PUBLIC CONSULTATION DISCUSSION PAPER

Issued by Planning and Environment w/c 24th September 2007

PURPOSE OF CONSULTATION : To seek opinion on the proposed policy options put forward in respect of Jersey's energy future.

DEADLINE FOR RESPONSES 7th December 2007

SUMMARY OF REPORT / QUESTIONS TO CONSIDER This report sets out the background, context, technical arguments and evidence base for the policy options put forward in respect of energy. It is supported by a summary document that contains 9 questions, with subsets of questions, on which the public are invited to give their views to help in the further development of this policy. You are also invited to provide any additional feedback or information you would like.

FURTHER INFORMATION AND FEEDBACK A summary document is available along with the supporting commissioned reports for this document, from www.gov.je, or from the Environment Department at the address below. Comments received by 7th December will be analysed and used to help design the final proposals that will be brought to the States for debate early in 2008.

Please send your comments to:

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SUPPORTING DOCUMENTS

'Fuel for Thought' Summary Document

States of Jersey

DRAFT ENERGY POLICY

Fuel for thought?

Consultation Document

September 2007

This consultation report is a discussion document intended to stimulate debate and launch a process of consultation on the subject of energy. It contains a range of ideas and is designed to encourage interested individuals or organisations to contribute views and information that will help form a final set of official proposals that will be proposed to the States of Jersey for adoption as policy.

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This document is also available on the States of Jersey website www.gov.je

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Preface

Today's population take for granted a world that allows them access to food, goods and services on an unprecedented scale. It has not always been so. In fact, as recently as the childhoods of our grandparents and great grandparents, there would have been a very different world where air transport, motor cars, central heating and electric lighting had yet to be invented.

For much of humankind's existence development was constrained by the limitations of individual and collective labour. This was then supplemented by harnessing the power of animals – literally horsepower - and the development of mechanical systems such as levers and pulleys, wheeled carts etc.

Wind and water power, now being feted as new technologies, have been in use for several millennia but it was the advent of fossil fuel technology that gave rise to the phase of industrialisation that has lead to the modern world as we know it. Coal fired steam engines gave way to the internal combustion engine as oil was brought into play. Oil, gas and coal now power the modern developed world.

Distributed power systems linked to central generating stations (power stations) have become the norm. In the latter half of the 20th Century nuclear power generation also entered the frame as another source of concentrated energy production.

The spectacular development and economic growth of the 20th Century is matched by a parallel growth in the use of energy, one has driven the other and our society is massively dependent on this injection of energy to sustain it. Consider for instance heating, lighting, travel and transport, food production, manufacture of goods and materials, and electrical devices from carpet cleaners to computers. Without access to large quantities of energy our society across the developed world would grind to a halt.

Unfortunately this relatively recent technological miracle has significant downsides too, for instance environmental damage in the extraction and transport of fossil fuels, the legacy of radioactive waste from nuclear generation and the impacts of gaseous emissions on air quality. The local impacts of energy production were well known in industrial towns where air quality reached dangerously poor levels. Much of this has been overcome by the regulation of processes to improve emissions, however, problems do remain, noticeably where they arise from mobile sources such as motor vehicles. And it is now clear that the emissions from burning fossil fuels are capable of changing the earth's climate. Tackling climate change is widely regarded as the most important challenge facing humankind in the 21st Century.

Fossil fuels are a huge but finite resource. They were laid down by biological and geological processes millions of years ago and they are not being replenished. The current world population is set to double in the next 30 years and at the same time industrialisation and development is happening in the emerging economies of China, India and Africa. Pressure on remaining fossil fuel reserves will be intense as it is calculated that the peak for oil (where the rate of use exceeds the rate of discovery) has already been reached. The easiest sources have already been taken and what remains

will be ever more costly to extract, so whilst fossil fuels may never literally run out they will become too expensive to use in the way that they are used today.

Coping with this future will require a significant transformation in thinking. Economic growth and development need to be de-coupled from the use of energy, the demand for energy has to be reduced by using it more efficiently, and new non-depletable energy sources have to be developed and deployed.

Whilst this is happening there is a need to focus on ensuring that current energy systems are secure and resilient (both physically and from the economic influences of the global market) and that energy services are delivered in an efficient and competitive way.

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Foreword by the Minister

The goal of this energy policy is to achieve secure, affordable and sustainable energy.

Energy costs are significant to our economy and are set to rise. Virtually all of our primary energy is imported which increases vulnerability to price shocks and physical failures in supply. The importation of energy requires infrastructure and if energy use exceeds planned demand levels there are significant costs to the Island. And, of course, unless energy costs can be contained the most vulnerable in society are exposed to disproportionate costs in relation to their disposable income. This consultation paper therefore has a cross-departmental scope.

There is no longer any real debate over the fact that climate change is happening and that man-made emissions are the main cause. If Jersey is to prove itself a responsible global player and a good place in which to live, work and do business it must set itself the highest standards in respect of our energy procurement and use. Jersey has outperformed the UK in reducing greenhouse gases and this advantage will be maintained by the challenging but achievable targets that are proposed for the next 30 years. Emissions of carbon dioxide are already down 36% on 1990 levels and by the year 2030 it is proposed to reduce this to 52%.

This green paper establishes the context and rationale for action and goes on to describe the key policy elements. It sets out a simple hierarchy for action backed up by a range of proposed policy options. The main policy objective is to reduce energy use by becoming more efficient and reducing wastage. A new body “Sustainable Energy Jersey” is proposed to lead this activity and it will provide both advice and grant support as necessary, funded through environmental taxes. Financial support will be targeted initially at improving the energy performance of buildings.

Large scale wind and tidal schemes are not considered viable in the immediate term but smaller scale micro-generation technologies such as solar water heating and ground source heat pumps are already available and offer the prospect of making a contribution to the amount of low carbon energy produced locally. Energy from waste schemes are also viable for both municipal waste and animal manures.

Security of supply and resilience are important factors for an Island dependent on imported energy. There is a marginal economic case for bringing oil products to the island through a pipeline and this will be examined alongside possible changes that are required to on–island facilities following the report into the Buncefield fuel farm disaster.

Competition in the supply of energy needs to be stronger, within, as well as, between sectors. This may need to take the form of regulation rather than new market entrants. Global energy markets will inevitably continue to drive up prices and it is important to mitigate these rises as much as possible through achieving efficiencies in the supply chain.

Energy is a critically important issue for Jersey and I look forward to hearing your views on all aspects of this consultation.

Senator Freddie Cohen
Minister for Planning and Environment
September 2007

Executive summary

Context

The future production and use of energy is recognised as a global issue which increasingly is being tackled at the national and international level. Oil prices continue to rise and increases are commonly associated with political instability in oil producing countries. This causes concern for the security of supply as more countries rely on imports and supplies become concentrated in fewer areas.

Fossil fuels are a large but finite resource, the rate of use of oil globally is approaching and may even have passed the rate of new discoveries whilst proved reserves of oil are mostly concentrated in politically unstable areas. Mitigating the environmental consequences of retrieving reserves from different sources like oil shales will cause their cost to be high and the viability of their extraction will need to be carefully considered.

Energy demand is growing, especially in developing nations like China and India, despite an increasing cost. The environmental consequences of burning fossil fuels are causing increased concern and leading to stronger inter-governmental action to tighten emission limits. The challenge for the 21st century is to manage the transition between current carbon based energy systems and whatever comes to replace them.

Jersey is very vulnerable to trends in global energy because of the characteristics of its energy systems:

- High import dependency ; Jersey imports electricity from the European grid and petroleum products arrive by tanker. Jersey is a 'price taker' in a global market of increasing energy costs
- Energy use patterns are dominated by the domestic and transport sectors, however Jersey's main exporting industry, international financial services, uses relatively little energy
- There are low levels of competition in the energy market
- Consumer behaviour is unresponsive to rising energy costs

Jersey's energy related carbon emissions are very small on a global scale and have fallen by around 36% in the period between 1991 and 2005 as a result of the switch from on-Island oil-fired electricity generation to importing low carbon electricity from France.

Overall energy patterns differ from elsewhere :

- Electricity consumption per head of population is higher than in the UK;
- Consumption of heating oil is far greater than in the UK;
- Consumption of gas (on-island liquid petroleum gas is used) is far lower than the consumption of natural gas per head population in the UK;
- Consumption of road fuels is higher than might be expected for such a small Island;
- There is very limited generation of energy from renewable energy sources.

- The imported electricity supply is already very low carbon and measures which displace it will have to be equally low carbon options

Rationale

The goal of energy policy is to achieve **'Secure, Affordable and Sustainable Energy**'

Environmental – There is an acceptance by the international scientific community that global climate change is being accelerated by the emissions of greenhouse gases arising from the burning of fossil fuels. This 'accelerated climate change' has led to an overall warming of the earth's surface in the last 150 years and this trend is predicted to continue – to what degree depends on the amount of future emissions.

International Reputation - If Jersey is to prove itself a responsible global player and a good place in which to live, work and do business it must set itself the highest standards in respect of our energy procurement and use.

Economic - Energy costs are significant to the economy and are set to rise. Importing energy requires infrastructure and if energy exceeds planned demand levels there are significant costs to the Island.

Security of Supply - Jersey's current high import dependency poses physical and economic risks if our energy supplies are not secure and resilient.

Social – As energy costs increase the most vulnerable in society are exposed to disproportionate costs in relation to their disposable income.

An Energy Framework is proposed which establishes a hierarchy for action:

1. Use less – Reduce the environmental and economic consequence of energy use by simply reducing our energy demand;

2. Use less carbon-intensive fuels – These are finite in the long term and the environmental (and thus economic) costs of their use are great. The options for switching to renewably generated fuels will continue to increase as technologies become viable;

3. **Use less imported energy** – the exploitation of the Island's indigenous generating capacity will give greater security and resilience in the longer term;

4. Reduce other impacts – All energy sources have environmental impacts. Where possible these impacts should be reduced by choosing the most benign options capable of servicing the energy needs of the Island;

5. Off-set residual carbon emissions – Decarbonising the economy will not happen immediately and even with vigorous progress there are likely to be residual carbon emissions. To demonstrate Jersey's high levels of international responsibility, the Island could mitigate its unavoidable contribution to global pollution by contributing to *bona fide* carbon reduction projects.

Key elements of the policy

To achieve an overall goal of secure, affordable, sustainable energy through application of policies which adhere to the energy framework hierarchy as follows :-

Decrease energy use – Particularly in the face of a growing population and trends of increased energy demand. Policies will aim to ensure the highest standards of demand management and energy use are vigorously pursued in order to promote environmental sustainability, avoid the costs of energy infrastructure and reduce exposure to international energy prices.

Make sustainable energy choices – There is a strong economic case backed up by improvements in the security of supply as well as environmental benefits to decarbonising our energy choices. Policies will aim to achieve the highest environmental international standards and beyond. This will demonstrate that Jersey acts responsibly and intends to use energy more sustainably and minimise the environmental impact of the Island's energy choices by reducing dependence on imported fossil fuels.

Prepare for the effects of climate change –The effects of accelerated climate are already being felt and despite future emission scenarios there is a need to prepare, at least, for the predicted effects of climate change

Ensure that our energy supplies are secure and resilient – The economy relies on secure supplies of energy being available at predictable and affordable prices. This requires the appropriate infrastructure and back up of supply. The energy market must be diverse, flexible, well structured and appropriately regulated to fulfil this.

Targets for Carbon emissions and energy use

Between 1990 and 2005 Jersey increased its total energy use by **26%** from 170,500 tonnes of oil equivalents (toe) to 214,700 toe. In the same period carbon emissions have reduced by **36%** as a result of the switch away from on-island oil based electricity generation to low-carbon nuclear/hydro imported electricity.

A target is proposed for 2030 of a **52% reduction on 1990** levels of carbon emissions. This equates to a 20% reduction on 2005 levels in addition to the 36% already achieved in the period 1990 to 2005. This target will be achieved by:

- The continued shift towards electricity (6,700 t/C[1])
- Additional reductions as a result of 15% reduction in road fuels and a 20% increase in the efficiency of energy use in the home, by government, businesses and industry (15,000 t/C)

Projections on these trends lead to carbon emissions of about 50,000 t/C by 2050 – this equates to a reduction of **64%** on 1990 levels of emissions.

[1] t/C - tonnes of Carbon

Proposed policy options centre on stabilising energy use at 2005 levels by encouraging energy efficiency via a suite of legislative and fiscal measures. These would include the development of new legislation that adequately reflects the highest energy conservation standards in the UK and other jurisdictions to ensure that all homes reach minimum standards and occupants are not put in a position of fuel poverty.

Awareness and education programmes are proposed to assist informed decisions in energy use patterns. These would include the creation of a not-for-profit organisation modelled loosely on the UK's Energy Savings Trust ('Sustainable Energy Jersey') whose role would be to deliver energy efficiency programmes and mechanisms for carbon-saving. The ECO-ACTIVE programme would assist this initiative. The body would be funded by revenue from environmental taxation.

Sustainable Transport Options

Jersey has very high car ownership and dependency with road fuels accounting for over one third of final energy consumption. Overall trends are of stabilising energy consumption in this sector due to a saturation of vehicles on the road and new vehicles becoming more fuel efficient. Nevertheless, congestion with associated local pollution and road accidents are acknowledged areas for improvement.

The Integrated Travel and Transport Plan identifies a package of measures to reduce dependency on the private car and reduce peak time congestion by 15% - this reduces carbon emissions by 11% on predicted 2030 carbon emission levels.

There is scope to use cleaner and carbon neutral fuels, for instance the production of biodiesel locally could displace 5% of diesel imports with a consequent saving of 500 t/C. Similarly, the importation of petrol that is 5% blended with bio-ethanol that could be sold from the forecourts would be to save 1,000 t/C.

There are no proposals to tackle energy use by the aviation and shipping industries in isolation. National Governments have accepted that these measures should be examined by the international community or at least at the European level.

Energy Options for Jersey at the utility scale

Jersey has a very good on and off shore wind resource. However, there are likely to be insurmountable planning barriers to exploiting on-shore wind resources. But there is some potential for exploiting off-shore wind although this is very expensive – a 90MW offshore wind farm costs in the region of £135-160M.

Jersey's large tidal range makes it attractive as a test-ground for proven technologies such as tidal barrages of emerging technologies such as tidal lagoons. The environmental impact of tidal barrages is likely to prove insurmountable for Jersey. However, Government can offer attractive financial conditions for research and development and this may encourage trials of tidal lagoon technology in local waters.

Energy from waste

By constantly evaluating best practice, Jersey can seek to exploit existing and emerging technology to generate energy from waste as well as contributing to waste management solutions.

The replacement Energy from Waste Plant has the potential to exploit the latest technology by considering the thermal efficiency of the processes and the recovery of energy for further end uses, for instance to provide district heating.

The restructuring of the dairy industry can bring opportunities for the anaerobic digestion of livestock and agricultural wastes. A centralised Anaerobic Digestion plant will have additional benefits of recovering heat and power, capturing methane and reducing pollution.

Micro-generation energy options for Jersey

Microgeneration involves generating small amounts of heat and power from renewable sources to meet individual and community needs. It has numerous benefits that include:

- Lowering carbon emissions;
- Decreasing the environmental footprint of the displaced power;
- Increasing security of supply;
- Diversifying the supply of electricity;

There are numerous proven technologies available and high quality well installed systems can deliver substantial cost savings to premises. This saving means that the capital cost of the technology investment will be paid back over the lifetime of the installation although some technologies have far shorter payback periods than others.

To encourage the take up of microgeneration technologies the following policies are proposed :

- Requiring by 2010 that at least 10% of the energy in all new building is provided by renewable sources.

- Providing impartial advice to the public through ‘Sustainable Energy Jersey’ on choosing and installing the appropriate technology.

- Providing assistance to the local microgeneration industry through ‘Sustainable Energy Jersey’ in the form of training opportunities and the possibility of an accredited standards scheme.

- Simplifying the development control process to encourage the uptake of microgeneration technologies.

- Requiring the JEC to continue to pay the ‘avoided cost’ to customers for excess electricity generation sold back to the grid as well as assisting with the provision of the appropriate metering equipment necessary for this.

- Bringing forward an Energy Crops Action Plan by the end of 2008 that will address the growing energy crops locally with the additional aims of diversifying the rural economy and assisting in waste management solutions.

Importing a higher proportion of renewable energy

Considerable capital investment is required in the exploitation of utility scale renewables and in the short term it is more economic to simply make more sustainable fuel choices from among the currently available energy mix. Current energy choices must take account of the carbon content of the fuels used in order to minimise our emissions and decarbonise the local economy.

There has been a continuing trend towards increased electricity use and because of the low-carbon content of imported electricity this has the added benefit of reducing the Island's carbon footprint. Policy options centre on requiring the JEC to continue to take account of the low carbon content of its electricity as a material consideration when considering purchasing options.

Preparing for the effects of Climate Change

Jersey has an enviable historic climatic data set that has and can continue to contribute to climatic modelling. The continued collection and contribution of these datasets to leading organisations in climatic modelling will assist future patterns of climate change to be better assessed.

Agriculture, fisheries and to some degree tourism, are industries at the 'coal-face' of climate change. The States must assist these industries to identify and plan for the effects of climate change and help to adjust their business models to account for the opportunities and challenges climate change presents.

Opportunities arise out of climate change including the potential to participate in global carbon markets or Kyoto mechanisms. It is proposed that the States should investigate and provide, where appropriate, the support and advice mechanisms necessary to enable and empower the financial sector to participate.

The compliance market provides support to achieve compliance with regulations. This is a growing sector, particularly in the construction industry, where increased standards must be adhered to. The States can investigate and provide, where appropriate, the support and advice mechanisms necessary to enable and grow the compliance market.

Increasing awareness of Corporate Social Responsibility in the consumer market means that there is a growing market advantage for companies to improve their environmental credentials. Government can assist through, for example, a business accreditation scheme run under the umbrella of the ECO-ACTIVE campaign.

Security and resilience of Supply

The availability of reliable and resilient supplies of energy at predictable prices is essential to maximise economic efficiency. The physical security of supplies is potentially threatened in the short term by force majeures, technical problems or terrorist action that, in turn, can have financial implications.

In the longer term price security is harder to guarantee as fossil fuels become scarcer and as an importer of fuel Jersey is particularly vulnerable.

Risk management is the key to managing our import dependency. There are vulnerabilities in the supply routes (e.g. the reliability and safety of maritime supply routes of petroleum products) or storage facilities (e.g. limited capacity and facility dependence at the fuel farm, La Collette) and strategies will be formulated to mitigate unacceptable or predictable risks. Proposed policy options centre on:

- Ensuring supply and demand can be met in normal circumstances and, in an emergency situation, via adequate and robust contingency planning. Shipping costs are high and expose Jersey to price shocks in this area and there are long term doubts as to the availability of suitably sized double-hulled ships for local waters/harbour. It is also anticipated that the Buncefield Investigation Report will recommend stricter controls on land use around fuel farms. These may prove sufficiently restrictive in the master planning of the East of Albert area to make alternatives such as moving the fuel farm more viable.

- Alternatives such as the economic viability of the importation of petroleum products via pipelines will be further investigated. Benefits to such a scheme in addition to combating the challenges outlined above are an increased flexibility of the fuel mix, an improved security of supply, and a reduction of facility dependence.

- Ensuring the Island is protected from and, if necessary compensated for, the threat of environmental pollution or damage to human health by either nuclear or maritime incidents.

- Requiring the JEC to operate the local electricity network to n-1 planning standards (i.e. being able to withstand the loss of the single biggest element in the supply). After the closure of the La Collette Plant this will require the installation of the third interconnector.

- The States will enter into discussions with stakeholders in the petroleum products industry to ensure adequate security of supply for the future. This will involve further consideration of the possibility of the importation of liquid hydrocarbons via pipelines which could have the following benefits: increased flexibility of the fuel mix; improved security of supply; and a reduction of facility dependence.

The energy market

A key of this policy is to ensure that the correct market forces coupled with appropriate regulations are in place to ensure the reliable and stable supply of well-priced energy. There is a competitive market within the petroleum market and in recent years this has served to reduce prices for consumers. Wholesale gas and electricity normally works under a ‘natural monopoly’ arrangement given the high costs of infrastructure. Locally there is no competition in either the wholesale or retail of electricity or gas supply. Currently, regulation of the electricity and gas utilities is limited to Competition (Jersey)

Law and the Jersey Competition Regulatory Authority rather than by sector specific regulation. Policies in this area centre on

- Build upon the existing work and clarify the opportunities for efficiency savings in the electricity industry by increasing wholesale competition and/ or cross-Channel Island working. This could include a more formalised approach to the existing collaboration across the Channel Islands' wholesale electricity market and the rationalisation of generating assets across the Channel Islands.

- Build upon the existing work and clarify the necessity for regulation of the gas and electricity markets. Regulation is commonly accepted as a surrogate to competition in a monopoly situation. It seeks to drive down costs to that equivalent to a competitive market. It is unlikely there is scope for retail competition in the electricity or gas markets.

Part 1- Current and future energy trends, from global to local

"There are worrying trends in world energy markets and Jersey must quickly develop and implement a robust and forward-looking energy policy"

States of Jersey Strategic Plan 2006-2011. July, 2005

CHAPTER 1 International energy policy

Chapter summary

Energy is recognised as a global issue and increasingly is tackled at the national and international level. For example, the EU has just produced a European Energy Policy.

Oil prices continue to rise and increases are commonly associated with political instability in oil producing countries. This causes concern for the security of supply as more countries rely on imports and supplies become concentrated in fewer areas.

Although fossil fuels are a finite resource, globally proved reserves of oil have increased and are mostly located in the Middle East. Mitigating the environmental consequences of retrieving reserves from different sources like oil shales in the future will cause their cost to be higher than current reserves.

Energy demand is increasing - Despite price rises oil consumption continues to grow especially in developing nations like China.

The environmental impact of energy in terms of green house gas emissions is causing increased concern and leading to a tightening of pollution standards.

There is an ever-increasing realisation of the need to move away from a carbon-based economy to something more sustainable.

INTRODUCTION

1.1 In recent years, the challenges relating to energy and climate change have become truly global in nature. Countries such as China and India continue to develop rapidly. Global energy consumption continues to increase and the effects of climate change become increasingly apparent.

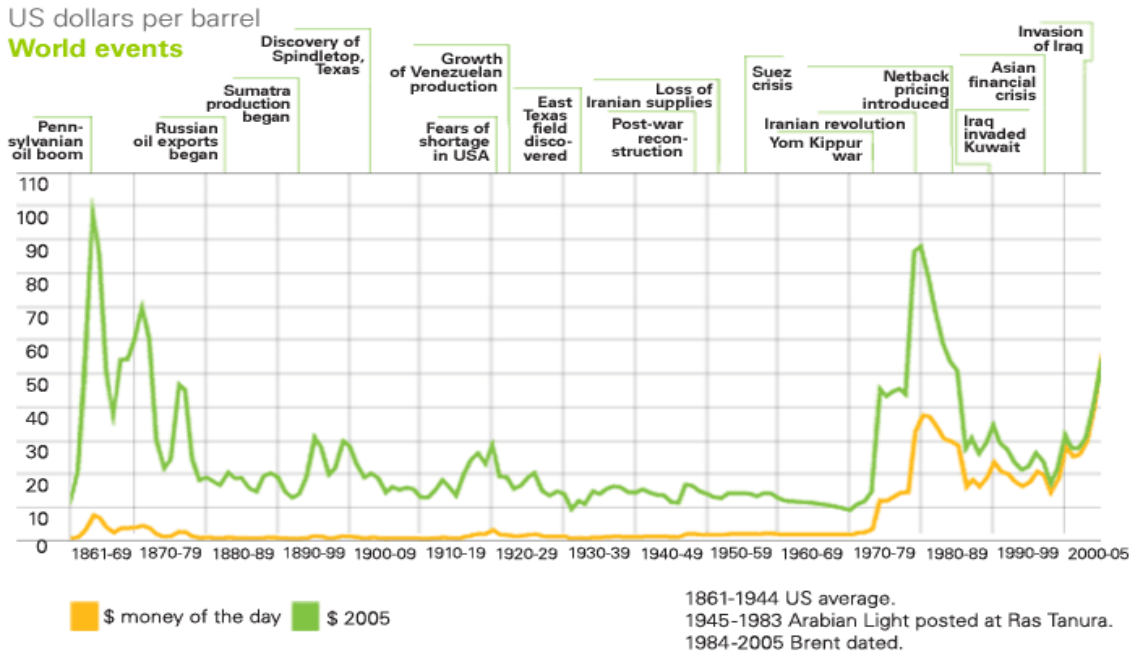
1.2 Mitigating the effects of climate change and ensuring the Island has secure and affordable energy supplies are vital to its future prosperity and security. The challenge ahead is complex and global. It requires an understanding of development in not just the domestic and European, but also the international energy environment.

The current international energy market

Oil and gas prices

1.3 Oil prices continue to rise (Figure 1) as a result of a number of factors : tight capacity; extreme weather; continued conflict in the Middle East and other civil strife elsewhere as well as a growing interest in energy among financial investors.

Figure 1 Crude oil prices since 1861 linked to world events



Source: BP Statistical Review of World Energy

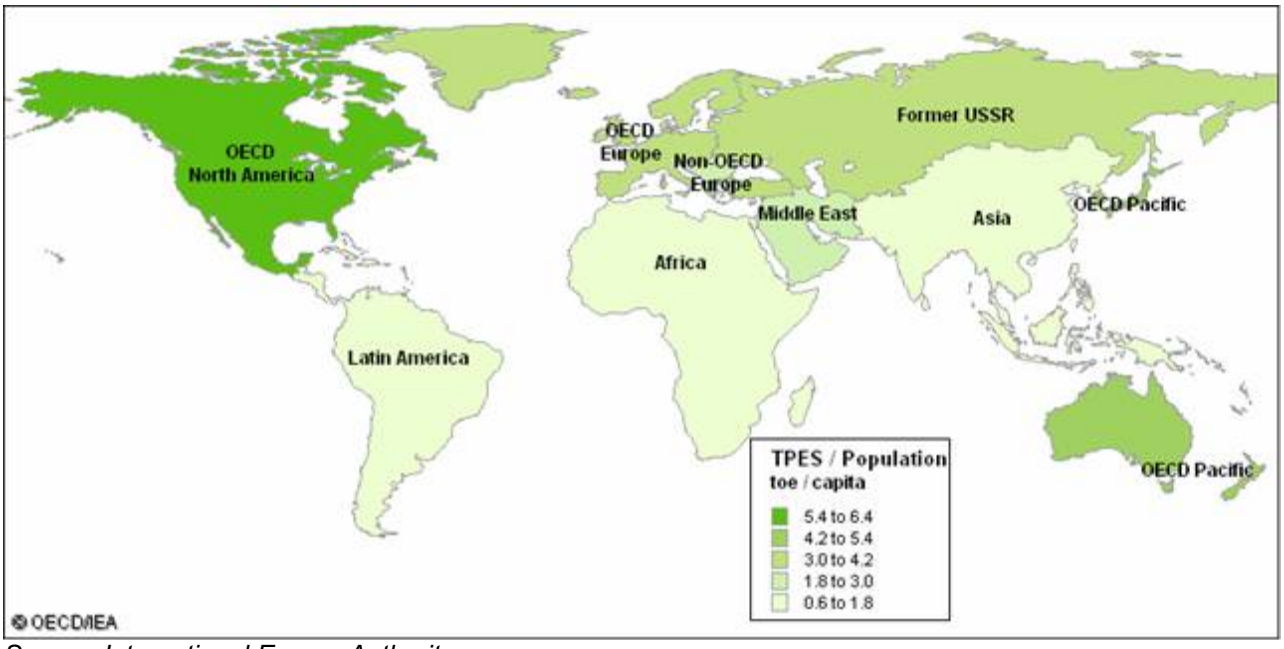
1.4 Although it is clear that current prices have remained below the peak of the early 1980s, prices have continued to rise to levels far higher than they have been for over a decade.

World energy demand

1.5 Despite increasing costs there continues to be a very strong demand for fossil fuels. Oil consumption growth was the fastest since 1976, with around one-third of this growth occurring in China.

1.6 Figure 2 shows world total primary energy supply in tonnes of oil equivalents[2] per capita. Whilst currently this is lowest in South America, Africa and Asia, demand is increasing rapidly, particularly in the Asia-Pacific region.

Figure 2 Map of energy consumption per capita



Source: International Energy Authority

World energy and security of supply

1.7 The debate continues over the future availability of energy resources, the possibility and timing of oil and gas production peaking and the need for lower-carbon sources of energy. High oil and gas prices, and the fear of wars, terrorism and political instability associated with some of the producing nations have caused some consumer nations like the USA and European countries to seek to be more self-sufficient in energy. However it is debatable whether this is a realistic option for most import-dependent nations. The reality is that oil and gas will still account for most of the world's energy supply over the next few decades, and in many OECD nations, reserves are limited in comparison to demand.

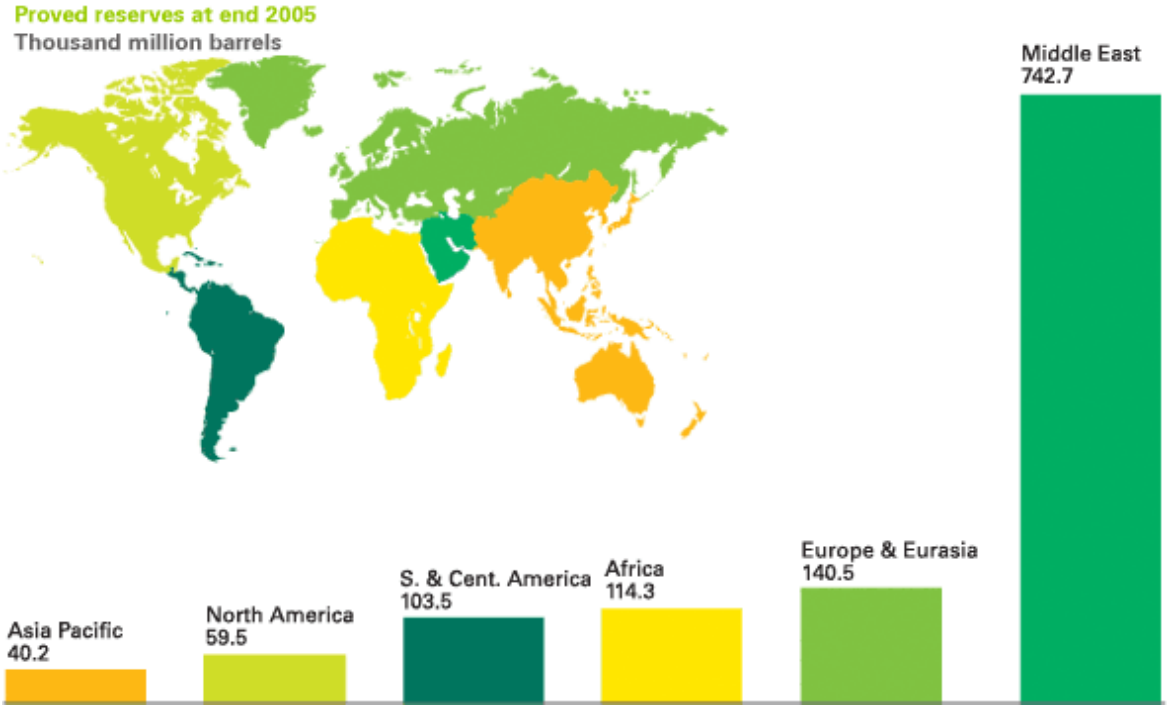
1.8 However, there have been positive developments in energy markets during the past year. So far, the international economy has proved surprisingly resilient to higher energy prices and continued to grow. In particular, supply is set to increase again due to a large increase in investment by the 30 largest private-sector

[2] A toe (tonne of oil equivalent) is a unit of measurement used when aggregating different energy sources. As different fuel sources provide different amounts of energy, a pure volume measure such as tonnes will not represent the energy values of the fuels; instead, each fuel is converted into toe based on its calorific value. A toe is a measure of energy = 10 million kilocalories or 11,630 kWh.

producers. This is because technological advances and political changes in regions such as Russia and the Caspian region have opened up new opportunities.

1.9 While access to energy resources is an area of continuing uncertainty, global proved reserves of oil and gas have continued to increase (Figure 3).

Figure 3 Proved reserves of oil at end 2005



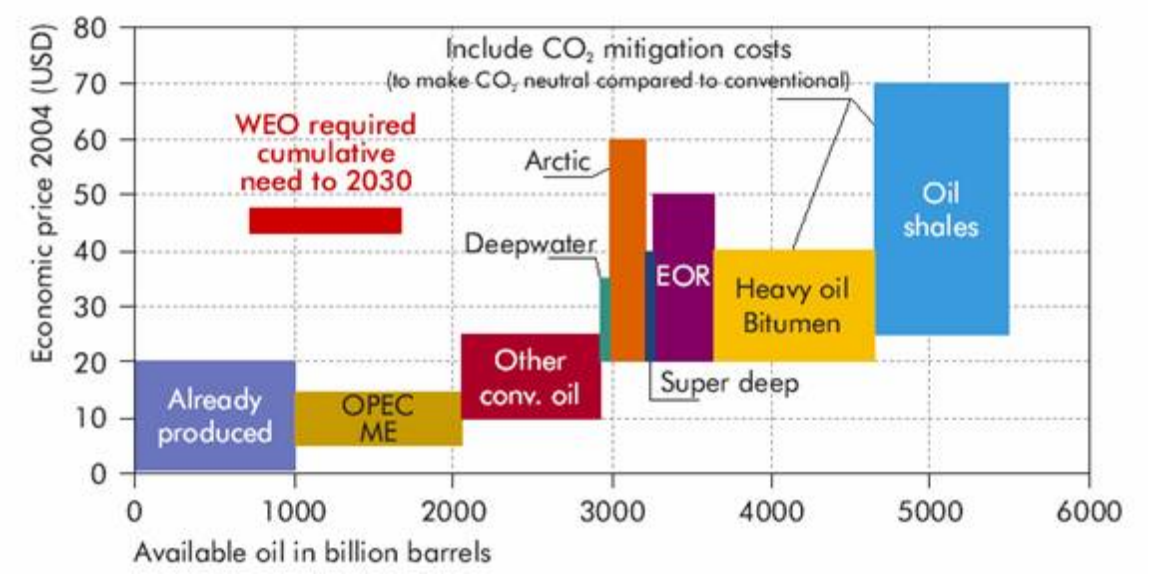
Source: BP Statistical Review of World Energy

1.10 As fossil fuels reserves become less accessible, recovering them will incur increased costs according to the accessibility of the oil and the nature of the reserve (Figure 4). Until about 2030 it is expected that prices will remain of a similar order of magnitude to those experienced currently. However, as different sources like heavy oil bitumen and oil shells are exploited the environmental costs of these in terms of carbon dioxide must be mitigated (for example by carbon sequestration[3]), and this will cause costs to rise considerably.

[3] The overall concept of Carbon Dioxide Capture and Storage (CCS) is to capture CO_2 from large point sources such as fossil-fuelled power stations and store it for thousands of years in natural underground reservoirs.

Figure 4 Oil cost curve, including technological progress: availability of oil resources as a function of economic price

WEO required cumulative need to 2030 refers to the World Energy Outlook (WEO) estimated cumulative energy need to 2030, OPEC ME refers to the Organization of the Petroleum Exporting Countries Middle East reserves, EOR refers to the emerging industry of Enhanced Oil Recovery technology



Source : *Source : International Energy Authority*

Drivers of the energy future

1.11 To summarise, there are four main future drivers of energy:

1. **Demand growth**: World energy demand is projected to grow by more than 50% by 2030, with the developing world accounting for two-thirds of that growth[4].

2. **Location of supply and resources**: Although it is believed that the world has enough oil, gas and coal to last many decades, there are growing challenges in making new resources available. Technology can help improve the accessibility of remote conventional resources as well as unconventional resource such as viscous oil or biofuels, but there are potential consequences on prices.

3. **Security of supply**: Concern over supply is likely to grow as many countries rely more on imported energy and supplies become concentrated in fewer areas.

4. **Environmental impact of energy**: With a steady tightening of standards to address concern about pollution and climate change from emissions.

1.12 As an importer of energy, Jersey's energy policy will need to be flexible enough to cope with changes in these drivers in future years.

[4] World Energy Outlook 2004 OECD/IEA

European energy policy

1.13 As Jersey imports all of its energy from within the European Union, changes and developments in European energy policy and the European energy market have a significant bearing on security and affordability of Jersey's own energy sources.

1.14 In January 2007 the European Union bought forward an integrated energy policy that addressed the challenges of sustainability, security of supply and competitiveness. The 'point of departure' for the policy has three aims: 'combating climate change; limiting the EU's external vulnerability to imported hydrocarbons and promoting growth and jobs, thereby providing secure and affordable energy to customers'[5]. The policy is underpinned by a commitment to reduce GHGs by at least 20% by 2020 compared to 1990.

1.15 The Action Plan for achieving this, addresses :

1. The internal energy market – via unbundling, effective regulation, transparency, infrastructure, network security, adequacy of electricity generation and gas supply capacity and energy as a public service;

2. Solidarity between Member States and security of supply for oil, gas and electricity

3. A long term commitment to greenhouse gasses reduction and the EU Emissions Trading System

4. A programme of energy efficiency measures - including the use of fuel efficient vehicles, tougher standards and better labelling on appliances, improving building performance, using taxation to achieve energy efficiency, improving the efficiency of heat and electricity generation, transmission and distribution, a new international agreement on energy efficiency to promote a common effort.

5. A longer term target for renewable energy – to achieve a 20% share for renewables will result in an additional average annual cost of approx. 18 billion euros (approx 6% extra on the EU's total expected import bill in 2020)

6. A European Strategic Energy Technology Plan – whose objectives are to lower the cost of clean energy and to put EU industry at the forefront of the rapidly growing low carbon technology sector.

7. Moving towards a low CO_2 fossil fuel future – This includes tackling cleaner coal generation and CO_2 abatement as well as providing leadership in the international development of clean coal and carbon capture and storage.

8. ***The future of nuclear*** – It is accepted that nuclear power has been one of the ways of limiting the EU's CO_2 emissions as well as being a relatively cheap and secure form

[5] Communication from the Commission to the European Council and the European Parliament ; An Energy Policy for Europe. Brussels, 10.1.2007 COM(2007) 1 Final

of energy generation. The EU will continue to develop the most advanced framework for nuclear energy meeting the highest standards of safety, security and non-proliferation.

9. An International Energy Policy that actively pursues Europe's interests – with Member States acting internationally with a common voice

10. Effective monitoring and reporting – through a proposed centralised body – the Office of the Energy Observatory

1.16 Jersey high import dependency and consequent links to the EU market means the Island needs to remain aware of progress in Europe to ensure it is taking the best advantage of progress.

CHAPTER 2 - Jersey

Chapter summary

Jersey has never had an energy policy. The following are key features of the Island's energy use:

1. High import dependency;
2. A high dependency on petroleum products;
3. Jersey tends to import its energy in the form in which it is used;
4. Jersey imports electricity from the European grid;
5. Energy use patterns are dominated by the domestic and transport sector;
6. Jersey's main exporting industry, international financial services, uses relatively little energy;
7. Jersey is a 'price taker' in a global market of increasing energy costs;
8. Currently consumer behaviour appears inelastic in respect of rising energy costs;
9. A low competition energy market.

Jersey's energy related carbon emissions are very small on a global scale and have fallen by around 36%, between 1991 and 2006 as a result of the one-off switch from on-Island oil-fired electricity generation to importing low-carbon electricity from France. Overall energy patterns differ from elsewhere :

1. Electricity consumption per head of population is higher than in the UK;
2. Consumption of heating oil is far greater than in the UK;
3. Consumption of gas (on-island liquid petroleum gas is used) is far lower than the consumption of natural gas per head population in the UK;
4. Consumption of road fuels is higher than might be expected for such a small Island;
5. There is very limited generation of energy from renewable energy sources.

The need for an energy policy

1.17 Jersey has never had an energy policy. In the face of rising global oil prices and the need to move away from a carbon-based economy to something more sustainable, it is now imperative that the Island sets out to decisively shift to a policy framework that provides Jersey with secure, affordable and sustainable energy into the future.

1.18 It is the responsibility of the States of Jersey to set the overall goals for energy policy and to ensure that the energy markets and other policies deliver those goals. Energy producers, investors, business and consumers need a clear, settled, long-term framework within which they can plan and make both long and short terms decisions with confidence about their energy options.

1.19 But Jersey does not operate in a vacuum. In order to succeed and be effective, an Energy Policy for Jersey must recognise the legislative and policy context of each of these perspectives at all scales. Jersey's reliance on imported energy means it is particularly vulnerable to the trend of increasing global energy prices. Local greenhouse gas emissions have a global as well as local impact. Changes in European legislation to improve the efficiency of cars and household appliances will have a positive effect on local energy consumption as these goods become the only ones available to import. Locally, aspirations of the Strategic Plan, the Waste Strategy, the Rural Economy Strategy, the Integrated Traffic and Transport Plan, the forthcoming Air Quality Strategy, the Island Plan 2002 review and the proposals for the 'East of Albert' developments will all need to be dovetailed into policy options for energy in Jersey.

1.20 This section sets out the legislative and policy context from a global to a local scale in which the future energy policy for Jersey will sit.

Jersey's current overall energy patterns

1.21 In 2000, 93% of Jersey's greenhouse gas emissions originated as CO_2[6] but in a global context, Jersey's carbon emissions are small. Provisional[7] energy related carbon emissions have fallen sharply, by around 36%, between 1991 and 2006 from 139,000 tonnes to 89,400 tonnes. The cause of this reduction is the switch from on-Island oil-fired electricity generation to importing low-carbon electricity from France (Figure 5). Excluding electricity generation, overall there has been very little change in carbon emissions over the past 14 years, with the 2006 level 3% below the 1991 level.

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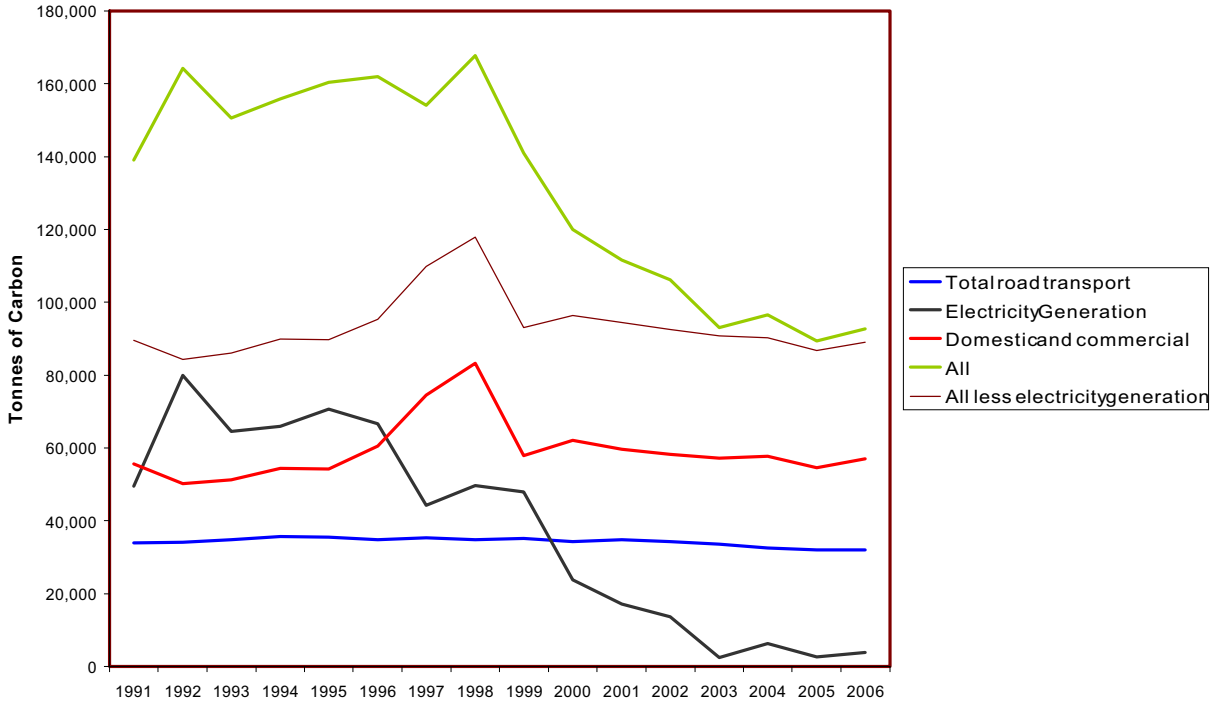
6 Coley and Romeril (2000) 'Greenhouse Gas Inventory, Jersey 2000' Centre for Energy and the Environment, University of Exeter.

7 Carbon emissions from land use change (the conversion of countryside to building use) and agriculture are not included, nor, at present are the carbon emissions from waste burning/electricity generation at Bellozane. It is also important to keep in mind that the energy data for 1991 to 2000 is not as accurate as that for the most recent years. (source: Jersey Energy Trends 2005)

Figure 5 Energy related carbon emissions in 2006

As currently there is no international agreement on the treatment of aviation emissions these are excluded

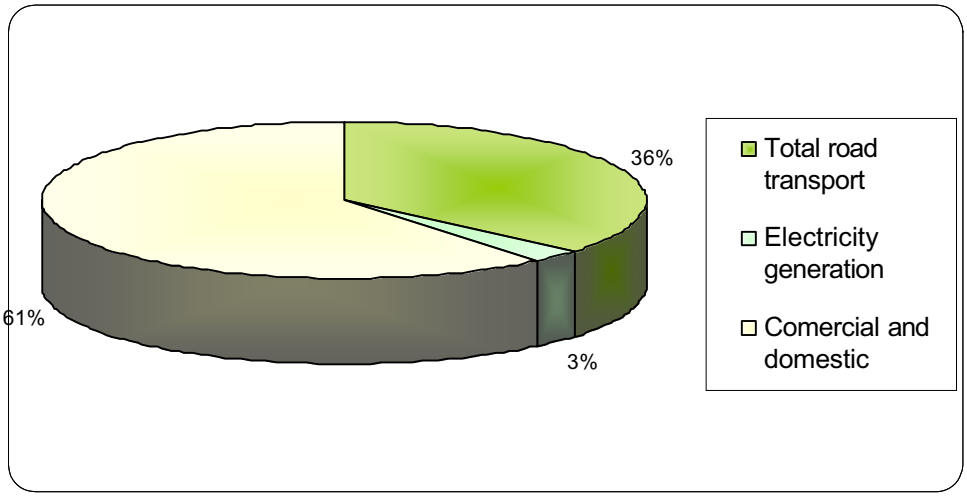


Source: Jersey Energy Trends 2006 Statistics Unit

1.22 Total carbon emissions have decreased substantially due to the switch away from on-island oil-generated electricity (Figure 6). The greatest proportion of Jersey's carbon emissions arise from the road transport sector and domestic and commercial – and it is these two sectors where action must be taken and is most likely to be effective.

Figure 6 Energy related carbon emissions by source 2006

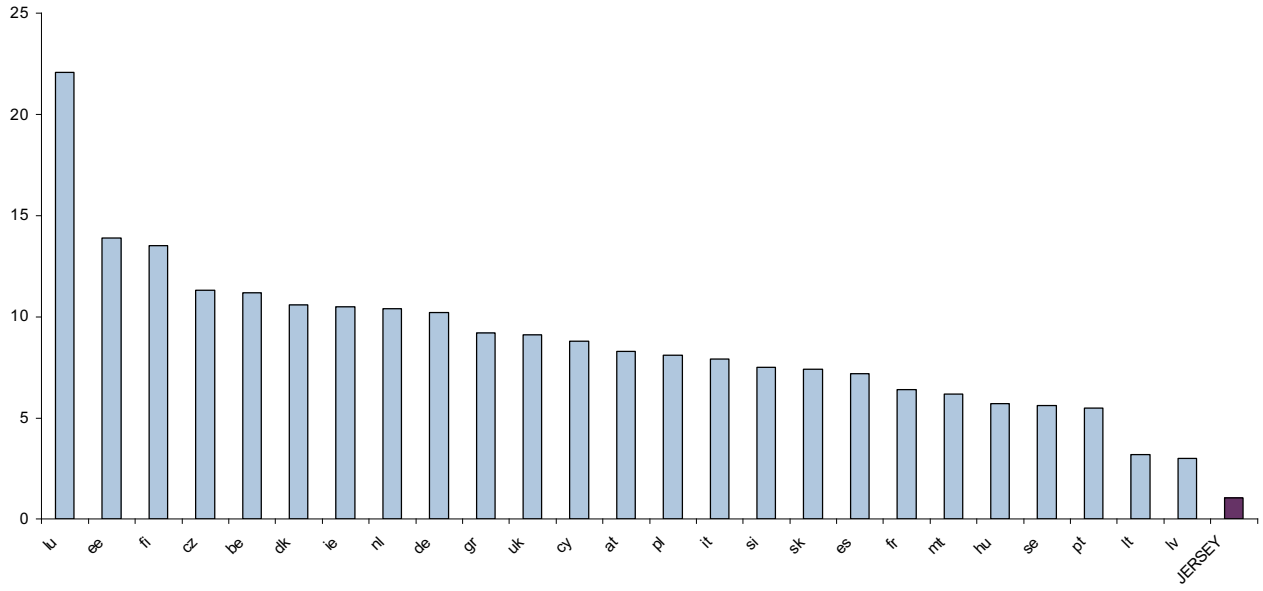
NB Electricity generation excludes the energy from waste plant (which is further discussed in Chapter 2). Carbon arising from agricultural emissions (discussed further in Chapter 8) or those resulting from land use changes are not included. Figures show the percentage of total tonnes of carbon



Source: Jersey Energy Trends 2006 Statistics Unit

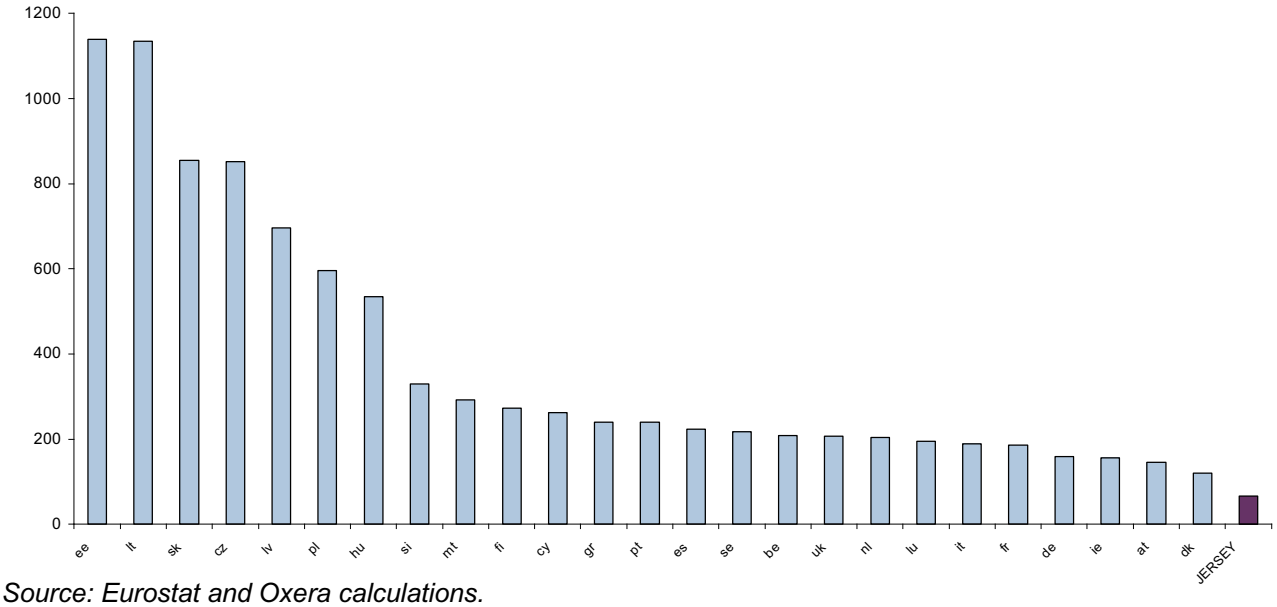
1.23 The low reliance on energy intensive industry within Jersey's economy and the fact that the majority of the Island's electricity consumption is imported means that, in comparison with other developed economies, Jersey currently performs well against its energy related environmental objectives. As Figure 7 shows, Jersey's carbon dioxide emissions of just over 1 tonne per capita is significantly better than any of the EU states and approximately 12% of the EU 25 average. Similarly, Jersey's energy intensity (Figure 8), at around 66 kilograms of oil equivalent per 1,000 euros GDP, is less than 1 third of the EU average.

