the objective was to build 10 installations using renewable energy sources in Upper Austrian schools and make investments in sustainable technologies a unique learning experience.
Financing	EU renewable programme ALTENER
Outcome	• Installation of energy systems in 10 schools • Creation of awareness • Good co-operation with all involved parties • Inspire teenagers for renewable energy

Discovering Renewable Energies

Country	France
Target group	Age 8 - 10
Overview of the programme	At the time of its creation in March 1981, the ASDER organisation responded to the teachers' request for renewable energy interventions on a voluntary basis. Subsequently, the ASDER organisation - in close cooperation with the educational advisor to the Savoie Board of School Inspectors - developed an educational tool baptised "Discovering Renewable Energy". This tool is based upon the children's creation of and experimentation with an educational device. The intervention is broken down into 3 half-day sessions. During the first session, the trainers present the different energy sources, their transformations, their uses, the problems associated with each and the distinction between renewable and non-renewable energy. This presentation is developed in agreement with the teacher who – systematically – has worked on the subject beforehand. The ASDER organization has decided to present energy sources and uses in a concrete fashion. Therefore, the animators bring demonstration tools with them, such as a thermal solar captor, a photovoltaic panel, a solar dryer, concentrators, a turbine model, and various samples. The applications of these models are then illustrated using slides, or visits if there are renewable energy installations close to the school. The children can then experience these installations through an experimental, hands-on approach. The children can manipulate photovoltaic panels, measure the influence of light, see how a dynamo works, etc. The devices most frequently made are: • The Individual Solar Water Heater (A plastic bottle painted in black and placed within a box with a Plexiglass topside). The heater can heat water to 65° - 75°C. Each student makes his own device, which then belongs to him/her. Benefit: Illustration of the transformation of solar energy into heat, using various comparisons (bottle colour, role of the Plexiglass, of the reflectors…). • The Solar Cooker). It is impossible to make one solar cooker for each student. Generally, only one or two are made, and these

	remain in the school. These cookers allow very high temperatures (200°C) to be reached and food to be cooked (apples, potatoes, eggs…). Benefit: Visualisation of the optical concentration phenomena and creation of a spectacular result. • The Solar Dryer (Paned box pierced with holes in its base and top, in which a thermoconvection current is created in order to dry fruit or vegetables lain upon a fruit tray). One or two solar dryers are made, and these remain the property of the school. Benefit: Testing and observation of the desiccation of food products (transformation of solar energy into heat). Reflection concerning food conservation (the products obtained are delicious). Before starting construction, the children will study the chosen devices on paper. They then draw and cut out (with a saw) the device's various constitutive elements. They therefore appropriate the object as their work advances, and elaborate several hypotheses concerning the role of the pane, the colour of the bottle, the insulation. Electrical tools are used (jig-saw, drill). This allows the energy and consumption concepts presented during the 1st session to be reintroduced.
Financing	Region Rhone-Alpes and Savoie County Council
Outcome	Over the last few years, the project team has made the following observations: • During device construction: Strong mobilisation. • Good validation of acquired knowledge at the end of the session (question/answer games). • The written and illustrated instructions given to the children are often used to remake the devices that they were not able to make in class at home. • During various events (fairs, expositions), the project team frequently meets children who have participated in the workshops. Often, on these occasions, they explain to their parents how, for example, a solar water heater works.

Appendix D – International Review of Energy Efficiency Organisations

The following organisations have been summarised

- Energy Savings Trust
- Carbon Trust
- SEI

Energy Savings Trust

Name	Energy Savings Trust
When Established	Set up by the UK government after the 1992 Rio Energy Summit.
Role	The EST is a non profit organisation that is an independent organisation leading on sustainable energy and carbon emissions reduction in consumer markets in the UK (EST Annual Review 2005-06). It has two main goals: • To achieve the sustainable use of energy • To cut carbon dioxide emissions The EST encourages energy efficiency and the integration of renewable energy sources into the economic fabric of society. They promote the use of cleaner fuels for transport and better insulation and heating efficiency for buildings as well as support small scale renewables. Whilst most of the EST's work is funded by the government they also compete for some private sector work.
Key Programmes	The EST runs a successful website that contains many details on how to save energy. This includes details of a number of programmes, some of which it runs, some of which are run by other organisations. This breaks down into • Consumer Programmes – Commit to 20%, On-line energy audits, tips to save energy • Housing and building – information on housing and building efficiency including grants available • Local Authorities – advice support and information including free consultancy on low energy packages • Transport - Information and advice about cleaner vehicle • Community – Energy efficiency for schools and communities The EST Programmes are sometimes information, but can be grants or access to a funding database with information about grants from other parties.