Figure 7 Carbon intensity (2004) (annual tCO2 per capita)



Source: Eurostat and Oxera calculations.

Figure 8 Energy intensity (kg oil equivalent per 1,000 euros GDP)



Source: Eurostat and Oxera calculations.

Key features of Jersey's energy use

1.24 The Statistic's Unit produces an annual analysis of Jersey's Energy Trends which provides a picture of Jersey's energy usage since 1991 from when data has been available and is comparable. Arising from this are key features of Jersey's Energy Trends:

- High import dependency
- A high dependency on petroleum products
- Jersey tends to import its energy in the form in which it is used
- Jersey imports electricity from the European grid
- Energy use patterns are dominated by the domestic and transport sector
- Jersey's main exporting industry, international financial services, uses relatively little energy
- Jersey is a 'price taker' in a global market of increasing energy costs
- Consumer behaviour appears inelastic in respect of rising energy costs
- A low competition energy market

High import dependency

1.25 Total primary energy supply (TPES) is the energy that a country imports or makes from its own natural resources or imports. As Jersey has no fossil fuel natural resources it is not surprising that imports account for almost all of primary energy. In 2006 Jersey's TPES was 202,000 tonnes of oil equivalent (toe)[8]. Of Jersey's TPES, 99% was imported with just 1% (around 1,600 toe) produced in Jersey, through electricity generated from the waste to energy plant at Bellozanne. By international standards this is a very high level of import dependency; for example across all OECD countries the average is around 30% of TPES coming from imports, although with considerable variation between current net exporters of energy (like Norway) and high importers such as Japan (82% imports) and Germany (60%).

A High dependency on petroleum products

1.26 Crude oil can be manufactured into a range of petroleum products that are used by different consumers. Locally, there are three categories of fuel that make up the majority of the 34,000 tonnes of petroleum products imported in 2006: motor spirit (petrol); Kerosene (heating oil used in homes); and gas oil (diesel and oil used by industry). Annual levels of imports vary each year depending on both consumption and imported surplus to build up stock levels.

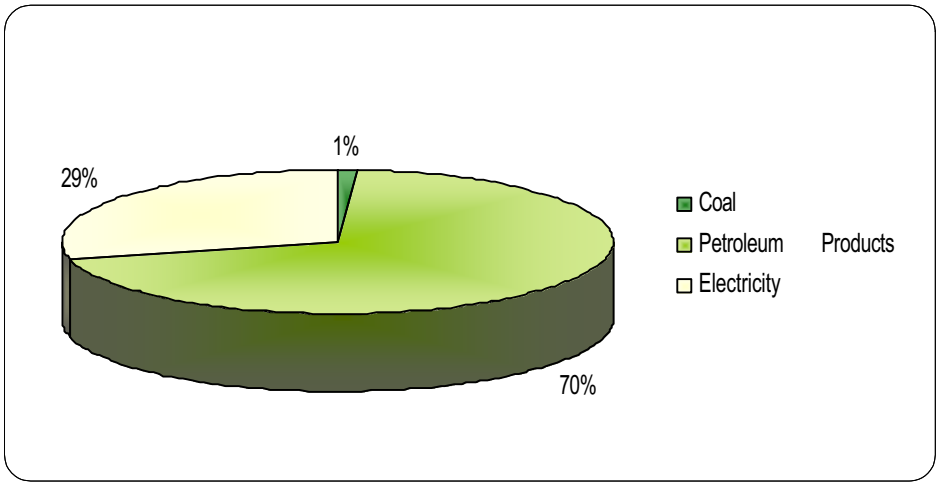
1.27 As Figure 9 shows, petroleum products (petrol, diesel, heating oil, aviation fuel and liquefied petroleum gas, etc) account for 70% of Jersey's TPES, with the remainder mainly coming from electricity (imports from France and energy from waste) apart from the 1% that is coal. This represents a low level of diversity by European standards.

1.28 A specific feature of the Jersey energy market is that the gas used is all sourced from LPG (a petroleum product). In 2006, 12,600 toe of gas was consumed, of

[8] Jersey Energy Trends 2005 Jersey Statistics Unit

which around 80% was supplied as manufactured gas (via pipes) with the remaining 20% supplied as LPG.

Figure 9 Jersey's total primary energy supply, by fuel type 2006

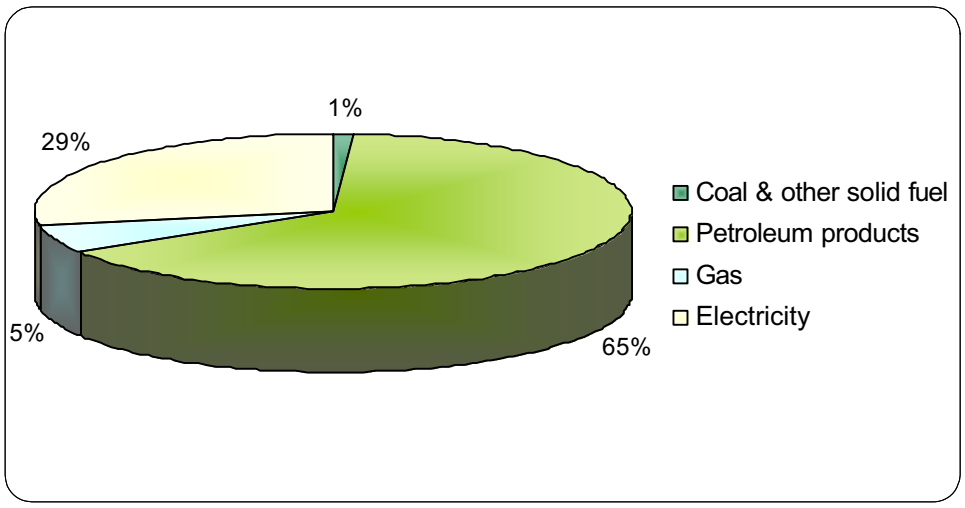


Source: Jersey Energy Trends 2006

1.29 Petroleum products represent a significant proportion of Jersey's total energy consumption, not only for transport, but also for industrial and domestic use (Table 1). This high use of petroleum products in the non-transport sectors primarily takes the form of heating and is a consequence of the absence of natural gas within the Island's energy mix. Although there is some reticulated gas on Jersey, this takes the form of imported LPG regasified on the Island.

1.30 The high degree of dependence on petroleum products remains evident in final consumption with Petroleum Products accounting for 65% of final consumption in 2006. Figure 10 also shows that electricity accounts for about a quarter, with gas 5% (7% if the gas which is consumed as LPG is included), and coal 1%.

Figure 10 Jersey's total final energy consumption, by fuel type 2006



Source: Jersey Energy Trends 2006

Jersey tends to import its energy in the form in which it is used

1.31 The transformation of energy means turning it from one form to another that is normally easier to use. For example crude oil contains a great deal of energy, but this can only be harnessed when the oil is refined into other products such as petrol or heating oil.

1.32 Within Jersey there is relatively little transformation as most of the fuel imported is in the form that consumers want. Oil is still used to produce electricity, although now at much reduced rates. In 2006 5,300 tonnes of oil were used to generate 18,600 MWh of electricity (about 1% of which was at Bellozane). Although this does represent an increase compared with 2005 (when 3,600 tonnes of oil were used to produce 12,300 MWh of electricity), the longer term trend is one of decline, with the 1990s seeing around 80,000 tonnes of oil used for electricity generation. In 2006 oil generation accounted for about 3% of total electricity compared to 37% in 1991. In pure energy terms approximately 5,500 toe of oil was needed to produce 1,600 toe of electricity in 2006.

1.33 The other form of energy transformation that occurs in Jersey is to change Liquefied Petroleum Gas (LPG) into a gaseous form so it can be piped through the gas network. Compared to generating electricity or refining crude oil, this gas transformation loses very little energy for example just under 160 toe was consumed in converting 11,000 toe of LPG to gas.

All electricity is imported from the Continent

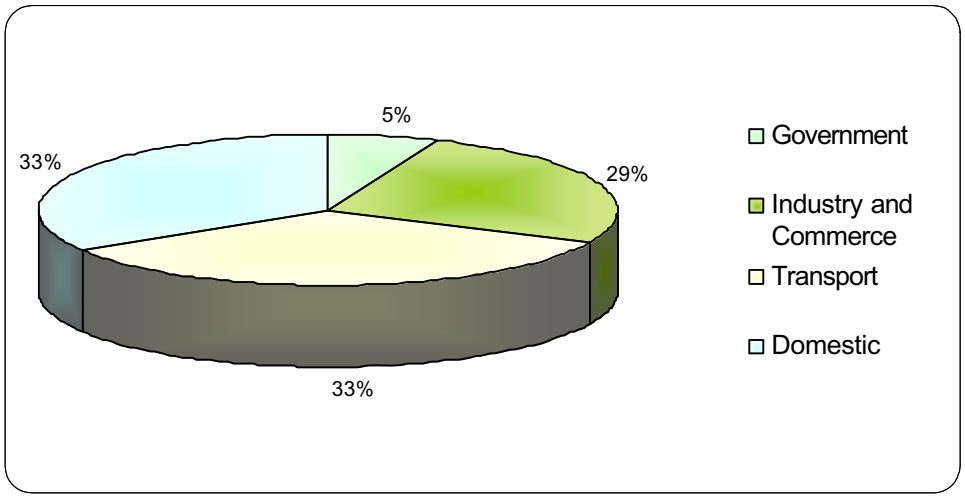
1.34 The main change within the overall consumption of petroleum products in Jersey has been the decline in oils (fuel oil and gas oil) used to generate electricity from around 80,000 tonnes of oil per year in the early 1990s to around 5,300 tonnes in 2006. This is a consequence of the installation of an enhanced interconnector to import electricity from the European grid. Domestic generation of electricity is now determined by the combination of prices in the Jersey and European market and oil prices, in addition to availability through the interconnectors. This is an important feature of Jersey's energy mix and has implications for the reliability and security of supply.

1.35 Electricity in Jersey is imported from France where generation is a mix of nuclear and hydro power sources (80:20 respectively). Jersey and Guernsey have been connected to France via a submarine cable since the mid 1980s. Described as the largest engineering project ever undertaken in the Channel Islands, the Channel Islands Electricity Grid (CIEG) project is a significant investment (£50 million) by the Jersey and Guernsey generating boards resulting in financial and environmental benefits. The cost of burying the 22kms of new cable, between Archirondel and Grève de Lecq was ten times more expensive than building an overhead line but has resulted in virtually no unsightly visual impact on the countryside.

Energy use patterns are dominated by the domestic and transport sector

1.36 Due to the absence of any significant energy intensive industries on the Island, the domestic sector accounts for a large proportion (around one third) of total energy consumption (Figure 11) as does the proportion of the energy used for transport[9].

Figure 11 Jersey's total final energy consumption, by user 2006



Source: Jersey Energy Trends 2005

1.37 Approximately 10% of energy consumption in 2005 arose from air and marine transportation to the Island which is petroleum based (Table 1). The domestic market is 60% dependant on petroleum products particularly due to the prevalence of oil-fired space and water heating as well as the provision of LPG for space heating.

Table 1 2005 Energy Consumption (tonnes of oil equivalents; toe)

	Coal & Other Solid Fuel	Petroleum products	Gas	Electricity	Total
Industry and	-	27,827	4,413	27,555	59,796
Air and marine	-	19,607	-	-	19,607
Road	-	43,116	-	-	43,116
Domestic	2,340	30,162	6,171	25,471	64,143
Total	2,340	120,711	10,585	53,026	186,661

Source: Jersey Statistics Unit 2005.

Jersey's main exporting industry uses relatively little energy

1.38 Data from the 1998 input / output tables suggest that the two industrial sectors with the greatest overall energy use are: Wholesale and Retail; and Hotel, restaurant and catering. However, as Table 2 shows, other sectors have a higher energy spend as a proportion of their gross value added (GVA), with Agriculture and Fishing being the most energy intensive non-public sector group.

[9] Jersey in Figures 2005 Jersey Statistics Unit

Table 2 Economic sectors with highest energy intensity (1998)

	Spend on Energy (£m)	Energy costs as a proportion of GVA (%)
Public Services	1.5	11.1
Water	0.6	9.1
Agriculture & Fishing	2.0	6.9
Manufacturing	2.6	6.0
Recreation, Culture & Sport	1.3	4.8
Sea & Air Transport and Transport Support	2.5	4.5
Hotels, Restaurants & Catering	5.7	3.8
Health, Social Work & Housing	3.3	2.8
Wholesale & Retail Trade	5.9	2.2

Source: 1998 Input Output Tables for Jersey.

1.39 Jersey's main exports – international financial services – have a very low energy input as a proportion of GVA, in the order of less than 0.03% for banks and building societies. Measured as a proportion of direct costs, energy costs are also a small proportion of international financial services – in the order of less than 0.5%. However, tourism, the other main export industry, is more energy intensive with direct energy costs approaching 5% of total costs in 1998.

Jersey is a 'price taker' in a global market of increasing energy costs

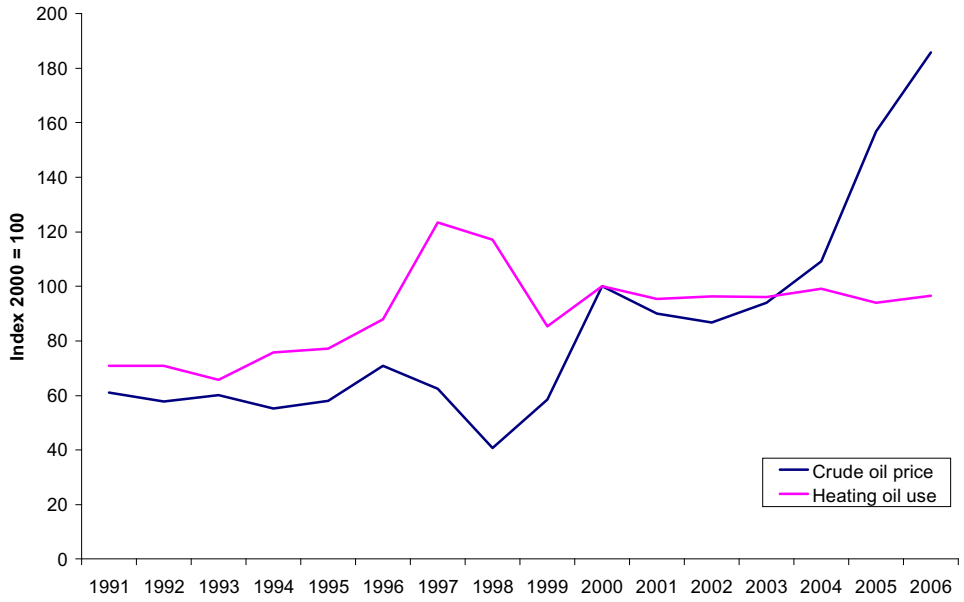
1.40 The high percentage of imported energy and current dependence on petroleum products derived from crude oil (over 70%) mean the impact of global increases in energy prices and especially oil has a major impact on household and business energy costs in Jersey. For example, between 2005 and 2006, average domestic energy bills were up 9.7% for electricity, 9% for gas[10]. The cost of heating oil in spring 2006 was 20% higher than in spring 2005 and 9% higher than the average for 2005. Whilst the level of oil prices in the future is unknown, it is likely in the short to medium term at least that the current factors surrounding uncertainty of supply and strong demand in the developing economies will continue to have an upward rather than a downward pressure on prices.

1.41 With the decrease in oil fired electricity generation seen recently in Jersey, electricity prices have been insulated from increases in oil prices. However, there have been increases in the cost of European wholesale power. The JEC made the decision to substantially absorb these external increases which resulted in a 36% fall in profits between 2006 and 2007[11]. However in January 2006, the JEC increased prices for all consumers by 9.7% and from the 1st January 2007 there was an average tariff increase of 19.75%.

[10] Based on tariffs in force up to May 2006.
[11] http://www.jec.co.uk/pdfs/preliminaryannouncementofannualresults2006.pdf

1.42 Figure 12 plots the crude oil index against consumption of heating oil as an index; the assumption is made that crude oil is a good indicator for heating oil prices. When oil prices were low in the mid to late 1990s, oil consumption increased but as oil prices started to rise, there was only a small initial reduction in use. However as oil prices started to rise there was only a small initial reduction back to around trend level whilst recent large increases in costs have had little impact on consumption.

Figure 12 Crude oil prices and heating oil consumption



Source: Jersey Energy Trends 2006 Statistics Unit

Consumer behaviour appears inelastic in respect of rising energy costs

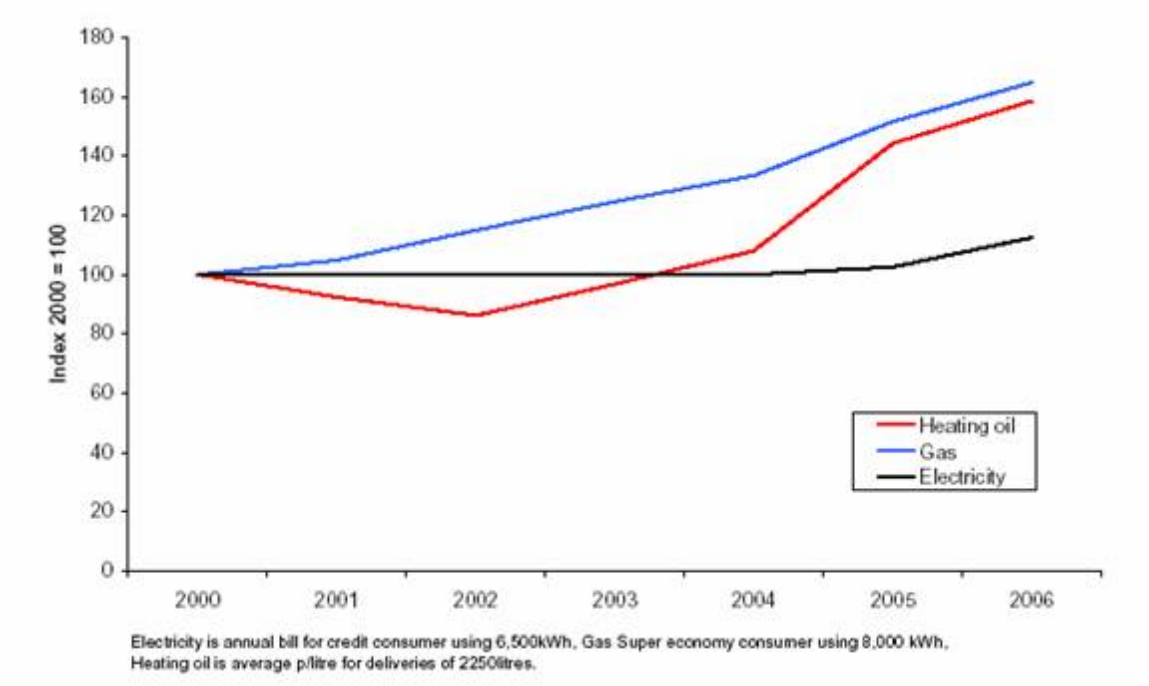
1.43 Despite exposure to global rising energy prices there has appeared to be little change in consumer behaviour with respect to energy use - total final energy consumption has been relatively flat over the past 5 years (especially if allowance is made for warmer and colder winters), and energy demand has risen by 9% since 1991.

1.44 With the ongoing increases in oil prices it might have been expected that consumers would have sought to use energy more efficiently and thus reduce their exposure to rising costs. However, up until 2004 there was no evidence of this occurring, whilst use of heating oil in 2006 was 3% higher than in 2005.

1.45 Electricity prices remained unchanged between October 2000 and January 2005, however from January 2005 to January 2006, prices for all consumers rose by about 10%, followed by a 19% increase from January 2006 to January 2007, meaning that the bill for a standard credit consumer using 6,500 kWh increased from £602 in 2006 to £713 in 2007, whilst that for a Comfort heat consumer on 9,000 kWh increased from £504 to £600.

1.46 Thus, for all (domestic and commercial) consumers of gas and electricity, the situation is very similar as for oil. Prices are more likely to go up rather than down and the trends seen in Figure 13 are likely to continue. Therefore the importance of using energy efficiently as a means of limiting exposure to increased costs becomes more important.

Figure 13 Domestic energy costs



Source: Jersey Energy Trends 2006 Statistics Unit

1.47 The Jersey Annual Social Survey 2006 provides some interesting insights into the public's patterns of energy use. Jersey's uptake of household appliances is high - virtually every household in Jersey has at least one fridge/freezer, TV, DVD/video and washing machine and there is a very high proportion of homes containing at least one music centre (87%) and computer (76%). Nearly two-thirds (63%) of homes have a tumble dryer and over half (54%) at least one dish washer, whilst two in five homes (42%) have at least one games console and one in ten homes (9%) have a patio heater.

1.48 Key points of the survey are:

- Overall there is very little knowledge of the energy efficiently rating of appliances.
- The most common forms of home energy efficiency measures are an insulated hotwater tank (76% of homes know their tank is insulated) and double glazing (69% having double glazing everywhere in their home and 15% partially).
- Just over half (54%) of homes with a loft have it have it fully insulated, whilst 15% have it insulated partially.
- No other form of energy efficiency measure is present in more than a third of homes.

- Less than one in ten homes (7%) have energy efficient light bulbs
- Penetration of energy efficiency measures was lower in the rental sectors with only 55% of homes having full double glazing in both of the States rental and private rental sectors and more than 50% of homes in these sectors having no energy efficient light bulbs.
- Nine out of ten people believe it is important to improve the energy efficiency of their home with the older age groups in general thinking that this is an important issue, with the exception of the over 75 year olds with 8% of them thinking it is not at all important.

1.49 There are a number of steps that people take to limit their energy consumption but not all are applied (Table 3).

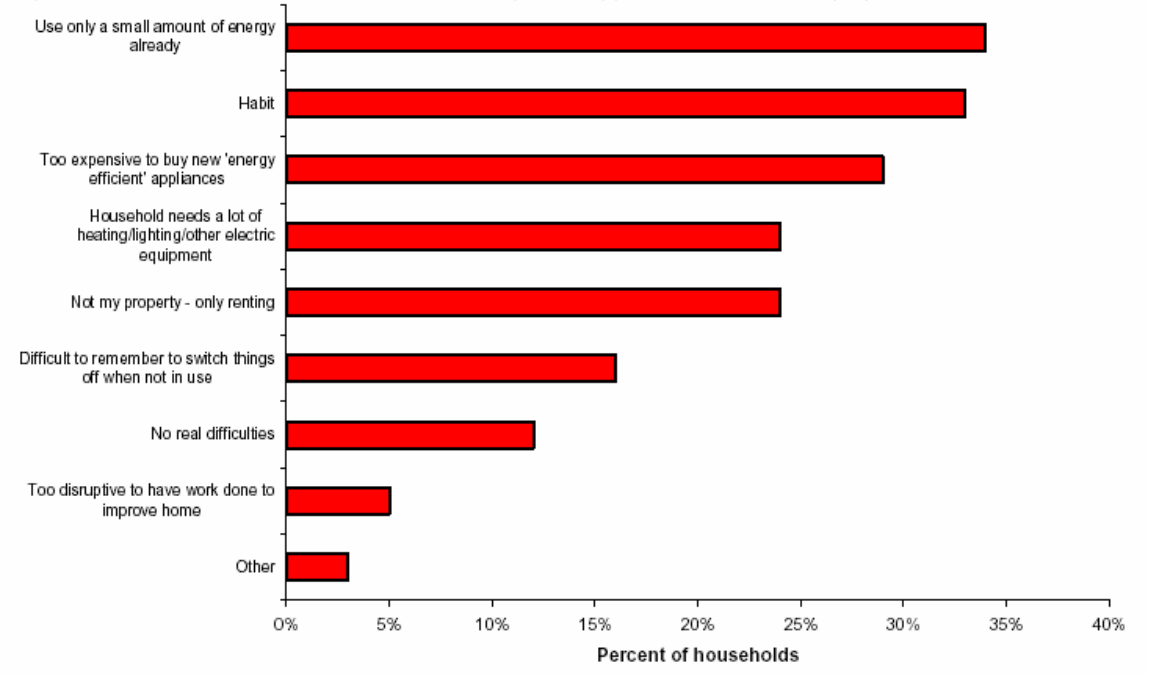
Table 3 How often do you limit your energy consumption (%)?

	Always	Sometimes	Hardly ever	Never
Turn the lights off when not in use	76	22	2	0
Turn computers off when not in use	71	19	5	5
Only heating enough water for a bath when you need it, not all the time	34	25	19	22
Turning the heating down in unused rooms	67	21	7	5
Turning electrical items off 'stand-by' when not in use	48	33	11	8
Buying 'energy efficient' products	22	51	17	10
Using less water in the kettle when you boil it	55	32	6	6

Source : Jersey Annual Social Survey 2006

1.50 When asked what were the difficulties in reducing consumption the leading answers were habit and a lack of belief that they were using significant proportions of energy initially (Figure 14).

Figure 14 Main difficulties in reducing energy consumption (%)



Source : Jersey Annual Social Survey 2006

1.51 There is significant scope for improved behaviour to reduce energy demand and one key criteria for success would be changing people's habits or raising their awareness of the importance of the issue. These are often best tackled by education campaigns.

A low competition energy market

1.52 Currently the CI energy market comprises:

- A competitive road and heating fuels sector;
- One electricity generator and retailer, the Jersey Electricity Company, is a London Stock Exchange Listed Company of which the States of Jersey owns approximately 60%, with large UK institutional investors and private individuals holding most of the remaining stock. The JEC describes it's relationship with the States of Jersey as 'arms length', consistent with the Listing Rules and neither the States nor the Company enjoy any privileges beyond those which apply between any public company and individual shareholders;
- One private gas company that imports, manufacturers and distributes LPG gas for domestic space and water heating as well as retailing Autogas.

1.53 The lack of competition in the electricity and gas utilities could suggest that the companies are not operating to the same level of efficiencies that they would in a competitive environment. In small markets such as Jersey where there may not be a proven business case for other competitors, regulation usually plays the role of competition. The creation of the Office of Utility Regulation (OUR) recently in Guernsey has recently resulted in the regulation of electricity prices. Regulation in Jersey is currently carried out by the Jersey Competition Regulatory Authority who do not have specific licensing authority in relation to electricity and gas although

they do for the postal and telecoms sectors. Thus they do not set prices at an efficient level instead intervening only in the case of a complaint. The JCRA could take action against a company if it could demonstrate that it had:

- abused its dominant position; or
- engaged in collusive behaviour.

1.54 No such complaints have ever been received against the CI energy utilities but energy policy will examine whether there is a role for sector specific regulation locally.

1.55 Energy prices make a significant contribution to the retail price index thus are inflationary should they rise. On an annual basis, the largest contributors to the change in the Retail Prices Index in 2006 were fuel costs. These increased by 16% compared to March 2005 as a result of global increases in energy prices. The consequence of this was an overall annual increase in the RPI[12] of 0.5 percentage points. The States of Jersey itself is a significant end user of energy (5% of the total in 2006) and its outgoings will increase in a rising energy market. In addition, the States are responsible for financially protecting the most vulnerable in society from unaffordable energy costs.

1.56 Energy usage provides a revenue stream to the economy. In 2005, impôt duties on road fuel generated £18.5 million of revenue which comprised 37% of the total. Tobacco duty, vehicle registration duty and various categories of alcohol comprise the rest of the total duty collected. The revenue raised from motor fuel duties has increased markedly over the past 10 years and in quantum has increased three fold over this period, but is now showing a slowdown. The profits of the energy utilities are taxable, for example, the operating profits of the JEC in 2006 were £6.5M[13].

How does Jersey compare ?

1.57 In making comparisons a range of factors have to be taken into account, such as the nature of industry, size of country, climate, availability of energy sources and fuels used. All of these factors make international comparisons of energy use very difficult for Jersey. However there are some salient points to consider:

- *Total Primary Energy Supply per head of population* - Jersey is considerably below the UK, at 2.2 toe/capita compared with 4.1 in the UK. However, almost all the energy Jersey uses is imported in its final usable form whereas a large amount of processing occurs in the UK (final energy consumption is 70% of primary for the UK, but almost 100% in Jersey), the ratio of Final Energy Consumption per head of population in Jersey at 2.1 toe/capita is still below the 2.9 in the UK, but is closer.

[12] The Jersey Retail Prices Index in March 2006 - States of Jersey Statistics Unit.
[13] http://www.iii.co.uk/investment/detail%3Fcode%3Dcotn:JEL.L&it%3Dle

- *Electricity Consumption* - Total final consumption across all sectors of electricity per head of population is higher in Jersey than in the UK (7,000 kWh/capita, compared to 5,700 in the UK)

- *Heating Oil* - Total consumption per head of heating oil is nearly 10 times greater in Jersey than in the UK (0.3 tonnes to 0.04 tonnes)

- *Gas* - Per capita consumption of gas is much lower (1,400 kWh per head in Jersey 11,300 in the UK).

- *Road fuels* - Consumption of road fuels is 0.63 tonnes/capita in the UK compared to 0.44 tonnes/capita in Jersey, which is closer than may be imagined especially given the differences in road use i.e. very few large lorries in Jersey and far smaller distances.

- *Renewable Energy Sources (RES)*- Renewable energy is the term used to describe energy obtained from naturally occurring and replenishing elements within the ecosystem e.g. from the sun, the wind and the oceans, and from plants and the fall of water. The EU has set a target of 12% of energy consumption to be derived from such sources by 2010. Therefore, the UK and France, along with the rest of Europe, are pushing towards an increase in energy derived from renewable sources with ever challenging targets being introduced. Currently, Jersey does not exploit any renewable sources of energy at the large scale e.g. tidal stream, wind turbine; and the use of renewables at the micro level is limited. Jersey does import some renewably generated energy – 20% of the imported electricity is hydro-generated putting the Island's proportion of renewable energy at about 6%.

Local Policy

The Strategic Plan 2006-2011

1.58 The States' Strategic Plan 2006-2011 was adopted by the States of Jersey in July 2006. It acknowledges that 'there are worrying trends in world energy markets and Jersey must quickly develop and implement a robust and forward-looking energy policy'. It pledges that a comprehensive Energy Policy will be bought forward for consultation and debate in 2006.

1.59 The Strategic Plan commitment 1.4 '*There is greater enterprise in the Island'* asks that within an Energy Strategy for Jersey, the potential for exploiting the Island's indigenous energy sources is examined.

1.60 The Strategic Plan advocates the creation of environmental taxes and asks that, in association with the several policies (energy, waste and transport), a package of environmental taxation/expenditure measures will be bought forward that will encourage beneficial shifts in behaviours.

The State of Jersey Report (2005)

1.61 This report identifies environmental perspectives for Jersey. Looking at the global or international perspectives two key areas are highlighted that are relevant to Energy Policy – climate change and air quality. The Report goes on to highlight Climate Change as the first of 5 Environmental Priorities for Jersey:

'Man-made emissions are accelerating global climate change. Jersey as an affluent Island has an opportunity to aggressively tackle its' contribution to climate change and it can do this by reducing our carbon emissions. Jersey is not immune to the effects of climate change which is expected to affect sea defences, water resource availability, disrupt ecosystems and alter conditions for agriculture and human health. The Island must prepare, plan and adapt for these inevitabilities'

Integrated Travel and Transportation Plan

1.62 The State of Jersey report notes that the Island has the world's highest car ownership ratio. This results in:

- local congestion and an associated reduction in economic efficiency
- high carbon dioxide emissions which contribute to the greenhouse effect
- localised air pollution that occasionally breaches internationally agreed standards and has risks to health
- the fragmentation of natural habitats by the road networks, airport and harbour development.

1.63 Fuel used for transport, (Figure 11) contributes to approximately one third of Jersey's greenhouse gas emissions. It is an inescapable fact that a reduction in car usage together with cleaner fuels and vehicles will be essential to meet planned objectives.

1.64 Despite a small percentage decrease in the use of road fuels between 2005 and 2006, vehicle use in Jersey is very high. In order to address this, a Sustainable Travel and Transport Plan '*Turning Travel Around'* was put forward in 2005 by the States. Subsequent work has developed an Integrated Travel and Transport Action Plan which recognises that improvements in the use of energy in the transport sector are crucial in achieving the objectives of the energy policy and would also substantially improve air quality issues and congestion[14].

Rural Economy Strategy

1.65 Data from the 1998 input / output tables[15] (Table 2) suggest that agriculture and fishing has the highest energy spend as a proportion of the gross value added (GVA), with these sectors being the most energy intensive non-public sector group, a good example being the protected crops industry. Clearly this has an effect on the profitability and the sustainability goals of this strategy.

1.66 The Countryside Renewal Scheme (CRS) is a scheme set up within the Rural Economy Strategy that gives grants to landowners to assist in the sustainability and improvement of the countryside. Energy audits are a component of the current CRS. Improvements in energy efficiency would have benefits such as reducing

[14] Integrated Travel and Transport Plan Published by The States of Jersey, Transport and Technical Services Department 2006
[15] Jersey Statistics Unit

smoke emissions and a reduction in the amount of greenhouse gases produced (carbon, sulphur and nitrous dioxides). Another benefit would be a reduction in the amount of energy used per unit of production. Upgrading/replacement of items identified in the energy audit may include: economisers / condensers for boilers; heat storage tanks; waste heat recovery units; and thermal screens.

1.67 Support is available for the production of a professional report on the efficiency of energy use on farms and protected crop units. Equipment that is outdated or inefficiently maintained will use increased amounts of fuel or electricity. This increased energy usage adds to the production of greenhouse gases which have an adverse effect on the environment. By identifying poorly performing machinery and equipment, and providing clear advice on how improvements can be achieved, there would be a reduction of these polluting emissions.

Air Quality Strategy (2007)

1.68 Although air quality in Jersey is generally good, pollution can arise locally from traffic congestion, from the ageing incinerator at Bellozanne, the oil-fired power station (now rarely used) large boats in the harbour and from further afield via long range transportation processes. Poor air quality can adversely affect ecosystems and human health.

1.69 Local air quality can be addressed both by reducing diffuse sources of emissions of sulphur dioxide and oxides of nitrogen from transport and by reducing emissions from point sources such as the Island's failing incinerator whose contribution of various pollutants to the atmosphere is well beyond European compliance.

1.70 A draft Air Quality Strategy was produced in 2003 and through an inventory process it highlights significant sources of local pollution and pollutants[16]. A number of failures were identified that prevent Jersey from reaching compliance with International Standards as defined under Multi-Lateral Environmental Agreements that Jersey is a signatory to or has indicated a wish to work towards. In particular localised pollution arose from the Energy from Waste Plant, La Collette Power station and the crematoria. However increased standards and plant replacement or retirement have largely addressed these problems.

1.71 The draft is to be re-launched for consultation in 2007 taking account of these improvements. However, the principle source of local pollution was identified as arising from traffic emissions and did in some instances cause localised reductions in air quality particularly as a result of increased particulates and nitrogen oxides. Of course the combustion of hydrocarbons in vehicles is a major component of Jersey's CO_2 emission and the statement made in the 2003 draft still stands : '*It is therefore important to note that any actions to reduce air pollution from road transport in Jersey should also aim to reduce greenhouse gas emissions.* '

[16] An Air Quality Strategy for Jersey' A report for the States of Jersey by AEA Technology

Solid Waste Strategy and electricity generation from Energy from Waste (EfW)

1.72 The waste disposal process generates energy as a by-product rather than being a primary energy source. Currently the majority of energy produced is consumed within the process itself or other operations on the same site. The heat energy released by burning municipal waste is used to generate electricity. Of the electrical output in 2006, 92%[17] was used on site in what is effectively a closed-loop to power the EfW and associated plant as well as the Sewage Treatment Works (STW) (Table 4). The remaining 8% was exported back to the JEC and was then distributed into the Island's grid, it is included in that attributed to 'electricity' when referring to the energy use data in Section 2.

Table 4 Comparison of waste, electricity output and carbon emissions from the EfW in 2006 and predicted for 2030

	2006	2030
Tonnage of waste to EfW	73,600	126,000
Total electricity generation (MWh)	17,000	72,800
Electricity used on-site (MWh) (% of total)	15,700 (92%)	18,800 (26%)
Electricity exported into grid (% of total)	1,300 (8%)	54,000 (74%)
Total non-biogenic carbon emissions arising from EfW process (tonnes of C)	18,600	31,900
Non-biogenic carbon emissions arising from portion of electricity exported into the grid (tonnes of C)	1,500	23,600

1.73 The incineration of waste produces carbon emissions and these will depend primarily on the composition of the residual waste entering EfW. In particular, it is accepted that the biogenic fraction, that composed of recently photosynthesised material, of the residual waste is a renewable resource. Therefore it is considered carbon neutral[18] and the emissions arising from this portion of the waste stream are not counted in a climate change inventory.

1.74 The National Inventory for Greenhouse Gas Emissions advised that the most recent calculations for typical carbon emissions from the non-biogenic fraction of one tonne of waste treated by incineration is 253kg/Carbon (An inventory of greenhouse gas emissions carried out in 2000[19], used a slightly lower emissions factor but the higher figure has been adopted here). Therefore In 2006, the

[17] Information provided by Transport and Technical Services Department whereby - the site generated 17,018,935 units of electricity and exported 3,286,100 units of electricity. The site consumed 15,699,035 units of electricity of which 1,966,200 units were imported from the JEC. Therefore 15,699,035 / 17,018,935*100 = 92% of the electricity generated by the EfW was used on-site.

[18] IPCC Guidelines and 'Meeting the Energy Challenge' UK Energy White Paper 2006 http://www.dti.gov.uk/energy/whitepaper/page39534.html

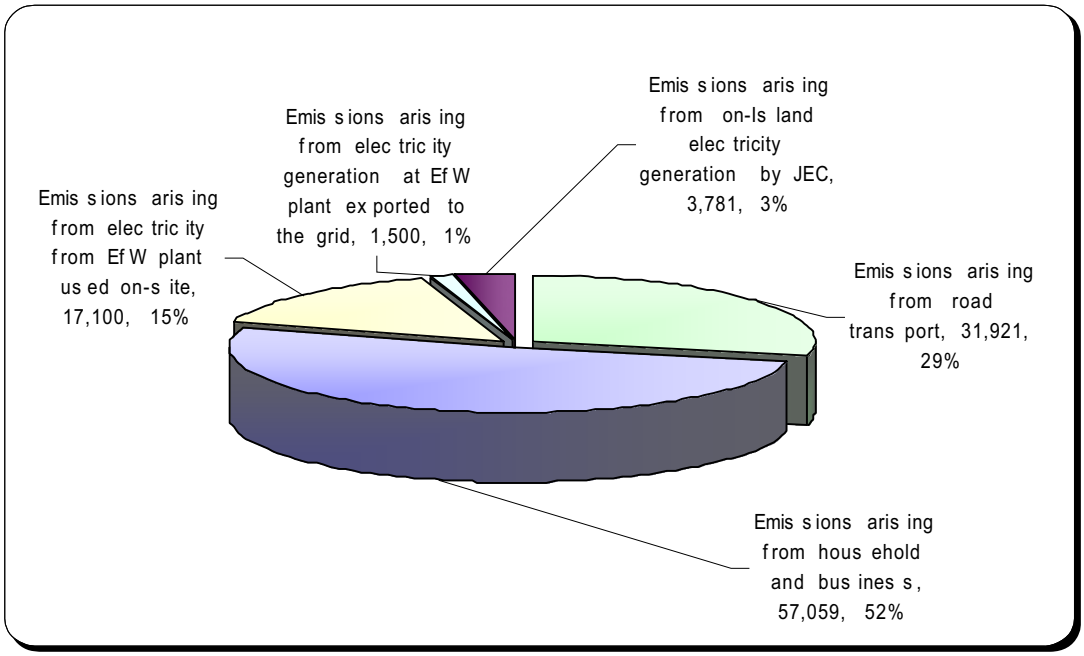
[19] 'Greenhouse Gas Inventory, Jersey 2000', Coley, D.A. and Romeril, M. Published by the University of Exeter using an emissions factor of 0.2 t/C per tonne MSW

residual waste treated by the EfW was 73,600 tonnes[20] and the carbon emissions from the 8% of this electricity exported into the grid comprised approximately 1,500 tonnes (Table 4 and Figure 15).

1.75 To date, no emissions from the EfW have been included in the Island's carbon budget since it is not considered that the emissions factors and composition of the waste stream were sufficiently known to provide meaningful evaluations. However, when high level assumptions on emissions are made, the carbon emissions arising from the electricity exported into the grid from the EfW are about 2% of the total Island's energy-related emissions.

1.76 Other emission sources which have not been previously accounted for in carbon budgets include those arising from agricultural activity (these are discussed further in Chapter 8) and land use changes.

Figure 15 Energy related carbon emissions from local sources including EfW 2006



Source: Jersey Energy Trends 2006 Statistics Unit, and the assumptions on emissions from the EfW outlined in the text

1.77 The use of Energy from Waste as a solution to the management of residual waste is one that many Islands have adopted and that the States have agreed is appropriate for Jersey. The existing plant at Bellozanne has reached the end of its design life and is due for immediate replacement and in addition the level of emissions does not comply with European Standards[21]. In addition, the current emissions prevent Jersey from being able to comply with the Aarhus Protocol on heavy metals (United Nations Geneva Convention On Long Range Transboundary

[20] 'Jersey in Figures, 2006' Statistics Unit, States of Jersey
[21] 'Changing the way we look at Waste' - Solid Waste Strategy for Jersey 2005

Air Pollution,1979) which targets three particularly harmful metals: cadmium, lead and mercury. Under one of the basic obligations, Parties will have to reduce emissions for these three metals to below the 1990 levels (or an alternative year between 1985 and 1995). The Protocol aims to cut emissions from industrial sources (iron and steel, nonferrous metal), combustion processes (power generation, road transport) and waste incineration. The replacement of the existing inadequate EFW, which is expected by 2012, will allow compliance with this protocol as well as opportunities to invest in more thermally efficient plant and energy distribution networks.

Future carbon emissions associated with EfW

1.78 The future carbon emissions from the EfW and other waste management processes such as recycling are difficult to estimate accurately. They will depend on the tonnages of waste (as a function of population and household size) as well as the composition of the future waste stream. This is expected to change when reduction, reuse and recycling initiatives come online at the European level as a result of legislation such as the the European Parliament and Council Directive 94/62/EC of 20 December 1994 on packaging and packaging waste, Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE), and the End of Life Vehicle Directive (2000/53/EC) Article 4 - Prevention.

1.79 However, waste arisings in Jersey are predicted to increase, even with effective local reduction, reuse and recycling programmes. This is because of the increase in the number of households (people are living in smaller households than previously) as well as population growth. It is predicted that by 2030 the replacement EfW may process up to 126,000 tonnes of municipal solid waste (Table 4) with estimated non-biogenic emissions of approximately 31,900 t/C.

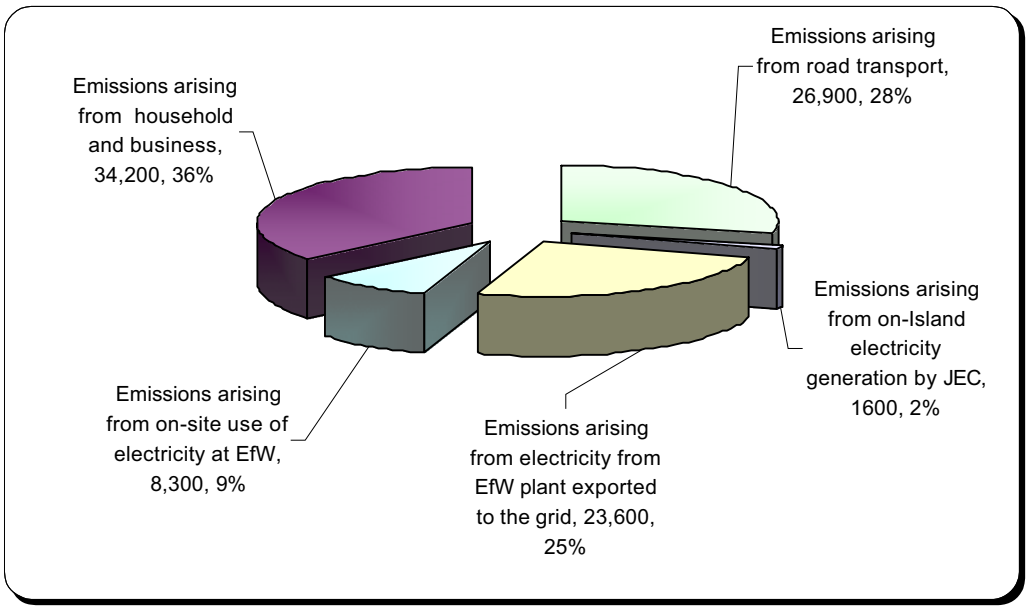
1.80 The replacement plant will be more thermally efficient than the existing one and so will generate more electricity (Table 4, approx 72,800 MWh[22]). Even assuming increased on-site energy demand[23], the greater throughput of waste means that approximately 74% of the generated energy will enter the local grid. Therefore in 2030, the amount of carbon arising from on-island electricity generation from EfW is likely to be approximately 23,600t/C; significantly more than in 2006 (Figure 16).

1.81 The simple, high-level assumptions and calculations presented do not take into account the whole picture in respect of predicted on-island carbon emissions as a result of waste management. Therefore, the effect of EfW on energy production and carbon emissions has been treated separately from overall energy policy for the following reasons:

[22] Assuming a plant of 10.4MWe when processing 18 tonnes per hour of waste, so exporting 578kWh of power per tonne of waste or 72,800MWh

[23] A 20% increase on 2006 levels of demand are assumed to account for a larger plant and increased work

Figure 16 Predicted energy related carbon emissions from local sources including EfW in 2030



Source : Output from modelling exercise in Chapter 4 and assumptions on EfW as shown in text

- Currently, the majority of energy generated from EfW is used on-site to power the EfW and the STW in effect, operating as a 'closed-loop' system. With the development of the proposed replacement EfW facility It is acknowledged the proportion of exported energy into the local grid will increase by approximately 66%;

- It is very difficult to predict the effects of the treatment of waste by EfW on future levels of energy production and local carbon emissions. This is because of the unknown composition of the future waste stream. In particular, as European measures to reduce waste take effect, the composition of the waste stream is likely to change making it difficult to predict future emissions;

- The future effects of the transportation and recycling or recovery of increased tonnages of materials of unspecified composition on carbon emissions are not known;

- The effects of alternative recycling or recovery technologies that might be used on-island on energy demand and on emissions of carbon are not known.

- On-island recycling or recovery will require energy (e.g. transport fuels, plant power) and as tonnages increase as a result of increased waste output from a growing population, so will the energy demand. This could increase emissions from these other sources.

CHAPTER 3 - Why current energy use patterns are not sustainable; the challenge ahead

Chapter summary

There is an acceptance by the international scientific community that global climate change is being accelerated by the emissions of greenhouse gases arising from the burning of fossil fuels. This 'accelerated climate change' has led to an overall warming of the earth's surface in the last 150 years and this trend is predicted to continue – to what degree depends on the amount of future emissions.

The review by the economist Sir Nicholas Stern highlighted the need to mitigate this situation urgently. He estimates that if no action is taken the global costs and risks of climate change are equivalent to losing 5% of global Gross Domestic Product (GDP) each year now and forever. However, the costs of action to reduce greenhouse gas emissions are far lower at about 1% GDP each year.

Even if all greenhouse gas emissions were reduced to zero tomorrow, there would still be some climate change. This is because there is considerable inertia in the atmosphere and so the effects of the increased atmospheric concentrations of GHGs from emissions to date will continue to be felt for up to 40 years.

Global mechanisms to climate change include emissions trading schemes and project based mechanisms to mitigate carbon emissions under the Kyoto Protocol which sits under the United Nations Framework Convention on Climate Change.

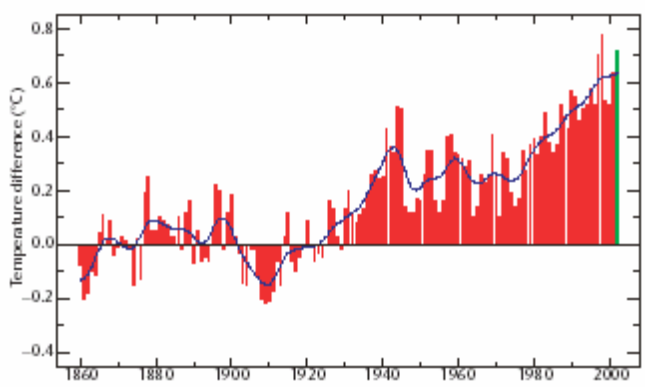
Climate change for Jersey is expected to mean hotter drier summers, warmer but wetter winters with increased storminess and heavy rainfall events and an increase in sea level. This will affect marine and terrestrial ecosystems as well as the industries that rely on them like agriculture, fisheries and tourism.

The environmental impact of energy use

Anthropogenic effects on global climate

1.82 Whilst climate has historically undergone long term cyclical variations, it has changed unusually quickly over the past century. This is most clearly seen in the record of global average near-surface temperature shown in Figure 15; the global mean is a combination of surface air temperature over land and sea-surface temperatures whilst the blue line is the smoothed trend. Large year-to year variability is evident, but so too is an underlying upward trend, mainly over the period 1910 to 1940, and again since about 1970. All of the top ten warmest years have been since 1980; 1998 was the warmest year in the record reaching back to 1861, and 2002 was the second warmest. Furthermore, at least in the past 25 years, this warming has been experienced almost everywhere around the globe. Figure 15 shows data relative to that at the end of the 19th century, indicated by red bars, with 2002 in green. The earth's surface warmed by 0.6°C during the 20th century and the Intergovernmental Panel on Climate Change estimates that it could rise between 1.4 and 5.8°C by the end of the 21st Century.

Figure 17 Global-mean, annual-average temperatures 1861–2002



Source: Met Office Hadley Centre and Climatic Research Unit, UEA

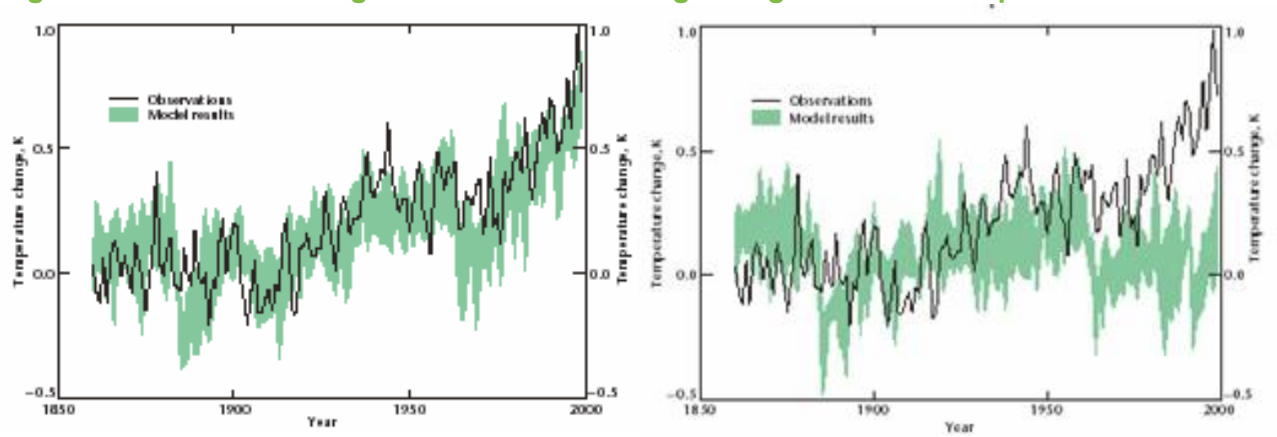
1.83 In addition to rises in global mean temperatures, there is evidence that rainfall patterns are changing, sea levels are rising, glaciers are retreating, arctic sea-ice is thinning and the incidence of extreme weather is increasing in some parts of the world.

1.84 Climate can change for many reasons however, ever since human activities started to emit GHGs, their concentrations in the atmosphere have increased, acting to warm the planet through the greenhouse effect.

1.85 To investigate the extent to which global warming may be natural or man-made, a super-computer model of the climate system has been used, firstly influenced by changes in only natural factors (Figure 16 graph on the right) and, secondly, with changes in natural and manmade factors (Figure 16 graph on the left). Natural factors alone cannot explain the observed rapid rise in global-mean temperature over the past 30 years, whereas when manmade factors are included, the agreement between the model simulation and observations is greatly improved.

The Intergovernmental Panel on Climate Change (IPCC) has been established by WMO and United Nations Environment Programme to assess scientific, technical and socio- economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation. The IPCC concluded that, " …*most of the warming observed over the last 50 years is likely to have been due to increasing concentrations of greenhouse gases*[24]."

Figure 18 Observed changes and modelled changes to global mean temperature



Source: Met Office Hadley Centre – taken from Scenarios of climate change for islands within the BIC region 2003

1.86 The greenhouse gases are commonly referred to as 'the basket of 6': carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); sulphur hexafluoride (SF_6) and the HFC and PFC groups of fluorinated gases. All of these gases have different global warming potentials and can be converted into an equivalent quantity of carbon dioxide (for example, methane has 23 times the global warming potential of carbon dioxide, so 1 tonne of methane emitted is equivalent to 23 tonnes of carbon dioxide), For this reason "carbon emissions" is used as a shorthand way of describing all greenhouse gas emissions in carbon equivalent terms. The Global Warming Potential of the various greenhouse gases are[25]: Carbon dioxide – 1; Methane – 23; Nitrous oxide – 310; HFCs: up to 11,700; PFCs: up to 9,200; Sulphur hexafluoride - 24,000.

Atmospheric inertia – the inevitability of some change

1.87 It is important to recognise that even if globally there could be a reduction in carbon emissions to zero tomorrow, there still would be some form of climate change. This is because there is considerable inertia in the atmosphere. Therefore, the effects of the increased atmospheric concentrations of GHGs from emissions to date will continue to be felt for up to 40 years.

1.88 The reality is that the emissions of GHGs will not cease tomorrow, and the level of climate change later this century will be determined by the emissions from this

[24] Climate change scenarios for the United Kingdom: the UKCIP02 Scientific report (Apr-2002) Authors: Hulme, M., Jenkins, G.J., Lu, X., Turnpenny, J.R., Mitchell, T.D., Jones, R.G., Lowe, J., Murphy, J.M., Hassell, D., Boorman, P., McDonald, R. and Hill, S.

[25] http://www.shellspringboard.org

point on. There are many environmental challenges facing the energy industry, from improving local air quality to protecting biodiversity. However, the greatest challenges for the 21st century is the increasing temperature of the planet, associated with carbon-based fuels that increase levels of greenhouse gases (GHGs) in the atmosphere and raise the atmospheric temperature.

The economics of climate change

1.89 The Stern review represents the most through and current thinking on the economic consequences of climate change; it was carried out by Sir Nicholas Stern, Head of the Economics Service and Adviser to the UK and published in October 2006.

1.90 The messages from the Stern review[26] are strong and clear; it concludes that:

- '*the scientific evidence is now overwhelming: climate change is a serious global threat, and it demands an urgent global response';*
- '*If we don't act* [to reverse climate change]*, the overall costs and risks of climate change will be equivalent to losing at least **5%** of global Gross Domestic Product (GDP)each year now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more.*
- *In contrast, the costs of action – reducing greenhouse gas emissions to avoid the worst impacts of climate change – can be limited to around **1%** of global GDP each year.*

1.91 The Review is clear that if action is not taken to reduce GHG emission, the scientific evidence is that the concentration of GHGs in the atmosphere could reach *'double its pre-industrial level as early as 2035, virtually committing us to a global average temperature rise of over 2°C* '. If this occurred it raises the likelihood to greater than 50% that the temperature rise would exceed 5°C – well beyond the range of human experience. Even more moderate levels of future emissions '*shows that climate change will have serious impacts on world output, human life and on the environment'.*

1.92 Despite this alarming picture the conclusion is more positive - *'although the costs of stabilising the climate are significant but manageable; delay would be dangerous and much more costly'.* Stern makes strong cases for the following :

1.93 **1. Adapting to climate change** – Steps must be taken to build resilience and minimise costs. This is especially relevant to the next two to three decades and the level of climate change that is already committed to as a result of current elevated GHG concentration levels in the atmosphere. It is important to recognise that it is the poorest countries that are most vulnerable to climate change;

1.94 **2. Stabilising GHG emissions** – Stern estimates that the impacts of climate change can be substantially reduced if GHG levels in the atmosphere can be

[26] The Stern Review: The Economics of Climate change, published by HM Treasury and The Cabinet Office see http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change / sternreview_index.cfm

stabilised between 450 and 550 ppm CO_2 equivalent (CO_2e). Current concentrations of CO_2e are 430ppm. Although a challenge, the costs of doing this are far below allowing GHG concentrations to arise and attempting to deal with the consequences of this. A highly cost-effective way to reduce and stabilise emissions is to reduce deforestation;

1.95 **3. Making an international response to climate change** – All countries must take action but Stern points out that developing countries should not be required to bear the full costs of action alone; mechanisms like carbon markets can deliver finance to support low-carbon development;

1.96 **4. Decoupling growth from greenhouse gas emissions** - in particular 'decarbonising' the power sector by 60% by 2050. Stern concludes that '*the world does not need to choose between averting climate change and promoting growth and development*'.

1.97 **5. Technology co-operation –** Technology and innovation must work to deploy low-carbon technologies as well as boosting energy efficiency. This may occur via informal co-operation or through formal agreements but international co-operation is likely to be necessary.

1.98 **6. Placing a social cost on carbon -** In economic terms GHGs are an externality i.e. those who produce greenhouse gas do not face the full consequences of the costs of their actions themselves. By putting an appropriate price on carbon, through taxes, trading or regulation, means that people pay the full social cost of their actions. This will lead individuals and businesses to switch away from high-carbon goods and services, and to invest in low-carbon alternatives.

1.99 A number of studies have attempted to quantify the social cost of carbon and in early 2002, the UK suggested £70/tC (within a range of £35 to £140/tC) as an illustrative estimate for the global damage cost of carbon emissions[27]. These figures should be raised in real terms as the costs of climate change will increase over time.

1.100 Global mechanisms like the EU Emissions Trading Scheme or the Chicago Climate Exchange, attempt to account for the social costs of carbon in two ways. Targets are set for carbon emissions but the trading of carbon as a commodity allows free markets to make emission reductions in the most cost efficient way and importantly, because of the global nature of emissions, the schemes to deliver reductions can be located anywhere.

[27] The UK 's Economic Service (GES) paper 'Estimating the Social Cost of Carbon Emissions' presented a review of the available literature on the social cost of carbon.

Global mechanisms to tackle climate change

The United Nations Framework Convention on Climate Change and the Kyoto Protocol

1.101 The majority of nations have now placed combating climate change high on the political agenda accepting the need to make cuts in GHG emissions. As a consequence of global dependence on fossil fuels, almost all the CO_2 emissions generated by man are attributable to the energy sector.

1.102 The Kyoto Protocol is an agreement made under the United Nations Framework Convention on Climate Change (UNFCCC). Countries that ratify this protocol commit to reduce their emissions of carbon dioxide and five other GHGs. If countries maintain or increase emissions of these gases they can engage in emissions trading with compliant countries. The Protocol now covers more than 160 countries globally and over 55% of global greenhouse gas (GHG) emissions.

1.103 Under Kyoto Governments are separated into two overall categories:

1.104 *1. Non-Annex 1 countries or developing countries* – These have no GHG emission reduction obligations.

1.105 *2. Annex 1 or developed countries* – These have accepted GHG emission reduction obligations; Annex 1 countries that fail to meet their Kyoto targets are penalized in the next period by having their reduction targets increased. By 2008-2012, The global target is for Annex 1 countries to reduce their GHG emissions by 5% below their 1990 levels (the EU member state share is 8.5%, the UK share is 12.5%). Reduction targets expire in 2013.

In order for Annex I economies to meet their GHG targets, Kyoto includes three “mechanisms":

- Joint Implementation (JI) - applies in transitional economies mainly covering the former Soviet Union and Eastern Europe
- Clean Development Mechanism (CDM) – applies in non-annex I economies
- International Emissions Trading (IET)

1.106 Both JI and CDM are “project based mechanisms” and these involve the development and implementation of projects that reduce greenhouse gas emissions overseas. These generating carbon credits that can be sold on the carbon market. These so-called “climate change projects” not only reduce GHG emissions, they can also generate an additional income stream for the project in the form of ‘carbon credits’. International emissions trading involves trading in emissions reduction or carbon credits.

1.107 Even if all countries meet their Kyoto targets, global emissions are only expected to fall by 1-2% and a number of the main contributors, most notably the USA have still not signed up to achieving these targets.

1.108 Jersey became a signatory to the UN Convention on Climate Change in 1994 but has no specific carbon reduction target. The Kyoto Protocol was extended to the Island in 2006 and Jersey’s greenhouse gas emissions figures have already been

included within the UK's "assigned amount" which was submitted to the EU on 15th January 2006.

Emissions trading and the EU Emissions Trading Scheme (EU ETS)

1.109 The rationale behind emission trading is to ensure that the emission reductions take place where the cost of the reduction is lowest thus lowering the overall costs of combating climate change. Emissions Trading is particularly suited to the emissions of GHG because they have the same effect wherever they are emitted.

1.110 The objective of the scheme is to provide clear incentives for investment in energy efficiency and cleaner technology at the lowest cost. If a country is producing more actual emissions than its allowance, it can purchase credits to make up the shortfall. Only CDM Executive Board-accredited Certified Emission Reductions (CER) can be bought and sold in this manner and it is through the Unitied Nations, Bonn-based, Clean Development Mechanism Executive Board that projects are assessed and approved. Approved CDM projects span 15 countries, from large-scale industrial gas projects in India and China to smaller energy efficiency and renewables projects in Mexico, Fiji and Nicaragua. They not only reduce emissions of greenhouse gases, but they contribute to sustainable development and help developing countries gain access to investment and cleaner technologies.

1.111 The EU ETS is central to the European Union's long-term policy to reduce carbon emissions and works on a "cap and trade" basis. Governments can regulate the total amount of emissions produced by setting the overall cap for the scheme. However, individual companies have the flexibility of determining how and where the emissions reductions will be achieved.

1.112 EU Member States are required to set emissions limits for all installations in their country covered by the scheme. Each installation is then allocated allowances equal to that cap for the particular phase in question. The allocations of allowances are set out in the National Allocation Plan for the particular period. The first phase of the EU ETS runs from 2005 – 2007; Phase II runs from 2008 – 2012.

1.113 The scheme covers electricity generation and the main energy intensive industries for example, power stations, refineries, paper, food and drink, glass, engineering and vehicles. Participating companies are allocated allowances, each allowance representing a tonne of the relevant emission normally expressed as the carbon dioxide equivalent.

1.114 If a company emits more than their allocation of allowances they can meet their limit by purchasing allowances from the market. Alternatively if a company emits less than its allocation, they can sell the surplus allowances. This system operates in contrast to regulation which imposes emission limit values on particular facilities; instead emissions trading gives companies the flexibility to meet emission reduction targets according to their own strategy. For example, they might choose to reduce emissions on site or by buying allowances from other companies who have excess allowances. The environmental outcome is not affected because the

amount of allowances allocated is fixed but by allowing participants the flexibility to trade allowances, the overall emissions reductions are achieved in the most cost-effective way possible.

The Linking Directive

1.115 The "Linking Directive" was adopted by the EU parliament in April 2004 and allows emission reduction units generated by the project-based Kyoto mechanisms (Emission Reduction Units (ERUs), for Joint Initiative and Certified Emission Reductions (CERs), for Clean Development Mechanism to be used for compliance by companies operating under the EU ETS. The rationale for this linkage is twofold :

- the cost of complying with Kyoto is prohibitive for many Annex 1 countries. This is especially so for those countries, such as Japan or the Netherlands for example, that already have highly efficient, low GHG polluting industries, coupled with already high environmental standards. Instead of further reducing GHG emissions domestically, Kyoto allows these countries to purchase Carbon Credits;
- The sale of carbon credits is seen as a means of encouraging Non-Annex 1 developing economies to reduce GHG emissions because it is now economically viable to do so.

1.116 The Linking Directive allows all credits that comply with the requirements established by the Kyoto project-based mechanisms, with a few exceptions the most notable of which are nuclear projects.

1.117 DEFRA's Climate Change Projects Office (CCPO) notes importantly that 'the carbon market is young and illiquid at the moment. The most important buyers are large institutional buyers (like the World Bank's Prototype Carbon Fund) and national Governments (like the Dutch Government). Many other Governments have announced that they will start buying carbon credits in the near future. More private buyers are beginning to emerge, and it is very likely that it will be possible for companies who participate in the EU Emissions Trading Scheme (EU ETS) to use credits from CDM and JI projects to comply with their targets.

1.118 Chapter 11 sets out how Jersey is in the process of being admitted to carbon markets and the EU ETS and the implications of this. This is an important opportunity given the CCPO's statement that 'It is likely that the carbon credit market will increase substantially over the next few years, and that demand for climate change projects will increase'.

What climate change means for Jersey

1.119 The Hadley Centre (UK Meteorological Office) used high resolution climate models to predict how climate change could affect Jersey[28]. These models attempt to address all of the many relevant factors and are the most credible and self-consistent data available (Table 5).

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[28] UK Met Office, the Hadley Centre (2003) 'Scenarios of climate change for islands within the BIC region'

1.120 Predicted increases in sea levels and increases in the height of the 50-year storm surge are particularly relevant to Jersey with its 90 km coastline. Damage to coastlines and inundation is caused mainly by short-lived, extreme, high-water levels in storm surges due to the effects of wind and low pressure particularly around the time of high tide when they can be most damaging. On the south coast of the Island, many properties built on or close to natural or man-made sea defences, will be at risk.

Table 5 Predicted change in Jersey's climate under a medium-high scenario for future emissions by 2080s

Parameter	Summer	Winter
Average Temperate	+ 3.8°C	+ 2.4°C
Frequency of hot summer days	X 4-5 fold	
Frosts		- 70%-80%
Snowfalls		- 100%
Wind speeds	+ 8-10%	
Precipitation	- 45%	+24%
Heavy precipitation	- 40-50%	+ 30-50%
Net sea-level	+ 74cm	

Source: UK Met Office, 2003

Marine ecosystems

1.121 The impact of climate change on marine ecosystems is particularly relevant to Jersey. The Marine Climate Change Impacts partnership (MCCIP) Annual Report Card co-ordinates leading research on climate change's impact on the UK's marine environment. The 2006 Report card concluded that the biodiversity and productivity of seas around the UK could already be suffering the consequences of climate change. Despite recognising the complexity of modelling changes in seas around the UK, key messages included :

- An increased frequency of damaging storms with greater incidence of severe winds and increasing wave heights in western and northern UK territorial waters has been recorded over the past 50 years.
- Sea Surface Temperatures (SST) are rising faster than land temperatures in the English Channel.
- Overall rises in sea temperatures have led to an apparent northward shift of warm-water plankton by 1,000km over the last 40 years. This is likely to have a major influence on the distribution of fish stocks and animals further up the food chain, such as sea birds where poor breeding success, reduced survival and population declines have already been observed.
- The report revealed a complex picture with respect to fish stocks – There is some correlation between plankton shifts and changes in various fish stocks, cold-water species have moved further north in some regions, such as the North Sea, the shifts had not happened elsewhere.

- It acknowledged that whilst the variety and distribution of marine species were being altered by climate change, it was not the only factor; commercial fishing remained the major cause of changes in fish populations.

- Future scenarios are very likely to include increases in SST that will be strongest in the south-east compared to the north-west as well as increased wind strength and wave heights.

- Oceans are becoming more acidic as increasing CO_2 is absorbed at the sea surface – Models suggest that surface pH has decreased by 0.1 pH unit since pre-industrial times. The future effects of this are unknown but it is expected that organisms such as corals, some plankton, shellfish and sea urchins will become less able to produce calcareous parts such as shells by the middle of this century.

- In conjunction with rising sea temperatures, the incidence of Harmful Algal Blooms (HABs) has increased in some areas of the north east Atlantic in the last 50 years and this trend may continue.

1.122 It is clear that the impact of climate change on the marine ecosystem is immense and there is much still to be understood. Jersey's economy is influenced through the fishing, aquaculture, tourism and leisure industries which rely on a high quality marine and inter-tidal environment and the biodiversity that this supports.

Terrestrial ecosystems

1.123 The impacts of climate change on terrestrial ecosystems include :

- **Shifts in distribution of plants and animals -** Changing patterns of climate will change the natural distribution limits for species or communities. Some species or communities may be able to migrate in response to changing conditions although physical barriers or the lack of suitable recipient eco systems may prevent this. This may be particularly obvious in Jersey given its' location at the junction of two biogeographic areas.

- **Inability of species to keep pace with a changing climate** – The study of phenology describes how plants and Animals are in critical synchrony with the climate and each other. As the climate changes biodiversity can either move or adapt. However, movement is often difficult or impossible and many species cannot adapt quickly enough for example, there is evidence that blue tit hatching in Oxfordshire now is not co-inciding with the peak caterpillar numbers[29]. The British Trust for Ornithology has identified 33 bird species that, on average, are laying up to 29 days earlier than they did 35 years ago. This will lead to local extinctions.

- **Invasive species** - Climate change can offer better conditions for invasive species for example, Hottentot fig that is an aggressive alien species which grows on the

[29] Department for Environment, Food and Rural Affairs, Literature review of the implications of climate change for species, habitats and the wider UK countryside

coast and shades out maritime heath. It is the cold winters that can retard growth but in warmer global temperatures it could spread significantly displacing important native habitat

- **Disease** – Climate change can offer better conditions for disease vectors for example, projections for Colorado beetle suggest that, by 2050, warming is likely to enable this species to expand into Britain as far as the north of England. Blue Tongue is a disease that effects ruminants like cattle and sheep transmitted between animals by a biting midge. It was identified for the first time in 2006 in southern Netherlands and nearby areas in Belgium, Germany, and France. It has been present in Southern Europe since 1999 but the present outbreaks in Northern Europe are the furthest north the disease has ever been.

1.124 These changes are likely to occur in tandem with the other pressures that currently affect biodiversity including habitat fragmentation and loss.

Changes in global economics as a result of climate change

1.125 The Stern Report predicts that the implications of climate change on the global economy are severe, particularly if there is any delay in addressing them. As a financial centre relying on a buoyant global economy is clear that Jersey must remain alert to the impacts of climate change at the international scale.

CHAPTER 4 - Meeting the challenge ahead

Chapter summary

The goal of energy policy is to achieve '**Secure, Affordable, Sustainable Energy**'

The production, transportation and use of all types of energy has a range of environmental impacts which in turn have an economic cost. The consequences of energy use can be considered from 5 perspectives that range in scale from the global to the local level and finally down to level of the individual :

Global
1. Environmental – The burning of fossil fuels and other human activities release greenhouse gases that have contributed to accelerated climate change. Alternatives to fossil fuels like nuclear energy and renewables have some negative impacts but the environmental impacts of low-carbon energy sources might be considered as secondary to the threat posed by global climate change.

2. International Reputation - If Jersey is to prove itself a responsible global player and a good place in which to live, work and do business it must set itself the highest standards in respect of energy procurement and use.

Island wide

Economic
3. Energy costs are significant to the economy and are set to rise. Importing energy requires infrastructure and if energy exceeds planned demand levels there are significant costs to the Island.

4. Security of Supply - Jersey's current high import dependency there are physical and economic risks if energy supplies are not secure and resilient.

Individual
5. Social – As energy costs increase the most vulnerable in society are exposed to disproportionate costs in relation to their disposable income.

The Energy Hierarchy provides a way to achieve the goal of energy policy whilst remaining aware of the consequences of energy use as seen through the five perspectives.

An Energy Framework is proposed which establishes a hierarchy for action.

LEVEL 1. Use less – Reduce the environmental and economic consequence of energy use by simply reducing our energy demand.

LEVEL 2. Use less carbon-intensive fuels – These are finite in the long term and the environmental (and thus economic) costs of their use are great. The options for switching to renewably generated fuels will continue to increase as technologies become viable.

LEVEL 3. Use less imported energy – the exploitation of the Island's indigenous generating capacity will give greater security and resilience in the longer term

LEVEL 4. Reduce other impacts – All energy sources have environmental impacts. Where possible these impacts should be reduced by choosing the most benign options capable of servicing the energy needs of the Island.

LEVEL 5. Off-set residual carbon emissions – Decarbonising the economy will not happen immediately and even with vigorous progress there are likely to be residual carbon emissions. To demonstrate Jersey's high levels of international responsibility the Island could mitigate its unavoidable contribution to global pollution by contributing to *bona fida* carbon reduction projects.

To achieve an overall goal of Secure, Affordable, Sustainable Energy through adherence to the Energy Hierarchy the following actions are necessary:

1. Decrease energy use – Particularly in the face of a growing population and trends of increased energy demand. Policies will aim to ensure the highest standards of demand management and energy use are vigorously pursued in order to promote environmental sustainability, avoid the costs of energy infrastructure and reduce exposure to international energy prices.

2. Make sustainable energy choices – There is a strong economic case backed up by improvements in the security of supply as well as environmental benefits to decarbonising our energy choices. Policies will aim to achieve adherence to the highest environmental international standards and beyond to show the world that Jersey sets itself high standards in reducing the unsustainable use of energy by minimising the environmental impact of the Island's energy choices by reducing dependence on imported fossil fuels.

3. Prepare for the effects of climate change – The effects of accelerated climate are already being felt and despite future emission scenarios there is a need to prepare, at least, for the predicted effects of climate change.

4. Ensure that energy supplies are secure and resilient – The economy relies on secure supplies of energy being available at predictable prices. This requires the appropriate infrastructure and back up of supply. The energy market must be diverse, flexible, well structured and appropriately regulated to fulfil this.

Carbon emissions and energy use

Between 1990 and 2005 Jersey :

- Increased it's total energy use by **26%** from 170,500 tonnes of oil equivalents (toe) to 214,700 toe;
- Reduced its carbon emissions by **36%** since 1990 – this is the result of the one off switch away from on-island generated electricity to low-carbon nuclear/hydro sourced electricity;

Simple projections estimate that by 2030 there will be a further increase of 20% in final energy demand by 2030. However there are shifts among the sources of energy and different behaviours between the sectors which have impacts on overall carbon emissions.

By 2030 a target of a 52% reduction on 1990 levels of carbon emissions will be achieved by:

- The continued shift towards electricity (6,700 tonnes of carbon)
- Additional reductions as a result of 15% reduction in road fuels and 20% energy efficiency measures (15,000 tonnes of carbon)

Given that by 2005, Jersey had already achieved a 36% reduction on 1990 levels of carbon emissions there is a further 16% to be achieved by 2030.

By reaching the proposed energy reduction targets by 2030, along with a continued switch towards low-carbon electricity, there will be a further reduction in carbon emissions to 25% below 2005 levels (c. 22,000 tonnes of carbon).

By 2050, Jersey could achieve a 64% reduction on 1990 levels of emissions by achieving the energy reduction targets and continuing the switch towards low-carbon electricity.

INTRODUCTION

Perspectives and consequences of energy use

1.126 Energy is a broad ranging topic that touches on most aspects of social and economic organisation. Energy drives society; from the need of each and every one of us to have a warm place to live, and fuel with which to cook, right up to the functioning of the global economy. However, in so doing, the production, transportation and use of all types of energy has a range of environmental impacts which in turn have economic costs. Society's interaction with energy has consequences that can be considered from 5 perspectives that range in scale from the global to the local level and finally down to level of the individual:

Global

1. Environmental – It is now widely accepted that man-made emissions of greenhouse gases and in particular, carbon dioxide, have driven a change in the global climate. Environmentally, the use of fossil fuels has the most damaging consequences since they emit high levels of CO_2 when burnt. Nevertheless, alternatives to fossil fuels like nuclear and renewables have some negative impacts but the environmental impacts of low-carbon energy sources might be considered as secondary to the threat posed by global climate change.

2. Jersey's International Reputation – If Jersey is to prove itself a responsible global player and a good place in which to live, work and do business it must set itself the highest standards in respect of energy procurement and use.

Island wide

3. Economic – The costs of purchasing energy are economically significant and as finite sources of fossil fuels diminish and become more difficult to extract, energy will cost more. With these rising costs there will be consequences for economic efficiency across all sectors of industry with those that have a high energy intensity being most affected. There are significant costs for the Island in increased infrastructure, if energy demand exceeds currently forecast levels.

4. Security of Supply – Jersey's current high import dependency poses physical and economic risks if our energy supplies are not secure and resilient.

Individual

5. Social – Social wellbeing is underpinned by affordable energy. As energy costs increase, the most vulnerable can be exposed to disproportionate costs in relation to their disposable income. In addition the environmental impacts of the unsustainable use of energy can affect the heath and wellbeing of individuals.

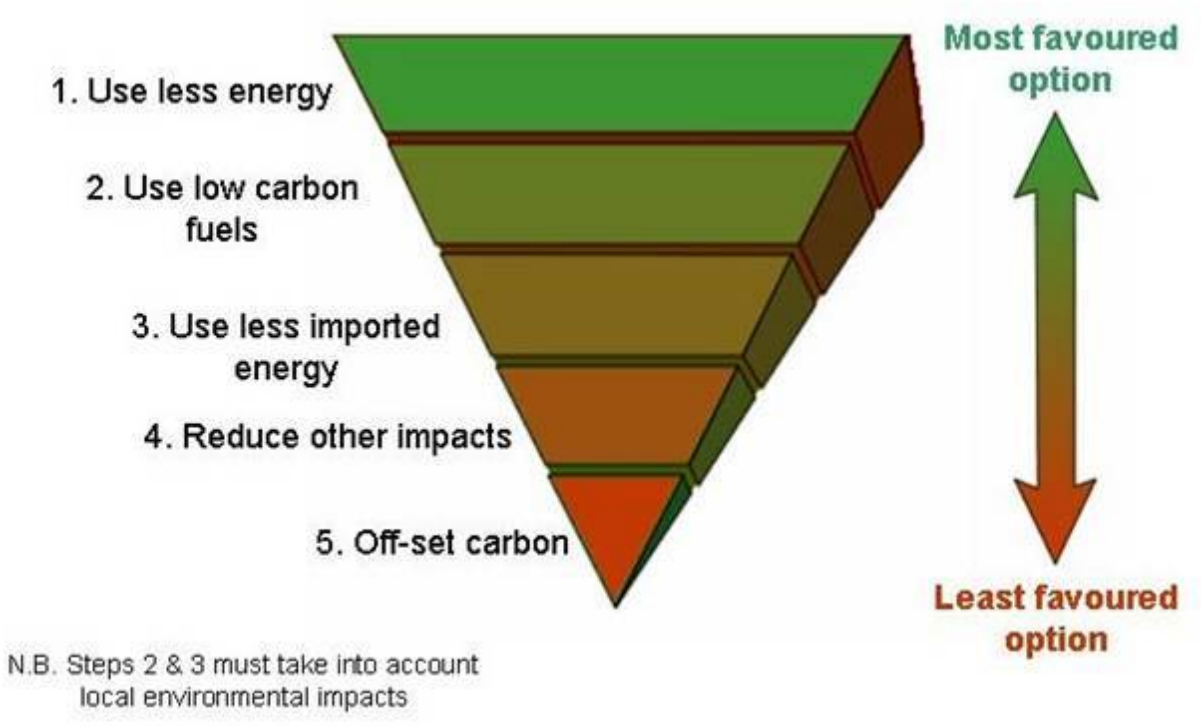
An Energy Hierarchy to achieve secure, affordable and sustainable energy

1.127 The perspectives and consequences of Jersey's energy are encompassed in the goal of Jersey's energy policy which is to achieve:

'Secure, Affordable, Sustainable Energy'

1.128 This goal can be realised by adhering to the proposed Energy Hierarchy for Jersey (Figure 17) which mirrors the international Waste Hierarchy and follows the principle that it is best to reduce use as a first step.

Figure 19 An Energy Hierarchy for Jersey



1.129 The Energy Hierarchy accepts that all forms of energy have economic, social and environmental consequences and by ranking these, it assists in prioritising Jersey's energy choices :

1.130 **LEVEL 1. Use less** - All forms of energy production have consequences which can be avoided by simply reducing energy demand :

Economic Consequences – Affordable energy underpins the economy and unpredictable and rising energy costs cause inflation

Social Consequences – energy costs are a significant proportion of individual expenditure particularly for low income households

Environmental consequences – These include green house gas emissions from the burning of fossil fuels, the waste products produced by the nuclear industry or the use of chemicals and high energy consumption in the manufacture photovoltaic cells.

1.131 **LEVEL 2. Use less carbon-intensive fuels** – Jersey performs relatively well in terms of global carbon emissions however, the environmental impacts of carbon based energy sources are great and their finite nature raises questions of their security. To lessen exposure environmentally and economically, the types of energy used should be as low in carbon as possible and represent the most environmentally sustainable choices available. It must be recognised that these choices will evolve as new technologies become viable.

1.132 **LEVEL 3. Use less imported energy** - There are significant consequences to Jersey's dependency on imported energy which can be avoided by reducing our dependency on imported fuel:

Security of Supply - The reliance on imported energy makes Jersey vulnerable to global prices of energy. The physical security of supply networks and storage facilities are further risk that must be identified and managed.

Financial – There are significant costs associated with the infrastructure required to import and transmit energy.

It is important to recognise that in adhering to the Energy Hierarchy, energy choices must also be tested against local environmental impacts. For example, Jersey is unlikely to choose displacing some energy imports at the expense of its high quality local environment by say growing energy crops on local habitats of high biodiversity value.

1.133 **LEVEL 4. Reduce other impacts –** As Level One of the hierarchy acknowledges, all energy has environmental consequences. Hydrocarbons emit Greenhouse Gases with effects on global climate, nuclear generation has challenges associated with waste products and large scale renewable e.g. wind generation can have significant impacts on biodiversity for example bird and bat collisions with turbine blades. Jersey's energy choices must take into account these impacts but it must be accepted that at the global scale the emissions of greenhouse gases are the most severe.

1.134 **LEVEL 5. Off-set residual carbon emissions** – Even when Jersey has completed levels 1 to 4 it is likely that the Island will still emitting residual GHGs. By off-setting Jersey's unavoidable contribution to global pollution it can be demonstrated to the international community that Jersey sets itself the highest standards and aspires to act with the utmost responsibility by mitigating the Island's pollution with contributions to *bona fide* carbon reduction projects.

Actions to achieve the goal of secure, affordable and sustainable energy

1.135 To achieve the goal of secure, affordable and sustainable energy through adherence to the Energy Hierarchy the following actions are necessary:

1. Decrease energy use

1.136 This is the first level of the Energy Hierarchy. Ensuring that the highest standards of demand management and energy use are aggressively pursued will promote environmental sustainability, avoid the costs of energy infrastructure and reduce exposure to international energy prices.

1.137 The benefits of reduced energy use are :

- All energy is used efficiently and wisely ;
- There is a reduced exposure to international energy prices;
- Economic efficiency and social equity will be underpinned by affordable energy
- Homes can adequately and affordably heated;
- Investment in energy infrastructure remains within planned limits and existing infrastructure remains sufficient for the Island's needs for longer;
- There is a reinvestment of revenue into the local economy associated with the uptake of energy efficient measures and the compliance industry;
- There is an increased contribution to the security and resilience of energy supplies;

2. Make sustainable energy choices

1.138 Adhering to the highest environmental international best practice and beyond, will show the world that Jersey sets itself high standards and intend to reduce its' unsustainable use of energy. Levels three and four of the Energy Hierarchy recognise the environmental impacts of energy, firstly as a result of their carbon content and also the other impacts that energy production might have. There are economic reasons and improvements to the security of supply that can be achieved by reducing dependence on fossil fuels which are polluting, finite in nature and likely to display trends of increasing prices.

1.139 The benefits of making sustainable energy choices are :

- A reduction in carbon emissions;
- An enhanced international reputation proving that Jersey a good place to live, work and do business;
- All energy is used efficiently and wisely and the Island's energy mix comprises secure, affordable and sustainable options in the long term;
- The opportunity for local businesses and the economy to take advantage of new low-carbon / renewable technologies as and when they are proven and economically viable;
- Improved local air quality.

3. Ensure that energy supplies are secure and resilient

1.140 The third level of the Energy Hierarchy requires Jersey to use less imported energy. The costs of infrastructure needed to import energy are significant and reducing the amount of energy imported will make best use of these assets. In addition, Jersey must identify and manage the risks associated with the physical and financial security of the current and future energy mix. Risk management centres on the diversity, flexibility and back-up of fuel choices. A well structured, competitive and regulated energy market will reduce exposure to price shocks arising from the global energy market.

1.141 The benefits of secure and resilient supplies are that :

- Jersey is well prepared for the effects of any force majeures and can recover quickly whilst maintaining continuity of supply for essential services supported by sufficient back up stocks;
- Jersey has a flexible energy supply system that does not place undue reliance on one particular type of fuel, facility or infrastructure;
- In the medium and long term the safe use and transportation of energy is ensured and energy is available at predictable prices to support economic activity;
- The energy market functions efficiently and effectively for the benefit of the economy and the customer.

4. Prepare for the effects of climate change

1.142 It is necessary to prepare, adapt and mitigate the effects of climate change by working with others to monitor the effects of climate change by participating in programmes of data gathering and analysis. Jersey must also explore the options in a different global climate.

1.143 The benefits of preparing for climate change :

- The effects of climate change have been considered and planned for;
- The threats and opportunities of climate change have been identified and considered.

Why Jersey should step up to the 'carbon reduction challenge'

Enhancing international reputation

1.144 Jersey performs relatively well in terms of carbon emissions. Nevertheless, it has an opportunity to enhance its international reputation by seeking to act responsibly in its approach to climate change. It could seek to shelter behind the carbon reduction achieved as a result of its one-off switch to electricity from low-carbon sources, and allow its emissions to slowly increase with no action or it could set an example of what can be achieved in a relatively affluent economy.

1.145 Whilst the States have a responsibility to set challenging targets for the Island, these can only be achieved in partnership with every citizen of Jersey and with the business community.

1.146 Corporate Social Responsibility (CSR) is the business contribution to the goal of sustainable development. It is how business operations take account of its economic, social and environmental impacts – maximising the benefits and minimising the downsides. The dominance of the international finance industry in Jersey gives scope for real successes through CSR and the voluntary actions that business can take, over and above compliance with minimum legal requirements, to address both its own competitive interests and the interests of wider society.

Meeting international targets, obligations and more

1.147 The first step for Jersey to take in respect of its GHG emissions is to demonstrate that it takes its global environmental responsibilities seriously and meets its international targets and obligations. Jersey is a signatory to the United Nations Framework Convention on Climate Change and the aim of this Convention, and any related legal instruments, is to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous human-induced interference with the climate system. It is intended that such a level should be achieved within a time frame that would allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

1.148 The Kyoto Protocol under the United Nations Framework on Climate Change was extended to Jersey in December 2006[30]. In total, Jersey has reduced its carbon emissions by nearly 36% since 1990 (Table 6). Thus the Island has already achieved more than the GHG emissions reduction targets set by the UK within the Kyoto Protocol. This is mostly attributable to the 'one-off' switch to low carbon imported electricity compared to on-island oil-fired electricity generation. However, in real terms there has been a rise in electricity demand of an average 2.2% per year. Although this has not increased emissions, it does expose Jersey to global energy price rises. Even with a growing population carbon emissions from road transport have fallen slightly reflecting a near saturation in use and the improved energy efficiency of vehicles.

Table 6 Percentage change in the number of tonnes of carbon emissions per annum

	Total road transport	Electricity Generation	Domestic and business	All	All less electricity generation
1990 – 2005	-5.6%	-94.7%	-1.8%	-35.8%	-3.2%

Source Jersey Statistics Unit

1.149 However, Jersey should seek to set its own challenging but realistic targets for reductions in energy use and GHG emissions for reasons of economic sustainability in the face of a growing population, as well as to demonstrate the highest environmental standards.

[30] Extension of ratification of the Kyoto Protocol to Jersey. (MD-PE-2006-0047) ; A decision made 12/04/2006

Jersey's future energy profile

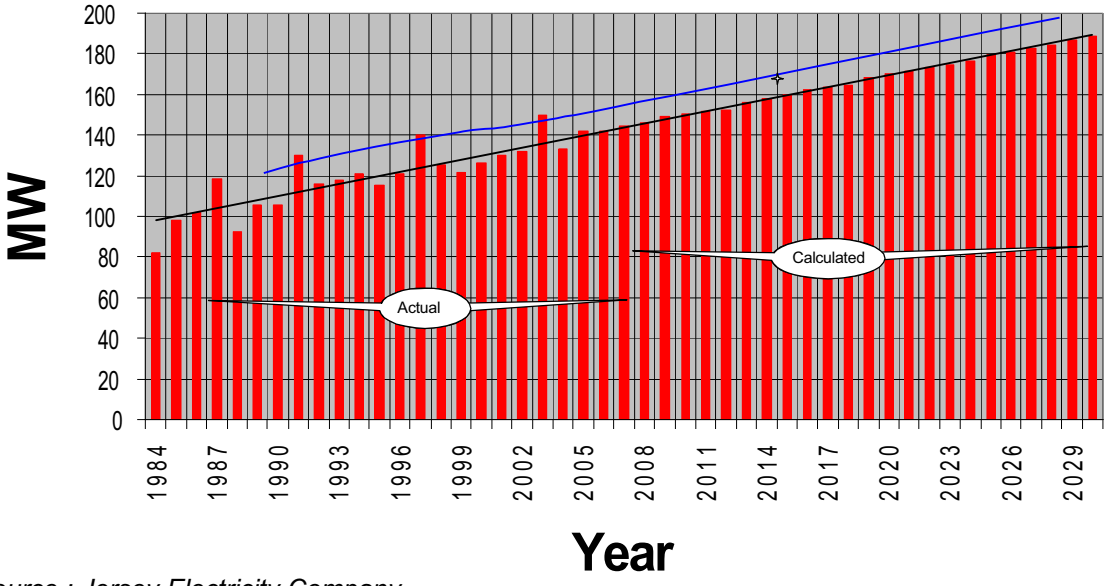
1.150 Jersey's energy use is led by the domestic and transport sector whilst the economic sectors with the highest energy costs include the public services, water and agriculture. In developing energy policy, projected trends of future energy use need to be understood.

Planning electricity infrastructure to meet future demand

1.151 Electricity infrastructure provides a good example of why it is important to understand projected trends of energy use. Meeting electricity peak demand is the principal factor for establishing what installed capacity is required. There has been a trend of increased electricity use and this is predicted to continue (Figure 12). The existing JEC system is designed to meet a peak demand of 150MW and this was reached in the cold winter of 2003 by its 44,000 customers (of which 37,000 are domestic). As Figure 18 shows, by 2030 it is predicted that there will be a necessity for 189MW of peak demand.

Figure 20 Actual and extended load growth

The blue line represents peak maximum demand in worst weather winters; The black line represents the average trend



Source : Jersey Electricity Company

1.152 The ability to supply this capacity must be considered alongside the design life of existing plant and infrastructure. There is a future planned closure of the oil-fired generating plant at La Collette and to replace this capacity, a third interconnector into the Continental system will be laid.

1.153 By 2015, with the installation of the third interconnector and the replacement of the aging first interconnector with one of a slighter higher capacity, the system will be able to securely deliver 200MW. However if electricity use, and importantly peak

demand, rises more quickly than this, for example as a result of accelerated population growth, the point at which demand outstrips supply will be sooner than is planned and additional capacity may be needed to be installed to meet demand. A fourth interconnector is likely to require investment of another £55M.

1.154 Electricity (or energy) use could increase faster than expected if :

- Population rises significantly;
- Winters become on average considerably colder;
- People use energy more wastefully;
- Demand increases e.g. through energy intensive industry establishing on the Island;
- Oil prices increase significantly above existing levels and electricity wholesale prices, dominated by nuclear production in France, remained relatively stable.

1.155 Conversely, the predicted grow in electricity demand could be slowed if :

- Demand management is successful in reducing peak demand The building stock is improved to perform more thermally efficiently
- Population reduces
- There are significant shifts in the availability of nuclear-produced electricity causing market forces to increase the price above that of LPG or kerosene.

1.156 The argument for the aggressive pursuit of energy efficiency and demand management can be made on a purely financial basis since increased energy demand (as a result any factors) can be accommodated within the existing and planned infrastructure until 2025. Beyond 2030, if energy demand can be retarded, there will be a consequent delay in the need to make significant investment in a fourth interconnector

Predicted rises in final energy consumption

1.157 A simple energy growth rate model has been used to show how Jersey's energy use is likely to change over the next decades if patterns continue in a 'business as usual' scenario. The model must make a number of assumptions in order to attempt to predict patterns of energy use from 2005 to 2030, these are :

1.158 ***1. Annualised growth rates*** (% per annum) are applied for all fuel types to assume a business as usual scenario – these are calculated from trends between 1991 and 2005

1.159 ***2. Key Assumptions:***

- ***Motor fuel*** - Continuing improved engine efficiency, already at near saturation of car use, increase growth of diesel fleet. LRF is declined to residual by 2010;
- ***Gas oil*** – Continuing fuel switch to gas and electric occurs;
- ***Heavy Fuel Oil*** – For electricity generation, usage is assumed to fall;
- ***Kerosene*** –Reduced use for domestic heating oil, replaced by electricity and gas, but some significant continued use;
- ***Coal –*** Declined to residual by 2010;

- ***Gas*** – LPG and manufactured; Increase use in industry replace some oil via growth in CHP. Fall in marginal use in domestic - central heating users continue to use;
- ***Electricity*** - An increasing use in all sectors because of the ability to fix to longer term price contracts with more certainty and ease of use compared to oil and LPG which are expected to rise according to developments in world fossil-fuel prices;
- ***Population Growth*** – is of the same order as between 1990 and 2005.

1.160 Under a 'business as usual' scenario with a continuation of the observed trends to date, the model predicts a shift in fuel types by 2030 (Table 7). For example, diesel usage increases, heavy fuel oil diminishes and electricity rises significantly.

Table 7 Projected fuel use changes from 2005 to 2030

	Final energy demand by fuel as % of total fuel use		
Fuel	**2005**	**2030**	**Change (%)**
Electricity	28	42	+14
Petrol	17	13	-4
Kerosene	19	12	-7
Aviation	9	11	+2
Gas oil	11	7	-4
LPG	7	7	0
Diesel	6	7	+1
Heavy Fuel Oil	3	1	-2

Source Jersey Statistics Unit

1.161 It is simpler to examine these changing trends in each sector (Table 8). This table shows how road fuel use is predicted to decline slightly as a result of perceived levels of saturation on the roads and the advent of more fuel efficient cars. Areas of significant growth include the aviation sector, the domestic sector (up 30%), and industry and government.

1.162 The consumption of gas oil and heavy fuel oil appears to rise dramatically between 2005 and 2030 (+160%). This is due to the purchasing trends of fuel oil over the budget period. In 2004, 9,100 tonnes imported and in 2003, only 3,400 was imported. The three year average consumption of fuel oil is 5,433 toe which compared to a predicted 2030 final demand of 9,900 is a rise of 117%, still large but less so than a direct comparison between 2005 and 2030 of +160%. It is important to note that at less than 10,000 toe gas oil and fuel comprise the smallest sector of energy use.

Table 8 Final energy demand by sector in a 'business as usual scenario'

	Final energy demand in toe		
Sector	**2005**	**2030**	**Change (%)**
Road Fuel	43,100	42,400	-2
Aviation	17,200	22,700	+32
Industry and government	56,900	62,700	+10
Domestic	68,100	86,900	+28
Gas oil and heavy fuel oil	3,800	9,900	+160
Total	**189,100**	**224,500**	**19%**
Total (excluding aviation)	**171,900**	**201,900**	**17.5%**

Source : Statistics Unit.

It is predicted that if Jersey takes no action to reverse these trends then overall energy demand will increase by nearly 20% between 2005 and 2030.

Avoiding growth in energy demand

1.163 It is environmentally and economically advantageous to use energy as efficiently as possible and so reduce energy demand as much as possible. Energy policy will go on to explain how energy reduction targets can be achieved but realistic targets for a reduction in predicted energy growth are proposed as :

- 20% reduction in predicted energy use in the domestic, industry and government sectors
- 15% reduction in predicted use of road fuel

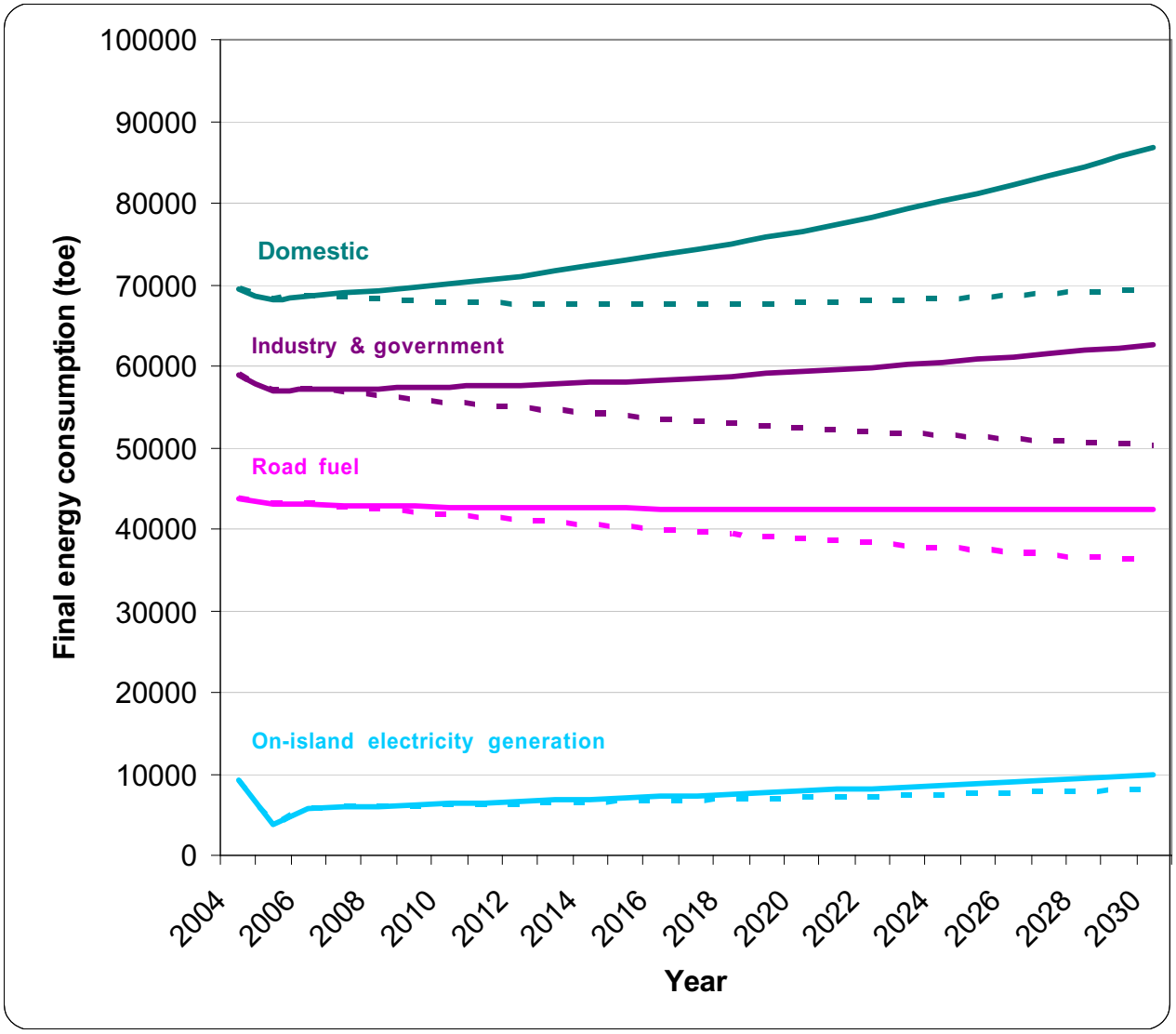
1.164 Aviation has not been set a reduction target. This is because the dependency of the Island on external transport links and the potential to re-fuel off-island makes it difficult to impose an achievable realistic target. There is also an acceptance that the growth in aviation with its consequent emissions of GHGs should be tackled internationally since the actions of just one jurisdiction will not be effective. In December 2006, the EU issued a draft EU Air Emission Trading Scheme Directive which proposes a cap and trade system among EU registered airlines and Jersey has contributed to the UK's Department for Transport Consultation process.