Membership	There are a number of government members which are: • The Secretary of State for the Environment, Food and Rural Affairs; • The Secretary of Stage for Transport; • The Secretary of State for Northern Ireland; • The First Minister for Scotland; and • The Welsh Assembly Government. From the private sector the following companies are members BG Group plc, BG Microgen, BP Oil UK Ltd, Calor Gas Ltd, Centrica plc, EDF Energy plc, Innogy plc, Johnson Matthey, National Grid Transco plc, Northern Ireland Electricity, Phoenix Natural Gas, Powergen plc, Scottish and Southern Energy, Scottish Power plc, Shell International Ltd. The list of private members includes all major gas and electricity suppliers.
Governance	Have a fully independent board.
Budget	In 2006 the budget was £60m. This is a reduction from £74m in 2005. Most funding for programmes is not under this budget e.g Energy Efficiency Commitment
Budget per Household	2004 National statistics state there were 24.7m households in the Uk. This gives a cost per household of £2.43. It should be noted that other programmes such as the EEC are funded separately.
Funding	Funding comes from both the public and private sector. This is best shown from the breakdown of funding for 2005/06: • Defra 33.7m • DfT 9.9m • DTi 8.5m • Scot Exec 6.1m • Mem Fees 0.4m • Other 0.95 • Total 59.5m
Staffing Numbers	*Unknown*

Additional Information	
Website	www.est.org

Carbon Trust

Name	Carbon Trust
When Established	29 March 2001
Role	The Carbon Trust is an independent company that is funded by a number of government divisions. Their role is to help the UK move to a low carbon economy by helping business and the public sector reduce carbon emissions now and capture the commercial opportunities of low carbon technologies.
Key Programmes	The Carbon Trust offers a range of different services which are well described on its website. Programmes are focused on 3 key areas: • Developing low carbon technologies • Helping organisations to reduce carbon emissions • Helping organisations to respond to climate change
Membership	See Governance below
Governance	There is a good balance between the 17 Board Members. Two Board members are Executive Directors, four are Non-Executive Directors representing governments departments which funding the company during 2005/06, one is a Non Exec Director representing a government department which has begun to fund the company in 2006/07, and 10 are Non Exec Directors contributing a wide range of experience from industry, trade union and non governmental organisations. The Board consider that the 10 Non Executive Director who do not represent government departments are independent of the Carbon Trust.
Budget	The Company has secured an additional £10m funding from the DTI for 2006/07 and further funding from DEFRA and the Devolved Administrations making total grant funding in 2006.07 of £106m.
Budget per Household	Not applicable
Funding	The funding comes from grants from DEFRA, the Scottish Executive, the National Assembly for Wales and the Northern Ireland Assembly, and in part from Climate Change Levy receipts.

Staffing Numbers	120 Staff at 31 March 2006
Additional Information	
Website	www.carbontrust.co.uk

Sustainable Energy Ireland

Name	Sustainable Energy Ireland
When Established	Sustainable Energy Ireland (SEI) was formerly the Irish Energy Centre and was established in May 2002 as Ireland national energy authority under the Sustainable Energy Act 2002.
Role	The Authority promotes and assists environmentally and economically sustainable production supply and use of energy, in support of government policy, across all sectors of the economy. The remit of SEI relates to improving energy efficiency, advancing the development and competitive deployment of renewable sources of energy and combined heat and power and reducing the environmental impact of energy production and use particularly in respect of greenhouse gas commission. The Authority is charged with implementing significant aspects of the Green Paper on Sustainable Energy and the National Climate Change Strategy as provided for in the National Development Plan. SEI is organised into five division which are: • Sustainable Energy Services • Industry • Built Environment • Development Services • Customers Services
Key Programmes	Sustainable Energy Ireland manages programmes aimed at: • Assisting deployment of superior energy technologies in each sector as required; • Raising awareness and providing information, advice and publicity on best practice; • Stimulating research, development and demonstration (RD&D); • Stimulating preparation of necessary standards and codes; and • Publishing statistics and projections on sustainable energy and achievements of targets.
Membership	SEI is funded by the Government and do not have members

Governance	SEI's Board take a proactive approach to the delivery of SEI's remit providing leadership and focus on organisational activities, including strategic direction and planning, management and control of risk, financial and operational control. The board is a wide ranging group and contains: • A professor of environmental studies; • Property develop and surveyor; • An MD and architect; • Safety and environment consultant; • MD of a biogas consultancy; • Principal officer of the Department of Communications, Marine and Natural Resources (DCMNR); • Director of a charity; • Union officer; • County Council Director of Environmental services; • Director of National Disability Authority; • Civil Engineers; and • CEO of SEI.
Budget	Total Income in 2005 was €17.3m. Major Expenditure items were: • Built Environment Programme €3.36m • R& D Programme €5.74m
Budget per Household	2002 statistics state that there were 1.28m households. This give a cost of €13.5 euros per household
Funding	The authority is funded by the government through the National Development Plan with programmes part financed by the European Union.
Staffing Numbers	In 2005 the average number of permanent staff was 9 with an average of 34 contract staff.
Additional Information	