1.165 Figure 19 shows how achieving the reduction targets will affect the predicted energy demand growth rates and this can be related to 2005 levels of use:

- **Domestic sector –** Energy demand is predicted to grow substantially (by nearly 19,000 toe) but a 20% uptake of energy efficiency measures will stabilise this to keep 2030 demand levels at those of 2005.
- **Road Fuels** – Energy demand is predicted to decline slightly and with actions to reduce road use by 15%, by 2030 energy demand can be reduced to below 2005 levels.
- **Industry and government sectors** – The growth rate of energy demand in the Industry and government sectors is predicted to rise by about 10% but achieving a 20% reduction in demand in this sector will reduce energy demand to below 2005 levels.
- **Heavy fuel oil and gas oil –** Levels of heavy fuel oil required for electricity generation are predicted to rise substantially on 2005's levels although they will remain at the same levels as 2004 and under approx. 10,000 toe. Achieving the 20% target for energy efficiency will reduce predicted demand to just below 2005 levels. However the role of heavy fuel oil and gas oil required for on-island electricity generation are likely to change beyond the scope of the model with the closure of the La Collette plant and the establishment of the interconnector and so these results must be treated with caution. These fuels comprise a small proportion of the overall fuel mix.

Figure 21 Final energy use by sector, with and without reduction scenarios

Model predictions of energy use are shown in bold lines. Reduced final energy consumption result of reduction targets (20% in use of Heavy fuel oil and gas oil, domestic, industry and government and a15% reduction in the use of road fuel) are shown in dashed lines



Source : Data from Statistics Unit Model

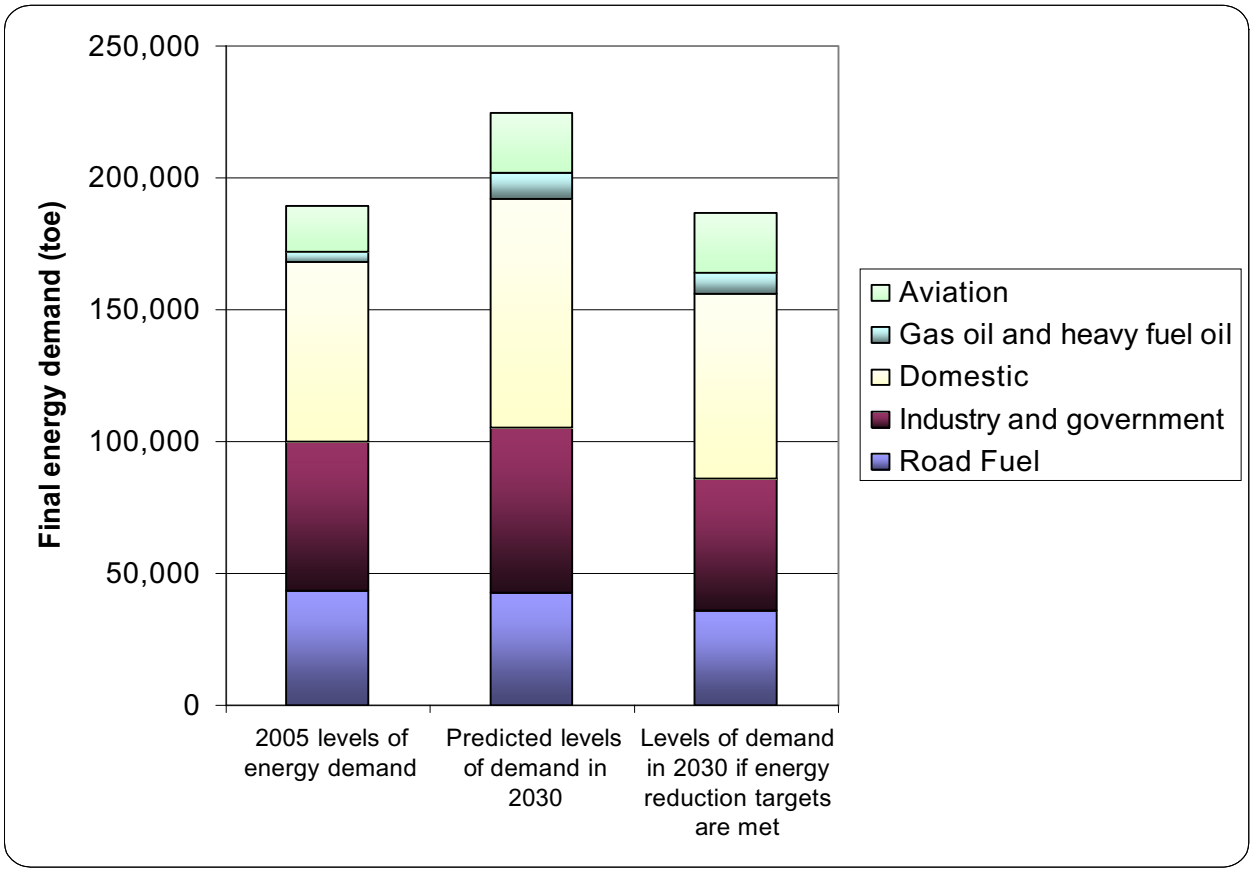
1.166 If the proposed efficiency targets are imposed on predicted energy growth, there is an *avoided growth* in final energy demand of some 38,000 toe from a predicted 201,900 in 2030 to 164,000 toe (Table 9). This would avoid an increase in energy demand of nearly 19% (Figure 19).

Table 9 Predicted energy demand by 2030 with and without reduction targets

Sector	Final energy demand in toe 2030		
	Business as usual 2030	Energy use if reduction targets are met by 2030	Change (%)
Road Fuel	42,400	36,000	-15
Aviation	22,700	22,700	0
Industry and government	62,700	50,000	-20
Domestic	86,900	70,000	-20
On-island electricity generation	9,900	8,000	-20
Total	**224,600**	**186,700**	**-17%**
Total (excluding aviation)	**201,900**	**164,000**	**-18.75%**

1.167 Figure 20 shows graphically, the information presented in Table 9. It is clear that without achieving the reduction targets, the predicted levels of energy demand are about 20% above 2005 whereas achieving the reduction targets will stabilise these to 2005 levels.

Figure 22 Predictions of energy demand compared to 2005 data showing the importance of reduction targets in reducing energy requirements in 2030



Source : Data from Statistics Unit Model

By reaching the proposed energy reduction targets by 2030, energy demand can be stabilised at 2005 levels.

POLICY OPTION 1: By 2030, implement demand reduction measures to avoid the predicted growth of energy demand of 20%. This growth can be avoided by :

1. A 15% reduction on predicted 2030 levels of road transport use
2. A 20% reduction on predicted 2030 levels of domestic, industry and government sector energy use

Achieving these targets against predicted energy growth will stabilise energy demand at 2005 levels.

Carbon emissions

1.168 In this section we examine how Jersey's carbon emissions will change over the period 2005-2030 as a result of the energy reduction targets we have proposed in Policy Option 1:

1. Because of the continuing shift towards low-carbon electricity there will be a reduction in carbon

1.169 The continuing trend towards imported electricity means that there will be a reduction in carbon emissions of 6,700 tonnes by 2030 because in comparison to the other fuel types, electricity is very low carbon. For example, although domestic energy use is predicted to rise by nearly 30% (Table 8), a continuation of the current trend of a shift away from high-carbon content heating oil to low-carbon content electricity will have the effect of reducing carbon emissions by some 21% in the domestic sector (Table 10).

1.170 Again it is noted that the model shows a dramatic increase in carbon emissions from on-island electricity generation (comprising the heavy fuel oil and gas oil used in generation) and as previously explained, this is associated with purchasing patterns in the budget period. This acknowledged anomaly must be put into perspective in that it makes up a small proportion of the Island's total emissions.

Table 10 Predictions on carbon emissions by sector in a 'business as usual scenario'

	Carbon emissions (t/C)		
Sector	**2005**	**2030**	**% change**
Road Fuel	32,100	31,600	-1.5
Industry and Government	22,600	17,800	-21
Domestic	32,100	25,500	-21
Electricity Generation	2,600	7,800	+200
Aviation	12,700	16,700	+31
Total	**102,100**	**99,400**	**-2,706t/C**
Total excluding aviation	**89,400**	**82,700**	**-6,700t/C**

2. In achieving the energy reduction targets there will be further carbon savings

1.171 If the reduction targets set out in Table 9 are applied to the predicted carbon emissions for 2030, there is an avoided growth in carbon emissions of 15,000 t/C between 2005 and 2030 (Table 11).

Table 11 Carbon reductions targets and savings

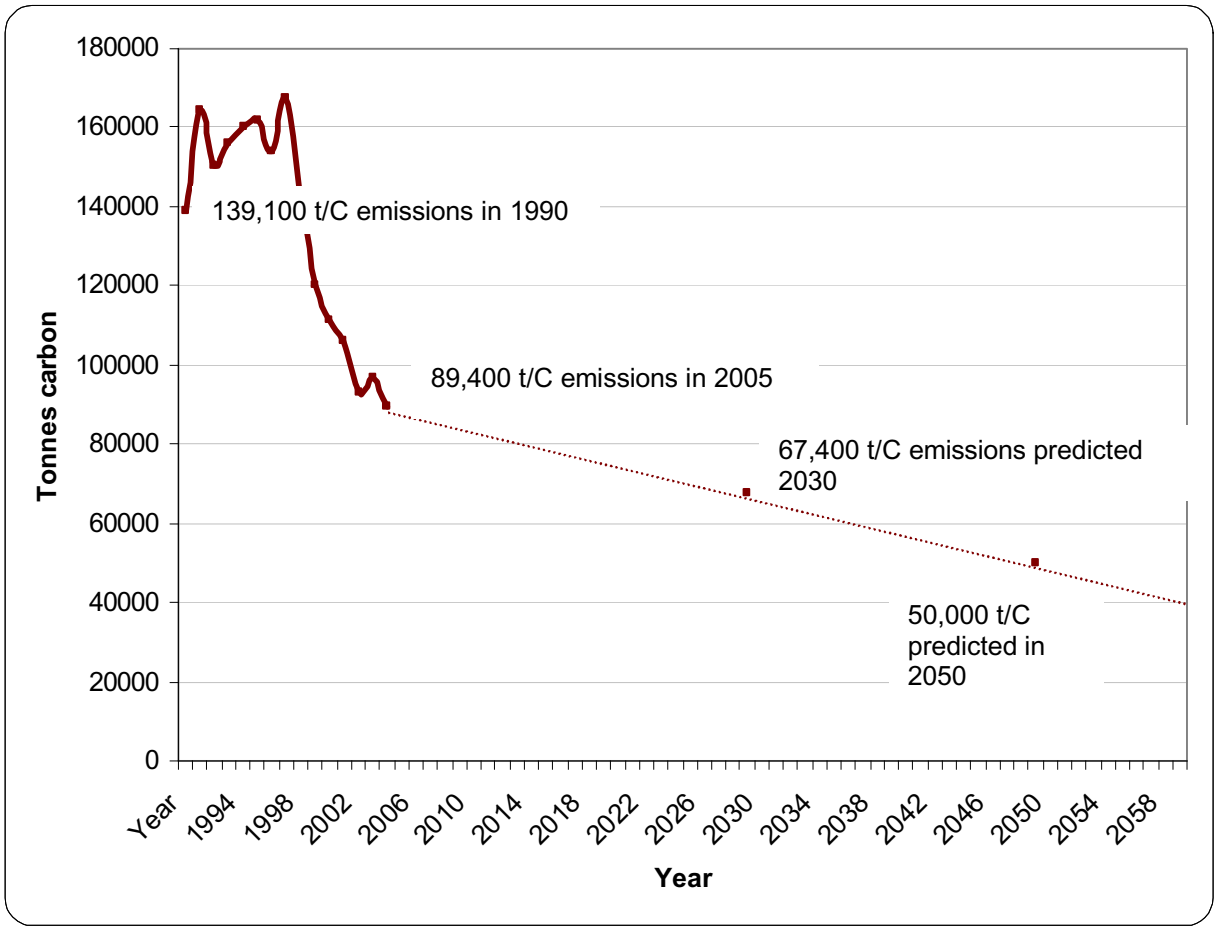
	Emissions (tonnes of carbon)	
Sector emissions	**Predicted emissions under business as usual scenario by 2030**	**Avoided carbon if reduction targets are met by 2030**
Road Fuel	31,600	4,700
Industry and Government	17,800	3,600
Domestic	25,500	5,100
Electricity Generation	7,800	1,600
Total	**82,700**	**-15,000**

By reaching the proposed energy reduction targets by 2030, along with a continued switch towards low-carbon electricity, there will be a further reduction in carbon emissions to 25% below 2005 levels (22,000 tonnes carbon).

International carbon emission targets

1.172 For the purposes of International comparisons carbon emission reductions are normally measured against the baseline year of 1990. Figure 21 shows the known carbon reductions and also projects to the 2030 level of reduction. The figure also extrapolates forwards to 2050 to predict an estimation further carbon reductions if levels of savings can be maintained.

Figure 23 Carbon emissions showing a 56% reduction on 1990 levels by 2030



Source Jersey Energy Trends 2005 with targets added from model projections (Statistics Unit)

1.173 Using the information shown in Figure 21, and taking the known savings and projected avoided growth in carbon, percentage carbon savings can be calculated between various years of measurement (Table 12).

Table 12 Carbon savings or avoided growth between various periods

Period of measurement	Carbon emissions in start year (t/C)	Carbon emissions end year (t/C)	% saving of carbon	How is saving achieved ?
1990-2005	139,100	89,400	36	One-off switch to imported electricity
2005-2030	89,400	67,400	25	Continued switch to electricity and further reduction in energy demand
1990-2030	139,100	67,400	52	Combination of one-off switch and projected reductions in demand
1990-2050	139,100	50,000	64	All of the above with continuing reduction trend to 2050

By 2050, Jersey could achieve a 64% reduction on 1990 levels of emissions by achieving the energy reduction targets and continuing the switch towards low-carbon electricity.

1.174 The UK Draft Climate Change Bill[31] is seeking to make statutory, the current voluntary reduction target of 60% carbon reduction by 2050 on the baseline year (1990). Jersey's trajectory shows that by 2050 the Island will have achieved a 71% reduction on 1990 levels.

1.175 To ensure that long-term targets will be met in good time, the EU called for a 20% reduction in GHG emissions by 2020 on the baseline year (1990). Again Jersey's trajectory shows that by 2020 the Island will have achieved a 48% reduction on 1990 levels.

POLICY OPTION 2: By 2030, avoid growth in carbon emissions of 25%.

To achieve this requires a minimum of
1. The continued switch towards greater electricity use
2. A 15% reduction on predicted 2030 levels of road transport emissions
3. A 20% reduction on predicted 2030 levels of domestic, government and industrial levels of emissions

For the purposes of international comparisons, forward projections show that this could achieve the following reduction targets :

52% carbon reduction between 1990 and 2030
64% carbon reduction between 1990 and 2050

This pathway puts Jersey ahead of the current UK reduction target of 60% reduction by 2050 and the European reduction target of 30% by 2020 on 1990 levels.

Carbon neutrality – one step further

1.176 Jersey's low overall carbon emissions and the considerable carbon reductions that have already been made, mean that the proposed reduction targets are achievable. An even more progressive move, in line with the Energy Hierarchy outlined earlier, would be for Jersey to have a long-term objective of carbon-neutrality.

1.177 Even with exceptional progress, the Island will still generate some unavoidable carbon emissions. To mitigate these remaining emissions, an option could be to off-set the Island's carbon by purchasing Certified Emission Reductions (CERs) in the international market.

1.178 Carbon off-setting involves calculating emissions and then purchasing equivalent credits from emission reduction projects that have prevented or removed the emission of an equivalent amount of carbon dioxide somewhere else.

1.179 Concerns have been raised that 'off-setting' must be properly regulated to ensure that the money raised is contributed to *bona fida* projects that result in emission

[31] http://www.defra.gov.uk/corporate/consult/climatechange-bill/consultation.pdf

reductions and would not have happen otherwise. The UK Government has recognised this and is currently investigating the *'introduction of standards and codes of practice which would be based on the use of certified credits from the established Kyoto market, through sources such as the UN's Clean Development Mechanism (CDM). These credits are backed by an international framework and institutions to ensure that real emission reductions take place, as well as providing a clear audit trail. The code of practice proposes that off-set providers supply consumers with clear information and transparent prices. Defra plans to support the standard by providing guidance to consumers on off-setting, which will also help consumers to make informed decisions about their actions'*[32].

1.180 Such measures will be helpful in ensuring that if a decision were made to off-set Jersey's residual emissions, genuine benefits were accrued. There are opportunities to link the Island's overseas aid awards with carbon reduction project since most of renewable projects are carried out in developing countries. By linking with an appropriate project, assistance could be given to a community whilst also achieving a reduction in the Island's emissions.

1.181 *Bona fide* CERs, although effective in contributing to a global reduction in emissions, should only be seen as a secondary measure to vigorously pursuing on-island reduction measures since are several drawbacks :

- Buying CERs would impose a cost on the Jersey economy without providing any direct benefits.
- By contrast, some of the costs of measures targeting energy reductions in Jersey itself would, at least in part, be recycled within the Jersey economy and also reduce imports of energy products.
- Purchasing and relying on CERs would leave Jersey exposed in the long term to movements in the international price of these credits. Currently the cost of CERs is quite low due to the relatively high availability of projects. However, there is the possibility that prices in the future could rise as the cheapest options begin to be fully utilised.

1.182 Currently CERs can typically be purchased on the international market for less than £9/tCO2. At these prices, Jersey's entire on island carbon emissions could be mitigated for less than £3m per annum. By 2020 total carbon emissions are predicted to be 78,000 tonnes and it is likely that neutrality could be achieved for about £700,000. The impact of this approach on the Jersey economy would depend on how the purchase of certificates would be funded. One approach would be through the extension of environmental taxation beyond the current proposals. For example, an energy consumption tax based on high carbon fuels would have the dual benefit of encouraging reduction through energy efficiency measures and the revenue raised could be used to directly off-set the pollution caused by the emissions.

[32] http://www.defra.gov.uk/news/2007/070118a.htm

POLICY OPTION 3: For Jersey to aim to be Carbon-neutral by 2020. This will be achieved by a combination of :

1. Vigorous adoption of energy reductions targets;
2. The continuation of current trends towards increased electric use;
3. The purchase of carbon off-sets perhaps by linking with specific projects in developing countries to which the Island would provide support through oversea's aid.

This will allow Jersey to market itself as a carbon-neutral jurisdiction.

Part 2 - Decreased Energy Use

'The cheapest, cleanest and safest way of addressing all our goals is to use less energy. We have to improve energy efficiency far more in the next 20 years than in the last 20'

The UK Energy White Paper 2003 Our Energy Future – creating a low carbon economy

Preface to Part 2

1.183 The first level of the Energy Hierarchy is to use less energy. There is no doubt that improved energy efficiency can be achieved through managing demand and changes in behaviour.

1.184 The EU paper 'Doing More with Less' shows how an energy efficiency initiative has wide reaching implications that can address the key aims of an Energy Policy for Jersey by Government assisting in delivering secure, affordable and sustainable energy. A re-invigorated energy efficiency programme for Europe has multiple objectives that also apply to Jersey :

- Increase SECURITY by *reducing import dependency* - It constitutes a major contribution to reduction of the importing country's energy dependency on third countries, in a setting of high and volatile oil prices. Price shocks occur when supply availability comes very close to demand levels.

1.185 Increase AFFORDABILITY by promoting sustainable economic growth - The States' Strategic Plan vision echoes the attainment of sustainable economic growth in its vision that *'People living here enjoy a good standard of living based on a strong, environmentally sustainable and prosperous economy'* and Commitment 1.1 is to *'Show the world that economic and environmental success can work together'*

- Increase SUSTAINABILITY by *fighting against climate change* - Energy saving is without doubt the quickest, most effective and most cost-effective manner for reducing greenhouse gas emissions, as well as improving air quality, in particular in densely populated areas.

1.186 Money saved through energy efficiency improvements represents money that can be re-invested in the economy. For example, the University of Manchester estimated that businesses in Manchester could save up to £17million through energy efficiency improvements[33]. Some of these improvements would require very little capital investment. In addition, it is estimated that in the domestic sector if homes were better insulated and less money was spent on heating then this money could be spent in the local economy. It is estimated that for every pound saved through energy efficiency, up to 30p is spent in the local economy.

1.187 The move from unsustainable energy to sustainable energy provides a wealth of business opportunities. Ethical investment is an opportunity for investment banks, particularly those which are based on co-operative principles. There are also job creation opportunities from the installation of sustainable energy if the appropriate training opportunities are in place.

[33] Manchester Energy Strategy http://www.manchester.gov.uk/environment/energy/strategy.htm

1.188 The following two chapters go on to examine how energy use can be reduced by improving energy efficiency in the domestic and industry sectors and also in transport. When considering a sectorial analysis of Jersey' energy, the profile of Jersey's fuels and their ultimate uses must be examined.

1.189 An analysis of the energy intensive industries shows that despite some quite specific cases such as water treatment, on-island electricity generation and the agricultural industry, the majority of energy (be it in the form of electricity, gas or heating oil) on-island is used for space and water heating. Additionally, there is a high energy demand within the industry and commerce sectors to service electronic appliances like computers and servers and associated services for example air conditioning.

1.190 Therefore, improved efficiency in domestic, governement and commercial buildings could make significant reductions to overall energy use with consequent carbon reductions. In addition, improved efficiency and changes in behaviour with respect to the use of appliances could also help achieve these aims. Chapter 5 addresses energy use within these sectors.

1.191 There is little intensive industry in Jersey but a major end use for gas oil is in the agricultural industry where it is used by the protected crop industry. This is mainly burnt in the summer months to produce carbon dioxide that is pumped into greenhouses to elevate levels and stimulate crop growth such as tomatoes.

CHAPTER 5 Improving energy efficiency use in the domestic, government and industry sectors

Chapter summary

Reducing the amount of energy used is the simplest way to manage the problems associated with energy use. Ensuring that the highest standards of demand management and energy use are vigorously pursued will have many benefits:

1. All energy is used efficiently and wisely;
2. There is a reduced exposure to international energy prices;
3. Economic efficiency and social equity will be underpinned by affordable energy;
4. Homes can be adequately and affordably heated;
5. Investment in energy infrastructure remains within planned limits and existing infrastructure remains sufficient for the Island's needs for longer ;
6. There is a reinvestment of revenue into the local economy associated with the uptake of energy efficient measures and the compliance industry;
7. There is an increased contribution to the security and resilience of energy supplies.

Proposed policy options to achieve these benefits centre on :

1. Stabilising domestic energy use at 2005 levels by encouraging energy efficiency via a suite of legislative and fiscal measures. These would include contributing to the development of new legislation that adequately reflects the highest energy conservation standards in the UK and other jurisdictions to ensure that all homes reach minimum standards and occupants are not put in a position of fuel poverty

2. Establishing awareness and education programmes to assist informed and unbiased decisions in energy use patterns. These would include the creation of a not-for-profit organisation - modelled loosely on the UK's Energy Savings Trust whose role would be to deliver energy efficiency programmes and mechanisms for carbon-saving. Planning and Environment's ECO-ACTIVE programme would assist this initiative. The body would be funded by revenue from environmental taxation.

3. For the States to lead by example in achieving the highest attainable standards of design standards and energy efficiency in capital projects, energy procurement and transport.

Introduction and Aims

Space and water heating

1.192 Jersey has a high dependency on imported petroleum products and energy use patterns are dominated by the domestic, and transport sector. Despite being exposed to increasing energy costs, consumer behaviour is unresponsive to these increased prices.

1.193 One third of energy use is in the domestic sector and the majority of the Governmental and industrial/commercial energy use arises from space and water heating. Thus improvements in the performance of buildings would allow enormous gains to be made. This holds true across Europe, for example, the buildings sector alone accounts for 40% of the EU's energy requirements and offers the largest single potential for energy efficiency. If there was an application of more ambitious standards to new and when refurbishing buildings, this would represent a considerable contribution to meeting carbon reduction targets.

Appliances and lighting

1.194 Jersey has strong retailing and financial services and it follows that there are gains to be made in overall energy consumption by addressing the use and performance of appliances and lighting. For example, non-LCD monitors use 80% of the energy consumed by a computer and both should be switched off when not in use.

1.195 In a sector that is set for expansion as a result of a target of increased economic activity and growth, energy demand can be expected to increase. Chapter 4 has shown that if demand is not reduced significantly then eventually there will be a requirement for increased expenditure on infrastructure like a fourth electricity interconnector to France. The economic argument for strong action on demand management is therefore clear.

The agricultural industry

1.196 Eleven percent of final energy consumption in 2006 was gas oil used mainly by the agricultural industry[34]. This contributed significantly to making agriculture and fisheries the third most energy intensive industry locally with energy costs amounting to nearly 7% of Gross Value Added.

1.197 Whilst it is recognised there have been improvements in technology allowing more efficient use of energy, at these levels of use, there is a strong business case for the industry to act to further increase energy efficiency, especially in a climate of predicted energy price rises.

[34] Jersey Energy Trends 2006, The Statistics Unit

How does Jersey compare ?

1.198 When comparing Jersey and elsewhere, a range of factors must be accounted for, for example, the nature of industry, size of country, climate, availability of energy sources and fuels used. It is difficult to find comparable energy data for similar small islands.

1.199 However, domestic electricity consumption in the Isles of Scilly and the Orkney Isles can be directly compared with Jersey as, unlike the UK mainland, they do not have mains natural gas (Table 13). Surprisingly the southern islands consume most electricity per household. This high level of average electricity consumption in Jersey may partly reflect the relative size of properties, which are likely to be on average larger than in the UK.

Table 13 Island domestic electricity consumption

2004 regional energy data published by the Department of Trade
Number of households refers to the number of metered supply points identified as domestic

Island	Number of households	Domestic electricity consumption (MWh)	Average domestic consumption (kWh)
Jersey (2005)	38,376	296,200	7,720
Isles of Scilly	1,000	8,000	7,644
Orkney Isles	11,900	83,000	7,019

Source Jersey Energy Trends 2005 The Statistics Unit

1.200 Across Europe there is still considerable room for improvement in terms of energy efficiency and concerted efforts elsewhere show that the efficiency of the UK housing stock could be improved substantially by 2050 e.g. 40% house[35]. One of the main stumbling blocks can be the attitude of consumers, who are reluctant to adopt energy efficiency technologies and the highest efficiency products which can really contribute to energy saving. According to numerous studies[36] the EU could save at least 20% of its present energy consumption in a cost-effective manner, equivalent to €60 billion per year, or the present combined energy consumption of Germany and Finland.

Energy characteristics of the housing stock in Jersey

1.201 The characteristics of the housing stock are not fully known for Jersey. In order to assist the development of Energy Policy, a high level study was commissioned by the States of Jersey to look at opportunities for delivering energy efficiency measures locally. The Consultants KEMA[37] considered the composition of the housing stock by having detailed discussions with key stakeholders who described the local housing stock. At the detail required for policy development, the results of these discussions and comparisons with proxies from the UK are sufficiently accurate.

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[35] '40% House' (2005) Published by the Environmental Change Institute, The University of Oxford
[36] Green paper on Energy Efficiency or Doing More With Less Brussels, 22.6.2005 COM(2005) 265 final

[37] 'Energy Efficiency Study' KEMA Ltd (March 2007) commissioned by the States of Jersey

1.202 The factors that have the greatest correlation with energy performance of the existing stock are the age and dwelling type/size and ownership:

Housing stock age

1.203 Using the States of Jersey housing stock as a guide, a considerable proportion of the stock was built between the 1970s and 1980s. Houses built before the mid 1980s would not have had building regulations that required any insulation and although some will have benefited from retrofitting, many of these are likely to be poorly insulated. Using the Standard Assessment Procedure (SAP[38]) to measure of thermal efficiency of dwellings, an age analysis shops that the older a house is, the less well it is likely to perform. Step changes in performance improvements are seen with the advent of building regulations (in the early 1990s for Jersey).

1.204 The implication is that the emphasis of programmes to improve SAP ratings should be focussed on properties built pre-1990.

Dwelling Type

1.205 Dwelling type also has a significant impact on the SAP ratings. A breakdown of the Jersey housing stock in 2001 is compared to the average SAP values from England shown for each dwelling types alongside the housing chart (Table 14).

Table 14 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	1,068	3	n/a
Temporary or mobile structure	123	-	n/a
TOTAL	**35,562**	**100**	**UK mean 50.6**

Source KEMA report for the States of Jersey

1.206 The highest SAP ratings are generally obtained in purpose built low rise flats since they have fewer external surfaces, which reduces heat loses. Furthermore, a high proportion is modern and is 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; the high rise flats already have plans for improved insulation and therefore better SAP.

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

1.207 Conversely, detached houses and bungalows have relatively poor SAPs primarily due to the large external envelope which leads to extensive heat loss if they are not well insulated. The least efficient stock is converted flats, they tend to have the lowest levels of insulation, and a high percentage of less efficient heating. The implication is that here there is the largest potential for improvement but this may be compounded by the difficulty that there is a higher than average level of private landlord ownership.

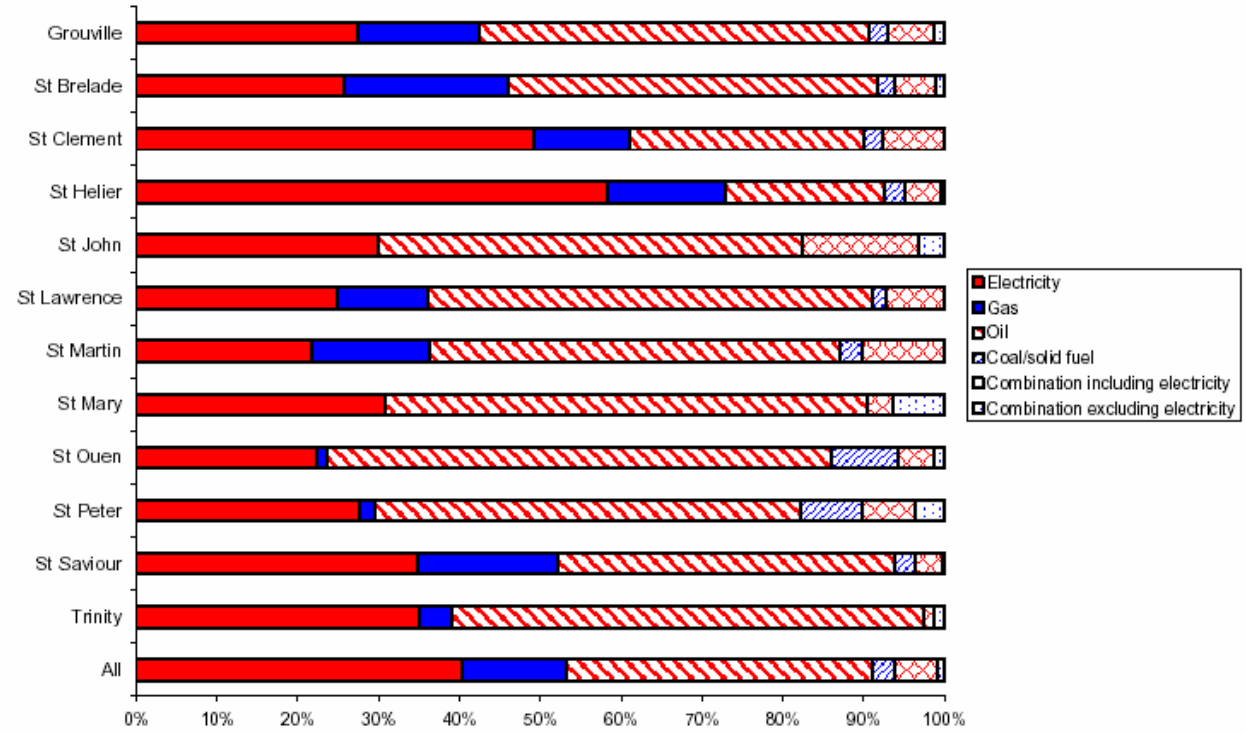
Ownership of dwellings

1.208 The ownership of a property affects the relative energy efficiency. There is a relatively good performance of the local authority and social landlord which is likely to be reflected in Jersey. Private landlords tend to have properties with the lowest SAP ratings as a result of the 'split-incentive' problem. This is because the landlord, who makes the capital investment in the property, does not pay the fuel bill so does not have the incentive of lower energy costs to drive the expenditure. The tenant, who pays the heating bill, does not have the control or capital to make energy efficiency investments and may not have a guarantee of residence that is sufficiently long to recoup the benefit of his investment. It is worth noting that flat in converted houses scored relatively low in terms of SAP, these are often the lodging houses where the split incentive problem is most exacerbated.

Space and water heating

1.209 Jersey differs significantly from the UK in this respect particularly due to the sizeable reliance on electricity for central heating along with heating oil. In comparison to the UK, gas consumption is considerably lower. In general, the Annual Social Survey (Figure 22) showed that the main fuel used for heating water was the same as household heating, although with slightly more homes overall (48%) having electric water heating and fewer (34%) oil water heating. One-fifth of households (21%) had boilers which are more than ten years old, 19% were installed between five and ten years ago and 26% are between one and five years old. Newer boilers, installed within the last year, are present in 7% of households, whilst 27% do not know when their boiler was installed. This is of interest since the newer a boiler is, the more energy efficient it will be.

Figure 24 Main form of household heating by parish (percentages)



Source Jersey Annual Social Survey, 2006 published by the Statistics Unit

Social equity and energy expenditure

1.210 There are considerable health and social impacts of unsustainable energy use. In the UK's Fuel Poverty Strategy 2001, a fuel poor household was defined as one "which needs to spend more than 10% of its household income to achieve a satisfactory heating regime (21°C in the living room and 18°C in other occupied rooms)"

1.211 Fuel poverty arises from a combination of factors:

- low household income;
- poor heating and thermal insulation standards in the property;
- high fuel costs;
- A split responsibility for a property with landlord / tenant;
- Under-occupation of a property, common amongst the elderly.

1.212 Whatever the combination of factors, the result is cold, damp unhealthy homes where the resident cannot afford to adequately heat their home. The link between energy inefficient housing and ill health is well documented. Cold, damp homes, which are inadequately heated and insulated, have repeatedly been linked to ill health and early deaths amongst the most vulnerable people in society. In the UK there are known to be around 30,000 excess winter deaths per annum through cold related illnesses. Those living in fuel poverty are more likely to live in homes without central heating and therefore they rely on expensive portable electric

heaters or heating to one room only, which just exacerbates their situation[39]. In old, poorly insulated, draughty homes much of the spending on energy is simply wasted.

1.213 Fuel poverty damages people's quality of life and imposes wider costs on the community. The most direct effects are in relation to the health of people living in cold homes although ironically those in fuel poverty may find that in the hotter summers they cannot afford to keep cool. The affects of high temperatures can be clearly seen from the summer of 2003 where in Europe 35,000 extra deaths occurred as a direct result of high summer temperatures. Although these risks apply to all people, older people, children, and those who are disabled or have a long-term illness are especially vulnerable.

1.214 The number of people living in fuel poverty may well rise over the coming decades as heating and electricity costs are predicted to rise faster than incomes.

Does Jersey have fuel poverty ?

1.215 By the UK's definition, Jersey does not have fuel poverty. The Household Expenditure Survey[40] provides a measure of the proportion of local income spent on fuel. Table 15 shows the average weekly household spend on energy in Jersey by income quintile, in actual expenditure and expressed as a percentage of total household income. Low income households spend a higher proportion of their income on energy.

Table 15 Proportion of household income spent on energy (%)

Fuel	Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Average
Current spend as % of household income	4.1	2.7	2.6	2.5	2.0	2.5
Current Actual Spend (£)	11.4	10.2	15.2	21.1	30.1	17.6

Note: Average income levels in each quintile were estimated from the total expenditure.
Source: Oxera calculations based on Jersey Household Expenditure Survey 2005.

1.216 Whilst the actual money values of housing costs are quite different the proportions are similar - a little over 4% of total spending in the lowest quintile and just over 2% in the highest. Even for the lowest quintile, the figure of 4.1% is some way short of the definition of fuel poverty. Nevertheless, this is an average figure and which will mask some individual circumstances which are far worse.

[39] Manchester Energy Strategy http://www.manchester.gov.uk/environment/energy/strategy.htm
[40] Household Expenditure Survey 2006, states of Jersey Statistics Unit

Actions to decrease energy use

1.217 Energy users have been unresponsive to rising fuel prices. Comparison with similar jurisdictions shows that Jersey is using a limited and expensive resource wastefully. This has implications for the environment, for the security of supply and for the ability of the most vulnerable to pay for energy.

1.218 In order to improve and address issues relating to security, affordability and sustainability, energy policy will propose a range of actions to ensure that the highest standards of demand management and wise energy use are vigorously pursued in order to promote environmental sustainability, economic efficiency and to protect the most vulnerable in society. This will mean changing behaviour to use less energy and adopting energy efficiency measures.

1.219 Improvements in energy efficiency and demand management can achieve a 20% reduction on predicted 2030 levels of domestic, industry and government sector energy. Achieving this target will help reach the dual targets of energy reduction i.e.

- The stabilisation of overall energy use at 2005 levels
- An avoided growth in carbon emissions of 31% between 2005 and 2030

Making the change

External drivers to assist improvement in energy efficiency

1.220 In addition to changing behaviour, improving energy efficiency means using the best technologies to consume less, whether at the final consumption or energy production stage. This means, for example, replacing an old household boiler with a new one which consumes one-third less; or putting in place systems which avoid the energy consumption of standby mode on numerous household appliances (TV, electric oven, etc.); or using light bulbs which, for the same brightness, use less energy thanks to new technologies.

1.221 Research and development underpins progress towards new technologies. In April 2005, the EU Commission adopted a proposal for the 7th Framework Programme for Research and Development. For energy, it is proposed to concentrate on a limited number of key priorities among which are renewables for power generation and fuel production, clean coal technologies, smart energy networks and energy efficiency within the main “cooperation programme”. Considerable research efforts are also being focused on power management for computer systems and energy “scavenging” techniques where electronic devices draw their power from ambient sources such as the motion of the user, body heat or sunlight.

1.222 Jersey can adopt these advancements as and when they are commercially available. Specific examples of impending improvements upheld by legislation are the EU legislation re appliance ratings[41]

POLICY OPTION 4: The States will keep under review advancements in energy efficiency and provide information to the public to assist them in making energy efficient choices in line with the availability of proven new technologies. The provision of such unbiased advice is a key priority for ECO-ACTIVE and the proposed 'Sustainable Energy Jersey' organisation.

Demand management and changes in behaviour

1.223 Energy saving derives from a change in consumer behaviour, and the potential impact of raising awareness of energy conservation should not be under-estimated. Education plays an important part. This means, for example, providing advice for people on how to reduce heat losses from their house, or use heat more wisely by the correct use of the thermostats or not leaving appliances on standby overnight. By providing people with better information and control over their energy use through the use of smart metering, there is evidence from the USA, Australia and Norway that savings of 10%-15% can be achieved[42].

1.224 The key to translating these often simple and money saving measures into action is the provisions of advice and information and there are many models of successful information and assistance programmes. Appropriate aims for a Jersey programme must encompass both advice and support to encourage changes in behaviour as well as information and access to energy efficiency measures.

Delivering changes through a dedicated organisation

1.225 To raise awareness and provide an incentive to change, requires a proactive approach. Success depends on the changes being as straightforward and as easy to adopt as possible. The energy conservation message must be simple, clear and reinforced. Publicity campaigns providing clear information on how to make cost-effective energy savings, as well as providing stimulus for consumers to act, can be effective in changing perceptions and encouraging action.

1.226 Action at three levels in this respect can be identified:

- information to citizens on issues such as how to reduce energy consumption in homes, through, for example, efficient lighting and heating and sensible purchasing decisions;
- information to industrial customers;
- information to energy efficiency experts and service providers to ensure that a network of such well-trained experts exists and function well.

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[41] EU Energy Labelling Framework Directive 92/75/EC

[42] http://www.nea.org.uk/Policy_&_Research/Policy_position_papers/Smart_Metering. The simplest form of smart metering is a display meter which allows consumers to monitor consumption in money terms rather than kWh

1.227 Consumers need to be convinced that by relatively simple measures, the average household can save a significant amount in its spending, which is especially important for households spending a large share of their budget on energy.

1.228 There may be suspicion that energy conservation advice provided by utility companies is biased and experience elsewhere has shown that locally based accessible information from one source is very successful. A particularly successful model is the formation of not-for-profit bodies such as the Energy Savings Trust (EST) in the UK. The EST acts as a central point for grant information, and provides advice on low energy use products.

1.229 In order to deliver behavioural change and increased energy efficiency in Jersey a similar body is proposed. For the purposes of this document and in order not to prejudice how it will be set up, this organisation has been termed ‘Sustainable Energy Jersey’.

POLICY OPTION 5 : By 2008 the States will bring forward proposals for the creation of a not-for-profit semi-governmental organisation to deliver energy efficiency programmes and mechanisms for carbon-saving.

The objectives of 'Sustainable Energy Jersey' will be to :

1. Assist the domestic, industry and governmental sectors to stabilise their energy use at 2005 levels so avoiding a predicted 20% increase in energy demand by 2030;

2. Assist the domestic, industry and governmental sector in reducing carbon emissions to achieve carbon reduction targets of 25% below 2005 levels;

3. Assist to low income customers;

4. Promote small scale renewables; and

The expected scope of 'Sustainable Energy Jersey' is likely to be :

1. Run education campaigns to promote energy efficiency etc at the individual, business, domestic and public levels;

2. Promote unbiased advice for home owners, business and commercial sectors on the most sustainable way to use energy e.g. energy audits;

3. Promote / provide training opportunities for operatives within the industry in energy efficiency / renewables and potentially recognise with accreditation schemes;

4. Use the trust's purchasing power to source energy efficiency materials and or microgeneration technologies cost effectively so passing on these saving onto the consumer.

Funding of the organisation will be from revenues raised from environmental taxes.

Proposed budget for energy efficiency programmes

1.230 It is intended that funding of the organisation will come from revenues raised from environmental taxes. The current proposal is that approximately £1.4M annually could support sufficient programmes to achieve target levels of carbon savings[43]. 'Sustainable Energy Jersey' is expected to co-ordinate, promote and enable energy efficiency activities with a staff of 3 to 5 dependant on the number and type of programmes run. It is expected to grow according to demand, success and available funding.

[43] 'Energy Efficiency Study' KEMA Ltd (March 2007) commissioned by the States of Jersey

The ECO-ACTIVE campaign

1.231 The ECO-ACTIVE Campaign was launched by the Planning and Environment Minister in February 2007. This is a programme designed to provide information that allows people to make environmentally responsible decisions.

POLICY OPTION 6 : The ECO-ACTIVE Campaign will assist and complement the work of 'Sustainable Energy Jersey' in raising awareness and providing information for consumers

Improving the energy performance of buildings

1.232 An analysis of the housing stock[44] has shown that older properties and converted flats along with detached (particularly bungalows) dwellings not in private ownership are most likely to benefit from improvements to increase energy efficiency.

1.233 In the housing and buildings sector, simple and effective energy efficiency improvements include:

- Hot water insulation;
- Cavity wall and solid wall insulation;
- Loft insulation;
- Improved heating controls;
- Draught proofing;
- New efficient condensing / A rated boilers;
- Double glazing;
- Innovative solutions to insulate the hard to treat homes.

1.234 A significant energy saving can be achieved through cavity wall insulation. More heat is lost through walls than any other way, about 1/3 in an un-insulated home. It costs approximately £350 to undertake cavity wall insulation and the payback period is 3 – 4 years. There is an added benefit to cavity wall insulation in that during hot spells the house will be cooler.

1.235 A summary of the potential energy, cost and carbon that could be saved by each of these measures is given in Table 16. The calculations are based where possible on Jersey data, but this has been supplemented by UK data from DEFRA[45]. 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; a full description on the derivation of each column is shown in (Appendix E).

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[44] 'Energy Efficiency Study' KEMA Ltd (March 2007) commissioned by the States of Jersey

[45] 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 16 Summary of potential carbon savings for key measures in Jersey

Measures	Kwh/ year saving	Jersey Energy Cost saved per year (no comfort taking)	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	47	25	43	10,362	447	0.58
Cavity Wall Insulation	4,217	203	568	208	19,650	4094	2.73
Loft Insulation (professional)	3,312	160	475	164	4747	777	2.90
Loft Insulation (DIY)	2,775	134	241	137	4747	651	1.76
Improved Heating Controls	1,457	70	251	72	3,556	256	3.48
Draught Proofing	743	36	171	37	20,339	747	4.65
Solid Wall Insulation	12,085	582	4,676	597	5,228	3122	7.83
A Rated Boiler	1,951	94	329	153	17,615	2694	2.15
Glazing E to C	458	22	354	23	6,140	139	15.65

Source KEMA report for the States of Jersey

Improving the energy performance of appliances

1.236 Electrical appliances also represent an enormous savings potential. More effective standby mechanisms would permit substantial savings. Key areas are

- Lighting
- Fridges – More efficient models of the highest standards
- Freezers
- Consumer electronics
- Laundry
- Miscellaneous such as towel heaters and kettles
- Air conditioning (currently limited but possibly increasing)

1.237 Improvement measures are simple. For lighting, the replacement of bulb and fixtures with compact fluorescent lamps (CFLs) whilst for the other areas, using the most efficient models and standards will make considerable savings (Table 17).

Table 17 Summary of potential carbon savings for key measures in Jersey

Measures	Kwh/ year saving	Jersey Energy Cost saved per year (no comfort taking)	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	4	0.57	35,690	20	6.34
Torchiere (upright lighting)	50	5	28	1.00	35,690	36	28.00
Wet appliances	102	9	181	3.62	30,701	111	49.82
Cold Appliances	34	3	36	0.68	30,701	21	53.53

Source KEMA report for the States of Jersey

1.238 Consumers are often in need of information in order to make the most appropriate decisions. The accessible labelling of appliances displaying rating and performance information is an important tool to enable consumers to make fully informed choices.

POLICY OPTION 7: By 2009 the States will introduce a requirement for retailers to guide consumers with more informed labelling of appliances to show rating and energy performances.

Improvements in public purchasing and sustainable procurement

1.239 The development of energy efficiency technology is enhanced when the potential market is significant enough to off-set development and production costs through increased forecast sales. Public procurement is a large customer that can help achieve this objective. States' Departments have an important role in setting an example and achieving efficiency savings.

POLICY OPTION 8 : By 2008, State's Departments will introduce a minimum environmental standard which must be reached in the procurement process. This will cover aspects such as energy efficiency, recycled content and biodegradability.

POLICY OPTION 9: By 2008, the States will set in place a programme of office action plans to achieve targets of energy savings this will be supported by the work of 'Sustainable Energy Jersey' and the ECO-ACTIVE campaign.

An Action Plan to achieve the energy reduction targets

1.240 In Chapter 4 a target was proposed to maintain energy demand at 2005 levels until 2030. This will avoid a predicted 20% increase in energy use if positive actions are not taken. Alongside this, a further target was set to achieve a reduction in carbon emissions of 56% on 1990.

1.241 These targets can be achieved by implementing various improvements in the performance of buildings, in particular the housing stock, together with improvements in appliances. It will be the role of 'Sustainable Energy Jersey' to bring forward an Action Plan for the implementation of such measures.

POLICY OPTION 10: The two targets of maintaining energy demand at 2005 levels and reducing carbon emissions will be reached by implementing the key energy efficiency measures in buildings across the domestic, commercial and governmental sectors.

'Sustainable Energy Jersey' will recommend an Action Plan and timetable to achieve this.

The Action Plan will identify how, when and who will carry out the improvements and the range of support measures needed and will address:

1. Advice and support measures to encourage the uptake of energy efficiency measures and behavioural changes

2. Assisting low income groups

3. The role of legislation

Advice and support in encouraging uptake and overcoming barriers

1.242 Increased awareness of purchasing choices will support the uptake of more energy efficient appliances / measures. For example, as consumers the boiler stock is replaced, more efficient models will become predominant. A measure more swiftly adopted is likely to be the uptake of Compact Fluorescent Lamps since these are more readily available in many fittings.

1.243 However, despite the existence of financial incentives to take up energy efficiency measures, studies have shown[46] that the most important barriers to increased energy efficiency are :

- Lack of information on the costs and availability of new technology;
- Lack of information on the costs of own energy consumption;
- Lack of training of technicians on proper maintenance and the fact that these aspects are not properly taken into account by market participants.

[46] EU Paper 'Lets overcome our dependency'

- Savings from energy efficiency measures may well be used on greater thermal comfort so defeating the object of the programmes.

1.244 It is here that information, advice and support are crucial tools and the success of campaigns like those designed to address drinking and driving shows how successful they can be. In the field of promoting energy efficiency and conservation, there are many lessons to be learnt from experience elsewhere and opportunities to extend existing campaigns to Jersey.

Assisting low income groups

1.245 There will be some situations where the consumer will not be in a position to make improvements themselves, for example the low-income sector may not be in a position to make investments in insulation. Targeted grant aid is likely to be the mechanism to assist in this case. The States Strategic Plan 2006-2011 outlines the success of an energy policy indicated by a number of measures including a commitment to 'Decrease the number of households experiencing fuel poverty'. Whilst levels of fuel poverty are low in Jersey there is a need to identify and assist those most vulnerable.

1.246 The States are a significant property owner and the landlord of much social housing. To improve the worst performing stock there is an ongoing programme of maintenance and refurbishment of the States-owned social housing stock. This needs to be funded from the Capital Programme and from the sale of property that is no longer required. The Strategic Plan 2006-2011 indicates that success is indicated (among other indicators) by increase in the percentage of homes in public ownership reaching 'Decent Homes Standard[47]'.

1.247 The proposed winter fuel payment would be better targeted by giving grant support for better home insulation in low income households. This approach has been taken by the Isle of Man whose 2007 budget proposes additional funding for fuel efficiency in public sector housing[48].

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[47] In its Green Paper 'Quality and Choice: A Decent Home for All' (July 2000), the Government set two targets: *To reduce by 1/3 the number of social housing properties which fail the Standard by 2004 and To have all social rented homes meeting the Standard by 2010.*
The UK 's defines a decent Home as *'one which is wind and weather tight, warm and has modern facilities*'. The made it their priority to reverse the decades of neglect and this standard was to be the cornerstone for improving people's quality of life in the home.

[48] http://www.gov.im/lib/news/treasury/8mainbudgetspeec.xml

The role of legislation

1.248 The landlord / tenant split incentive problem can be difficult to address. Landlords are likely to have responsibilities under new legislation to maintain certain standards of thermal efficiency in properties. 'Sustainable Energy Jersey' can act on behalf of the tenant to ensure these standards are being adhered to and ensure that improvements are adequate and appropriate.

1.249 Currently in consultation is the Draft Health and Safety (Dwellings)(Jersey) Law 200-. The intention of this legislation is to introduce minimum safety standards with respect to dwellings for a number of parameters including the conservation of heat and power. The law would provide an enforcement mechanism through the use of inspectors to ensure compliance with prescribed standards.

1.250 This proposed legislation is an important tool in enforcing minimum standards within dwellings and offers a route for identifying areas for improvement in the existing stock. This is likely to go some way to addressing the difficulties sometimes observed when the landlord does not remedy problems because of the lack of incentive to make and investment in the property.

POLICY OPTION 11: The States will ensure that The Draft Health and Safety (Dwellings)(Jersey) Law 2000- adequately reflects current energy conservation standards in the UK and other jurisdictions.

Improving the energy performance of new developments

1.251 Including energy efficiency and the principles of sustainable architecture at the design stage enables large energy savings. In some instances there can be increased capital costs to this but these are generally a small proportion of the overall costs of a new build and would often be paid back in increased energy savings in the first few years of occupation. Nevertheless in order to prompt the highest standards, a combination of measures and regulations should be introduced.

Building regulations and legislation

1.252 The Planning and Environment Department uses legislation to ensure that new buildings meet minimum standards in terms of conservation and power. It is intended that the Building Bye-Laws will be strengthened in 2008 to further improve the energy efficiency of all buildings. These changes will specifically deal with the conservation of energy in homes, offices and other buildings to help reduce their CO_2 emissions and will set high standards for architects, engineers and contractors to create a more sustainable built environment and to reduce carbon emissions.

1.253 The Bye-Laws will also require improvements to be made to existing buildings by setting requirements for reasonable provision to be made to improve the efficiency of the thermal envelope (walls, floor, roof, windows and doors), boiler and heating systems and other fixed services. This will help improve the energy performance of the existing stock over time as and when extensions, alterations and replacements take place.

1.254 Key changes will be the setting of target rates to limit CO_2 emissions for both new dwellings and new non-domestic buildings as well as setting standards to limit solar gains and ensure air airtightness to reduce the need for heating and cooling.

1.255 Whilst there have been some difficulties in the introduction of these regulations in the UK, Jersey has the opportunity to learn from these experiences and adopt measures to ensure their smooth introduction locally.

POLICY OPTION 12 : By 2008, the States will strengthen the building bye-law requirements relating to the conservation of fuel and power in buildings. These will be aimed at further improving energy efficiency in all new buildings and will set performance standards for improving existing buildings when these are altered, extended or where a material change of use of a building occurs.

1.256 Supplementary planning guidance builds upon the policies of the Island Plan 2002 and provides more detailed advice on the way in which those policies are likely to be interpreted and applied. 'Planning Advice Note No 1 : The Design of New Homes' is currently being consulted upon. As well as advice in respect of many areas such as density, landscape, amenity space and water use, it is noted that it is 'generally desirable and good practice for designers to be aware of the likely energy performances of their creations'. The principles of low-energy house design outlined within PAN 1 take into account factors such as:

1. Layouts to take maximum advantage of passive solar gain
   - Planning and designing new homes to take full advantage of solar gain
   - Window design (to assist passive solar gain and prevent heat loss)
   - Introducing high thermal insulation standards

2. Installing or making provision for 'active' solar energy systems
   - Solar panels – that use solar energy to heat hot water used for space and water heating
   - Photovoltaic installations – which take solar energy and turn it into electricity

3. Other energy efficiency measures e.g. High efficiency appliances, exploiting Combined Heat and Power (CHP) opportunities.

1.257 In addition consultation is also being carried out on the Supplementary Planning Guidance (SPG) note 'Design and Policy G.4 - Design Statements'. Amongst addressing a number of design issues, all eligible developments require a Design Statement that addresses an environmental audit dealing with waste management, type and sourcing of construction materials, efficient energy and water consumption.

1.258 Whilst there is overall a considerable knowledge of these principles in the local architecture industry it may prove necessary to provide support and training and this could be a role for 'Sustainable Energy Jersey'.

POLICY OPTION 13: By 2008, the States will ensure that the highest standards of energy efficiency from the UK and elsewhere are reflected in the following documents currently under consultation:

1. Supplementary Planning Guidance in 2007 re Design the New Buildings
2. Design and Policy G.4 - Design Statements

Rating systems

1.259 The Buildings Research Establishment Environmental Assessment Method (BREEAM) is a rating system that is used to assess the environmental sustainability of new developments. Credits are awarded based on the performance of buildings in the areas of: energy use, transport, pollution, materials, water use, landuse, ecology and health and well-being. A set of environmental weightings then enables the credits to be added together to produce a single overall score. The building is then rated on a scale of 'Pass, good, very good or excellent', and a certificate awarded that can be used for promotional purposes.

1.260 BREEAM has specific schemes to assess the environmental impacts of new houses, offices, schools, industrial units and retail developments and other developments can be assessed using a bespoke version of BREEAM. It is proposed that all new developments should achieve minimum of "very good" at the post construction phase and encourages developers and designers to consider environmental sustainability issues at the earliest opportunity.

1.261 Increases capital costs at the design phase should be paid back within the early lifetime of the building. These paybacks would provide savings for the public purse which can be clearly shown and appreciated as part of the project budget and showcased as part of the information available with exemplar projects for others to benefit from.

POLICY OPTION 14 : All States' capital projects will undertake BREEAM / Ecohomes assessment and achieve 'very good' or 'excellent' ratings for energy efficiency. Similar standards should also be achieved for new and refurbished public buildings.

Exemplar projects

1.262 Demonstration or exemplar projects are helpful in promoting standards of best practice. They provide an accessible way to observe the latest energy saving design and technologies and can be used as an educational resource and awareness raising facility. Phase III of the sheltered housing refurbishment at Le Squez will incorporate cutting edge technology which will aim to make the remaining three phases 'carbon neutral.

POLICY OPTION 15: The States will showcase exemplar projects in order to provide assistance to others in achieving the highest standards of design

Recognising the value of the energy efficiency of a building

1.263 An energy efficient building is a valuable asset; well designed buildings are cheaper to run and offer a high standard of living for economic outlay; there is room to improve recognition of this in the housing market. Markets may need assistance in appreciating and valuing energy efficiency as a valuable commodity in a new or existing building. Increases in costs at the building stage in order to achieve these highest standards need to be translated to the consumer who must be made aware that in the long term the initial investment would be paid back through reduced energy bills. Advice and support programmes would highlight this issue and help guide the market.

1.264 The UK are introducing Home Information Packs[49] on 1/07/07 which must be produced at the point of sale. Part of the Pack is and Energy Performance Certificate which is produced as the result of an energy audit. All houses would be rated from A for the best, to G for the worst for energy efficiency and carbon emissions. The EPC, prepared by qualified home inspectors, includes practical information such as current average costs for heating, hot water and lighting in their home. In addition the EPC would recommend which energy efficiency measures could cut carbon emissions from the home and reduce energy running costs, resulting in an improved energy rating.

1.265 The success of the Home Information Pack remains to be proven and the UK's experience will be observed closely. The Energy Performance Certificate has an important role in added value to energy efficiency measures that can be realised for the homeowner at the point of sale.

POLICY OPTION 16: By 2010, 'Sustainable Energy Jersey' will bring forward proposals for the appropriate framework and mechanisms for introducing a requirement for an Energy Performance Certificate (EPC) to be produced to accompany a building at its point of sale.

Commercial energy consumption and the opportunities for energy efficiency

The business case for energy efficiency

1.266 The industrial sector is relatively small in Jersey but improving energy efficiency should still be a priority - it is estimated that if full use was made of the available and viable energy saving technologies in the construction industry, such as thermal insulation, air circulation, electrical equipment, considerable savings in energy consumption could be made.

1.267 Although the market should strive to do this to save on costs it can be assisted by legislation and regulations such as renovation incentives, standards regarding consumption, energy saving thresholds, energy certificates, etc.

1.268 In determining the benefits of capital investment, businesses need to be satisfied that the pay back period is financially acceptable to them. It will be the role of

[49] http://www.Homeinformationpacks.gov.uk

'Sustainable Energy Jersey' to provide an impartial service to help business and industry identify the appropriate and economic measures for each case.

1.269 Apart from the financial incentive, improved environmental performance is now central to good business practice. Offering better value to customers as a result of lower overheads, an enhanced reputation and an increased appeal to potential employees all add weight to the case. In addition there is added value and exposure if best practice is recognised through award schemes like the Jersey Construction Awards hosted by the Jersey Construction Council. A good example, is the Gold Award for Environmental Best Practice[50] that Jersey Water received in 2005 for the Les Platons Water Supply Scheme**.** The implementation of the Scheme, powered by gravity, enabled Jersey Water to achieve its objectives of reducing energy consumption and operating costs – through abandonment of the pumping stations

Policy Option 17: 'Sustainable Energy Jersey' (SEJ) will assist business and industry to identify and implement appropriate energy efficiency initiatives by:

1. Providing advice and support;

2. Encouraging and assisting the carrying out of energy audits and the implementation of efficiency plans throughout business and industry as part of Corporate Social Responsibility programmes;

3. Recognising these achievements through award schemes under umbrella campaigns like ECO-ACTIVE or existing initiative organisations like the Jersey Construction Awards.

Energy use in the protected crop industry

1.270 The protected crop industry is energy intensive and this can be exacerbated if equipment is outdated or inefficiently maintained. There can be significant reductions in both energy use and greenhouse gas emissions if poorly performing machinery is identified and remedial actions are taken to increase energy efficiency. Energy audits are the mechanism for this and typical recommendations include lining greenhouses, thermal screens, shelter belts and waste heat recovery units. Grant assistance for up to two thirds of costs can be claimed through the Countryside Renewal Scheme.

Policy Option 18 : The States will continue to assist the agricultural industry, through the Countryside Renewal Scheme, to carry out and implement the recommendations of farm energy audits

[50] Green Apple Awards, UK

CHAPTER 6 - Pursuing Sustainable Transport Options

Chapter summary

Jersey has very high car ownership and dependency with road fuels accounting for over one third of final energy consumption.

Overall trends are of stabilising energy consumption in this sector due to a saturation of vehicles on the road and new vehicles becoming more fuel efficient. Nevertheless, congestion with associated local pollution and road accidents are acknowledged areas for improvement.

The Integrated Travel and Transport Plan identifies a package of measures to reduce dependency on the private car and reduce peak time congestion by 15%.

Energy policy will work alongside the ITTP to cut transport-related carbon and other emissions by encouraging people away from a dependence on fossil fuel powered transport.

Targets to help achieve this goal are to :

- Reduce peak time congestion by 15% - this will reduce carbon emissions by 11% on predicted 2030 carbon emission levels;
- Using cleaner / carbon neutral fuels or vehicles;
- The use of more fuel efficient road vehicles.

Policy options to achieve this centre on :

1. Education programmes to change behaviour;
2. Fiscal levers to encourage more sustainable patterns of vehicle use;
3. Fiscal levers to encourage fuel efficient cars and alternative fuel vehicles;
4. Spend packages to provide the measures outlines in the ITTP;
5. Support for the growth of oil seed rape for the manufacture of biodiesel locally;
6. To encourage the importation of 5% bioethanol blended petrol.

The States does not propose to tackle energy use by the aviation and shipping industry in isolation. It is accepted that these measures should be examined with the international community. Instead government will work with the EU to address emissions from aviation.
Raised awareness of embodied energy in the products used will allow consumers to make informed choices that also support the local economy and the States will promote opportunities for consumers to off-set the emissions arising from their travel choices.

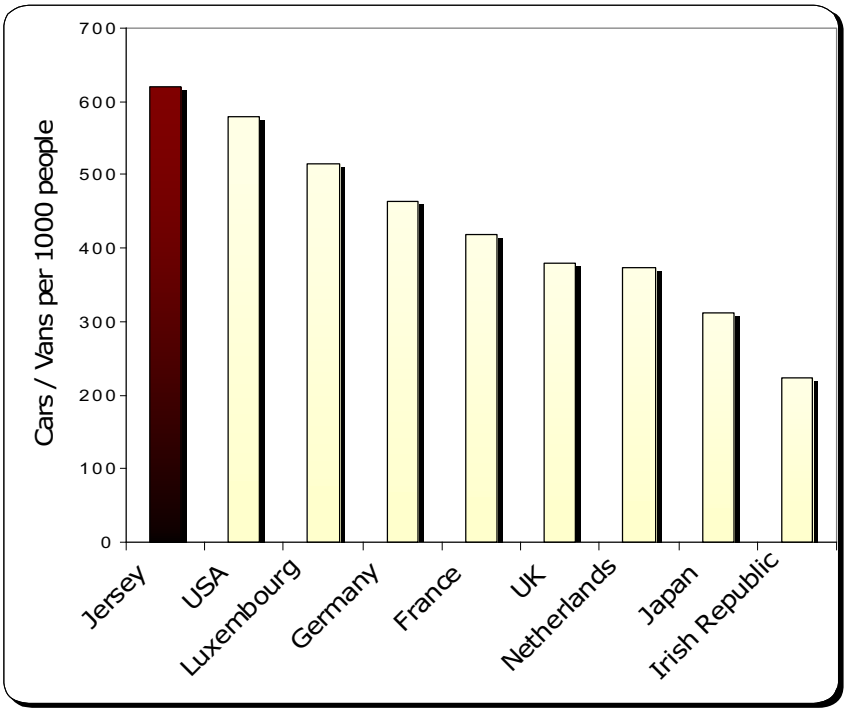
INTRODUCTION AND AIMS

A dependency on road transport

1.271 By international standards, Jersey has a very high car ownership with 1.42 cars per household (Figure 17).[51] Between 1995 and 2005 the number of vehicles in Jersey grew on average by 2.7% per annum - like the UK the reasons for this are likely to include income growth and the declining real cost of car ownership.

1.272 36% of all energy related carbon emissions are from road transport although these have decreased very gradually over the past decade as a result of greater efficiencies in engines, the phasing out of older less efficient cars and the growth in diesel (which is marginally less carbon intensive than petrol, but does cause other emissions). The overall trend of emissions and consumption of fuel, does perhaps suggest that Jersey is near a maximum level of road use and that whilst technical improvements are helping to reduce emissions, there is no evidence of significant behavioural change. Emissions arising from the domestic and business sector have also shown slight increases.

Table 18 The number of cars/vans owned per 1000 people in Jersey (red bar) compared with other countries (yellow bars)



Source 'An Air Quality Strategy for Jersey', AEA Technology 2003

[51] Source: Jersey Statistics Unit (2006), 'The Jersey Annual Social Survey 2005.

A plan for the future - The Integrated Travel and Transport Plan

1.273 The increase in traffic in Jersey has resulted in an increase in congestion and a worsening in the local air quality during peak traffic times. The Integrated Travel and Transport Plan (ITTP[52]) was bought forward in 2006 and identifies some salient issues :

- Over 11,000 people come into St Helier in the morning rush hour in 8,500 private motor vehicles; by comparison only about 700 people come into St Helier by bus at that time;
- There is no spare capacity on the bus fleet at peak times on the most popular routes, in particular the route 1 along the coast to Gorey, and the route 15 through St Aubin to the Airport. In contrast, most of the routes to the northern parishes have some spare capacity at peak times;
- The Connex fleet of buses have far lower emissions than previous fleets;
- A recent survey in the morning rush hour identified that over two thirds of private cars coming into St Helier had only one occupant. The Jersey Annual Social Survey shows that, on a weekday, around 50% of all car journeys are made for work purposes. Around 50% of people travelling to work usually do so by car, on their own;[53]
- 35% of car users driving to work travel a distance of less than 2 miles;[54]
- 2.55 million trips were made on the Connex-run, States subsidised bus service in 2005 with a subsidy equating to £2.6M or £1.04 per person per journey.

Energy use by aviation and ferries

1.274 Jersey is reliant on sea and air links. The total number of passengers (air and sea) in 2005 was 2.36 million, a number that has reduced by about 6% since 2000. The total number of sea passengers (arrivals and departures) for all routes was over 880,000, which is an increase of about 4% from 2004. About 525,000 tonnes of freight were shipped (exports and imports combined) through St Helier in 2005. Exports from Jersey have fallen by about 12% since 2000[55]. 10% of energy consumption in 2005 arose from air and marine transportation to the Island.

1.275 Aviation emissions make a significant contribution to global climate change. It is estimated that the world's commercial jet aircraft generate more than 600 million tonnes of carbon dioxide per year. Globally, it is expected the number of people flying will virtually double over the next 15 years. However it is not just the

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[52] Integrated Travel and Transport Plan 2006 Transport and Technical Services Department, States of Jersey
[53] Jersey Statistics Unit (2006), 'The Jersey Annual Social Survey 2005: Chapter 4 Travel and Transport'; and a survey undertaken for the Transport Plan.
[54] 2005 Jersey household Social Survey, Jersey Statistics Unit
[55] Jersey in Figures 2005 Jersey Statistics Unit

emissions from aircraft themselves that are problematic: carbon dioxide; water vapour; nitric oxide; nitrogen dioxide and sulphur dioxide. At the high altitude at which these gasses are being emitted these chemicals have twice the effect on global warming than they have near ground level. Clearly Jersey has a reliance on aviation and sea links for travel to and from the Island and in turn the underpinning of economic growth. Nevertheless there are opportunities for people to make more informed choices about their travel patterns and choices.

Actions to decrease energy use in the transport sector

1.276 The transport sector contributes to a reliance on imported petroleum products which give rise to carbon emissions. Energy policy, will work alongside the objective of the Integrated Travel and Transport Plan to cut transport-related carbon and other emissions by encouraging people away from a dependence on fossil fuel powered transport. This will mean providing more sustainable alternatives to car use and encouraging an understanding of the impacts of travel to and from the Island.

1.277 Whilst it is the role of energy policy to deliver these commitments, the ITTP sets targets[56] that would assist the first of these commitments in respect of road traffic:

1. To reduce peak hour traffic levels to and from St Helier by 15% - This is the amount which traffic reduces by during the school holidays and is therefore known to reduce congestion and pollution. The challenge is to achieve this reduction against a background of increased economic activity and population growth combined with housing developments outside of St Helier and the Waterfront developments.

2. A 20% reduction in road injury rates by 2011, and zero fatalities - The numbers of injuries on the Island's roads has been falling since the 1970s but despite this downward trend there are still about 400 injuries on Jersey's roads each year. If the public is to be encouraged to take up sustainable transport initiatives like walking and cycling there needs to be confidence that the roads and the way people behave on are safer.

3. Support the Aims of Jersey's Air Quality Strategy in reducing pollution - Reduced congestion would also reduce emissions and associated pollution. Further reductions in emissions can be achieved by the use of vehicles which have lower or zero emissions. Measures in the plan would reduce the volume of traffic and encourage the use of less polluting vehicles, and thereby support the aims of Jersey's Air Quality Strategy.

1.278 Addressing patterns of road use and a dependency on fossil-fuel powered vehicles will achieve the dual targets of energy reduction i.e.

- The stabilisation of overall energy use at 2005 levels.

[56] Draft Integrated Travel and Transport Plan, Transport and Technical Services Department Nov 2006

- An avoided growth in carbon emissions of 31% between 2005 and 2030.

1.279 These targets will be achieved by: the package of measures in the ITTP; the use of 'cleaner' or carbon neutral fuels such as locally produced biodiesel or bioethanol and the use of more fuel efficient road vehicles as incentivised by environmental tax proposals.

MAKING THE CHANGE

The use of education programmes to change behaviour

1.280 Encouraging the use of different types of transport can be successfully achieved through education programmes and campaigns: journeys that would otherwise have taken place by car are substituted by car sharing, journeys by bus, walking or cycling. The ECO-ACTIVE campaign recognises this and identifies transport as one of its 5 themes. It will promote awareness of the need to reduce the reliance on private cars and suggest and perhaps co-ordinate alternatives, for example, work place travel plans, flexible working hours and remote working opportunities. ECO-ACTIVE intends to encourage companies to make public commitments in respect of their Corporate Social Responsibility and so can recognise those companies that are making positive progress.

POLICY OPTION 19: The States will use the ECO-ACTIVE programme to increase awareness of more sustainable transport options in order to achieve and exceed the targets set out in the ITTP.

Fiscal levers to change behaviour

1.281 The ITTP sets out targets and a suite of measures to reduce congestion by reducing dependence on private transport that would contribute to a cut in motor traffic use and thus carbon emissions and congestion as well as improving air quality. The intention is that the revenue from environmental taxes will fund the necessary measures required to implement the package of measures to achieve this.

1.282 The mechanisms include increasing bus and cycle use and changing attitudes and it is recognised that noticeable change may only come about through a "carrot and stick" approach, the "carrot" being improvements to facilities which support public transport, cycling and walking, the "stick" being increased costs of using a car or limitations in the availability of parking.

1.283 The States can support the move to a low carbon transport system by ensuring the appropriate taxation of vehicles, fuels and infrastructure. Levels of fuel duty and duty differentials for alternative fuels and road fuel gases are justified for fuels that have proven environmental benefit. A differential tax rate (either on ownership or usage) would encourage low consumption vehicles or alternative fuel vehicles and penalise so-called 'gas guzzlers'. To assist the public by providing certainty in making investment choices, Government will make a commitment to set and fix duty differentials for all alternative fuels every three years.

1.284 In order to gain public acceptance and confidence in any new tax measure and in line with the 'polluter pays' principle it is important that those exhibiting good behaviour are rewarded. There needs to be a clear link between any taxation and the spend measures that allow behavioural shifts in order to reduce exposure to the tax. The ITTP outlines in detail the spend measures that would be funded through VED proposed to achieve a reduction in congestion, safer roads and improved air quality :

- **Improved public transport** - Around 2% of the proposed real reduction in peak traffic is to be achieved through increased bus usage and this service requires additional funding of approximately £835K annually[57]

- **Support measures** - Initiatives that encourage more cycling, walking, car sharing, tele-working and reductions in unnecessary car trips

1.285 In addition the to revenue raised from any new fiscal mechanism being spent on the proposed measures, VED must also fund general revenue expenditure of around £4M per annum. This will replace the revenue currently raised by the Vehicle Registration Duty (VRD), which is being abolished upon the introduction of GST.[58]

Tax design - Vehicle Emissions Duty (VED)

1.286 In February 2007 a consultation paper was launched suggesting a model for environmental taxes in Jersey whereby tax and spend measures were proposed[59]. The proposals were bought forward jointly by the Minister for Treasury and Resources and the Minister for Planning and Environment. They asked for comment on the principle of raising revenue from either increasing fuel duty or from a 'Vehicle Emissions Duty' (VED). VED is intended to be a banded system based on vehicle emissions with an annual charge that increases for the least efficient and most polluting cars. The UK introduced a similar model – a Graduated Vehicle Excise Duty in 2001 whereby new cars with CO_2 emissions below pre-defined levels have benefited from a reduced VED tariff, so incentivising choices that include the most efficient and least polluting cars.

1.287 The results of the consultation process were supportive of a hypothecated environmental tax that was based on usage rather than ownership. This would indicate a preference for the introduction of fuel duty but at the time of writing, the final proposals are under consideration and will be put forward for debate by the Minster for Treasury and Resources.

1.288 The revenues raised from whichever measure is decided are intended to be streamed through an environmental fund that will be used initially to fund:

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[57] Draft Integrated Travel and Transport Plan, Transport and Technical Services Department Nov 2006
[58] Source: Jersey Statistics Unit (2006),'Jersey Facts and Figures 2005', quoting Jersey Customs and Excise.
[59] 'Funding our Future' A consultation paper on Environmental Taxes launched jointly by the Minister For Treasury and Resources and the Minister for Planning and Environment 28-02-07

- The Integrated Travel and Transport Plan;
- Increased recycling;
- Energy efficiency measures;
- Replacement revenue lost from the abolition of Vehicle Registration Duty.

Independent research[60] has shown that the experience in the UK is that even when there are financial incentives for motorists to chose the most 'environmentally-friendly' vehicles, environmental factors were not the most significant in influencing new car purchasers. However, the proposals for Jersey are likely to be more successful since there is intended to be a return of funding directly into providing more sustainable transport options which will provide real alternatives to car use. In addition, the continued support of education programmes can assist consumer choices and there is a role for the ECO-ACTIVE programme in encouraging the environmental consequences of patterns of vehicle usage and purchasing decisions to be recognised and improved upon.

1.289 The market is right for consumers to immediately benefit from improved purchasing choices, locally there has been a very gradual decrease in road emissions as a result of greater efficiencies in engines, the phasing out of older less efficient cars and the growth in diesel (which is marginally less carbon intensive than petrol, but does cause other emissions such as particulates).

POLICY OPTION 20: The States will implement fiscal measures, as decided in the light of the results of the environmental taxes consultation process in order to:
1. Encourage more sustainable patterns of vehicle use
2. Incentive improved choices of vehicle purchase
3. Raise revenues to spend on environmental improvements including sustainable transport options, increased recycling and energy efficiency programmes.

1.290 State's Departments can take the lead in setting the appropriate example in fuel efficiency whilst also maintaining economic efficiency. The UK sets challenging targets in the 'Powering Future Vehicles Strategy'; by 2012 10% of new passenger cars sold in the UK would have CO_2 emissions of 100g/km or less at the tailpipe. The States of Jersey have a substantial vehicle fleet and many of these could comply with a low emissions standard with the added benefit of having lower running costs.

POLICY OPTION 21 : By 2009, the States will introduce a minimum environmental standard, (which must be adhered to wherever practicable) for new cars procured for official use to emit less than 110g/km of carbon dioxide. This level will be kept under review.

[60] www.dft.gov.uk/stellent/groups/dft_control/documents/contentservertemplate/dft_index.hcst?n=11192&l=4

Achieving improvements in local air quality

1.291 In order to achieve the goal of improving air quality, must not only encourage the purchasing of more fuel efficient and low-emission vehicles; there needs to be a mechanism to ensure that the regular maintenance of a vehicle keeps it compliant with its manufacturer's published emissions levels. The introduction of compulsory annual vehicle emission testing for all/some vehicles would achieve this.

POLICY OPTION 22 : The States will bring forward options for a programme of emissions testing to ensure that vehicles remain compliant with emissions levels set out by manufacturers.

Lower carbon transport fuels

1.292 Despite a current high dependence on the private car and the inevitable dependence on fossil fuels, there are alternative low-carbon fuels available and in use elsewhere. Biofuels commonly refer to the liquid transport fuels biodiesel and bioethanol :

1.293 ***Biodiesel*** : is a renewable source of energy made from plants. It is similar to traditional (mineral) diesel used in cars, buses and lorries, but instead of being produced from non-renewable fossil fuels it is made from plant oils such as peanut, sunflower and rapeseed oil as well as from waste cooking oil.

1.294 Despite its environmental benefits, the use and acceptance of biodiesel in Jersey lags behind other countries for example, biodiesel is widely available in the US and some garages have started to sell biodiesel in the UK. In the UK a few local authorities are specifying biodiesel for their fleet vehicles e.g. Southwark, York and Cheshire County Council. The UK 's tax reduction of 20p per litre of biodiesel from April 2002 has started to encourage the use of biodiesel on a larger scale. Each year c200 tonnes of used vegetable oil is produced on the Island and this previously was sent to the UK for conversion into biodiesel. This operation will be carried out locally from mid 2007.

1.295 ***Ethanol :*** Ethanol (ethyl alcohol) and Methanol (methyl alcohol aka wood alcohol) can be used to fuel internal combustion motor vehicles, either as sole fuels or, more usually, when mixed with petrol (gasoline). Most contemporary petrol cars will run on E10, a 10% mixture of ethanol to petrol, although warranties may state that a mix of 5% is the maximum allowed. In the UK, in 2005, tax concessions for ethanol encouraged a minor shift and a 5% ethanol mixture entered the retail market, the ethanol source being Brazilian sugar cane who is the world leader in ethanol fuel production where today, all non-diesel vehicles run either on gasohol (22% ethanol : 78% petrol) or on neat hydrated ethanol (95% ethanol : 5% water).

1.296 Biofuels must be treated with caution – they are not necessarily the panacea fuel. There is growing evidence that their widespread growth is displacing food crops or natural habitats. For example, 85% of commercial palm oil is grown on plantations in Indonesia and Malaysia, much on cleared rain forest, threatening the home of endangered animals like the orangutan and the Sumatran tiger. There is also concern that these fuels are not as carbon neutral as they might first seem.

Producing biofuels locally

1.297 Greater use of biofuels could reduce carbon emissions and increase security of supply by reducing reliance on fossil fuels. Additional benefits are:

1. Diversification in the rural economy if they were grown locally on appropriate land;
2. Waste management – contributing to the Waste Hierarchy by reusing 'waste' products
3. Assisting in waste management by providing cropped land area not under food production that sewage sludge could be returned to.
4. Residues have the potential to be used as animal feed e.g. oil seed rape cake.

1.298 A study commissioned[61] to investigate the feasibility of the local production of biofuels identified the challenges as:

- ***Economies of scale*** – The availability of sufficient land in order to grow and manufacture sufficient quantities of biofuels locally
- ***Gross-margins of crops*** - The gross margins from biofuel crops is low in comparison to alternative / existing land uses such as food crops for export.

1.299 Potential biodiesel feedstocks in Jersey bearing, in mind husbandry and current agricultural regimes are:

1. Winter or Spring Oilseed Rape – Assuming a five year rotation to avoid the establishment of disease. Spring oilseed rape has the potential to be grown on some land after the Jersey Royal Potato crop although yields will be lower; approximately 2.8t of rapeseed can produce 1t biodiesel and the area available.
2. Used vegetable oil – currently this is already being converted to biodiesel on island and there are further plans for additional capacity in mid-2007.

1.300 Potential bioethanol feedstocks on Jersey are :

1. Wheat – At a yield of 9t/ha locally, 3.2.tonnes of bioethanol per hectare could be produced. Wheat is already grown in Jersey for food purposes at a gross margin of c. £445/ha but if it were grown as a bioethanol feedstock this is likely to reduce to approximately £300/ha
2. Barley – This is currently grown locally at a Gross Margin of £67/ha and is used for cattle fodder
3. Waste Potatoes – Estimates are that between 4,500 and 8,000 t/year of waste potatoes may be available from pack house

1.301 In all instances the gross margins (GM) of biofuel feed crops is lower than that of high value potato crops and so these crops would not displace the existing high value potato crop. However, other scenarios exist for the growing of biofuel

[61] *Development of Jersey Energy Policy'* (March 2007) A report commissioned by the States of Jersey AEA Energy and Environment Ltd.

feedstocks which are more favourable since the GMs are greater than those land uses being displaced[62] –

- The growing of oilseed rape and wheat on suitable redundant agricultural land that is currently uncultivated – estimated to be up to 216 hectares planted with oil seed rape one year in five and wheat for four years in five.
- The growing of spring oil seed rape on land currently used for green manure crops and grass after the Jersey Royal potato crop. Spring oil seed rape would fulfil the functions of returning organic matter to the soil and suppressing weeds. Available land is estimated to be up to 320 hectares in a one in five year rotation.

1.302 Taking the potential yields and areas of land available in the categories above, the analysis[63] shows that it is possible for:

- A maximum of between 270 and 490 tonnes of biodiesel could be produced which would equate to a 5% share of biodiesel
- A maximum of between 1,00 and 1500 tonnes of ethanol could be produced which would equate to an 8% share of bioethanol by weight could be produced locally.

1.303 Since conventional vehicles can use biofuels at up to 5% blend (assuming they meet quality standards) there is clearly a market for these fuels locally if they were blended with mineral fuels. Whilst direct sales through the forecourts are likely to be problematic due to the existing contracts with suppliers, a more direct route to on-farm vehicles or dedicated States' diesel fleets for example would be simpler and provide assured sales.

1.304 Any displacement of imported hydrocarbon fuel oils by biofuels would result in a reduction in fuel duty revenue but at the levels of the scenarios described here would be in the region of £133,000 for a 5% share in biodiesel displacing diesel or £379, 000 for indigenously produced bioethanol displacing imported petrol (using 2007 rates of duty).

1.305 There are several reasons to favour the production of biodiesel over bioethanol:

- Biodiesel is already being produced locally from waste vegetable oil;
- It is economic and achievable to add a seed crushing plant to process oil seed rape to the existing waste vegetable oil operation although this will require discussion with the existing incumbent;
- Markets can be assured from dedicated diesel fleets of on-farm vehicles or even States' diesel fleets;
- The forgone revenue from diesel fuel duty is lower than from petrol fuel duty;

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[62] *Development of Jersey Energy Policy'* (March 2007) A report commissioned by the States of Jersey AEA Energy and Environment Ltd.

[63] *'Development of Jersey Energy Policy'* (March 2007) A report commissioned by the States of Jersey AEA Energy and Environment Ltd.

- The production of bioethanol requires the addition of waste potatoes to achieve sufficient tonnages but these could equally be used on the Anaerobic Digestion process (Chapter 8) and so are discounted from the calculations
- The growth of wheat and barley for bioethanol production requires the current land area used for these crops to be turned over to biofuel production; However, growing wheat and barley would realise lower GMs than currently where they are destined for food or cattle fodder production and so it is unlikely that the switch would be made.

1.306 The production of biofuels contributes to the diversification of the local economy and may be eligible for support under the Rural Initiative Scheme which is a grant-based initiative for rural enterprise which can fund up to 50% start up costs. Additionally the single area payment of £35 per vergee per year is applicable and capital grants might be available from the Countryside Renewal Scheme (CRS). The CRS requires schemes to demonstrate and environmental benefit so the production of biofuels would only attract support if the proposed scheme included extra benefits such as buffer strips etc. The potential availability of such support adds to the economic case for the production of biofuels and can assist in start up costs.

POLICY OPTION 23: The States will bring forward a Biodiesel Action Plan by 2008 that will address the role of the local production of biodiesel in :

1. Reducing diesel imports by 5% with a consequent reduction of c.420 t/carbon per annum[64];
2. Diversifying the rural economy;
3. Increasing the economies of scale of the existing waste oil reprocessing plant;
4. Contributing to the principles of the Rural Initiative Scheme and Countryside Renewal Scheme (and thus qualifying for grant aid);
5. Providing areas of land under oil seed rape production that can be used to return sewage sludge back to land

Importing biofuels

1.307 The local growing and manufacture of bioethanol might prove to be less favourable than the production of biodiesel. Therefore a simpler way to reduce dependence on imported hydrocarbons may be to import petrol that already has a 5% ethanol mix, this can be used in conventional cars with no modifications. For example, Tesco has converted all of its filling stations in the SE and NW of England to 5% bioethanol (and biodiesel) blends.

1.308 Both France and the UK present possible sources of bioethanol for importation – in 2004 France was the second largest producer of biodiesel and bioethanol in the EU whilst the UK currently imports all its bioethanol from the Continent. The feasibility of importing biofuel blended petrol under existing contractual obligations

[64] 10126 tonnes of diesel imported in 2005 = 8,455 tonnes carbon; 5% reduction = 423 tonnes carbon.

will be investigated. As well, the origin of imported bio-fuels should be considered and the sustainable origin of bio-fuels must be verified.

1.309 This would have the effect of reducing carbon emissions by 1,153 tonnes on 2005 data[65]. Imported non-fossil fuels would not be subject to duty and this would represent a loss in revenue of £379K; 1.9% on 2005 figures.

POLICY OPTION 24: To investigate with the fuel companies the potential of importing a 5% ethanol mix in petrol by 2009 with the consequent reduction in emissions of c.1,150 t/Carbon per annum.
It is important to ensure that any imported bio-fuel comes from a sustainable source, is carbon neutral and its production is not contributing to environmental degradation in the country of origin.

Alternatively powered vehicles

Petrol-electric hybrids

1.310 Petrol-electric hybrid vehicles use a combination of a conventional petrol engine and an electric motor powered by an energy storage device such as a battery pack. They work on the principle that an electric motor provides the power at low speeds such as in urban driving, with petrol for driving at higher speeds. The batteries are recharged while driving and hybrids use regenerative braking, which means that energy is put back into the battery when braking, which improves energy efficiency. Hybrid technologies improve fuel efficiency and therefore provide considerable fuel savings compared with a normal petrol vehicle – as well as carbon emissions savings.

1.311 Purchase costs are greater than conventional cars but running costs can be two-thirds that of equivalent petrol-fuelled vehicles. Maximum fuel economy benefits are achieved in built-up areas where they primarily run on electric rather than petrol so whilst they may not be better than, for example, a fuel efficient diesel on a motorway drive, in an urban environment like Jersey their performance will be maximised. The UK recognizes these environmental benefits and offers reduced vehicle excise duty; favourable budget treatment and exemption from the London Congestion Charge.

Battery-electric cars / scooters

1.312 Electric cars / scooters use a battery and electric motor to power the vehicle, meaning they have no emissions at the point of use. Currently there are two electric models of car on the UK market. Due to the capacity of the battery, their range is normally limited to about 40-60 miles between recharges, which means they are often only considered suitable for city-based users but given the average journey length locally (3.3miles[66]) they are also very suitable for use on island. Electric vehicles can be recharged by plugging them into an existing electrical socket (taking c.6 hours). However, whilst making a clear contribution to cutting

[65] 27858 tonnes petrol imported in 2005 = 23,068 tonnes of carbon 5% reduction = 1,153t/c
[66] Jersey in Figures, 2006 published by the States of Jersey Statistics Unit

pollutants that cause poor air quality, they are only truly 'green' if they are recharged with electricity from renewable sources such as windfarms. Jersey's nuclear / hydro sourced mix of electricity means that both electric cars and scooters represent a very low–carbon transport option.

1.313 The environmental benefits afforded by electric cars are recognised in the UK where they are not subject to road tax and they also enjoy a 100% congestion charge discount and they can receive discounted residential parking permits. Although the lack of tailpipe emissions and low noise levels are benefits, their batteries are lead or cadmium-based, and must be properly disposed of at the end of their life to avoid serious pollution.

Autogas – LPG

1.314 Vehicles running on Autogas produce far fewer of the harmful emissions that contribute to environmental and health problems. In 2004, the results of the European Emissions Testing Programme[67] confirmed the environmental benefits of Autogas particularly in respect of contributing to improved air quality:

- **Carbon Dioxide** - Autogas is 17% better than Petrol and 2% better than Diesel;
- **Small Particle Emissions** - Autogas vehicles produce 120 times less small particle emissions than diesel vehicles;
- **Nitrogen oxides** - LPG emits 20 times less NO_x than diesel and around half that of petrol.

1.315 The use of LPG also contributes to the UK's security of supply since it is produced as a by-product of the oil refining process and around 3 million tonnes of LPG per annum are exported from the UK. These advantages are recognised by UK in the following ways :

- **Fuel price**: Duty is not paid on LPG so that it is typically around half that of petrol or diesel.
- **London Congestion Charge**: Many autogas vehicles qualify for a 100% discount.
- **Company Car Tax**: CO_2 emissions in LPG are lower than equivalent petrol cars thus pay less company car tax. On top of that, the Government allows a further 1-2% discount on this tax when the vehicle is registered as bi-fuel.
- **Vehicle Excise Duty**: New Autogas vehicles may be eligible for lower rates of Vehicle Excise Duty (Road Tax) as they produce less environmentally harmful emissions.

1.316 In Jersey import duty[68] is set for low sulphur fuels i.e. higher octane petrol, unleaded petrol and diesel pay 39.58p, 38.02p and 38.02p per litre respectively and for high sulphur dutiable hydrocarbon oil it is 41.13p per litre. There is no duty

[67] http://www.energysavingtrust.org.uk/fleet/Vehicles/Alternativefuels/LPG/
[68] States Of Jersey Customs And Immigration Excise Duties (Impôts); First Schedule – Customs & Excise (Jersey) Law 1999

payable on LPG in Jersey making it at approximately half the pump price of conventional fuels at the point of purchase.

POLICY OPTION 25: The States will ensure that the environmental benefits of dual, alternative and cleaner fuels are reflected in any fiscal mechanisms applied to transport.

Emerging technologies

1.317 New fuel types such as hydrogen cell-powered vehicles could help to change the dependence of road transport on fossil fuels. Vehicles powered by hydrogen fuel cells are a particularly exciting development although at a commercial level, hydrogen powered vehicles are some 10-15 years away and there are technological issues which fuel companies are currently working on resolving. Nevertheless, the States must keep abreast of developments and their on-island applicability.

POLICY OPTION 26: The States will monitor advancements in the practical availability and adoption of cleaner/alternative fuels with a view to encourage the adoption of proven technologies at the earliest possible opportunity through incentives in any fiscal mechanisms applied to transport.

Travel to and from Jersey

1.318 External links from a small Island economy are necessary and unavoidable. Any attempt to introduce fiscal levers to reduce air travel such as energy taxes would simply cause airlines to refuel off island since aviation fuel is not taxed elsewhere. There might be opportunities to change behaviour by the introduction of some form of 'passenger levy' which might be less avoidable. However, the demand for air travel is relatively insensitive to price. Therefore high levy rates might be required in order to make any material difference to demand for flights and their consequent emissions from flights to and from Jersey. In addition, application of tax in Jersey is unlikely to have much impact on the type of aircraft being used (i.e. to induce switching to more fuel efficient aircraft) so any reduction in emissions would need to arise from either a reduction in the frequency of services or the use of smaller aircraft, which actually might have higher emissions per seat kilometre.

1.319 Furthermore, levies applied just to Jersey routes may have little impact on the global emissions from aircraft, even if they succeeded in reducing the emissions on routes to and from Jersey. This is because potential inbound tourists put off flying to Jersey by higher flight costs may substitute alternative destinations that involve an equal (or even greater) emission of carbon. The impact of a Jersey levy on global carbon emissions would probably have to come mainly from Jersey residents who either fly less often, or substitute travel by sea for their journeys. Finally, levies that were effective in reducing demand for air travel to and from Jersey are likely to have a significant detrimental impact on the Jersey tourism industry and the economy generally.

1.320 This difficultly is faced at the international scale and the European Commission plans to present a Communication on climate change and aviation shortly. The Communication will focus in particular at the use of economic instruments (such as fuel taxation, emissions charges or emissions trading) which would promote energy efficiency and greenhouse gas reductions in the sector. In addition the EU has agreed that aviation should be included in the EU Emissions Trading Scheme from 2008 although there was no consensus what carbon caps should be imposed in the first sector. The UK has reserved the option to act bi-laterally if they consider progress towards international agreements too slow[69].

1.321 Currently it is believed that the most effective way to tackle this problem is to monitor international progress and apply appropriate best practice as solutions are recommended.

POLICY OPTION 27: The States will keep a monitor EU progress in addressing the emissions from aviation and apply advances locally.

1.322 In order for Jersey to indicate how seriously it takes its carbon emissions at the international scale a carbon negation programme must account for emissions that arise as a result of air travel. Education programmes would also encourage people to take personal responsibility for their carbon emissions for their air travel.

POLICY OPTION 28: The States will provide the opportunity for people to off-set their carbon emissions arising from travel through the provision of a localised carbon calculator as part of the ECO-ACTIVE education programme

[69] The Energy Challenge (July 2006) Department of Trade and Industry

Part 3 - Making Sustainable Energy Choices

The longer-term challenge is to promote the use of low-carbon energy sources, low greenhouse gas technologies and renewable energy sources"

Kofi Annan, UN Secretary-General, Message to COP10 of United Nations Framework Convention on Climate Change, December 2004

Preface to Part 3

1.1 At the level below 'decreasing energy use' in the Energy Hierarchy is 'using low carbon fuels' followed by 'using less imported energy'. Together these represent making more sustainable energy choices. Sustainability is linked to security of supply and Jersey can increase its security of supply by reducing its reliance on imported power, instead making use of its indigenous energy resources. The success of an energy policy for Jersey is indicated in the States' Strategic Plan by a number of measures but there is a commitment to '*Increase in percentage of energy production from indigenous sources'.* By 'de-carbonising' Jersey's fuel choices away from high-carbon fuels that are finite over the long term, the Island will increase its security of supply and reduce its vulnerability to global energy prices.

1.2 Superficially there appear to be opportunities to harness Jersey's vast natural energy resources at the utility scale – and the opportunities and barriers to the development of tidal and wind power are examined in Chapter 7.

1.3 There are also options for on-island power generation in the way that Jersey will be dealing with its waste – both from the population but also the waste that arises from the livestock industry. Chapter 8 examines how power generation might be 'decarbonised' by generating power from local waste products; this examination is particularly timely given the current procurement of the new Energy from Waste plant and the restructure of the dairy industry. On-island renewable energy can be also generated from energy crops and the manufacture of bio-fuels like bio-diesel or bio-ethanol. Chapter 6 considers the economic case and the contribution to carbon emission reductions.

1.4 Microgeneration allows the small scale generation of energy at the community or individual level normally from renewable sources. This allows individuals to take personal responsibility for their own energy use and generation and there are many proven and economic technologies on the market already. These are examined in Chapter 9 and an analysis is made of how their uptake might be encouraged.

1.5 Sustainable energy choices could also be made simply by choosing among the Island's existing fuel options to favour those with lower carbon intensities. Also, rather than the potentially expensive exploitation of natural resources, Jersey has the option of importing a greater proportion of renewable energy – for example the hydro/nuclear sources electricity mix means that Jersey currently imports 20% of electricity from renewably generated resources. This equates to about 6% of total primary energy arising from renewable sources currently, Chapter 10 examines the opportunities and barriers to increasing this.

CHAPTER 7 – Energy Options for Jersey at the utility scale

Chapter summary

One way to decarbonise the economy and increase security of supply is to exploit indigenous energy resources, however this is a long term vision and until large scale renewables become viable. Energy policy will ensure that energy choices account for the carbon content of the fuels used to minimise emissions and decarbonise the local economy and increase the security of supply.

This can be achieved by exploiting indigenous energy resources. A preliminary assessment of Jersey indigenous energy resources show that :

1. Jersey has a very good on and off-shore wind resources. However, there are likely to be insurmountable planning barriers to exploiting on-shore wind resources. But there is some potential for exploiting off-shore wind although this is very expensive – A 90MW offshore wind farm costs in the region of £135-160M.

2. Jersey's large tidal range makes it attractive as a test-ground for proven technologies such as tidal barrages of emerging technologies such as tidal lagoons. The environmental impact of tidal barrages is likely to prove insurmountable for Jersey. However, the States can offer attractive conditions for research and development and this may encourage the trails of tidal lagoon technology in local waters.

To achieve the aims, the States will

1. Carry out a further, more detailed feasibility study into off-shore wind generation and if a suitable area can be identified it will look to put mechanisms in place to encourage inward investment for such a project

2. Put in place mechanisms to encourage inward investment for research and development in tidal technologies in Jersey waters.

INTRODUCTION AND AIMS

1.6 An increasing demand for energy together with the finite nature, escalating costs and pollution associated with fossil fuels has led to the investigation of alternatives. Two main options have been identified - nuclear energy and renewable energy. Nuclear generation is a proven technology capable of meeting large scale intensive energy requirements. The problems associated with nuclear waste disposal are well known and the subject of international research. The current debate centres on the need to replace existing nuclear facilities and the absence of any replacement technologies other than fossil fuel power stations to take up that capacity. Energy from renewable sources is becoming an increasingly viable option, but is still not capable of displacing anything other than a small fraction of existing generating capacity.

1.7 Renewables contribute to certain aspects of security of supply. Local generation would not be disrupted by international crises. But some types of renewable energy would create additional system complications, depending on the extent to which they are intermittent (wind energy, wave energy, tidal and solar) and on the types of generation they displace. Intermittency causes additional system costs. And as the proportion of intermittent generation increases, the cost of maintaining stable supplies also increases[70]. The UK Energy White paper recognises that these costs need to be managed and new ways found to minimise them. Research is being funded through the DTI's Renewable Energy and the Engineering and Physical Sciences Research Council's (EPSRC)[71] SUPERGEN[72] programmes.

Jersey's relationship with nuclear energy

1.8 Jersey's entrance to the Continental energy market via the interconnectors has provided significant benefits. The JEC regularly go out to competitive tender for electricity and are able to buy from any supplier that can meet the terms of the tender. The current tender is met by a framework contract with Electricité de France (EDF) which runs until 2012.

1.9 Nuclear power provides around 20% of the UK's electricity and this is about 8% of the UK's total energy needs. Without intervention, this proportion will decrease over the next 30 or so years, based on the current schedule of plant retirement[73].

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[70] The additional system costs - attached to transmission, the distribution network and balancing generation and demand - of 20% and 30% of electricity supplied by intermittent generation is equivalent to a maximum of £0.9/MWh and £2.20/MWh respectively. It is quite possible that technical developments in storage, fuel cells and load management may by 2020 reduce such costs. *Quantifying the system costs of additional renewables in 2020 (Ilex, 2002)*. www.dti.gov.uk/energy/developep/080scar_report_v2_0.pdf

[71] The UK Government's leading funding agency for research and training in engineering and the physical sciences www.epsrc.ac.uk

[72] Sustainable Power Generation and Supply initiative www.epsrc.ac.uk

[73] 'The role of nuclear power in a low carbon economy' Sustainable Development Commission Position Paper March 2006

However, the UK[74] have taken the stance '*that nuclear has a role to play in the future UK generating mix alongside other low carbon generating options'.*

1.10 The UK base their argument on multiple factors including :

1. The need to fill the 'generation gap' created from the planned closure of existing nuclear and coal plants, over the next 15 years, which will create a shortfall in electricity generating capacity. Arising from this generation gap is the concern that there will be the construction of more gas-fired electricity generation, so increasing CO_2 emissions;

2. An increasing reliance on gas imports raise concerns over adequate security of supply with potential impacts on both electricity generation and heat supplies. In addition it is speculated that over reliance on gas will destabilise energy prices which could rise substantially over time, with potential impacts on the economy and fuel poverty;

3. Finally the argument of the 'technology gap' is used *'A substantial element of nuclear new-build will be required for the next generation as other low carbon technologies will not be sufficiently developed for the UK to rely on them alone in order to provide secure adequate power supplies and to achieve meaningful emission reductions by 2020'*[75]*.* Other commentators not share this opinion and believe that the UK power sector could cut its emissions without expanding nuclear capacity if significant increases in generation from renewable sources (up to 25%) were realised[76].

1.11 34% of European electricity is generated by nuclear power. Proponents argue that it offers an independent and stable means of meeting a large share of European energy demand, while avoiding a rise in greenhouse gas emissions equivalent to the entire European car fleet. It is argued that nuclear power has had a positive contribution to the European electricity market in terms of contributing to:

- the EU's goals for security of supply;
- continuity of electrical supply at competitive prices; and
- combating climate change.

1.12 France has long supported the production of nuclear energy with over 75% of their electricity demand being met from nuclear. They do this for reasons of strategic energy independence and economic growth and early in 2006 announced plans to expand their nuclear capability by 2012 and with further capacity using the newest technology by 2020.

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[74] The Energy Challenge July 2006 Energy Review A Report published by the Department for Trade and Industry

[75] '2020 Vision : The next Generation Meeting UK Power Generation Objectives in 2020- A Strategic Insight. A report by Deloitte

[76] 'The Balance of Power ; Reducing CO2 emissions from the UK power sector' A Report for WWF-UK by ILEX Energy Consulting May 2006

1.13 However, it is recognised that the nuclear industry itself creates challenges which must be managed. The nuclear debate will continue with concerns regularly raised over:

- Nuclear safety - although both the UK and French would argue that they have an exemplary safety record;
- The safe processing and storage of waste ;
- The true carbon costs of nuclear – some argue that the true life cycle analysis of the carbon costs of nuclear are not as low as the nuclear industry would suggest; it is argued that the continuing need to mine uranium to fuel nuclear power generation increases the carbon analysis. However if this argument were made on a like-for like basis and the life cycle analysis of hydrocarbon generation were compared to nuclear it is still likely that the GHG emissions from nuclear power generation are far below those from fossil fuels;
- Finding appropriate sites for increased nuclear infrastructure that meet operational requirements for the future. For example, in the hot summer of 2006, July saw some nuclear production shut down due since the elevated temperatures prevented sufficient cooling of the plant and discharged waters were too warm to be released back into rivers on environmental grounds. It must be noted that coal fired powered stations relying on river water for cooling suffered similar disruption[77].
- Sufficient fuel resource should nuclear capacity increase – Many would argue that there are sufficient proven stocks of Uranium, recycled plutonium and in the long term thorium to meet needs until 2050[78].

1.14 The nuclear debate will no doubt continue with often diametrically opposed views. Indeed locally, some people may never feel comfortable with using nuclear power to generate their electricity, nor with the proximity of the nuclear reprocessing facility at Cap de la Hague and the Flamanville power station. In August 2006, The States of Jersey formally objected to the proposed third reactor at Flamanville raising some concerns in respect of the design and operational safety of the plant[79]. Since then the Chief Minister and his officials and advisors has held discussions with Governmental representatives of the Normandy area and EdF. The aim of these was to seek assurances on the matters of safety and contingency planning raised in the formal objection.

1.15 However perhaps it is useful to consider that regardless of Jersey's opinion, both of its neighbouring nations have decided to generate a significant proportion of their power from nuclear plant and are expanding their infrastructure to accommodate this ambition.

1.16 That does not mean Jersey must choose to purchase nuclear electricity but there are price consequences and potentially carbon impacts if it does not. The two existing inter-connectors to the continental mainland make us secure customers of

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[77] e.g. http://www.commondreams.org/headlines06/0728-06.htm or http://www.speroforum.com/site/article.asp?id=1675

[78] Nuclear Power and Climate Change' A report for the Nuclear Energy Agency

[79] http://www.gov.je/ChiefMinister/International+Relations/Flamanville3.htm

the European energy market. The present contract with EDF is signed until 2012 and was the result of a competitive tender process which considered a number of criteria including price and a low carbon footprint. Jersey has benefited by having electricity costs significantly lower than the UK and making an albeit one-off, large reduction in carbon emissions.

1.17 However, the Channel Islands Electricity Group (CIEG) is not obliged to purchase 'French nuclear' electricity. Instead Jersey could choose to buy non-renewably generated electricity from other European countries but it would probably have to pay increased costs as a result of transmission charges across the grid network. This route would also increase Jersey's carbon footprint. In addition, Jersey could choose to purchase more renewably-generated electricity as part of its contract but is likely to be faced with increased costs since renewable electricity generation costs are higher – sometimes up to four-fold. Such a rise is likely to have strong social and economic repercussions.

1.18 Coming to full agreement on Jersey's stance on nuclear may never be possible. However, accepting that all energy has some form of environmental impact the obvious solution at the first level is to reduce energy use and Chapters 5 and 6 have proposed ways that this can be achieved.

1.19 The second level of the Energy Hierarchy ranks using low-carbon energy as the next step since GHG emissions are the most environmentally damaging by-product of energy use. Consequently, energy should be sourced from low carbon sources.

1.20 The third level of the Energy Hierarchy ranks reducing imported energy as the next most important step below reducing energy use and using low carbon fuels. One way to do this is for Jersey to exploit its' indigenous energy resources and this can be done at the utility scale as well as the microgeneration level (which is considered in Chapter 9).

1.21 The fourth level of the Energy Hierarchy looks to minimise other environmental impacts. This suggests that renewables would be favoured over nuclear energy if their environemental consequences were judged to be less damaging than the environmental impacts of nuclear energy, notably the problems associated with the long term disposal of radioactive waste. There are economic and therefore social consequences to importing more renewably generated electricity and utility scale generation is both costly and much constrained by the available proven technology as well as the availability of appropriate sites.

Renewable energy sources (RES)

1.22 The UK Utilities Act 2000, defines renewable energy as 'sources of energy other than fossil fuel or nuclear fuel' i.e. energy obtained from naturally occurring and replenishing elements within the ecosystem e.g. from the sun, the wind and the oceans, and from plants and the fall of water. The EU has set a target of 12% of energy consumption to be derived from such sources by 2010 but the 2007 EU's

Energy Policy[80] considers that this will not be achieved and that 10% is a more likely outcome. Nevertheless, in recognition of the considerable benefits of renewably generated energy the Commission has proposed a target of **20% by 2020**[81].

1.23 In 2005, 28 % of Jersey's final energy consumption was electricity. The nuclear: hydro source of Jersey's electricity is split 80:20 in favour of nuclear. This means that of Jersey's total final energy consumption, nearly 6% in derived from renewable energy, some way below European targets.

1.24 Currently, Jersey does not exploit any indigenous renewable sources of energy at the large scale although there is increasing interest in 'microgeneration' at the small scale particularly using ground source heat pumps, solar and wind power.

Actions to make choices in relation to sustainable energy resources

1.25 The Energy Hierarchy accepts that all forms of energy production have environmental consequences of one degree or another, be it carbon emissions from the burning of fossil fuels, the waste products produced by the nuclear industry or the use of chemicals and high energy consumption in the manufacture photovoltaic cells. The Energy Hierarchy allows us to prioritise energy choices:

1. *Decreasing overall energy use*
2. *Reducing the carbon content of the fuels used*
3. *Using less imported energy*
4. *Reduce other impacts of energy production*
5. *Off-set unavoidable carbon emissions*

1.26 By making the appropriate choices in terms of energy procurement and generation, Jersey can reduce carbon emissions and increase its international reputation as well as increasing its' security of supply by ensuring that energy choices account for the carbon content of the fuels used to minimise GHG emissions and decarbonise the local economy to increase the security of supply. This will mean ensuring that the Island's energy is of as low a carbon content as possible and investigating the opportunities for Jersey to exploit its indigenous energy resources

[80] 'An Energy Policy for Europe' : Brussels 10.2.2007 COM (2007)
[81] 'Renewable Energy Roadmap : Renewable Energies in the 21st Century; building a sustainable future' – COM (2006) 848

MAKING THE CHANGE

Utility scale marine resources

1.27 Energy is created in the marine environment in three main ways:

1. Tidal flows or streams – As tidal waters are funnelled through channels and straights or into and out of bays and estuaries currents are formed with varying degrees of potential power.

2. Tidal range – The land masses of France and England cause tidal flows to be constricted with the effect of increasing the tidal range and as a result of this Jersey has the forth highest tidal range in the world with a maximum spring range of 12m.

3. Wave energy – As winds and tides create friction at the surface layers of the oceans, waves of varying height are formed. The prevailing west south-westerly conditions on Jersey and the relative shelter caused by the proximity of the French Mainland means that average wave heights are around 1-1.8m.

1.28 The main technologies for harvesting power from these energy sources are :

a) Tidal barrages– these impound water to achieve a significant height difference between the contained water and that outside. Water is then released through turbines at a sufficient and controlled rate to generate power. Jersey has a working example of a hydroelectric station on its doorstep, La Rance Tidal Barrage in Brittany, which is successful because it can provide much greater energy in proportion to the size (and thus cost) of the impoundment structure. Although the barrage has now recovered its capital costs and the generation costs for the output are less than nuclear power, there have been environmental consequences of the impoundment scheme.

b) Tidal lagoons – These operate under the same principles as barrages but have been proposed as alternatives with lesser environmental impacts compared to barrages. Tidal lagoons can be sited clear of the shoreline avoiding the negative consequences of interfering with the natural tidal range and flow at the shoreline and in estuaries. However, there can be significant costs in engineering and building the impoundment structure offshore. The potential capacity of tidal lagoon schemes around Great Britain and France has been estimated at[82]:

- Severn Estuary – 4,500MW
- France – 2000MW;
- North Wales and Liverpool approaches – 1,500MW
- Thames Estuary – 150MW
- Jersey – 60MW
- Guernsey – 50MW

1.29 Tidal Electric Limited indicates that tidal lagoons could be cost-competitive with offshore wind where the site characteristics are optimum for the technology.

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[82] http://www.tidalelectric.com/ProjectsUK.htm

Despite the apparent attractiveness of these options, it should be noted that no schemes have been taken forward to the firm planning stage yet.

1.30 Considering the environmental and planning aspects separately, a high level technical and economic analysis has been carried out on the potential for tidal lagoons off Jersey[83]. The conclusions are summarised as follows :

- Although the high tidal range of Jersey's waters appears promising, compared with other locations such as the Severn estuary, the Baie Du Saint Michel or the Thames estuary, the areas of similar depth water are much smaller.
- The bathymetry is complex with rocky bottoms causing construction challenges and associated elevated costs.
- They are expensive - Indicative information from preliminary viewing of the marine charts suggests that of 5 potential sites capital costs vary between £160M and £1,800M with operating costs of up to £3,300K per MW. Projecting generating costs are significantly greater than large-scale offshore wind.
- Of the potential five sites all have significant factors that could lead to their preclusion such as Ramsar designation, conflicts with fisheries or environmental concerns

b) ***Tidal stream or marine current***

1.31 A tidal stream turbine works in a similar manner to a wind turbine except that it is structured under the sea either fixed to the sea bed or as a floating device. The relative high density of water compared to air means that the diameter of the turbine can be smaller than wind turbines for the same output. Since tidal streams are a diffuse source of energy, large numbers of devices need to be spread over relatively large areas of sea bed.

1.32 The potential amount of renewable energy that can de derived from the sea is immense yet tidal stream energy is an underexploited source. Tidal stream technology is currently in its infancy and companies are testing various types of technology in UK and Channel Island waters. Alderney is well placed to exploit the energy that exists as a result of the tidal streams running through the swift channel that separates the Island from France. Alderney Renewable Energy (ARE) has been set up to develop and exploit tidal stream power in the area and companies are test-bedding their technologies in these waters.

1.33 The Bailiwick of Guernsey has invested £250,000 for an equity stake in the UK company, Marine Current Turbines Ltd, whose SeaGen programme (supported by Electricité de France) aims to develop the world's first commercially viable underwater turbine. It has the potential to become one of the first areas in the UK

[83] Development of Energy Policy, AEA Energy & Environment report for the States of Jersey March 2007

to promote the use of tidal stream energy. Another area currently under consideration is the Pentland Firth, situated between the northern Scottish mainland and the Isles of Orkney.

1.34 The tidal stream velocities surrounding Jersey are estimated to be 3 to 3.5m/s which would be marginal for development and their resource potential does not compare favourably with Alderney or other areas of the UK for testing purposes. However as the technology becomes developed the business case for tidal stream exploitation should be revisited.

Planning barriers to the development of offshore marine renewables

1.35 The modes of operation and the location of the various technologies cause varying impacts on the environment. Currently the UK Government is carrying out a Strategic Environmental Assessment for marine renewables including offshore wind, wave and tidal power. This study will identify high resource areas and investigate the likely environmental impact prior to development.

1.36 For all commercial scale developments an Environmental Impact Assessment (EIA[84]) is necessary which will need to account for the following factors that are described in summary here:

- **Biological effects** – Although dependant on the technology chosen, scale and location of the development, the main issues are habitat loss, impacts on fisheries and fish spawning areas and flora and fauna;
- **Physical effects** – Including the disruption of the tidal and wave regime affecting sediment process;
- **Visual impact** – Clearly technologies operating close to, at or above the surface have the greatest impact; the impact of associated structures must not be overlooked;
- **Navigation** – It is imperative to quantify and mitigate any impacts with boating and fishing being key local industries;
- **Noise** – All mechanical structure will emit noise through the air or water whose effect on the marine life and residential amenity of the area or nearby shore must be accounted for and mitigated;
- **Archaeological** – The archaeological sensitivity of a site must be thoroughly investigated;
- **Decommissioning** – The environmental impact of the decommissioning process at the end of the design life of devices is an important part of the life-cycle analysis of the structure;

[84] http://www.jerseylegalinfo.je/Law/display.aspx?url=lawsinforce%5chtm%5cROFiles%5cR%26OYear2006%2fR%26O-106-2006.htm

- **Human environment** – Appropriate consultation with the relevant bodies are crucial to determine the impact on a range of activities including fisheries, sub-sea cables, tourism activities and aggregate extraction.

1.37 The influence of each of the potential issues outlined here will depend on the individual project but should there be a lack of mitigation opportunities, a development could fail to secure planning approval.

Utility scale wind resources

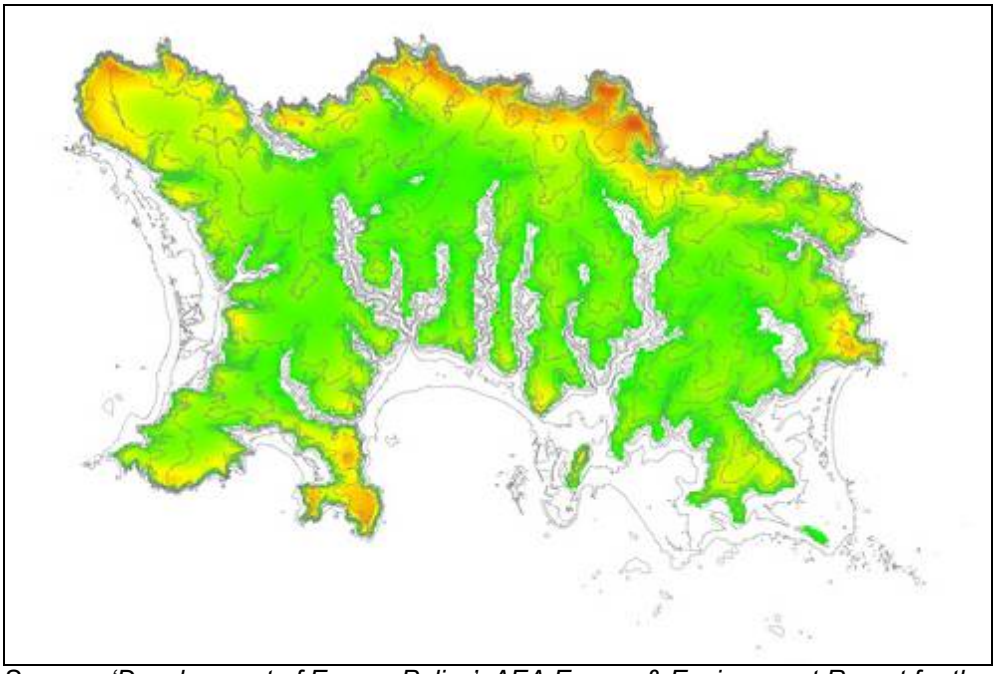
1.38 Wind turbines use the power of the wind to drive a generator and range in size from micro-turbines used for domestic installation to large utility scale up to 120m tall. Current technologies installed onshore deliver 1-2 MW with a hub height of 60-80m with rotor diameters of 80m. Wind has been the fastest growing renewable energy source for the last seven years and is expected to increase due to decreasing costs making it one of the cheapest large scale renewable technologies available.

1.39 The UK has good offshore wind resource with over 33% of the total European potential – this alone could meet the UK 's target of 10% of electricity from renewable technologies. If this potential wind energy were converted, it would generate a market of £48 billion in the UK alone, and an estimated 35,000 jobs in domestic manufacture and supply. France plans to produce 3,000 MW of wind-generated electricity from 21 separate wind farm projects by the year 2010 and five of those farms will be based in Brittany. *Jersey will need to be alert to proposed developments to ensure that the impacts on Jersey's environment are taken into account.*

Onshore wind resource in Jersey

1.40 A high level analysis has modelled the onshore wind resource for Jersey to be very good (Figure 21). In terms solely of the wind resource the north coast of the Island is especially good as is the west coast and a large area of the western escarpment.

Figure 25 Average mean wind speeds on Jersey.
White areas are below the 7m/s threshold and increasing wind speed is shown from green to red



Source : 'Development of Energy Policy', AEA Energy & Environment Report for the States of Jersey March 2007

Planning barriers to the development of onshore wind

1.41 However in practice realising this potential has many difficulties since the siting of wind turbines must take into account a number of factors which are summarised here :

Aviation impacts – The presence and operation of wind turbines is a cause for concern for airports and associated technical sites like air traffic control relay stations and radar installations. Clearly the location of turbines would be limited by their impact on air traffic safety;

Visual Impact – Wind turbines are large structures and whilst their aesthetic is a matter of opinion there is no denying their significant impact on the landscape;

Noise – Studies have investigated the impact of the noise from turbines and current practice is that installations should be 500m from residential properties to meet guidelines[85];

Ornithological Impacts – Birds are at risk from collision with turbines and avoid settlement in their vicinity thus the installation of turbines can represent a significant loss of habitat.

Radio Communication – Turbines can block signal paths from wireless radio communications services including microwave links, terrestrial TV systems and

[85] Noise Working Group set up by the UK Department for Trade and Industry in 1993

cellular telephony systems and so must be located at sufficient distance from such installations.

Landscape – The impact of turbines must be assessed in the context of the landscape's character especially if a site has designated status e.g. SSI.

Other feasibility issues – Such as grid connectivity, access, terrain steepness.

Offshore wind resource in Jersey

1.42 The possibilities offered by winds in Europe's shallow waters could theoretically cover and even exceed European electricity needs, due to the regularity and the power of offshore winds (70 to 100% higher than inland winds). Offshore windfarm projects have been tested in Denmark since 1991. France, Germany and the UK have followed by example, with all four countries continuing to contribute to the majority of offshore resources in Europe.

1.43 Despite the sheltering effect of the Continent and the other Channel Islands, the offshore wind resources is good and equal to areas within the UK where offshore wind farms are being installed e.g. East Anglia.

Barriers to the development of offshore wind

1.44 Many of the constraints described in the onshore section apply equally to offshore installation and are similar to those described as challenges posed by the installation of offshore marine renewables and these would need to be addressed through the EIA process.

1.45 Importantly the construction and operation costs of working at sea mean that offshore installations are almost double the cost of installation onshore. For example, a 30 turbine offshore wind farm comprising 3MW turbine, like those being installed in the UK, costs in the region of £135-160 million. The current projects in the UK which are financed under the Renewables Obligation[86] still require a capital grant of £10 million each for private developers to be able to make them economically viable. These small (30 turbine) round 1 projects are seen as a stepping stone to the larger (100-300 turbine) projects which are currently being developed in the UK.

The feasibility of exploiting utility scale resources

1.46 Jersey has yet to exploit its indigenous energy resources at the utility scale although a the high level analysis presented above shows that there are opportunities to do so in the medium to long term so reducing Jersey's dependence on imported fossil fuels (Table 19).

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[86] 'The Renewables Obligation (RO) aims to stimulate investment in renewable energy projects by placing an Obligation on licensed electricity suppliers to source an increasing proportion of their electricity sales from renewable sources or to pay a penalty (the buy-out price). The RO's aim is to provide a framework of financial incentives to invest in renewables with the long-term goal of supporting the transition of renewables into the mainstream of the UK's competitive electricity market.' Source : UK Energy White Paper 2007, Meeting the Energy Challenge DTI

Table 19 A summary of the opportunities and barriers for utility scale renewable generation for Jersey

The table is shown in *green* where factors are not limiting; *amber* where barriers are significant but not insurmountable; and *red* where the barriers are likely to be insurmountable

Technology	Status of technology	Resource Potential for Jersey	Costs	Barriers
On-shore wind turbines	Proven and extensively used elsewhere	Plentiful resource – about 10% of the Island's electricity could be generated with a wind farm comprising ten 2MW turbines	Installed cost[87] ranges **£750 - £1000 per kW**	Planning constraints of siting turbines appropriately on land taking into account environmental and human factors are significant
WIND : Off-shore wind turbines	Proven and used elsewhere	Plentiful resource	Installed cost ranges **£1,500 - £1,800 per kW** e.g. a relatively small 30 turbine offshore farm comprising 3MW turbines costs c£135-£160M	Planning constraints of siting turbines appropriately at sea are significant but perhaps not insurmountable
MARINE : Tidal barrages	Proven but few examples in use	Good resource although other areas in CI are better	Estimated installed cost of **£3,300 per kW** for a 50MW capacity barrage across St Aubin's bay (Capital costs of are c.£160M)	Planning constraints of siting an economically viable barrage taking into account environmental and human factors are significant
MARINE : Tidal Lagoons	Currently undergoing Research and Development	Relatively good resource arising from large tidal range	No utility scale systems in operation to determine costs from. Proposed projects in region of 60MW capacity have estimated capital costs of £79M giving installed cost of **£1,300 per kW**	Planning constraints of siting lagoons appropriately at sea are significant but perhaps not insurmountable
MARINE : Tidal Stream	Currently undergoing Research and Development	Tidal streams surrounding Jersey are marginal for development	No utility scale systems in operation to determine costs from.	Planning constraints of siting tidal stream technologies appropriately at sea are significant but perhaps not insurmountable

Source – Information summarised from Development of Energy Policy, AEA Energy & Environment report for the States of Jersey March 2007

1.47 Of the current proven technologies, the planning constraints of installing on-shore wind turbines are likely to be insurmountable given the high residential density of the Island. Off-shore turbines are possible but more expensive and elsewhere

[87] Installed costs are calculated as Capital costs / Capacity

subsidy assists in making these technologies competitive. Table 18 illustrates that the estimated cost of installing a 90MW wind farm would require capital investment of c£135-£160M. Whilst tidal barrages represent a proven and economically viable technology the costs and environmental impacts are likely to be prohibitive for Jersey.

1.48 Jersey has opportunities to offer its resources to assist in the development of the emerging tidal technologies. Jersey is unlikely to be a destination of choice to test tidal stream technologies since the resource in Alderney is significantly greater. However, Jersey's large tidal range makes it a potential site for the testing of marine lagoons. These have the added advantage that their environmental footprint is far smaller than other technologies (e.g. barrages) and thus potentially more straightforward to mitigate for.

1.49 Although Jersey has considerable tidal and wind resources, harvesting these is not straight forward or inexpensive and requires a long term view. At this time, there is realistic potential to warrant further investigation for the development of off-shore wind farms. In addition, Jersey's tidal range offers potential for development in the field of tidal lagoon technology.

1.50 However in further investigating these possibilities, there are challenges at all stages of the process :

- **Long-term confidence** - Creating an environment of confidence whereby government makes firm commitments to the development and integration of renewables. This can be assisted by the setting of targets within long-term policy objectives and consolidating these with a legal requirement on parties to meet these or face enforceable penalties[88];
- **Costs -** Financing the high capital costs of proven and applicable technologies i.e. off-shore wind. This is addressed elsewhere by financial support mechanisms which provide predictable support;
- **Creating a climate for investment** - Attracting research and development to the Island in the field of tidal lagoons at minimum risk;
- **Addressing development barriers** i.e.
  1. Identifying suitable sites (if any) whose environmental and human impacts can be mitigated in order to secure planning permission
  2. Creating favourable financial conditions of access into the market – these can be assisted by feed-in tariffs which are set in advance for a number of years and paid by the electricity distributor to the generator;
  3. Coping with the technical difficulties of introducing renewables into existing infrastructure, in particular coping with the intermittency of supply from renewables.

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[88] *Development of Energy Policy, AEA Energy & Environment report for the States of Jersey March 2007*

Supporting the uptake of energy generation from proven technologies

1.51 Encouraging the investment in large capital expenditure to facilitate either research and development or the installation of proven renewable energy generation relies on a suite of measures to provide the investor with confidence in the long-term viability of their investment. It is normally the combination of a range of measures that make a project viable.

1.52 ***Grants to assist in covering capital costs -*** The capital costs of making renewable energy generation a reality are enormous. Jersey is not eligible for any incentives such as the UK's Renewables Obligation (introduced in 2002) and similar schemes throughout Europe and elsewhere. The Renewable Obligation encourages investment in renewable electricity production as a key part of the UK 's strategy to tackle climate change and to develop business opportunities[89]. A target of 10% of all electricity to be generated from renewable sources by 2010 has been set. The RO applies to natural renewable energy resources e.g. large and small scale hydro-electric power, wind, solar and wave and tidal flows as well as renewable sources arising from human activity e.g. sewage sludge digestion. Nuclear derived energy does not qualify for ROs.

1.53 Under the Kyoto Protocol, the Joint Implementation Initiative applies to climate change mitigation projects implemented between two Annex I countries and allows for the creation, acquisition and transfer of 'emission reduction units' (ERU). A scenario would be that another Annex I country would invest in a renewable energy project in Jersey and the ERUs generated by that project would count towards that country's emission reductions. The advantage in this mechanism is that the country in which the investment is made can provide the project at a lower cost than an equivalent in-country project. Jersey would need to offer comparably low-cost projects to attract investment.

1.54 ***Attracting inward investment through other support mechanisms or incentives -*** Whilst Jersey may not be in a position to make Governmental investment in utility-scale renewable energy production it does offer an attractive market place with a low tax regime and an environment of diverse investment opportunities and financial expertise.

POLICY OPTION 29: When marketing Jersey as an international destination for business, the States will highlight the offshore wind resource as a development opportunity

1.55 ***Putting in place market conditions to ensure the long-term confidence of investors –*** The presence of a long-term target of renewably generated electricity often assists in creating an attractive market within which to invest. Additional support can also be in the form of 'feed-in tariffs' with an obligation on third party to purchase electricity.

[89] www.parliament.uk/post/home.htm

POLICY OPTION 30: By 2009 the States will commission a detailed feasibility study on the opportunities and barriers of taking an offshore wind generation project forward over the next 15 -20 years. The feasibility study will :

1. Examine potential sites for installation taking into account environmental, climatological and human factors;

2. Assess the market place in order to identify conditions necessary to attract inward investment

3. Assess the level of financial commitment needed to install an offshore wind farm. Compare this to other energy infrastructure investments such a third or fourth interconnector or the potential installation of gas or oil pipelines. Consider the funding opportunities such as public-private partnerships to deliver such a project over the long-term and in an environment of increasing world energy prices.

4. Consider the long-term market conditions to support the sale of renewably generated electricity locally and into the Continental markets such as local / Continental feed-in tariffs and targets for renewably generated energy.

Offering Jersey's resource as a test-bed for emerging technologies

1.56 The most feasible emerging technology relevant to Jersey is that of tidal lagoons. This is in its infancy and Jersey offers an excellent resource for research and development in the way that Alderney does for tidal stream technology.

1.57 However the risks are high. R&D is expensive and there are no guarantees that a feasible technology will arise. In recognition of these problems in the UK, the 'Technology Programme' supports industry-led, shared cost, pre-competitive Research and Development into projects 'based on research conducted in the UK'. Another UK programme the 'Marine Renewables Deployment Fund' assists with support towards the construction deployment and operation of wave and tidal stream arrays connected to the UK grid. Alderney Renewable Energy is attempting to negotiate funding to assist the testing of tidal stream prototypes under this programme.

POLICY OPTION 31: The States of Jersey will keep under review the progress of Alderney Renewable Energy's negotiations with the Department of Trade and Industry in respect of support mechanisms and explore further opportunities for a special arrangement with DTI if and when firmer projects arise. The States will also investigate the advantages for joint-negotiations across the Channel Islands.

1.58 Whilst it is doubtful that Jersey could currently apply for funding under these schemes, neither of these support tidal impoundments and thus could not support

research in lagoons which are Jersey's leading potential projects. However this may be an evolving area and Jersey should remain abreast of developments.

POLICY OPTION 32: By 2009 the States will commission a detailed feasibility study on the opportunities and barriers of attracting inward investment to undertake research and development in Jersey's waters to exploit Jersey's tidal range.

The feasibility study will :

1. Examine potential sites for installation taking into account environmental, climatological and human factors;

2. Assess the market place in order to identify conditions necessary to attract inward investment e.g. fiscal incentives such as reduced tax, the development of intellectual property rights;

3. Suggest a marketing strategy for identifying and approaching credible investors.

Coping with intermittency

1.59 If it were possible to generate utility scale electricity from renewable sources an important factor to account for is that of intermittency and this must be examined within the framework of the Channel Islands Electricity Grid (CIEG). Electricity demand varies daily and seasonally – peak winter demand is approximately 140MW whilst minimum summer demand is 32MW. Electricity infrastructure must be capable of immediate delivery of the peak winter demand and in Jersey this is currently met by importing electricity from France and also Guernsey and on occasion by indigenous on-island power plant. Contractually, Jersey must export a minimum of 16MW of electricity to Guernsey and typically Guernsey draws 55 MW. Managing the distribution of electricity across the Channel Islands in a reliable, efficient and in the most environmentally sustainable way is the responsibility of the Jersey Electricity Company and Guernsey Electricity Limited.

1.60 The impact of integrating renewably generated electricity into the system is proportional to the amount of generation achieved. In the absence of a particular scheme a scenario of wind generation being connected to the CIEG is described to illustrate the problems that must be considered. Electricity is generated semi-randomly according to weather conditions and is injected into the grid which results in a reduction in the peak load imported from France. This has a larger effect in summer when the overall load is lower and it may be that all of the Island's requirements could be met from a 60MW offshore wind farm. In the winter months the larger load would mean that more electricity would need to be imported and there could be a need for additional capacity from on-island or Guernsey and in the longer term from the increased capacity of the third interconnector.

1.61 Two significant challenges arise :

- **Technical issues** in relation to a significant intermittent renewable input to the electricity supply e.g. large power or voltage flows at the point of connection requiring upgrading works; the environmental and economic costs of increased stopping and starting of on-island back-up thermal plant; complying with codes and standards:
- **Future economic penalties** imposed for the under-consumption of agreed amounts of power.

1.62 An alternative would be to sell renewably generated electricity into the French grid and receive back a proportion for the Island's use. The far larger Continental grid has a greater margin to accommodate the difficulties outlined but this could add significant costs to the capital expenditure for such a project.

CHAPTER 8 - Energy Options for Jersey and waste management solutions

Chapter summary

As a small island, Jersey must seek to exploit innovative approaches to waste management. By constantly evaluating best practice, Jersey can exploit existing and emerging technology to generate energy from waste as well as contributing to waste management solutions. In addition this will increase the security of supply and assist in de-carbonising the economy. The States must constantly appraise technology and apply the latest advances where it is economic and proven to do so in order to generate energy as well as manage waste products as sustainably as possible.

There are two areas where this goal can be achieved -

1. The replacement Energy from Waste Plant has the potential to

    i. Exploit the latest technology in the procurement of the new plant by considering the thermal efficiency of the processes and the recovery of energy for further end uses.
    ii. Provide district heating

2. The restructuring of the dairy industry to include opportunities for the anaerobic digestion of livestock and agricultural wastes. This will have additional benefits of

    i. Recovery of heat and power
    ii. Plant disease management
    iii. Methane capture
    iv. Pollution control
    v. Nutrient management

Policy options to achieve this centre on :

1. A further investigation into energy recovery technologies and end use options associated with the new energy from waste facility

2. Further investigation into the feasibility of a centralised Anaerobic Digestion plant.

Introduction and aims

1.63 Opportunities for 'decarbonising' the transport infrastructure through opportunities in 'cleaner fuels' like biodiesel, bioethanol and electric cars are addressed in Chapter 6. There are further opportunities to decarbonise centralised generation by the use of non fossil fuels as feedstocks in the centralised generation of electricity via a conventional power station or of heat and electricity in a Combined Heat and Power Plant.

1.64 As a result of current changes in infrastructure and the industry there are opportunities to adopt non- fossil fuel based indigenous fuel sources for indigenous power generation i.e:

1. The replacement of the EfW and consequent opportunities for procuring the most efficient energy recovery technology and also the potential for combined heat and power;

2. The restructuring of the dairy industry and move of the dairy provides an opportunity to investigate the opportunity for the anaerobic digestion of slurry in order to generate biogas that can be used for combined heat and power for the dairy.

Actions to increase indigenous energy choices and tackle waste disposal

1.65 Jersey can increase security of supply, decarbonise the economy and tackle waste disposal challenges by constantly appraising technology and applying the latest advances where it is economic and proven to do so in order to generate energy as well as manage waste products as sustainably as possible. This will mean investigating the opportunities to generate energy from waste. Solutions to waste management problems may have multiple drivers and in addition to adherence to the Waste Hierarchy such as opportunities for power generation and other environmental benefits such as nutrient management.

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Opportunities offered by the replacement Energy from Waste Plant

1.66 The existing Energy from Waste plant, mass-burn incinerator, is soon to be replaced with a new plant. Currently approximately 3MW of power are recovered from the plant but a replacement plant using the most efficient technology may be able to produce significantly more energy possibly 8MW. The energy from waste plant is configured such that steam can be used to generate power in a dedicated steam turbine, or to supply existing turbines in the power station. In either scenario heat can be recovered from the steam at stages of the power generation cycle (although this will reduce the turbine's performance). Although the technical viability of this requires robust investigation to ensure that the necessary delivered heat loads can be achieved, there is clearly potential to deliver non-fossil fuel derived energy locally at the relatively large scale in the following ways :

1.67 ***1. The opportunity to procure thermally efficient technology*** – It has been accepted in the Waste Strategy that the best solution for Jersey is to treat local non-recyclable waste through an Energy from Waste Plant (EFW). Jersey has not yet finalized its choice of technology for EfW and there are many factors to account for in choosing the appropriate plant for the Island however, the final decision can include consideration of the most effective heat recovery mechanism.

POLICY OPTION 33: The States will ensure that the procurement process for the new Energy from Waste Plant will include, among other considerations, criteria relating to the thermal efficiency of the process and its recovery for further end uses.

1.68 ***2. The use of Combined Heat and Power in the installation of the new EfW*** - EfW Combined Heat and Power Plants can generate electricity and heat more efficiently than conventional electricity-only generation. Because they represent a more energy-efficient use of waste fuels, the UK Government has included them in the 2006 Renewables Order 2006[90].

1.69 District heating is a system for distributing heat generated in a centralized location for residential and commercial heating requirements and the heat is often obtained from a cogeneration plant. A district heating plant can provide higher efficiencies and better pollution control than localized boilers. Yet CHP, and particularly district heating, is less well developed in the UK than, for example, in Scandinavian countries. Waste CHP schemes can offer good quality CHP in the UK but presently, only four of the fifteen EfW facilities operate in this way. Higher capital costs, limited installed district heating infrastructure and the low price received in the market for electricity generated by smaller CHP plants, often mitigate against its uptake.

1.70 However, the procurement of a new EfW for Jersey provides an opportunity to maximise the potential of including CHP and / or district heating options. If the new EfW is to be located next to the La Collette power station and the associated infrastructure, district heating is possible since the existing steam turbines could be used. Furthermore, because the final land uses of the La Collette 2 area are still to be decided there remains the opportunity to install the appropriate infrastructure and distribution networks for the most efficient end use of distributed heat.

1.71 There will be a requirement for the installation of significant distribution mains and heating plant at each end-user and this is likely to require careful scrutiny under the planning process particularly because the end users in this case are likely to be spread across a large area i.e. not encapsulated in a single shopping centre or similar. However since the whole east of Albert is currently undergoing review and the subject of a master planning exercise there are opportunities to build in the infrastructure alongside projected timetables of development of the area.

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[90] Department of Trade & Industry - Renewables Obligation Order 2006 – Final Decisions, January 2006 See http://www.dti.gov.uk/files/file22420.pdf

POLICY OPTION 34: The States will carry out a feasibility study of the potential of CHP / District heating and its end-use as part of the procurement process of the new EfW and the master planning of the East of Albert / La Collette II area. The study should be carried out prior to the detailed planning application to accommodate any design changes as early in the process as possible.

The study will :

1. Assess the technical, commercial and environmental viability, considering the capital costs of the project against the anticipated rate of uptake to determine the necessary 'heat price' for the project to be successful

2. This will allow a direct comparison to be drawn with future oil and electricity prices.

3. As the economics associated with district heating are often unfavourable, the study should include district cooling and desalination to optimise the efficiency of the scheme across seasonal variations in energy use

Anaerobic digestion of waste products

1.72 Anaerobic digestion (AD) is the process by which anaerobic bacteria convert biomass into biogas and 'digestate' by-products. Biogas comprises mainly methane and carbon dioxide and it is the methane proportion that is used to generate energy. Methane, a greenhouse gas 23 times more potent than carbon dioxide, is diminished through the anaerobic digestion process. The digestate is comprised of a solid fraction – the fibre that can be applied to land as a soil conditioner, and a 'liquor' fraction that is high in nutrients and can be used as a fertiliser.

1.73 The Transport and Technical Services Department have considerable expertise in the anaerobic digestion process. The Sewage treatment works at Bellozanne currently treats sewage through an anaerobic digestion system producing approx. 1.2 million cubic metres of biogas and between 70,000 and 80,000 tonnes of digested sewage sludge. The sewage sludge is dewatered and treated to produce a residue that could be returned safely to land under ADAS guidelines[91]. However this is complicated by more stringent guidelines of two national supermarket chains that refuse to purchase food crops from fields where the residue has been applied. Due to the limited availability of land that is not used for food production, much of the processed 'enhanced treated sludge' residue is incinerated.

[91] The Safe Sludge Matrix, ADAS e.g. http://www.nutri-bio.co.uk/factsheets/safesludge.pdf

1.74 A high level analysis of a scenario of centralised Anaerobic Digestion (AD) has been carried out by AEA[92] for the States of Jersey. Decentralised AD plants are used on large farms on the Continent but in general these are not economically viable and are assisted by large capital grants and the running costs are often off-set by gate fees charged for received food waste. The most likely cost effective scenario for Jersey is considered taking into account its' small herd size is centralised AD. AD plants are designed around the predominant feedstocks and the constituents and volumes have different capacity to produce methane (Table 20).

Table 20 Potential inputs and energy creation from an anaerobic digestion plant

Feedstock	Total volumes to AD plant	Methane produced per year m^3 CH_4/y
Animal Manure from:	26,000t/yr	354,900
2,500 dairy cattle – • Manure collected in slurry stores for 165d/yr when housed = 18562.5 t/yr • Grazed for 200 d/yr = 7,500 t/yr		
6000 laying hens on deep litter	108 t/yr	16,100
Waste Potatoes - currently returned to field by farmers)	4,500 – 8,000 t/yr	240,00
Other vegetable and packaging waste - currently used for animals feed at no cost)	450 – 500 t/yr	
Dairy waste – currently returned to sewer therefore treated at the Bellozanne STW currently 76,774m^3 but improved facilities and water efficiencies at the new dairy are likely to considerably improve this)	20,000t/yr	4,320
Total		**644,180**

Source: Information summarised from AEA report

1.75 Additional potential AD feedstocks that have been discounted at present are :

- *Household food waste* – Current policy is that this will be treated by incineration[93]
- *Woody green waste* – Woody green waste is not a suitable feedstock for AD although non-woody green waste can be at up to 20% and it may be that the re-direction of some of this from the current composting operation at La Collette would prove helpful in the future depending on the progress of the waste management strategy.
- *Abattoir wastes* – Current policy is that this will be treated locally through the animal by-product incinerator which is currently being planned[81].

[92] *Development of Jersey Energy Policy'* (March 2007) A report commissioned by the States of Jersey AEA Energy and Environment Ltd.
[93] 'Changing the way we look at waste - Solid Waste Strategy' (2005) approved by the States of Jersey 2005

- *Horse manure* – the mixing of manure with bedding such as wood shavings may pose problems for the running of the plant

1.76 The current restructuring of the dairy industry and move of the dairy from its current location provides an opportunity to consider centralised AD (using the assumed feedstocks in Table 20) with the following advantages :

- ***Recover energy from waste products and use it to power the new dairy*** - Including livestock (especially dairy) slurries, waste dairy liquid etc.
- ***Plant disease management*** – By providing an alternative disposal route other than back to land for waste potatoes
- ***Methane Capture -*** Carry out the process of anaerobic digestion on livestock slurries in order to capture (and generate power from) methane emissions. The level of methane emissions arising from animals and animal wastes in 2005 are estimated to be 6,900 tonnes carbon equivalents (see Appendix B for calculations).
- ***Pollution control*** - Improve current nutrient management and contribute to the prevention of water pollution. Dairy farms currently manage their slurry by returning it to land, ideally being buffered by the storage of slurry in large holding tanks with capacities of up to 4 months worth of slurry. This allows better rates and timing of applications back to land to avoid periods of high rainfall and to match crop needs so as to minimise water pollution[94] however this requires expensive investment in on-farm slurry stores the majority of which are assisted by subsidy.

1.77 There are many advantages to considering centralised AD but there are some key challenges:

1.78 ***1. Yield and Economic Analysis*** - In order to convert the 644,180 m^3CH_4/y into useful energy there are two options:

- Combined heat and power (CHP) with a 300kW engine producing both heat and electricity, under this option a small amount (14%) of the generated electricity is consumed by the plant itself so reducing potential volumes of exported electricity;
- Heat only using a gas fired boiler.

1.79 Comparing the amounts of electricity and/or heat generated under these options and comparing them with the dairy's consumption of heat and electricity, it is concluded:

- **CHP** – The amount of available electricity generated is about 20% ***more*** than the dairy's demand. Conversely, the amount of heat generated is about 20% ***less*** than the dairy's demand. There would be a need to export electricity and buy in heat.
- **Heat only** – Under this option, the amount of heat generated is about 150% ***more*** than the dairy's demand so heat would need to be exported

[94] Water Pollution (Code of Good Agricultural Practice) (Jersey) Order 2004

1.80 Assuming that all the electricity and/or heat is able to be exported from the plant and sold the CHP option is more economically attractive because ***the value of the electricity is more than twice that of heat*** (Table 21)

Table 21 Cash flow forecast for CHP and heat only scenarios

Cash flow forecast (£/y)	CHP	Heat only
Credits		
Feedstock credit	0	0
Electricity income (7.2p/kWh)	138,436	186,271
Heat income (£8.97/GJ)	41,389	0
Total credits	***179,825***	***186,271***
Debits		
Electricity	0	26,555
Maintenance @1.5%	30,000	28,500
Rates/insurance @1.5%	30,000	28,500
Staff (2 FTE)	40,000	40,000
Total debits	100,000	123,555
Nett income	***79,825***	***62,716***

Source: AEA report - Development of Jersey Energy Policy' (March 2007)

1.81 The internal rate of return (IRR[95]) that banks usually need to see is 15% for them to be considered viable. AEA concluded that there was a negative IRR for the centralised AD plant **without** a capital grant.

1.82 In order to achieve a 15% IRR for the CHP scenario the following is necessary :

- A capital grant of at least 77% of the capital cost (c.£1.5M)
- Heat and electricity sold at going rates (calculated at Dec 2006 rate of 7.2p/kWh and £8.97/GJ respectively)

1.83 ***2. Technical operation of the plant*** - The difficulty of successfully operating an anaerobic digestion plant must not be underestimated. Factors such as the water content of the raw material, temperature, pH and carbon to nitrogen must be closely monitored and the most successful plants are those in which the feedstocks remain relatively constant over time. The expertise needed to run the plant is expected to be sourced from the Transport and Technical Services Department. The resource requirements, based on a 6,000m^3 plant in Denmark, have been factored into the analysis and are two persons.

[95] The **internal rate of return** (IRR) is a capital budgeting method used by firms to decide whether they should make long-term investments. The IRR is the annualised effective compounded return rate which can be earned on the invested capital, i.e. the yield on the investment. A project is a good investment proposition if its IRR is greater than the rate of interest that could be earned by alternative investments

1.84 ***3. Agreement from the dairy industry to ensure slurry delivery and digestate removal*** – An agreement at the outset would be necessary to ensure that the industry would provide the feedstock to the AD and would also take back the digestate (fibre and liquor). There are considerable advantages for farmers in that the digestate :

- Is quality controlled and assayed for its nutrient content;
- Has been pasteurised therefore destroying most pests and diseases;
- Can be applied to food crops.

POLICY OPTION 35: In 2007, the States will investigate the feasibility of the co-location of an Anaerobic Digestion plant with the planned new dairy or other appropriate guaranteed purchaser of heat and power with the objectives of :

1. Generating Combined Heat and Power
2. Capturing and using methane and nitrous oxide
3. Odour control
4. Waste management
5. Plant disease management through avoiding waste potatoes being returned to land

The feasibility study will :

1. Examine the potential for to grant aid such a project to achieve these objectives, through schemes such as the RIS and CRS or alternatives such as public-private partnerships.

2. Initiate discussions with dairy (or another purchaser) to explore the possibility of long-term contracts for the purchase for heat and electricity at retail prices

3. Initiate discussions with the JEC about electricity connection and buy-back options

4. Initiate discussions with the agricultural industry to explore the logistics of feedstock supply

CHAPTER 9 – Microgeneration energy options for Jersey

Chapter Summary

Microgeneration involves generating small amounts of heat and power, normally from renewable sources, to meet individual and community needs. It has numerous benefits that include:

- Lowering carbon emissions;
- Decreasing the environmental footprint of the displaced power;
- Increasing security of supply;
- Diversifying the supply of electricity;
- Increased support of the Transmission and Distribution system.

There are numerous proven technologies available and high quality well installed systems can deliver substantial cost savings to a premise in terms of avoided energy costs. This saving means that the capital cost of the technology investment will be paid back over the lifetime of the installation although some technologies have far shorter payback periods than others.

To recognise the value of microgeneration, 'Sustainable Energy Jersey' will investigate and support the opportunities for citizens of Jersey to exploit indigenous energy resources at the microgeneration level.

To encourage the take up of microgeneration technologies the following policies are proposed :

1. A requirement that by 2010 that at least 10% of the energy in all new builds is provided by renewable sources.

2. Providing impartial advice to the public through 'Sustainable Energy Jersey' on choosing and installing the appropriate technology.

3. Providing assistance to the local microgeneration industry through 'Sustainable Energy Jersey' in the form of training opportunities and the possibility of an accredited standards scheme.

4. Simplifying the development control process to encourage the uptake of microgeneration technologies

5. A requirement for the JEC to continue to pay the 'avoided cost' to customers for excess electricity generation sold back to the grid as well as assisting with the provision of the appropriate metering equipment necessary for this.

6. Bring forward an Energy Crops Action Plan by the end of 2008 that will address the growing energy crops locally with the additional aims of diversifying the rural economy and assisting in waste management solutions.

INTRODUCTION AND AIMS

1.85 Microgeneration involves generating small amounts of heat and power, normally from renewable sources, to meet individual and community needs. There are many existing technologies and these and others are being developed quickly giving microgeneration the potential for micropower to be taken up more widely thus making a noticeable impact on patterns of energy use. Advantages derived from microgeneration are :

- ***Lowering Carbon Emissions*** – if renewable technologies are used and high carbon fuels are displaced by the microgenerated power;
- ***Decreasing the environmental footprint of the displaced power*** – if the environmental impact of the technology used has a lower environmental impact than the power it displaces.
- ***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 transmission and distribution system (T&D)***– Microgeneration sited throughout a T&D system can lead to reduced need to upgrade the T&D system over time.

1.86 Microgeneration installations can provide electricity and heat not only in the home, but in small business, schools, leisure centres and schools. A study commissioned by the Department of Trade and Industry (DTI) and carried out by the Energy Saving Trust (EST) has estimated that microgeneration could meet 30-40% of the UK's electricity needs whilst reducing carbon emissions by 15% per annum. This carbon saving would be less for Jersey where microgeneration technology displaces electricity due to the very low carbon content of the imported nuclear / hydro generated electricity.

1.87 Microgeneration technologies are at various stages of development and availability. Germany's renewable energy sector has an annual turnover of 12 billion euros of which their Microgeneration Strategy is a major contributory factor. A Government incentive, the "100,000 roofs" programme, which promotes PV installation for electricity generation, has a goal of reaching a 1000MW capacity, and when this is reached, Governmental subsidy will cease.

Types of microgeneration technologies

1.88 An analysis of a range of microgeneration technologies has been carried out for energy policy[96] and common microgeneration technologies include :

- ***Solar energy systems :*** Use energy from the sun to generate heat (solar thermal) or electricity (photovoltaic);

[96] 'Energy Efficiency Study' by KEMA ltd (March 2007) commissioned by the States of Jersey

- ***Solar thermal*** is commonly available and the solar panels or collectors are typically installed on a roof and collect heat from the sun's radiation. This is used to raise the temperature of the household water; systems can be installed for domestic hot water, swimming pools, caravans and similar applications;

- ***Photo-voltaic –*** PV generates electricity directly from sunlight. PV modules are available as roof mounted panels, roof tiles and other systems;

- ***Micro-wind (small wind turbines) -*** Generate electricity using wind power. Installations are attached either onto the side or roof-top of a dwelling and modern designs are increasingly quieter than previously. Concerns have been raised over the efficiency of such units, particularly in urban settings where wind speeds can be quite low;

- ***Micro-hydro generation*** - 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;

- ***Micro Combined Heat and Power (CHP)*** - Usually the by-product of generating electricity from fossil fuel is heat, which is lost to the atmosphere. CHP harnesses this heat and allows it to be used for process steam, space heating, hot water and refrigeration through absorption chillers. Domestic CHP boilers derive their energy from mains gas supplies and act in the same way as a normal boiler by providing heat and hot water to the home. However, they also contain a generator which produces electricity from the same gas supply, which powers other domestic appliances such as lights and televisions;

1.89 CHP is a very efficient form of energy production when derived from fossil fuels and it can also be powered by renewable fuels e.g. biomass like wood further reducing its carbon footprint. Organisations with significant heating requirements throughout the year such as hotels, hospitals, leisure centres and farms will particularly benefit from CHP. CHP contributes to 10% of total electricity production across Europe (Denmark 50%, the Netherlands 40%).

- ***Biomass*** - A boiler is used to generate power derived from the burning of energy crops e.g. willow or miscanthus or waste wood like sawdust and pallets. These are carbon-neutral since the energy crop took up carbon dioxide whilst growing.

- ***Heat pumps*** - Transfer heat which is stored in the ground or air to a heating system. Ground source heat pumps capture heat from within the ground by either pipes laid into trenches or down a borehole. It is then distributed within a building via radiators or under-floor heating. Both ground and air source heat pumps are very efficient, for example by extracting heat from the surrounding air, air source heap pumps can release up to 4 times more heat energy compared to the energy required to power the equipment.

- ***Fuel cells –*** This is an emerging technology that combine hydrogen and oxygen to form electricity, heat and water. They 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. 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.

Excess power generation and buy- back tariffs

1.90 In favourable conditions, microgeneration can create a surplus of electricity beyond that required by the premises. This opens up the opportunity to sell excess back to the grid. Whilst this is possible locally and the JEC will back excess electricity, it does so at the avoided cost[97] price, not at retail price (See Appendix A).

1.91 This is a matter of disappointment for some microgenerators but the reasons are explained by the JEC - '*because electricity supply is such a capital-intensive utility, the cost of electricity transmission and distribution infrastructure represents a significant element of the total cost of a unit of electricity supplied to the end user. As a result, the cost of energy production typically makes up a little less than half the total cost of a kilowatt-hour with the result that even though being paid the avoided cost of generation, a customer selling surplus power to an electricity supplier will generally be paid less than half the rate they themselves are charged for every unit of electricity'.*

The uptake of microgeneration technology in Jersey

1.92 Despite the availability of proven systems there is still limited (but increasing) take up by individuals of microgeneration technologies. Barriers include :

- High initial capital costs;
- Long payback periods;
- A perceived inability to sell excess electricity back to the grid.

The Jersey Annual Social Survey compared what people are prepared to invest in energy saving measures to achieve a £50 a year saving. Whilst this refers to energy saving measures rather than microgeneration technologies, the message was that a grant of some description was necessary to encourage uptake. Importantly 30% and 50% of people said they would be encouraged to take steps if a 50% grant were available regardless of the level of expenditure they would be willing to make. Extending this argument and relating it to enquiries made of the Department for Planning and Environment, it would appear that the uptake of microgeneration technologies might require similar grant incentives.

1.93 Many other countries offer some form of incentive or grant to assist in the purchase of microgeneration technologies for example, in Ireland some forms of

[97] Avoided cost is the cost the utility would have incurred had it supplied the power itself or obtained it from another source.

technology like wood chip stoves or heat pumps will receive grant support – this scheme was very well received and in its first three months 3,500 grants were approved.

1.94 There is no doubt that grant incentives assist the uptake of microgeneration technologies but they require substantial funding – for example the Irish scheme has a budget of costs 27 million Euros.

Actions to encourage the uptake of microgeneration

1.95 Microgeneration fits into the second level of the Energy Hierarchy since it involves using low-carbon fuels and also the third level by displacing imported energy. Both of these factors contribute to environmental improvements and increase security of supply. In relation to microgeneration, energy policy proposes measures to investigate and support the opportunities for citizens of Jersey to exploit indigenous energy resources at the microgeneration level. This will allow Individuals and communities to play their part in making environmentally conscious decisions ensuring that the Island's fuel mix has a low as environmental impact as possible. It will also reduce the Island's level of import dependency is reduced which will increase the security of supply.

MAKING THE CHANGE

1.96 An analysis of the payback options for microgeneration technologies (Table 22) shows that the most cost effective technologies with the ability to payback within 10 years are :

- Geothermal heat pumps;
- Solar thermal pool heaters;
- Biomass boilers

1.97 This is a high level analysis and consumers are advised to investigate local suppliers and make technology comparisons for their individual circumstance.

Table 22 Simple Payback for microgeneration technologies

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

Source: KEMA report for the States of Jersey using DEFRA data[98]

1.98 It is also important to note that just because some technologies such as solar thermal space heating do not appear to have payback periods of less than a decade, they do not have merit. Indeed, there are many reasons for installing renewable energy technologies and these do not all hinge on payback periods. For example, many people exercise a personal choice in making an environmentally conscious investment regardless of shorter-term payback periods. In addition good quality, well installed microgeneration systems will add value to a property by considerably reducing its running costs.

Microgeneration in new builds

1.99 Microgeneration technologies are most realisable in new builds where they can be incorporated at the design phase making the costs of fitting considerably lower. In addition, the capital outlay is small in comparison to the investment of a new building. This provides immediate advantages for the new occupier and reduced running costs.

1.100 Progressively there are opportunities to move away from the traditional model of centralised and distributed power supply towards far more renewables and small-scale, distributed electricity generation.

POLICY OPTION 36: In 2010 the States will introduce a requirement for at least 10% of energy to be provided by renewable sources on all new builds including public sector investments. In multiple unit developments, it must be shown that at least 10% is achieved in each of the units.

[98] 'Energy Efficiency Study' by KEMA ltd (March 2007) commissioned by the States of Jersey

Encouraging the uptake of microgeneration technologies in retrofits / refurbishments

1.101 There are some barriers to the uptake of microgeneration technologies, especially when retrofitting to existing buildings when capital costs may be high. Any installation causes some inevitable disruption which can dissuade people from changes, for example, replacing of a boiler.

1.102 It is also recognised that the poor marketing of microgenerators can be a significant contributory factor behind lack of consumer understanding and therefore poor up-take. The private construction industry has a central role to play in improving customer take-up but barriers can include the cost, lack of demand from the consumer, and the industry remaining unfamiliar with microgeneration technologies.

1.103 The uptake of microgeneration technology can be encouraged by grants to off-set purchase price. This is effective but requires a considerable investment by government. However, good quality, well installed microgeneration systems will :

- Add value to a property by considerably reducing its running costs;
- Payback themselves (over varying periods of time) as a result of avoided energy costs;
- In some circumstances displace higher carbon types of energy.

1.104 It is no doubt important that the microgeneration technology expands. Microgeneration will be displacing imported energy and in some cases will be lowering carbon emissions if the energy they are displacing is high-carbon. However the first level of the Energy Hierarchy is to reduce energy and so at this stage, the States will provide assistance advice and support through 'Sustainable Energy Jersey' but grant aid will be prioritised towards initiatives that address energy reduction.

POLICY OPTION 37:

Through 'Sustainable Energy Jersey', The States will :

1. Provide impartial advice and assistance to the consumer and construction industry regarding microgeneration technologies to existing buildings and other applications such as the heating of outdoor swimming pools;

2. Engage in discussion with the local microgeneration industry and investigate opportunities for assistance in increasing the local skill base required to market and service microgeneration industry. This might include the introduction of a regulatory system for installers to increase consumer confidence and maintain standards.

3. Keep under review the need to provide grant aid to address market failures in the uptake of microgeneration technologies.

1.105 Planning and Building Regulations provide both opportunities and limitations for those attempting to install microgeneration technologies to buildings. Clearly there needs to be an a appreciation of the vernacular but a simplification of the planning process in addition to the exemption of the planning application fee can encourage the uptake of microgeneration technologies

POLICY OPTION 38 : The States will continue to simplify the development control framework to encourage the uptake of microgeneration technologies.

Buy-back tariffs for microgenerated electricity

1.106 Some countries set a buy-back tariff for purchasing surplus electricity from microgenerators. If the buy-back price is greater than the avoided cost, a premium is being paid by the retailer for the microgenerated electricity. Because the retailer is paying more than the electricity is actually 'worth' there is effectively a cross-subsidy being applied across the market. Those consumers who are not generating and selling their own power into the grid are subsidising those are have invested in microgeneration technology. Clearly the scale of this subsidy is proportional to the level of penetration of micro-generation across the entire grid.

1.107 There may be good reasons why the retailer may want to carry out this form of cross-subsidy, for example, if the microgenerated electricity is from renewable sources and it is displacing high-carbon centralised generation from say, a coal-fired power station. In this example, the low-carbon microgenerated electricity will be contributing to lowering the overall pollution of that jurisdiction. Therefore, there is a driver for the retailer to cross-subsidise since the carbon footprint of the whole jurisdiction is being lowered for the common good.

1.108 In Jersey the drivers are different to the example above in that the Island's electricity is already very low carbon. If the JEC were required by the States to pay more than the avoided cost for microgenerated electricity, customers who are not microgenerating electricity would have to cross subsidise this purchase but no carbon emissions would be achieved.

1.109 It is also important to recognise that there are significant reasons for individuals to invest in microgeneration technology beyond receiving a premium for their surplus electricity. Good quality, well installed microgeneration systems will :

- Add value to a property by considerably reducing its running costs;
- Payback themselves (over varying periods of time) as a result of avoided energy costs;
- In some circumstances displace higher carbon types of energy.

POLICY OPTION 39: The States will not require the JEC to pay more than the avoided cost for surplus microgenerated electricity that is sold back into the grid.

Mechanisms for buying back microgenerated electricity

1.110 In addition to the price paid for surplus electricity, mechanisms for selling back excess electricity requires consideration of the :

- The type of meter that can measure and record the balance of electricity flowing into (purchased at periods of minimal microgeneration) and out of (excess generation at peak periods) the premises;
- The appropriate time periods over which the metering is measured for example half hour or hour periods.

1.111 At the small scale, cases can be administered on their individual circumstances. However, if the number of microgenerators increases substantially, there will need to be a review to ensure correct settlement process for customers and administrative burden on the JEC.

POLICY OPTION 40: The States will require the JEC to continue to provide advice and assistance in the installation of the appropriate metering equipment to enable microgenerators to sell surplus electricity back to the grid. The mechanisms and technologies by which occurs will be re-assessed as the number of microgenerators increases.

Energy crops

1.112 There is insufficient land availability to grow energy crops and power a centralised biomass plant for large scale distribution but using biomass crops at the microgeneration level to fuel in-situ biomass boilers is possible[99]. Local companies are already exploring this business opportunity with an intention to grow and process miscanthus pellets on-island which is more sustainable than importing similar fuel. Currently recycled wood is available as a feedstock for such boilers and there is scope to use more locally derived wood as fuel to fuel such boilers.

1.113 The perennial grass, miscanthus, requires little to no fertilizer beyond the establishment phase which makes it suitable for Jersey whose waters have an island-wide sensitivity to fertilizer inputs. It is estimated that the crop should realise £250 to 400/ha[100] although this is critically dependant on the assessment of individual sites, yields and the prices paid. The growth of energy crops may qualify for the support mechanisms under the Rural Initiative Scheme may well be applicable.

1.114 Miscanthus or wood-pellet powered boilers represent a lower carbon option compared to gas or oil fired space and water heating.

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[99] *'Development of Energy Policy', AEA Energy & Environment report for the States of Jersey March 2007*
[100] Nix, J. (2005) *Farm Management Pocketbook*. Melton Mowbray, UK

POLICY OPTION 41: The States will bring forward an Energy Crops Action Plan by the end of 2008 that will address the role of the local production of biomass crops in :

1. **Providing a low carbon alternative to fossil fuels;**
2. **Diversifying the rural economy;**
3. **Assisting in waste management by providing land area not under food production that sewage sludge could be returned to.**

CHAPTER 10 – Achieving sustainable choices by importing a higher proportion of renewable energy

Chapter summary

Considerable capital investment is required in the exploitation of utility scale renewables and in the short term it is more economic to simply make more sustainable fuel choices from among the currently available energy mix. Current energy choices must account for the carbon content of the fuels used in order to minimise GHG emissions and decarbonise the local economy. This will increase Jersey's resilience to price shocks arising from changes in energy prices.

There has been a continuing trend towards increased electricity use and because of the low-carbon content of the imported electricity this has the added benefit of reducing the Island's carbon footprint. As other renewable technologies become more economic Jersey has the opportunity to retain the advantages from the procurement of low-carbon electricity whilst avoiding the dis-benefits associated with the generation of electricity from nuclear sources.

Policy options to achieve this centre on :

1. The States to require the JEC to have regard to the objective that maintaining the low carbon content of its electricity is a material consideration when considering purchasing options;

2. The States to encourage, but not drive, the continuing shift towards electricity as the Island's dominant fuel.

INTRODUCTION AND AIMS

1.115 Rather than exploiting indigenous energy resources, it may prove more economically viable to simply increase the amount of renewably generated energy currently imported. If the imported renewable energy imported displaces fossil fuels then this would contribute to carbon reduction targets. Alternatively, if the imported renewable energy displaces nuclear generated electricity, it would lessen Jersey's contribution to the negative impacts of the nuclear industry which despite being a low carbon source does have environmental impacts in terms of safe waste disposal.

1.116 ***Electricity*** – The current 'framework' contract with Electricité de France (EDF) and Jersey Electricity is that the mix of electricity is 80% nuclear generated and 20% hydroelectric. In 2012, when this contract expires a potential option for Jersey is to increase the percentage generated from renewables. There are likely to be substantial economic implications to this since nuclear electricity remains the most economically competitive especially in comparison to that generated from low-carbon renewable sources like wind for example. Typically, renewable electricity commands a price premium of 80%-100%, which is made acceptable elsewhere by the compulsion on large energy users to limit carbon emissions and by the modest National targets for contribution of renewables in the overall fuel mix (typically 10% of electricity to be renewable by 2010, 20% by 2020) which dilute the cost impact.

1.117 ***Road fuels*** – 34% of final energy consumption is of road fuels comprising mainly petrol and diesel. Chapter 6 has shown that there are opportunities to increase the percentage of renewable energy used to run standard motor vehicles by blending biofuels – ethanol with petrol and bio-diesel with road diesel.

Switching to low carbon fuels within the current fuel mix

1.118 The second level of the Energy Hierarchy indicates the carbon content of fuels should be reduced (Table 23). This can be achieved in the short-term by switching between the existing fuel options from the most carbon intensive fossil fuels (coal, heating oil, LPG, fuel oil, road fuels) to electricity.

1.119 The greatest potential for carbon savings would occur by increasing Jersey's reliance on electricity, particularly for domestic heating. The drive towards an 'electric island' is already underway with the majority of new builds adopting electricity. The benefits of this fuel switching would, however, need to be weighed against other energy policy objectives such as fuel source diversity and security of supply.

Table 23 Carbon intensity of energy consumption on Jersey (kgCO2/kWh)

	Coal	Heating oil[1]	LPG[1]	Electricity[2]	Petrol[3]	Diesel[3]
Carbon intensity ($kgCO_2$/KWh	**0.32**	0.27[1]	0.214	0.08	2.3	2.63

Source: [1]Defra and Oxera calculations based on IEA data; [2]EdF / JEC data; [3] BP Carbon calculator www.bp.com

1.120 When considering fuel switching in order to reduce carbon emissions there are often multiple factors to consider. For example, it might appear that petrol has lower emissions than diesel but what must be factored in is that diesel engines are far more fuel efficient and so overall volumes of fuel (and therefore emissions are lower) than petrol.

1.121 The high proportion (approximately 40%) of homes heated with oil in Jersey suggests that there could be potential for significant carbon savings through encouraging consumers to switch to less carbon-intensive forms of water and space heating, particularly electricity. In order for fuel switching to be attractive to consumers, it would have to result in lower unit energy costs. As Table 24 shows, in 2007, the cheapest form of heating is oil fired central heating with a combi boiler but very close is night-rate electricity which is also the energy source with the lowest carbon emissions per kWh of effective heat. Depending on the available tariffs and the type of systems involved, the potential for fuel switching based on price alone is limited.

Table 24 Relative cost and carbon emissions for different fuel types in Jersey

Heating type	Heating efficiency (%)	Cost (p/kWh of effective heat)	Carbon emissions (kg CO_2/kWh of effective heat)
Coal open fire	32	13.20	1.00
Coal open fire with back boiler	55	7.68	0.58
Gas central heating with existing boiler	65	10.31	0.33
Gas central heating with combi boiler	73	9.18	0.29
Gas central heating with condensing boiler	85	7.88	0.25
Oil central heating with existing boiler	65	6.3	0.42
Oil central heating with combi boiler	79	5.2	0.34
Oil central heating with condensing boiler	85	4.8	0.32
Electricity standard domestic rate	100	10.2	0.08
Electricity E7 night rate	100	5.6	0.08

Source: Jersey Electricity Company and Oxera calculations.

1.122 A significant barrier to fuel switching is the upfront costs that would be incurred in changing supply infrastructure and appliances. While such barriers could potentially be overcome through subsidising these switching costs, the level of subsidy required is likely to be high. Other factors such as personal preferences and perceptions of comfort are likely to steer consumer choice in a market with little difference in energy prices.

Actions to ensure sustainable energy choices among the current fuel mix

1.123 The second level of the Energy Hierarchy is to use low carbon fuels. This will ensure that the Island maintains its' low carbon emissions and is less vulnerable to rises in energy prices as a result of global increases in the price of fossil fuels. Energy policy will assist by ensuring that current energy choices account for the carbon content of the fuels used in order to minimise emissions and decarbonise the local economy. This will increase resilience to price shocks arising from changes in energy prices. This will mean encouraging people to choose low-carbon fuels like electricity.

MAKING THE CHANGE

Maintaining the current proportion of imported low-carbon electricity

1.124 Despite being a low carbon fuel it is recognised that there is an environmental impact of nuclear energy. However there may be considerable barriers to exploiting Jersey's indigenous energy options. Another way Jersey might choose to demonstrate its commitment to renewable energy sources would be to adjust the fuel mix of current imports.

1.125 Current JEC policy favours the nuclear/hydro generated electricity because of its relatively low price and low-carbon content. This has allowed Jersey to easily comply with its Kyoto obligations and must remain the case. EDF remains the most competitive provider of power in the European market for the volumes required by Jersey. The Jersey Electricity Company tracks their prices against those of other suppliers ahead of each contract negotiation. A proposed European Directive will guarantee renewables significant penetration into a liberalised electricity market, which will, in the future provide more cost effective incentives and make it more competitive to stipulate renewable sources in the energy mix of the electricity that the Island could import.

1.126 Increasing the proportion of renewable energy from abroad is a potential option for Jersey Electricity from 2012 when its 'framework' contract with Electricité de France (EDF) expires. Power from renewable sources trades at between two to three times the price of conventionally produced power, making it economically unfavourable for Jersey to source electricity from renewable energy sources at the present time.

POLICY OPTION 42: The States will require the JEC to :
1. Regard the low carbon content of its electricity as a material consideration when considering purchasing options;
2. Procure no less than the 80/20 nuclear/hydro electricity mix;
3. Keep the cost of renewably generated electricity under review so that when and if financial conditions are not prohibitive, an increased proportion of electricity imported into Jersey should come from renewable sources.

Fuel switching among existing resources to lower carbon fuels

1.127 Governments in other jurisdictions have generally allowed market competition amongst the energy utilities to decide the fuel used by the customer. Under current conditions, locally there is some difference in fuel prices between oil, electricity central heating and gas. Currently there is little financial incentive to switch to electricity which would be the preferred option in terms of carbon emission reductions. Chapter 5 shows that there is considerable scope to reduce energy usage and make carbon reductions by a raft of energy efficiency and behavioral mechanisms. Achieving these reduction targets will keep Jersey's carbon emissions very low on a European scale without the need for further fiscal incentives such as a carbon tax or grant assistance subsidy to drive switching.

1.128 Should progress towards the energy and carbon reduction targets outlined in Chapter 4 be too slow, the States will bring forward fiscal measures to reduce carbon emissions and final energy demand. One appropriate mechanism could be a carbon tax applied across the fuel base according to the carbon intensity of the fuel. By increasing the cost of high carbon-fuels, there would be an incentive to reduce energy use and consider low-carbon alternatives. In practice, this sort of taxation can be socially regressive. For example – locally, heating oil would attract taxation and vulnerable individuals in poorly performing properties (in terms of thermal efficiency) may find themselves heavily taxed yet be without means to improve their property. For this reason we intend to delay the consideration of such punitive measures in order that 'Sustainable Energy Jersey' becomes established and can provide advice and incentives to improve stock and produce results.

POLICY OPTION 43: The States will not interfere with market forces to encourage fuel switching. Progress towards carbon reduction targets through energy efficiency mechanisms will be kept under review. If progress towards these targets is too slow, by 2015, the States will bring forward fiscal mechanisms, likely to be a carbon tax, to encourage consumers to reduce their energy usage switch away from high carbon fuels.

Part 4 - Planning and Adapting for Climate Change

'There is no bigger long-term question facing the global community than the threat of climate change'

Tony Blair. Launch of the Climate Group. Tuesday, 27 April, 2004

CHAPTER 11 - Preparing for the effects of Climate Change

Chapter summary

Action to combat emissions of greenhouse gases is a necessary and vital step. However successful these actions are, some climate change is already 'built in' to the global atmospheric system because of past emissions. This creates challenges as well as opportunities, and The States must identify, prepare and plan for the effects of climate change be they adaptation and mitigation to its effects or being part of markets arising as from the challenges of tackling climate change.

To achieve this, the following policy options are proposed:

1. Jersey has an enviable historic climatic data set that has and can continue to contribute to climatic modelling. The continued collection and contribution of these datasets to leading organisations in climatic modelling will assist future patterns of climate change to be better assessed;

2. Agriculture, fisheries and to some degree tourism, are industries at the 'coal-face' of climate change. The States must assist these to identify and plan for the effects of climate change and help to adjust their business models to account for the opportunities and challenges climate change presents;

3. Opportunities arise out of climate change including the potential to participate in global carbon markets or Kyoto mechanisms – the States will investigate and provide, where appropriate, the support and advice mechanisms necessary to enable and empower the financial sector to participate;

4. The compliance market provides support to achieving compliance with regulations. This is a growing sector particularly in the construction industry where increased standards must be adhered to. The States can investigate and provide, where appropriate, the support and advice mechanisms necessary to enable and grow the compliance market;

5. Increasing awareness of Corporate Social Responsibility in the consumer market means that there is a growing market advantage for companies to improve their environmental credentials. The States can assist through for example and accreditation scheme run under the umbrella of the ECO-ACTIVE campaign.

INTRODUCTION AND AIMS

1.129 The future will present many challenges associated with climate change. Globally, changed climatic regimes are expected which in turn, will have social and economic consequences. The Stern Review makes the case for strong early action to stabilise GHG emissions but recognises that globally we are already 'locked' into a degree of climate change as a result of the already elevated levels of GHGs in the atmosphere. How the future looks will depend on how successful the international response is at reducing future emissions.

1.130 Chapter 3 presented the results of the Hadley Centre Study which predicts climate change scenarios for Jersey. A warmer climate is predicted with less summer rainfall and more winter rainfall. The weather is likely to be more unpredictable and stormy with increased occurrences of heavy precipitation. There are predicted increases in sea levels and increases in the height of the 50-year storm surge.

1.131 The problem of climate change is global both in its cause and its consequences. Wherever in the world GHGs are emitted, they have broadly the same impact on the climate and no region will be left untouched by their consequences. It is critical to understand precisely what the changed weather patterns predicted for Jersey will mean and what the Island must do to mitigate these effects. For example, different rainfall patterns are likely to affect the use, storage and distribution of water and increased stormy weather and sea level rises will have impacts on sea defences and flood prevention systems.

1.132 Jersey must play its part in contributing to the reduction in global emissions of greenhouse gases. It must do this to demonstrate that it will not behave as a free-rider in its approach to the global problem. At home, Jersey must plan for the necessary adaptation to climate change that is likely to happen. Practical steps, such as enacting the Water Resources Law will provide the tools necessary to respond to the different climate that will be faced. Maintaining the Island's climatological records will be an important action for the future as will participation in monitoring projects that quantify the rate of change being experienced.

Actions to plan for climate change

The Stern Review has made it clear that ignoring climate change and its effects is not an option and to act sooner rather than later will reduce the costs of adaptation and mitigation as well as stabilising emissions. In order address issues relating to the effects of climate change energy policy will identify, prepare and plan for the effects of climate change. This means adapting and preparing for its effects or being part of markets arising as from the challenges of tackling climate change.

MAKING THE CHANGE

Preparing for Climate Change

1.133 If Jersey is to be best prepared to cope with the challenge of climate change the Island needs to continue to participate in projects that can provide predictions of its effects upon us. The UK Climate Impacts ProgramME (UKCIP[101]) provided scenarios of climate change based on four different emissions scenarios (these scenarios are termed UKCIP02). Climate change scenarios are plausible, self-consistent, scenarios of future climate measured against current, or recent, climate. These scenarios are critical when carrying out assessments of the impacts that climate change may have on socio-economic sectors such as infrastructure, agriculture, forestry, water resources and coastal and river flood defences. In this way, adaptation can be planned well in advance, so that damages and costs can be minimised, and perhaps some potential benefits realised.

1.134 Adaptation flexibility is necessary to cope with inherent uncertainty in the climate change scenarios which arise from three sources:

- ***Emissions uncertainty*** - arises because it is not known how man-made emissions of greenhouse gases will change in the future. This is addressed by developing alternative scenarios, which cover a wide range of possible future emissions;
- ***Science uncertainty*** – arises because there is an incomplete understanding of how these emissions will change climate. This is harder to address but using predictions from a number of global climate models goes someway towards this;
- ***Natural variability*** - leads to significant year-to-year and decade-to-decade variability in climate, will still be superimposed on an underlying man-made trend in future, adding to scenario uncertainty. This can be addressed by calculating changes averaged over 30-year periods (generally used periods are 2020s, 2050s and 2080s).

1.135 Despite these uncertainties, the direction of climate change is known and the UKCIP02 scenarios formed the basis of the Hadley Report. The Hadley report has provided the most detailed picture to date on how climate change might look for Jersey and other regions in the British-Irish Council (BIC). As models advance and scenarios are honed, there will be a better understanding of future climate. For example, the Marine Climate Change Impacts Partnership (MCCIP[102]) works to provide a national co-ordinating framework and knowledge transfer of high-quality evidence on marine climate change. The MCCIP uses the scientific understanding developed through a number of programmes such as UKCIP and MarClim[103] - a

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[101] http://www.ukcip.org.uk UKCIP was set up in 1997 and is funded by the Department for Environment, Food & Rural Affairs (Defra). It is based at the University of Oxford and co-ordinates research on how climate change will have an impact at regional and national levels.
[102] http://www.mccip.org.uk/
[103] http://www.mba.ac.uk/marclim/

project Jersey participated in that investigated the effects of climatic warming on marine biodiversity.

1.136

1.137 These programmes are critical tools in predicting the size of climate risks and allow appropriate risk management based on high-quality climate information. They assist successful land use planning and provide a framework for the investment in long-lived infrastructure in the light of climate change. In addition there will be a need to protect natural resources be it coastal areas or climate-sensitive species as well as the most vulnerable in society who are likely to be most vulnerable but the least able to afford protection (e.g. insurance).

1.138 "*High quality, detailed climatologies are essential for the purposes of validating model simulations against the real world*"[104] To have any confidence in the predictions of any model, exercises must be undertaken to demonstrate the model's ability to predict present climate based on the data of the past. Only with that validation can the future climate predictions have any credence. The science of climate modelling, understanding the complex interactions of the atmosphere is continually evolving with newer more refined climate models being developed, there is therefore a continuing need to ensure the climate data is kept up to date to not only validate future models but also continually monitor the predictions of previous models

1.139 Recording the weather in Jersey has been undertaken for well over 100 years with some of the earliest records dating back to the middle of the 19th Century. The longest virtually unbroken data set is that of the Maison St. Louis Observatory (the official climate station for the Island). Details of rainfall, maximum and minimum temperatures, hours of sunshine, wind speeds and direction are all logged and recorded at least three times each day, resulting in a detailed picture on the background (mean) value of these variables for Jersey. Recent automation of the recording system at Maison St. Louis has enabled the Department to move from 3 records per day to now recording observations every hour, making the resulting data set from 2004 even more valuable.

Policy Option 44: The States will:

1. Continue to record high quality long-term climatological data.

2. Work with the British-Irish Council and others in using this data to provide high quality, validated climate information at an appropriate resolution for Jersey.

3. Use this data to bring forward policy with respect to risk management, land use and infrastructure planning, natural resource conservation and social equity.

[104] *'Scenarios of climate change for islands within the BIC region'* (July 2003) – British-Irish Council

Climate Change and the agricultural industry

1.140 The agricultural industry is a good example of a climate-sensitive sector since it is at the 'front-line' of climate change. Agricultural businesses must be aware of the nature of the challenges ahead and be prepared to tackle them as part of their long-term decision making. The rural economy is currently undergoing many changes as a result of market forces and in order to assist the industry the Rural Economy Strategy was developed in consultation with the industry[105]. The aim of the Strategy is to deliver increased efficiency and greater diversification within the countryside whilst at the same time protecting and enhancing all those features that define Jersey's unique landscape and environment. Through the diversification of the rural economy there is an opportunity for new business models in the light of different climatic regimes of the Island and its' competitors.

1.141 Climate change is likely to have a variety of effects on the agricultural industry:

- ***Changing crop / climate interactions*** - For example : Potential increased photosynthesis and yields as a result of increased carbon dioxide levels; lengthened growing season and reduced vernalisation[106]; damaged crops at extreme temperatures. Drier summers and wetter winters could affect crop yields and cause problems at harvest time. The need for irrigation in summer is likely to increase particularly in Jersey's light sandy soils whilst during the wetter winter periods poaching and waterlogging are likely to be problematic;

- ***Soil management –*** More intense rainfall increases soil erosion and working on wet ground cause a deterioration of soil structure; there would need to be modifications of agricultural practices and improved conservation methods;

- ***Disease management –*** Increased / change in range of native/alien pest and disease problems. Warmer winters and a decreased occurrence of frost and snow improves the conditions for pests and diseases to overwinter from one season to another e.g. potato blight;

- ***Livestock Management –*** In wet weather or extremes of weather such as very hot summer days and nights, animal welfare can be compromised and there may need to be house design changes e.g. increased ventilation, more shade needed. Changes in hard feed requirements from potentially reduced grazing season in very hot summers;

- ***Changing markets –*** There may be opportunities to change the crops grown for example diversification into vines, soft fruit, walnuts, peaches – these must be weighed against water resource requirements. It is important to be aware of the effects of climate change on the production of crops that compete with Jersey in the export market since limitations in production elsewhere might allow Jersey to enter new markets;

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[105] 'Growing the rural Economy' – Rural Economy Strategy, adopted by the States in July 2005.
[106] Cold winter weather required for flowering e.g. Apples and strawberries

- ***Managing increased energy costs to the industry -*** The agriculture and fisheries sector is the most energy intensive non-public sector group with a £2 million annual spend on energy. These energy costs contribute to almost 7% of GVA and in a scenario of increasing energy costs there are likely to be further impacts on gross margins. Adopting the highest standards of energy conservation and factoring this into long-term planning is essential (this is addressed in Chapter 5).

1.142 Whilst these challenges are serious, there are opportunities for agriculture to play a role in helping reduce Jersey's contribution to climate change :

- ***Sustainable food production –*** The production of local seasonal food not only stimulates the local economy in line with States policy, it reduces food miles.

- ***Energy Crops -*** Diversification of fallow land to grow biofuels can offer 60% saving on their fossil fuel equivalents[107]. Chapter 6 describes the potential for bio-fuels locally.

- ***Methane emission from Dairy cattle –*** The powerful greenhouse gas methane (CH_4) is produced as part of the normal digestive process of ruminant animals and the amount emitted by live animals varies with diet. Methane is also produced from the decomposition of manure under anaerobic conditions e.g. manure stored in lagoons. An estimate of methane emissions from livestock on Jersey[108] using 2005 livestock figures suggests that cattle dominate and total methane emissions from livestock and animal wastes are estimated as 956t CH_4/anum in 2000 (See Appendix B). This is compared to annual methane emissions arising from human waste of 81t CH_4/annum. The latter is a far lower figure as a result of the current process of collection and anaerobic digestion of human waste, recovery of biogas (minus losses as a result of typical leakage and venting) and a return to land or incineration of the residue. By centralised anaerobic digestion of animal wastes, methane could be recovered as opposed to emitted and the resultant energy derived from the process used to displace conventional energy sources (Chapter 7)

Policy Option 45: The States will assist the agricultural industry to identify and plan for the effects of climate change and adjust their business models to account for the opportunities and challenges climate change presents.

Climate Change and the fisheries and aquaculture industries

1.143 Chapter 3 has discussed the observed changes in the marine environment that are driven partly by climate change and that they are predicted to continue. Whilst climate change is not the only factor, the variety and distribution of marine species

[107] Agriculture and Climate Change (Nov 2005) a report published by the National Farmers Union www.nfuonline.com
[108] Coley, D and Romeril, M. (2001) Greenhouse Gas Inventory Jersey 2000, University of Exeter

are being altered and cold-water species of plankton, fish and intertidal invertebrates are retreating northwards around the UK and the ranges of southern species are expanding. The decline in prey species has already been shown to have an effect on ecosystems with for example, the decline in sand eels resulting in the low breeding success of black-legged kittiwakes and other seabirds. Jersey lies at the confluence of the cold and warm temperature marine biogeographical region together with the warming influence of the Gulf Stream. This means that important groups of animal and plants associated with the warmer waters of southern Europe as well as species associated with the cold, northern waters of the UK are found here. The fishing industry plays a significant role in Island life and the maintenance of the marine habitat is important to safeguard nursery grounds and feeding areas for commercial species. These factors make Jersey particularly vulnerable to the effects of climate change.

1.144 Present understanding of the impacts of climate change on natural and commercial marine activities is limited. Stock abundances have changed and there is some evidence of local warm water species becoming more abundant e.g. bass and trigger fish stocks in the last 10 to 15 years. There are also some reports of warm water species like tuna, bonitos and Mediterranean bream species appearing in local waters, but it is difficult to identify cause and effect relationships. Any such changes must be disassociated from many other factors in the marine ecosystem including fishing effort. However, it is certain that the future will present major challenges and perhaps some opportunities.

1.145 Climate change is likely to have a variety of effects on the fisheries industry and marine ecosystems :

- ***Changing structure of commercial fisheries*** – Continued declines in populations of commercial cold-water fish could provide new opportunities for fisheries and aquaculture

- ***Port management -*** Changes in sea level, storminess and wave height could provide challenges in the management of ports and harbours

- ***Pollution*** – The increased intensity and frequency of extreme events may alter the pattern of inputs of chemicals, nutrients and pathogens to the marine environment. Nutrient enrichment may be a particular risk in Jersey given the high incidence of nutrient runoff from land and the proximity of aquaculture in the inter-tidal zone.

- ***Pathogen management*** – Climate change may impact on the fate of chemicals, nutrients and pathogens in the marine ecosystem. Results of this may include changes in the exposure of humans to pathogen risk and also an alteration in the distribution and susceptibility of marine species.

- ***Changes in biodiversity*** – Jersey's 12 metre tidal range means a rich and diverse inter-tidal zone; 38 intertidal biotopes have been identified locally

compared to 87 identified in the entire UK[109]. This fragile and complex environment is especially vulnerable to alteration as a result of climate change.

Policy Option 46: The States will assist the fisheries industry to identify and plan for the effects of climate change and adjust their business models to account for the opportunities and challenges climate change presents.

1.146 The UK have adopted the route of integrated spatial planning within and protection of the marine environment through a 'Marine Bill'. This will be directly relevant to the development of marine renewables including the wave and offshore wind power industries, with the delivery of "streamlined, transparent and consistent" system for licensing marine developments. Jersey is moving towards this with continued work on the Integrated Coastal Zone Management Strategy which will be issued in 2007. There is the opportunity to give further direction to the spatial planning of the marine environment through the Island Plan review process and there will be much to be gained from monitoring the progress of the UK's Marine Bill.

Policy Option 47: The States will continue to consider marine issues and climate change impacts in an integrated way through the development of the Integrated Coastal Zone Management Strategy and the Island Plan Review process. The aim should be to provide consistent integrated policy advice on the use and exploitation of marine resources e.g. harvesting renewable resources against the objective for a clean, healthy, safe, productive, and biologically diverse marine environment.

Climate change and biodiversity

1.147 Chapter 3 has shown how there is likely to be a shift in the distribution of species as a result of climate change. This is because increased fragmentation and the loss of habitats means that species have less resilience to the effects of accelerated climate change because there is no available space to accommodate these changing ranges. Although frequently found species are just as affected by climatic changes as rarer species, the additional risk of climate change on already declining species can be more immediate. Therefore, it is important to continue to monitor the species composition of habitats and the status of the more vulnerable species so that attempts can be made to mitigate the effects of climate change.

Policy Option 48: The States will continue to carry out and encourage the monitoring of biodiversity in partnership with other organisations. In particular, attention will be paid to local priority species and habitats in order to monitor their status with the aim of identifying and mitigating the risk of extinctions exacerbated by accelerated climate change.

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[109] Kindleysides, D. (1995) *'Conserving the Intertidal Biodiversity of Jersey : A Strategy'*. Unpublished M.Sc. Thesis University of London.

Economic Opportunities Arising from the Climate Change Challenge

1.148 Technological innovation will play a critical role in mitigating climate change – The Stern review points out that emergence of increasingly energy efficient technologies and the development of renewable energy technologies will be accelerated if there is greater international co-operation. Whilst the private sector develops and disseminates innovation, governments can provide the framework to enable it to deliver most efficiently as well as removing barriers to collaboration.

Emissions trading and Environmental Enterprise

1.149 A key global mechanism to tackling climate change is the United Nations Framework Convention on Climate Change and the Kyoto Protocol. The market mechanisms of the Kyoto Protocol have created a new source of financing for projects that reduce emissions of greenhouse gases. Wind power, biomass, energy efficiency, landfill gas utilisation, and forestry are some of the sectors that are benefiting from the availability of carbon finance through the Clean Development Mechanism (CDM), Joint Implementation (JI), and emerging national schemes. In October 2006, DEFRA announced that the UK has provided a way for companies from non-Kyoto countries to participate in the global carbon market through the CDM[110].

1.150 An example of the way projects work under the new arrangements is that of a wind farm project in China that is connected to the power grid and will reduce emissions in China by an average 109,922 tonnes of carbon dioxide equivalent each year between 2006 and 2012. A Company, Climate Change Capital, had a Luxembourg-based fund that wanted to participate in a CDM project in China. The fund received approval from China on the condition that the UK also approved their participation which was duly given resulting in the project's go-ahead.

1.151 Jersey is a signatory to Kyoto through the UK and these new arrangements will also apply to the Island and allow it to participate in CDM projects. This is valuable since it is perceived that there are an increasing number of companies based abroad who would wish to join the CDM but could not participate through their own countries. For example, currently companies in places like California don't have a way to participate in the global emissions market and support CDM projects in developing economies. The decision means non-UK companies will be able to participate in the UK carbon market, so creating a way for local trading schemes to be linked via the CDM.

1.152 The global carbon market is predicted to be worth $40.2 billion by the end of the decade and 26% of registered CDM projects involve UK participants. This would appear to offer considerable opportunities to Jersey as an established financial centre with a favourable 0/10 tax regime. The States' Strategic Plan 2006-2011 commits to 'sustained economic growth' and this underpins the Economic Development Department's Enterprise and Business Development Strategy[111]

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[110] Department for Environment, Food and Rural Affairs, News Release (461/06) issued by The News Network on 27 October 2006

[111] http://www.gov.je/EconomicDevelopment/EnterpriseBusinessDevelopmentStrategy.htm

which aims to grow existing businesses and increase the number of new businesses.

1.153 The States' Strategic Plan 2006-2011 also makes a commitment to 'show the world that economic and environmental success can work together'. Jersey's financial services are low-carbon footprint industries and contribute to economic growth within population growth limits. It seems that entry into carbon markets and Kyoto Mechanisms are likely to be possible for Jersey whose experience in global financial markets makes it well placed to participate. Jersey is currently advised that it cannot participate in the European Union emissions trading scheme but the Island remains in discussion with the UK and the hope is to reach a positive resolution.

Policy Option 49: The States will investigate and provide, where appropriate, the support and advice mechanisms necessary to enable and empower the financial sector to participate in carbon markets and Kyoto Mechanisms.

1.154 Jersey may have the opportunity to develop its considerable indigenous renewable energy resources in the future. There may be opportunities through Joint Implementation projects which applies to climate change mitigation projects implemented between two Annex I countries. 'Emission reduction units' (ERU) are created, acquired and transferred for example, another Annex I country would wish to invest in a renewable energy project in Jersey. The ERUs generated by that project would count towards that country's emission reductions. However, the advantage in this mechanism is that the country in which the investment is made can provide the project at a lower cost than an equivalent in-country project. In order for Jersey to participate the Island would need to offer comparably low-cost projects to attract investment.

Policy Option 50: The States will investigate the opportunities for the exploitation of renewable energy providing or enabling the necessary conditions to attract inward investment through mechanisms such as Joint Implementation.

The compliance market

1.155 This sector provides support to achieve compliance with regulations. The UK has an expanding compliance market estimated to be worth £3.5 billion per year by 2010. The main opportunities in the UK are considered those in meeting tighter building standards, the supply of biofuels for road vehicles and the generation of renewable electricity.

1.156 The Shell Springboard Organisation[112] suggests that to anticipate the future shape of compliance markets in the UK and Europe, Small and Medium Sized Enterprises (SMEs) can monitor developments in other countries, particularly

[112] http://www.shellspringboard.org/

California, which has a track record of setting trends in environmental policy and has an economy and technology sector large enough to influence world markets. They can also consider the global trends which commentators such as the World Business Council on Sustainable Development have summarised, with major changes expected in power generation, industry and manufacturing, mobility, buildings and consumer behaviour.

1.157 When political direction is clearly given that new policy will require support through compliance, future market opportunities become clear to the industry. In addition innovation and the associated financial encouragement from financiers will serve to fuel the development and growth of this area.

Policy Option 51: The States will investigate and provide, where appropriate, the support and advice mechanisms necessary to enable and grow the compliance market through the Economic Development Department's Enterprise and Business Development Strategy.

The business case for 'being green'

1.158 In addition to new opportunities in the provision of 'environmental services', the need for any business to demonstrate environmental responsibility is now seen as a means to a competitive edge and associated with an increased market share. HSBC for example, have recently become the world's first carbon neutral bank and a recent campaign to donate a proportion of the sale of a financial product to biodiversity projects received the best market response to any advertising campaign the bank has ever had. While many of the big institutions have established environmental policies it may be more difficult for smaller more local businesses to demonstrate their credentials. As well as achieving a competitive edge environmental responsibility makes good business sense per se – inefficient energy practices reduce profits. Improving environmental performance adds to the profitability of business and the buoyancy of the wider economy and often contributes to the security of supply by reducing energy demand.

Policy Option 52: The States will investigate and provide, where appropriate, the support and advice mechanisms necessary to enable businesses to increase their environmental credentials for example through an accreditation scheme run under the umbrella of the ECO-ACTIVE campaign.

Part 5 - Ensuring that Energy Supplies are Secure and Resilient

"People only start to become concerned about energy when it is in short supply"

Loyola de Palacio, Vice-president of the European Commission, 2002 EU publication – 'Energy, Lets overcome our dependence'

CHAPTER 12 - The Security and Resilience of Supply

Chapter summary

The availability of reliable and resilient supplies of energy at predictable prices is essential to maximise economic efficiency. The physical security of supplies is potentially threatened in the short term by force majeures, technical problems or targeted action which, in turn, can have financial implications. In the longer term price security is harder to predict because fossil fuels will become scarcer and as an importer of fuel, Jersey is particularly vulnerable to price shocks or rising market prices.

Risk management is the key to managing import dependency. The vulnerabilities in supply routes (e.g. the reliability and safety of the maritime supply routes of petroleum products) or storage facilities (e.g. limited capacity and facility dependence at the fuel farm, La Collette) must be understood and plans made to mitigate unacceptable or predictable risks. The States must identify and manage the risks associated with the physical and security of Jersey's current and future energy mix.

Proposed policy options centre on :

1. Ensuring supply and demand can be met in normal circumstances and, in an emergency situation, via adequate and robust contingency planning;

2. Ensuring the Island is protected from and, if necessary compensated for, the threat of environmental pollution or damage to human health from either nuclear or maritime incidents;

3. The States will instruct the JEC that the local electricity network must adhere to n-1 planning standards (I.e. the single biggest loss in supply). After the closure of the La Collette Plant this will require the installation of the third interconnector;

4. The States will enter into discussions with stakeholders in the petroleum products industry to ensure adequate security of supply for the future. Threats to the status quo are:

   i. Shipping costs – overheads are very high and expose Jersey to price shocks in this area

   ii. Future availability of shipping – There are long term doubts about the availability of suitably sized double-hulled ships for local waters/harbour

   iii. Location of the fuel farm - It is anticipated that the Buncefield Investigation Report will recommend stricter controls on land use around fuel farms. These may prove sufficiently restrictive in the master planning of the East of Albert area to make alternatives such as moving the fuel farm more viable.

5. Alternatives such as the economic viability of the importation of petroleum products via pipelines will be further investigated. Benefits to such a scheme in addition to combating the challenges outlined above are :

i. Increased flexibility of the fuel mix;
ii. Improved security of supply;
iii. A reduction of facility dependence.

Introduction and aims

1.159 To maximise economic efficiency, people and business must be able to rely on secure energy supplies that are available at predictable prices. This is achieved through a resilient system that can cope with fluctuations in demand and recover quickly should problems occur. Threats to reliability and security of supply can be considered over different time scales, and both the physical as well as financial security must be considered:-

Physical and financial Security - the short-term / 'force majeure'

1.160 Supply is vulnerable to unpredictable events that arise as a result of geopolitical instability, major technical problems or targeted action such as terrorism and extreme weather conditions. Any unexpected interruption in the chain of supply and demand leaves receiving markets vulnerable to price-shocks:-

- ***Geo-political instability*** - There is a concentration of hydrocarbon (oil and gas) resources in a few countries, many of which are politically unstable. Europe is particularly economically dependent on certain types of energy, such as oil and gas, and on particular countries for supply, such as Russia and North Africa for natural gas and the Middle East for oil. The products have to be paid for in American dollars meaning that Europe is vulnerable to a strong dollar. However, geopolitical considerations are becoming more important than economic considerations. There are physical and political risks linked to the transport of energy products to Europe, which are more serious in the case of gas rather than oil.

Dependence on such regions involves risks. Hydrocarbon supplies, or the transit routes, may be vulnerable to disruption for political reasons or simply because law and order break down in the regions concerned. Liberalised consumer markets cannot isolate themselves from these risks and markets on their own cannot cope with the geo-political problems. The danger may not so much be from attacks by terrorists as from the potential intervention by producer or transit states either to interrupt supply or to manipulate prices for political reasons or because of political or social instability in those countries.

- ***Technical problems / targeted action*** – Capacity must be able to respond to any disruptions such as a major technical problem / or a targeted hostile action. "Facility dependence", the over-dependence on a single energy facility must be limited since over-dependence on any single energy facility/location is a key threat to the security of supply. This has been exemplified by the Buncefield fuel farm accident. Vulnerabilities also lie throughout the supply chain for example, Jersey relies heavily on import by ship making the Island susceptible to interruptions within marine supply routes or berthing opportunities.

- ***Weather*** – Extreme weather events can affect energy infrastructure or supply routes. For example electricity networks are particularly vulnerable when cables run

overhead and are damaged by trees in storms. Alternatively the difficulty of cooling power stations during hot summers may limit production.

Price security - the medium-term (next 50 years)

1.161 Jersey is already entirely dependant on imported energy from Europe. The majority of Jersey's energy is imported by sea as fuel oil, liquid gas and coal although about a third arrives as electricity through the interconnecting undersea cables to France. In 2005 two thirds of all energy was a petroleum product with road fuels accounting for nearly a quarter of final demand. Given this import dependency, a key external driver for Jersey's energy security is the European Energy markets and supply routes into these.

1.162 Currently, indigenous energy resources cater for half of Europe's needs. As the whole of Europe moves towards becoming a net energy importer it must have sufficient diverse fuel sources to secure a reliable supply. It has been recognised that if properly managed, this is not necessarily a problem for Europe[113]. At the global level, the International Energy Agency (IEA) is the key organisation for managing oil supply disruptions and the release of stocks by its members. Oil stocks can contribute to resilience in the event of actual or potential supply disruptions and the IEA plays an important role in helping to ensure stable energy markets.

1.163 Due to Jersey's almost 100% import dependency, the issue of resilience and contingency planning is critically linked to energy strategy.

Price security - long-term (more than 50 years)

1.164 Energy use must be reconciled with long-term environmental objectives, both domestically and overseas. Some countries across Europe, like France, Belgium and Spain have decided to increase their nuclear power programme to fulfil their energy requirements. The increased penetration of natural gas into markets like heating and electricity might give the impression of relatively abundant energy but the future is likely to be less reassuring[114]. Conventional oil reserves are sufficient to meet the projected global demand for around 30 years although new discoveries would be needed to renew reserves. Proven gas reserves will meet at least 60 years of demand but are also declining. These strictly finite quantities of oil and gas, and their geological constraints, mean that it is predicted that in a few decades they will be mostly exhausted. It is recognised that the very long term, reliance on fossil fuels as a source of energy cannot be seen as secure option and developing low carbon options would also create opportunities to increase energy reliability.

1.165 Although supplies are unlikely to be disrupted for long in the short term, the decline in overall global supplies of fossil fuels means that, there are risks of price shocks resulting from geopolitical disruption or damage to infrastructure in import

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[113] 'Energy Supply: How Secure Are We?' 5619/01 COM(2000) 769 final: Green Paper presented by the Commission —Towards a European strategy for the security of energy supply
[114] 'Energy - Let us Overcome our Dependence' – EU Commission 2002

networks. It is crucial that these risks need to be monitored and managed since Jersey is an energy price taker i.e. the price here is largely determined by global energy markets, although local suppliers are still responsible for local costs. As such, the Island will be exposed to escalating price trends and the price of oil has a major impact on household and business energy costs as over 70% of primary energy is currently a derivate of crude oil. As fossil fuel products diminish and reserves become more difficult to exploit, they will become more expensive.

Security and resilience through risk management

1.166 It is clear that a resilient energy supply is crucial to Jersey in economic and social terms. All industry sectors are dependent on a reliable supply of electricity whilst affordable energy for the domestic market is essential to ensure protection for low income households.

1.167 Whilst Jersey is currently reliant on imported energy from Europe, relying on imports need not be a problem in itself. Oil and, currently to a lesser extent gas, are internationally traded commodities. All countries, whether import-dependent or not, have a common interest in promoting open markets and predictable prices. Most advanced industrial economies already import significant proportions of their energy needs without noticeable disruption. Import dependency has long been a fact of life for all the G7 countries apart from the UK and Canada.

1.168 The European Union's Energy Strategy[115] makes the point that '*The key criterion for energy security should be risk management rather than self- sufficiency'.*

1.169 An energy strategy with a high import dependency carries some risk. Nevertheless the Island has operated successfully with this policy for many years. Furthermore, energy trade worldwide is beneficial both to producers and consumers and is not seen as a threat to the Island's security.

1.170 Rather than aim for self-sufficiency, which even if it were practicable would be expensive and only achievable in the long-term, it is more realistic to focus on effective risk management for at least the medium term. The aim of energy security policy is to understand, reduce, and mitigate those risks.

1.171 Sometimes, it is possible to identify a risk clearly and take specific protective measures. More commonly, the nature and scale of the risks will be uncertain, so the protective measures will need to be generic. The next sections will show the current situation for supply and distribution networks for each energy type to identify the risks within the supply chain and work within what are considered acceptable levels of risks.

[115] Energy Supply: How Secure Are We? 5619/01 COM (2000) 769 final: Green Paper presented by the Commission—Towards a European strategy for the security of energy supply

Supply and distribution networks - electricity

Product

1.172 With no viable possibility to store electricity, supply must be carefully matched to demand. The trend in Jersey is of a significant increase in electricity's market share. In particular, electricity has an 80% share of the new energy market created since the late 1990s by the extensive residential and commercial property development boom. With increasing demand there is need for existing and planned future infrastructure to keep pace. Jersey has made the decision and the necessary investment to displace the on-island power plant - this was driven by the strategic risk of having no diversity from oil which was considered a main vulnerability.

Primary supply of product

1.173 Within Jersey there is relatively little transformation[116] of energy as most of the fuel imported is in the final form that consumers want. Heavy fuel oil was used to generate the oil-fired electricity station at La Collette but since the inter-connector programme began in 1985 this has dropped and by 2005 oil generation accounted for only about 2% of total electricity compared to 37% in 1991.

1.174 *First Interconnector* – The driver behind the investment in the first French interconnector 1985 was to break way from the Island's fossil fuel dependency (gas and oil). For the first 15 years, this allowed 50% electricity import but investment continued at La Collette so that there was sufficient back up. At that time Jersey had an interruptible electricity supply and the on-Island power generating plant was required to operate throughout each winter to supply all Island demand and in the summer and shoulder months to supplement imported power.

1.175 *Second Interconnector* – The successful installation of the first interconnector led to a further investment in a second interconnector which was finished in 2000. This allowed further access to low-carbon electricity from the competitive European electricity market. In addition, power generation and therefore chimney emissions at the La Collette power station was almost eliminated. This supported Jersey's international obligations under Climate Change Protocols and also avoided the localised pollution problem which was anticipated ahead of the development of the Waterfront area for leisure, housing and commerce.

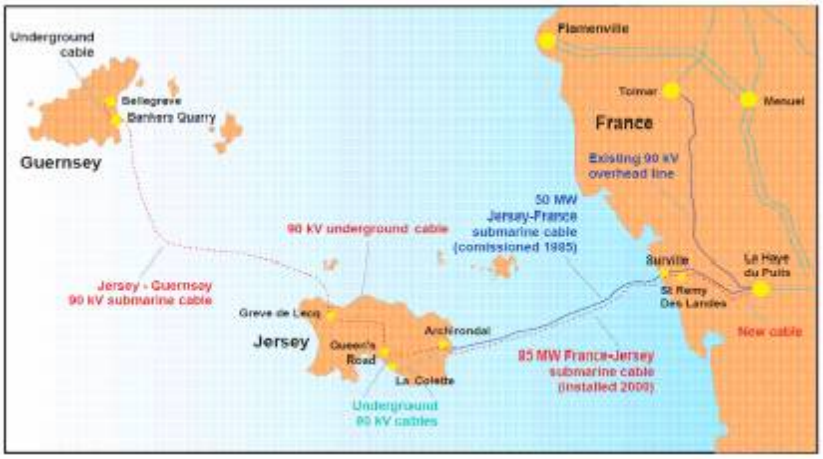
1.176 The second interconnector has meant that the Island is capable of importing all of its electricity needs but the current policy of operational independence is maintained by keeping capacity at La Collette power station. However, this has been eroded by higher demand and looking to the future with a potentially increased population, the gap between supply and demand is likely to expand.

1.177 The interconnector has been extended to Guernsey in order that the power utilities could share the power generating capacity held in each Island, thus

[116] Transformation means turning a fuel source from one form to another that is normally easier to use e.g. crude oil contains a great deal of energy, but this can only be easily harnessed when the oil is refined into other products such as petrol or heating oil.

delaying or avoiding the need to build more power station plant and thus benefit from economic and environmental advantage (Figure 24).

Figure 26 Interconnector routes and capacity to the Channel Islands



Source Jersey Electricity Company 2006

1.178 The capacity is spread across the Channel Islands and can be summarised as follows[117]:

1.179 Winter peak demand is assumed to be 150 MW for Jersey and 72 MW for Guernsey Jersey therefore is currently 5MW short at peak maximum demand. The CIEG interconnector capacities are:

- Electricity de France → Jersey - 145 MW (55 MW + 90 MW);
- Jersey → Guernsey - 60 MW (there is a contractual minimum of a supply of 16MW);
- Jersey ← Guernsey - 25 MW.

1.180 Plant capacity is

- Jersey : 209 MW (165MW from La Collette and 50 MW from Powerhouse, Queen's Road)
- Guernsey : 115 MW

1.181 From this it is clear that there is a surplus of capacity across the whole Channel Islands. This results from the on-going requirement to provide sufficient alternative generating sources to accommodate a failure within the CIEG cable networks. This is particularly relevant to Guernsey Electricity Limited (GEL) who must ensure they can accommodate a failure of the one 60MW cable between Guernsey and Jersey. In addition according to the terms of the CIEG, the contractual maximum entitlement for Guernsey across the link is only 16MW (less than 25% of peak demand). To add to this, the States of Guernsey have a policy of 'strategic independence' which aims to '*minimise the need to import electricity*'[118].

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[117] 'Jersey Energy Sector Review' a report commissioned by the States of Jersey by Design & Implement Consultancy

[118] States of Guernsey Business Plan, Billet XIX 2006 Priority 10

From Jersey's perspective, the principal issue is the impact of the loss of any one of the two interconnectors, which, although a low-probability event, is high impact causing an immediate loss of electricity supplies in Jersey. There have been four occasions in the ten years up until January 2007 on which all, or most, electricity supplies in Jersey were lost because both electricity importation circuits tripped from service[119].

1.182 In Jersey this means that JEC plan to be able to maintain supply if the largest in feed (the second interconnector) is unavailable. This means Jersey adhere to the system planning standard N-1 i.e. the system is planned to normal "n" minus the loss of x biggest supply input at system peak (N-1). A report was commissioned[120] to look at the structure of the Channel Island Energy Market and it models a high level scenario considering the "worse case" where at winter peak the 90 MW EdF cable is unavailable. In this circumstance, demand for electricity across the Channel Islands could be satisfied (assuming all other plant / links available) under the following scenario:

- GEL would generate all 72 MW of its demand (from the 115 MW capacity); and
- JEC would import 53 MW (assuming 2 MW losses) from EdF and generates 97 MW (from the 209 MW capacity).

1.183 Whilst this scenario currently provides Jersey with n-1 back-up, it is reliant on the stand-by capacity at La Collette but this can not be a long-term strategy since the life of this plant is limited for a number of reasons.

Supply and distribution networks - fuel oil

Product

1.184 All the petroleum products used in Jersey are imported as a range of fuels comprising: aviation spirit (Jet A1); Motor Spirit – 2 grades – light fuel oil and thicker oil that growers use in glasshouses and in the dairy; petrol; diesel; heating oil (kerosene); oil for electricity generation; Gas oil – Diesel vehicles & Commercial property heating e.g. Agriculture / States of Jersey. All diesels are ultra-low sulphur (ULSD) and due to UK/EU legislative drivers are expected to be sulphur-free eventually.

Primary distribution of product

1.185 Fuel is received from two main UK refineries; Pembrokeshire and the Fawley Depot, Southampton (sometimes even Rotterdam). There is approximately one delivery per week with each vessel loaded with about 2,500 tonnes of fuel, actual amounts depend on the density of the exact fuels – for example motor spirit is less dense than heating oil (kerosene). The fuel source mix changes seasonally; there is a higher demand for kerosene in the winter compared to the summer when the requirement for Jet A1 is greater. Stock holding and/or replenishment is monitored

[119] Communication with JEC
[120] *'The Structure of the Channel island Energy Market'* January 2007 a report by Design and Implement commissioned by the States of Jersey.

from Jersey according to forecasts for the following month and by daily monitoring of the tanks.

1.186 Schedulers nominate the supply vessels, dates and cargo mix. There are a number of tanks on a vessel so can adjust cargos to +/- 10%. The vessels are fully committed to sea-fed locations (such as Scotland, Northern Ireland, Jersey, Guernsey, Alderney, Welsh refinery and the Isle of Man) and the parent companies charter them and so the schedule is relatively fixed. Cargo and date agreements are made for the next month – the parent company schedules in and dialogue is maintained on exact dates in response to tides (voyage times); weather; anchorage; mechanical and operational matters. This is a very intensively managed supply situation with various contingency plans to ensure the continuity of supply.

Local storage capacity

1.187 Local storage capacity is recognised as a limiting factor, however there has been adequate storage for the last 25 years and even though fuel types have shifted, the market has remained pretty static (+/-1%), for example:

- Motor spirit grades have now shifted to unleaded and diesel (and some lead replacement petrol and super unleaded) compared to a predominance on leaded petrol previously;
- Light fuel oils have declined due to a reduction in the protected sector of the agricultural industry.
- Loss of aviation routes (especially the German and Nordic routes) led to a decline in Jet A1 in mid-1990s but recently there have been some increases again with the advent of cheaper airlines flying more routes to the Island.

1.188 Therefore, stock holding in the tanks has changed to account for different configurations but total volumes have stayed similar. Due to the predominance of oil fired central heating in Jersey, volumes of kerosene are often the driving factor since it is the fastest moving product according to seasonal demand; gas oil can mirror these patterns. Overall it is estimated that there is a 38 million litre market of about 15,000 households for heating oil which creates a large seasonal demand. Two of the tanks at the fuel farm are used for kerosene and at peak winter demand approximately one tank will service the Island's needs for a week. To replenish these supplies, about one third of the weekly ship's capacity is used to fill one tank.

1.189 Additional capacity for motor fuel is available at garage sites around the Island and although buying patterns shift from different retailers, the total litres in the market place stays the same. The product shift in recent years has seen an increase in diesel and a shift to unleaded petrol. There is some seasonality in demand with an increased number of road users in summer but the impact of an increased summer population as a result of the tourism industry has been less in recent years.

Secondary distribution from the tank farm

1.190 The physical infrastructure of the Island means that secondary distribution is very intensive. Product is distributed to the end user by tanker. Each company has a tanker fleet and they are apportioned according to vehicle size, the avoidance of cross-contamination and capacity. Jersey largest capacity tanker is 20,000 litres and this transports Jet A1 to the airport which has large storage capacity. Logistics dictate deliveries with motor spirit and gas oil being distributed in 10,000 to 12,000 litre tankers that hotels and agriculture can accommodate whereas domestic supply vehicles have to be about 7,000 litres to physically gain access down roads and driveways etc. This is compared to UK driving conditions which allow average tanker sizes of approximately 16,000 litres and the maximum carriers are 44,000 litres.

1.191 Scheduling and routing is challenging when considering these smaller capacity tankers and it is here that the major business efficiencies are to be made. For example, one local driver makes approximately 18 deliveries a day and must return twice to the Tank Farm to refill. Given that discharge times are about 15 minutes and the capacity of the average domestic tank of about 1,000 litres, it means that the delivery tankers have an average driving time of about 2.5 hours a day with considerable stop/start driving. This has changed in the last decade with the phasing out of single skinned domestic oil storage tanks in favour of double skinned tanks. Clearly this represents environmental best practice but an old domestic 2,700 litre tank has now been replaced by a double skinned tank of the same footprint but with a reduced volume of 1,300 litres. This has led to the intensity and frequency of supply being increased with more tanker movements being made.

Supply and distribution networks - liquid gas

Product

1.192 A specific feature of the Jersey energy market is that the gas used is all sourced from Liquid Petroleum Gas which is a petroleum product. In 2005 13,200 tonnes oil equivalent (toe) of gas was consumed, a decrease of 0.4% on 2004. Of the total around 80% (123,100MWh or 10,600 toe) is supplied as manufactured gas (via distribution pipes) with the remaining 20% supplied as LPG (2,200 tonnes or 2,600 toe). The lack of a Jersey-Continental pipeline means that Natural Gas (NG) is not available in Jersey. Instead Liquefied Petroleum Gas is imported and then transformed into a gas/air mix. A Jersey unique product is manufactured locally which comprises a gas (propane and butane) and air mix; the mix is controlled to a specific calorific value which is monitored by the authorities. Compared to generating electricity or refining crude oil, this gas transformation loses very little energy, for instance just under 200 toe was consumed in converting 11,000 toe of LPG to gas[121]. This gaseous form can be piped through the gas network but because gas operated appliances are built for NG, they must be converted locally by the Jersey Gas Company to operate correctly on the manufactured gas.

[121] Jersey Energy Trends 2005 published by the States of Jersey Statistics Unit

Primary distribution of product

1.193 LPG is delivered by ship twice a month from the Fawley Depot, Southampton which has a capacity of approximately 1000 tonnes. The product is held in a pressurised vessel within the ship and the capacity is approximately 1000 tonnes. The delivery is shared with Guernsey 50:50 and it is Jersey Gas's policy to take a delivery as soon as there is spare capacity in the tanks so as to maximise the volume of stock, should the ship be delayed. Gas markets set prices monthly so deliveries are booked ahead in order to take advantage of the most favourable prices. The volatile nature of LPG means that it does not carry the same pollution risk in the maritime environment compared to a dense emollient like oil.

Local storage capacity

1.194 Local storage is at the La Collette Tank Farm and at current demand there is two to four weeks supply depending on the season. The capital investment for bulk storage is considerable and such storage is a feature of the local markets since in the UK and mainland Europe wider infrastructure make this unnecessary. This period has been dictated historically from economic business risk assessment. Each of the 7 tanks has a storage capacity of 200 tonnes per tank giving total capacity of 1400 tonnes. It is estimated that there is room for possibly one more tank at the existing site.

Secondary distribution from tank farm

1.195 The mains gas network covers primarily the town and the densely populated areas in the south of the Island. Connecting gas mains to new developments can be advantageous since no bulk storage tanks are required at the point of delivery. This can be crucial to maximise space in high density developments. Where the gas network does not yet penetrate, Minibulk Tanks can be installed either above or below ground to feed individual properties or a LPG piped network supplied to service multiple properties. A Minibulk Tanker then tops up the Minibulks and when required. Alternatively LPG can be used to satisfy smaller demands from cylinders.

1.196 In order to ensure that supply is reliable, two criteria are considered :

- ***Instantaneous peak*** – This is the peak caused by customers simultaneously drawing from the system for example the 5.30 daily peak when most people set their heating to start. This is crucial since in order to service the network Jersey Gas must compress and boost the gas within the network since the system must maintain constant pressure. In turn, this dictates the diameter of the road pipes that are installed. Correctly calculating this demand is important since pipework is infrastructure that is put in place for 50/100 years.

- ***Continuous demand –*** The baseload demand and supply profile is affected by the number of customers and their demand use. For example, the loss of hotel beds has had the effect of decreasing the summer baseload but as these have been replaced with residential dwellings the year round profile has risen.

What are the risks to the physical security of supply ?

The short-term / force majeure – mismatches between supply and demand

1.197 In the short term there are a number of risks associated with the patterns of supply and demand.

1.198 ***1. Supply routes and maritime safety*** - Approximately two thirds of the Island's energy are imported by sea by finely tuned supply routes. Supply is therefore dependent on an uninterrupted and working schedule of deliveries and discharges.

1.199 Particular threats to these supply routes could arise from global climate change. High resolution climate change models[122] have predicted that Jersey will face increases in sea levels of approx 0.7m and a possible 0.5m increase in the height of the 50-year storm surge. Damage to coastlines and inundation is caused mainly by shortlived, extreme, high-water levels in storm surges due to the effects of wind and low pressure particularly around the time of high tide when they can be most damaging. This has relevance to shipping movements and berthing arrangements especially when considering the tight supply and demand import ratio.

1.200 ***2. Local electricity infrastructure*** - Trees coming into contact with overhead power lines are key factors in maintaining supply but to increase security of supply, the JEC's policy is to bury lines underground wherever possible.

1.201 ***3. Facility dependence*** – The fuel farm is the primary storage repository for all fuel oils. Sufficient contingency planning and the future of the La Collette area remains critical for future security of supply. The current position of the fuel farm also poses health and safety issues for La Collette and may prevent the true economic value of the land and port area being realised.

1.202 The principal legislation covering LPG establishments is the Control of Major Accident Hazards Regulations 1999 (COMAH; also applies to primarily the chemical industry and other dangerous substances). Their aim is to prevent major accidents involving dangerous substances and to limit the consequences of any accident to people and the environment. The regulations cover the unloading equipment at the jetty, the site itself, and the outfeed any transmission system.

1.203 Prior to the fire at the oil storage and transfer depot in Buncefield, UK in December 2005 petroleum storage sites were generally not considered to be sites where an explosion incident of such large scale could occur. Buncefield challenged this worldwide perception. The Control of Major Accident Hazards (COMAH) Competent Authority recognised that safety and environmental safeguards needed to reflect this new understanding even though they are extremely rare events.

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[122] **UK Met Office, the Hadley Centre** (2003) *'Scenarios of climate change for islands within the BIC region'*

1.204 The Buncefield Investigation[123] has identified that there are now fundamental questions about residential and commercial developments around sites like Buncefield. The phase of the investigation is currently addressing advice to planners and this may well have ramifications locally with the possible limits on the use of the area in the 'hazard zone around the fuel farm as well as impacting on the potential relocation of the Energy from Waste plant to the La Collette area. Clearly there is a balance to be made between the risks and benefits of development. The preliminary conclusions of HSE's current review of its advice to planning authorities[124] are suggesting that the revised guidance which wiill be released in July 2007 will call for more stringent regulations in relation to land use planning around such sites. This could mean an enlargement of the current hazard zones around the fuel farm meaning a limitation in the nature of any developments in areas around the site and the number of people engaged in activities within these zones.

1.205 This may have considerable consequences on the development of the 'East of Albert' area if the fuel farm is to remain in the same location.

1.206 ***4. Back up and on-island generating capability*** - There appears to be a safety cushion with sufficient on-island generating capacity to back-up most needs. However, this is oil fired and so still dependent upon imports. Under IEA and EU rules countries are obliged to hold 60 to 90 days stock of oil products. Jersey is a member of neither and currently back up for fuel oil and gas is limited to approximately 2 weeks in winter. Forward plans need to consider scenarios where oil is either scarce, unaffordable or both, as well as the limitations on using indigenous generation at the la Collette plant.

The Medium-term

1.207 The Island's high dependence on imported fossil fuels available at predictable and affordable prices is a medium and long term risk to security of supply.

1.208 ***1. The Status of Jersey*** - As a relatively small consumer in the European energy market place, Jersey could be considered at risk in a future market of increasing prices and falling supply. Nevertheless Jersey has full access to European (not just French) markets and as such, prices regulated by the open European market.

1.209 ***2. Vessel availability and capacity*** – Because maritime safety is a great concern for the European Union and there is much traffic of hydrocarbons in European waters, the EU is in the process of providing itself with better adapted laws on maritime safety. International legislation[125] requiring the phasing in of double skinned tanks on ships – the reduced capacity of the ships and the smaller size of the Channel Island ships this is likely to affect primary supply patterns. The fact

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[123] *'Initial Report to the Health and Safety Commission and the Environment Agency of the investigation into the explosions and fires at the Buncefield oil storage and transfer depot, Hemel Hempstead, on 11 December 2005'*. Buncefield Major Incident Investigation Board

[124] http://www.hse.gov.uk/comah/buncefield/bstg1.htm

[125] The IMO International Convention for the Prevention of Pollution from Ships (MARPOL) mandates calls for phasing out single-hulled vessels over the next decade or two.

remains that the more oil that is consumed, the more traffic there is and hence the risk of accidents is greater. Maritime safety is a great concern for Jersey. After almost 30 years, the Amoco Cadiz accident is still remembered. There is much traffic of hydrocarbon cargoes in European waters and Jersey, with her challenging waters, is totally reliant on shipping for the importation of petroleum products. Jersey is currently drafting legislation to implement the MARPOL Convention for Jersey ships and ships in Jersey waters.

The long-term

1.210 Reliance on fossil fuels as a source of energy is not a secure option and diversifying to and developing low carbon options could create opportunities to increase energy reliability. Scope for developing indigenous energy sources to be partly or totally self sufficient have been examined in Chapter 5.

1.211 However it is extremely unlikely that the Island's economy will be decarbonised in the next 30 years. In examining high level projections of energy use that assume a 'business as usual' scenario, there is a predicted increase of 20% increase in energy demand. Within this there is an overall expectation that there will be a far greater reliance on electricity although hydrocarbons still form significant components of the fuel mix in 2030.

1.212 The target is that energy efficiency and demand management strategies will stabilise final energy demand at 2005 levels (Table 25); if there are not successful energy demand is predicted to grow by 20%.

Table 25 Final energy demand by sector under an a 'business as usual scenario'

	Predicted final energy demand in toe		
Sector	**2005 Levels of demand**	**2030 Business as usual scenario**	**2030 With reduction targets met**
Road Fuel	46,000	42,400	36,000
Aviation	11,700	22,700	22,700
Industry and Government - petroleum products	32,000	24,500	19,600
Domestic – petroleum products	42,200	34,500	27,600
Gas oil and heavy fuel oil	3,800	9,900	8,000
Total toe petroleum products	**135,700**	**134,000**	**114,000**
Electricity - Industry and Government	26,700	38,200	30,600
Electricity – Domestic	25,000	52,400	41,900
Total toe electricity	**51,800**	**90,600**	**72,500**

1.213 Assuming the success of energy reduction strategies, there will still be a need for infrastructure to cope with the importation of some 114,000 tonnes of hydrocarbons to the Island (Table 25). This is less than current levels of demand, indeed changing patterns of hydrocarbon use indicate that even under business as usual scenario hydrocarbon imports will stay roughly static (a trend observed over the last 14 years). Therefore, the assumption is that although there is a future requirement for significant hydrocarbon imports to the Island it is not be

significantly greater than the current requirements. This assumption will not hold if there is a significant increase in the population.

1.214 Given the expected continued growth of the electricity sector there must also be the ability to import some 72,500 toe electricity – this is more commonly planned using peak demand since this is what drives installed capacity. The JEC have planned with the installation of the third interconnector, by 2015, and the replacement of the aging first interconnector that by 2030 the system will be able to deliver 200MW. As with the hydrocarbons scenario, if there is a significant increase in the size of the population and in particular number of households rise there comes a point when the planned capacity will not be sufficient and additional infrastructure beyond the third interconnector will be necessary.

Actions to ensure the physical security of supply

1.215 In order to ensure that Jersey has a sufficient continuity of energy supply to underpin economic activity, energy policy must identify and manage the risks associated with the physical and financial security of Jersey's current and future energy mix. This means ensuring a diverse and flexible supply which is the best way to protect the Island against interruptions of supply, exposure to sudden price rises, terrorism or other threats to reliability of supply. Energy stocks must be maintained at sufficient levels with adequate back-up and contingency planning to cope with the worst case scenario.

MAKING THE CHANGE

1.216 To achieve these goals on an Island with high import dependence and a finely tuned local distribution network with minimal storage for petroleum products presents many challenges. This strategy would identify the risks associated with the current situation in order that , together with energy providers, are to be able to ensure that there are adequate supplies to meet all responsible demands for energy. Both UK and European energy policy has identified three main elements to risk management :

- ***diversity***: of fuels, their sources and their supply routes, to avoid over-dependence on any particular source;
- ***flexibility***: so that the system can respond quickly to any disruption through a robust infrastructure;
- ***back-up***: via the existence of stocks or alternative sources which can be expanded in an emergency.

Short-term risk management

Adequate contingency planning

1.217 Contingency planning is the tool to cope with unpredictable events or Force Majeures. The Emergency Powers and Planning (Jersey) Law 1990 is the legislation that ensures the continuity of service should there be a breakdown in energy supply. Under this legislation, an Emergencies Council was constituted to provide generally for planning in case of emergencies and to re-enact with amendments the provisions relating to the declaration of a state of emergency.

1.218 It is the role of the Council to *'co-ordinate the planning, organization and implementation generally of measures which are designed to guard against, prevent, reduce, mitigate or overcome the effects or possible effects of any happening, event or circumstance*[126] *that causes or may cause loss of life or injury or distress or hardship to persons or that in any way endangers or may endanger the health or safety of the community*[127] *or that in any way threatens to deprive the community of the necessities of life'*.

1.219 In the event of an emergency, an Order can be made that outlines the designation of a Competent Authority[128] who can make provisions in relation to:

- The supply, distribution, acquisition or use of fuel type of fuel in respect of for all or any specified purpose;
- The price at which fuel may be supplied;
- Maintaining or making the best use of supplies of gas or other material available for the manufacture of gas;
- Conserving and making the best use of supplies of fuel;
- Preserving public safety;
- The disposal of stocks of any such material.

1.220 This is in essence, represents a contingency plan for rationing in the face of scarcity as a result of an emergency. But further clarification is required about the steps major companies and have taken to ensure continuity of service should there be a breakdown in energy supply. Nevertheless the States' Strategic Plan 2006-2010 makes many commitments to improved emergency planning.

1.221 The Plan also promises that *'Effective measures in place to deal with risks to life, property and the environment from major incidents and emergencies'* which is indicated by :

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[126] Means any happening, event or circumstance which has occurred, is occurring or which may occur in the future

[127] Means a substantial proportion of the community

[128] For the purposes of Articles 5 and 7 of the Emergency Powers and Planning (Jersey) Law 1990, the Council has designated, under the Emergency Powers and Planning (Competent Authority) (Fuel, Electricity and Gas) (Jersey) Act 1991, the Home Affairs Committee as the competent authority in relation to fuel, electricity and gas.

- Deaths, injuries and economic losses due to fires and other emergency incidents reduced;
- A resilient and effective response to major incidents and emergencies in line with best practice.

1.222 This is to be achieved by

1. Fully implementing the Integrated Risk Management Plan by 2009.
2. Carrying out an annual major accident simulation exercise and produce a report of the lessons learnt.
3. By the end of 2007, review the Emergency Measures Plan to ensure that provision is being made for the Island to deal with major incidents affecting
    - Economic stability e.g. changes to the economy arising from sudden increases in fuel prices; and
    - Environmental stability e.g. an accident involving one of the nuclear installations on the Cotentin Peninsular

1.223 Currently there is little installed back-up electricity capacity on the Island, for example, whilst the General Hospital has installed backup generation capacity this is uncommon. Instead levels of security are met by on-island plant (reliant on the availability of heavy fuel oil) or the option to import electricity from Guernsey should either interconnector fail. The third interconnector will be routed into a different part of the French grid which will further spread the risk of interruptions to supply in the event of a loss of power.

POLICY OPTION 53 : The States will plan for a resilient and effective response in line with best practice, in the event of a serious disruption to the Island's energy provision occurring through a major incident or emergency.

Sufficient levels of security of supply

Electricity

1.224 Jersey already benefits from electricity supply reliability normally about six times better than the average in the UK. However the dependence of the Island's finance industry on reliable electricity supplies has influenced the current infrastructure investment strategies most significantly by:-

- The retention of power generating facilities in Jersey, capable of meeting electricity demand in full without reliance on imported electricity.

- The investment in placing the electricity distribution system underground for weather resilience and the high levels of distribution system interconnection for increased fault-tolerance.

- The construction of a second interconnection to the European electricity system in 2000 which increased the importation capacity as well as reducing the impact on Jersey of the loss of a single interconnector circuit.

1.225 This has meant that the current levels of security of supply comply with the n-1 scenario i.e. the Island can cope with the single biggest loss of supply – the largest interconnector from France. However this relies on standby plant oil-fired power station plant in Jersey but this is not a long-term solution. The capacity of the La Collette plant offers back up as a recovery position but the ability to rely on that plant is eroded by :

a) ***Declining Availability of Fuel*** : The fuel that powers the bulk of the capacity at the La Collette plant is a heavy fuel oil that is high in heavy metals and sulphur content. As a result of its environmental impacts, this fuel is in increasingly short supply since it is being phased out by the industry.

b) ***Declining Availability of supply ships :*** Shipping availability to import is difficult since given the nature of Jersey's harbour it has to arrive in small ships. There is an International drive to move towards double-skinned hulls. It is difficult / impossible to attract investment in double skinned hulls of an appropriate size for Jersey. Maritime safety continues to rise up the agenda and the level of traffic of hydrocarbons in European waters remains a concern. The Union is in the process of providing itself with better adapted laws on maritime safety.

c) ***Declining tolerance of chimney emissions:*** The existing and planned development of the Waterfront areas surrounding the power station makes the occasional but unavoidable localised chimney pollution an unacceptable nuisance, even in emergency situations

It is for these reasons that the use of the La Collette Plant will be phased out by 2015. The impact of closing the La Collette diesel & steam Power Plant is a future reduction of the JEC's capacity by 135 MW. A "worse case" scenario would be where at winter peak the 90 MW EdF cable is unavailable. In this circumstance, demand for electricity across the Channel Islands could be satisfied (assuming all other plant / links available)[129]:

- GEL would generate 96 MW (from the 115 MW capacity) to meet the 72 MW Guernsey load and export a further 24 MW to Jersey; and

- JEC would import 53 MW (2 MW losses) from EdF and generate 74 MW (from the remaining 74 MW at Queens Road) and import 23 MW (assuming 1 MW losses) from Guernsey.

1.226 Whilst this is technically feasible, it is unlikely to sustainable or affordable for an extended period given the limited fuel storage within JEC and GEL for their gas turbine fleet. Given the technical and economic difficulties there is insufficient resilience of the Island's two Continental electricity interconnectors particularly in respect of the threats to continued operation of the Island's oil-fired power generating plant.

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[129] *The Structure of the Channel island Energy Market'* January 2007 a report by Design and Implement commissioned by the States of Jersey.

1.227 Consequently it was decided in 2006 by the JEC that the installation of a third interconnector by 2012/13 was in the Island's best strategic interests. The new interconnector will be connected into a different part of the EdF network mitigating the risk of a loss of the interconnector supply arising from a fault in the French Transmission network.

1.228 The case for the third interconnector is valid even in the unlikely scenario of zero growth in electricity demand, because it is principally one of supply security, environmental imperative and affordability, not necessarily the accommodation of demand growth. Simultaneous Maximum Demand (SMD, expressed as megawatts) is the driver for new additions to electricity supply infrastructure. In order to achieve a growth in energy sales at competitive prices, heating tariffs either penalise or interrupt consumption during peak hours since this does not incur a growth in SMD. If a growth in energy sales caused a rise in SMD, then there would be a need for investment in infrastructure that would only be required for peak periods and so be poorly utilised.

1.229 There is sufficient indigenous plant available in Jersey to meet demand growth beyond the capacity of the two existing interconnectors. This is important because at present, the loss of either of the two interconnectors will result in the loss of all or most electricity supplies in Jersey at most times of the year.

1.230 In the ten years to December 2006, unplanned interconnector trips have occurred four times. To mitigate the risk of prolonged loss of supplies to electricity users in Jersey, legacy power plant is retained which has the capacity to meet all demand in full. As we have discussed, this plant has sufficient capacity for this role until about 2012, beyond which annual growth in peak winter demand of about 2% could not be met without the support of imported power. A submarine interconnection to Guernsey, built in 2000 provides the Island with access to surplus power generation capacity there and taking that access into account, Jersey's full "independence" from imported European power extends to about 2017.

1.231 However, the planned third interconnector proposal is justified further by :-

- The oldest of the two submarine cables in the existing interconnectors to the European grid has been in service for 22 years and has known metallurgical defects. These render it likely to fail before its 40 years design life, but it is not possible to predict when. Replacement of the cable would take approximately 18 months.

- The expectation of continuing high oil prices makes it economically imperative to remain able to import most if not all of Jersey's electricity, rather than generate it locally using fuel oil.

- Jersey's inclusion in the UK's ratification of the Kyoto Protocol precludes the planned resumption of oil-fired power generation, either to meet demand growth beyond existing power importation capacity or to replace the defective interconnector, should it fail.

- Recent European Directives limiting the emissions of specific products of combustion from large plants.

- Extensive residential and commercial development of the St. Helier Waterfront is making it increasingly unacceptable to operate La Collette power station, due to ground-level chimney pollution and plant noise. The plant is typically operated on 100 days per annum, when the Island's electricity demand exceeds the importation capacity of the two existing interconnectors to Europe. However, running hours during these days are generally very low and normally only 2%-3% of electricity used in the Island is produced here. The environmental impact is though, disproportionately high with the risk of localised chimney pollution arising every day of power station operation. Demand growth will exacerbate this situation if not accommodated by the proposed increase in interconnection capacity to Europe, even though demand growth is not the principal reason for the proposed additional interconnector.

- The effect that it has on reducing the need for customers to make the significant capital cost of emergency standby generation (approx. £200/kW installed). This is important given the lack of space in Jersey's compact business premises to site power generation and fuel storage facilities. Such facilities also present operational and maintenance challenges in a tight labour market meaning that only a few essential facilities such as hospitals and the airport invest in standby generation facilities. The balance of power-sensitive customers tend to choose to activate a controlled shut-down of I.T. facilities instead.

1.232 It is unlikely that a company that was not States controlled could justify such a significant capital investment for no other gain than community investment. If the 62% controlling interest of the States of Jersey in the JEC were to drop to below 50%, it is unlikely that the other shareholders would allow this investment. However, the JEC is confident that they have a sustainable, majority States' controlled business with low enough prices in comparison to Europe to prevent another competitive operator entering. This allows the investment in the third interconnector to be planned for the community good.

POLICY OPTION 54: The States of Jersey to indicate :

1. That the Planning standards to which the local electricity network must adhere to is n-1, now and beyond the closure of the La Collette plant. This will provide market confidence that there is sufficient resilience within the infrastructure to support the continuing trend towards an electricity dominated energy market.

2. Their intention to remain the majority shareholder of the JEC in the long term so that there is a secure future framework within which the JEC can continue to make the capital investment in the 3rd interconnector.

External safety threats

1.233 Commitment Three of the States' Strategic Plan 2006-2010 is to **'Promote a safe, just and equitable society';** it goes on to commit to :

1.234 *'We will ensure that Jersey is protected against threat. We will review immigration controls and port security. We will continue to update our major incident planning and place a new emphasis on making sure that the Island is as resilient as possible against threats to its security and way of life'.*

1.235 The Plan goes on to promise '*Strong protection against threats to the security, social and economic integrity and environment of the Island*' which is indicated by :

- Appropriate arrangements are put in place for compensation to be paid to the Island following any nuclear accident or incident which proves harmful to the health of Islanders or to the Island's economy or environment

1.236 This is to be achieved by improved communication between the Council of Ministers and the French Authorities in relation to the nuclear activities on the Cotentin peninsula and compensation arrangements in the event of a nuclear accident.

POLICY OPTION 55: The States will continue to negotiate with the French authorities to ensure that the appropriate arrangements are put in place for compensation to be paid to the Island following any nuclear accident or incident which proves harmful to the health of Islanders or to the Island's economy or environment.

1.237 Jersey is in the process of introducing better laws on maritime safety. SOLAS is the Convention on Safety of Life at Sea and is a demonstration of best practice to which Jersey adheres. The main objective of the SOLAS Convention is to specify minimum standards for the construction, equipment and operation of ships, compatible with their safety particularly those carrying potentially dangerous cargoes. The Shipping (Jersey) Law 2002 and its subordinate regulations and orders lays out the safety requirements of ships operating in local waters.

POLICY OPTION 56 : The States will continue to reduce the risk from the shipping of petroleum products to the Island through adequate safety controls and contingency planning.

Infrastructure and location of the fuel farm

1.238 The current location of the fuel farm at La Collette next to the harbour is convenient for discharging fuel but it is in close proximity to the built up area, planned industrial units, and proposed infrastructure such as the Energy from Waste Plant. Clearly there is a risk but industry defined standards dictate risk management strategies with procedures. However there is likelihood that industry standards will become stricter in the light of the Buncefield investigation review.

1.239 Within the Strategic Plan is 'The States' Property Plan' which aims that Property Holdings, in some cases in conjunction with others, will during 2006/2007 review the use of certain sites and outline options for the future. They have identified that among others, a site requiring further study is East of Albert/La Collette 2. A steering group has been set up, coordinated by Property Holdings and with representation from Harbours, Transport and Technical Services, Planning, Economic Development, Waterfront Enterprise Board (WEB), Treasury, Chief Minister's Department and the Parish of St Helier. The group will commission the production of a development masterplan for the 'East of Albert' area for consideration by the States in 2007'.

1.240 The current location of the fuel farm is crucial since it provides difficulties due to its 'pinch point' location at the entrance to La Collette II. It is the opinion of the Fire Chief that there is a Health and Safety issue of entrance and egress from the site being through the same route. This has implications for the number of people able to live and work on the site and of course excludes certain development opportunities.

1.241 It is likely that the second report on the Buncefield Incident will recommend increases in current industry safety margins which may have implications for Jersey's fuel farm and current operations. For these reasons and in order to free up the full economic potential of the site and associated sites there is a case to reposition the fuel farm to the south of the site or at an alternative site entirely.

Alternatives to an on-island storage facility

Importing liquid hydrocarbons to Jersey by pipelines

1.242 There are a number of limitations imposed by the current position of the fuel farm and in particular the gas storage tanks which carry a high risk since they are potentially explosive. A report was been commissioned for the consultants Poyry, to look at the high level economic feasibility of the importation of hydrocarbons by pipeline[130] over the next 25 years. Any such high level study must make a range of assumptions and in the case of the Poyry report 4 scenarios were considered that have different routing options (Table 26).

[130] *'The economic feasibility of supplying hydrocarbon fuels to Jersey by pipeline'* (Dec 2006) A report commissioned by the States of Jersey Environment Division and the Economic Development Department.

Table 26 Summary of the analysis of importing hydrocarbons by pipeline

NPV - Net Present Value[131]

Cost	Assumptions
1. Do nothing	
NPV £51M	1. Continue current oil shipments. 2. Maintain existing infrastructure and land footprint 3. Costs include shipping costs; port dues; terminal throughput costs; costs of continuing degrading gas oil and the tank farm leasing and operations costs. ***N.B.*** The large proportion of this option are the shipping costs (£12.50/ton forecast at the rate of inflation)
2. Oil - Base Case Central Scenario	
NPV £30M **Benefit £21M** **High Base case*** **NPV £38M** **£13M Benefit** **Low base case*** **NPV £23M** **£28M Benefit**	1. Pipeline (6-8inch diameter) originates from an oil tank farm in Cherbourg, is then routed to Carteret (37km) and then undersea to La Collette (33km) 2. Pipeline maintenance is costed at 1% of system total ***N.B.*** In order to carry multiple products or grades in the same pipeline, the different products are held in separate storage facilities at the pipeline origin and are delivered into separate storage facilities at the destination (single day tank space). Key cost considerations not accounted for may be increased length to account for the mitigation / avoidance of the Ramsar sites – Harvre des Pas and at the Paternosters Current land footprint reduces by 51%
3. Caen Route	
NPV £44M **£7M Benefit**	1. Pipeline originates from delivery terminal at further inland to Caen with some inland routing (109km) before undersea route to St Helier (33km).
4. Cherbourg route with 10 days Compulsory Stocking Requirement	
NPV £30M **£21M Benefit**	1. As Base Case Central Scenario but with 10 days stocking in St Helier ***N.B.*** Assumption that only 40% of land footprint is freed up due to stocking area and service bay requirement No reduction in hazard zones unless fuel is stocked elsewhere in which case costing for rebuilding are necessary

* Varied NPV of base case scenario by +/-20% for high and low scenario respectively
Source Poyry Report

1.243 Even with a sensitivity analysis that varies NPV by 20%, in all cases there appears to be a benefit to laying a pipeline to import oil as opposed to continuing with current arrangements. This is because of the high costs of importing oil by shipping. In addition shipping costs can vary because of contractual arrangements such as: competitive environment; the length of the contract; volumes and the negotiating position of the parties involved.

[131] Net present value (NPV) is a standard method for the financial appraisal of long-term projects. Used for capital budgeting, and widely throughout economics, it measures the excess or shortfall of cash flows, in present value (PV) terms, once financing charges are met.

1.244 Another important factor is the exact route since costings will depend significantly on an engineering and environmental evaluation. Poyry state that they are confident that this is unlikely to change the estimates significantly.

Importing natural gas to Jersey by pipelines

1.245 The current importation of LPG to the Island could also be replaced by the laying of a natural gas pipeline although this would have significant impacts on the current gas network which would need to be converted to take the natural gas. This is not impossible and has been carried out elsewhere but it does add costs to the project. However, the analysis has shown that there is no scenario where there is a more attractive economic case than the 'do noting option' (Table 27); the volumes of consumption are too small and static to warrant investment

Table 27 Summary of the analysis of importing natural gas by pipeline

Cost	Assumptions
5. Do nothing	
NPV £12M	1. Continue current oil shipments. 2. Maintain existing infrastructure and land footprint 3. Costs include shipping costs; port dues; terminal throughput costs; costs of continuing degrading gas oil and the tank farm leasing and operations costs. ***N.B.*** NPV is the sum of shipping costs; port dues; terminal throughput costs and the leasing and operations costs for the LPG bulk storage, cylinder filling and gas manufacturing facilities. The largest proportion of this is shipping costs
6. Gas - Base Case Scenario	
£22M **£ 10M COST** **High Base Case Central Scenario *** **£29M** **£17M COST** **Low Base Case Central Scenario*** **£15M** **£3M COST**	1. 25 year lifetime costing for the pipeline; a discount rate of 6% and inflation rates of 2.5% in line with Jersey projections. Routed from Quettetot overland (18km) then undersea to St Helier (33km) and is connected to existing gas mains network ***N.B.*** This project requires that all household appliances and the network must be converted from LPG to natural gas (a similar exercise was carried out in Northern Ireland) No account taken from continued storage of LPG since all customers are assumed to switch (Autogas). However this does accure benefit from the freeing of land footprint
8. Ste-Mere-Eglise Route	
£25M **£13M COST**	1. Pipeline originates from the terminal at Ste-Mere-Eglise (overland 33Km) to St-Remy-des-Landes then undersea to St Helier
9. Base Case with 10 days Compulsory Stocking Requirement	
£41M **£29M COST**	2. Same costing info and routes as the base case but some gas bulk storage tanks at St Helier will remain to meet the compulsory stocking mandate of 10 days

* Varied NPV of base case scenario by +/-20% for high and low scenario respectively
Source Poyry Report

Dual lay of a natural gas and an oil pipeline

1.246 Given the apparent merit of laying an oil pipeline it is reasonable to assume that there are economies to be made in incorporating a gas line alongside the oil base case central scenario. Under this scenario there is a £1.5M benefit over the 'do-nothing' option but it is important to note that this option is actually one where the project is dependant on cross-subsidy. If all the benefits are apportioned to the natural gas pipeline it results in savings of c. £12M from laying both pipes together in mobilization and demobilization of the marine vessels and equipment that lay the line

Drivers for the consideration of pipelines

1.247 The analysis has indicated that that under some circumstances there is an economic case to import hydrocarbons by pipeline. In addition, there are a number of drivers to merit the further consideration of these options :

1.248 **1. Shipping costs -** The economic case for pipelines arises mainly from the high costs of shipping hydrocarbons to the island. Jersey is extremely exposed to price shocks in this area.

1.249 **2. Future availability of shipping** - Further weight is added to the argument because in the future there may not be availability of suitably sized ships for the Channel Islands that can meet local energy demand as a result of regulations requiring that ships have double-skinned tanks;

1.250 **3. There may not be a 'do-nothing option'** - The recommendations of the Buncefield report may place insurmountable restrictions on the development of the east of Albert area with the fuel farm in its current position. Any investment necessary in relocating the fuel farm adds to the economic case for importing hydrocarbons by pipeline

1.251 **4. Reduction of facility dependence** – and associated risks

1.252 **5. Flexibility of the fuel mix** – Pipelines can carry a mix of fuel types sent in separated batches. There is an amount of flexibility in this arrangement since a change in the fuel delivery mix can be responded more quickly than the current shipping arrangements can provide. Depending on the bunkering facilities and levels of stock holding, this would provide for more opportunity to respond to unexpected changes in fuel prices etc.

1.253 **6. Improved security of supply** – Current levels stocking levels are a long way below that required by international standards.

1.254 ***Oil*** : Current UK Compulsory Stocking Obligations mandates refiners to hold 67.5 days of stock.132 To achieve this requirement Jersey would lead to an increase in

[132] DTI Consultation document on the future of Compulsory Stocking Obligations for oil, December 2003, at http://www.og.dti.gov.uk/consultations/conoilstocking.doc; EC/EU Council Directive 68/414/EEC of 20

the La Collette tank farm – up to 1.5 times under the UK law. Currently there is some storage of road fuels at the retail outlets and there is some capacity for the storage of Jet A1 at the airport but during the winter months the fastest moving product is kerosene which typically has about 14 days storage, some 80% lower than International standards

1.255 ***LPG*** – As with oil, the UK Compulsory Stocking Obligations mandate is 67.5 days of stock. The current situation is 14-28 days depending on temperature; 58-80% below international standards.

1.256 Although the Island has considerably lower stocks than international standards the view has been taken to date that the system works sufficiently well although at times this is quite finely balanced. The following potential changes are likely to require current security standards to be heightened:

- A growing population and thus a growth energy demand;
- Climate change with increased storms making scheduling and deliveries more unpredictable.

1.257 Any requirement to increase stocking level would have to be met by a considerable increase in the size of the fuel farm and associated capital investment. In turn, a larger fuel farm would exacerbate the difficulties its current position poses and would also remove the potential for development of even more land.

The investment case

1.258 It is important to recognise that the high shipping costs from the importation of hydrocarbons and LPG are met by the incumbent companies. Naturally they pass these costs to the customer who is ultimately paying additional costs of approximately 3p per litre[133]. However, it is extremely unlikely that the limited markets in Jersey would be sufficient to warrant the parent companies themselves making such significant capital expenditure and any requirement to make such expenditure are likely to trigger a serious review of their business commitment to the Islands.

1.259 The investment case for the States of Jersey is different from that of private parties. It could be argued there are sufficient strategic drivers such as the release of land East of Albert, increased protection from future increasing in shipping costs to make the considerable capital investment for the project but much depends on the outcome of the Buncefield report and the East of Albert Masterplanning.

December 1968 - imposes an obligation on Member States of the EEC (EU) to maintain minimum stocks of crude oil and/or petroleum products

[133] 'Review of the Current Arrangements for the Importation, Storage, and Supply of Petroleum Products to the Distribution and Retail System in Jersey'. (2004) Consultancy Solutions for the Oil Industry 2004 for the Economic Development Committee

1.260 It is anticipated that should the States of Jersey decide to make the capital investment in a pipeline, the savings accrued by the retail market from reduced shipping costs would be passed on to the customer. Further savings would be made from the £0.25M that is currently paid for the lease of the fuel farm.

POLICY OPTION 57 : The States will further investigate the economic case for the importation of liquid hydrocarbons to Jersey in the light of the Buncefield report and the East of Albert Masterplanning. This investigation will require consideration of :

1. The impacts of the recommendations from the Buncefield Investigation on the current fuel farm (due mid 2007) and the potential for the development of land and harbour areas at La Collette II.

2. A further analysis of shipping costs perhaps including a detailed survey of shipping price quotations from companies around Europe for example how much they would charge if this was a tender for supply for all hydrocarbons in Jersey?

3. More detailing engineering study to feasible routes for pipelines taking into account environmental implications and the associated costs for the suggested routes

4. A dialogue with incumbent companies to assess their views on the feasibility of a pipeline project. This would include passing on the savings from reduced distribution costs to the customer and other economic factors like a 'payment for use' of a pipeline compared to the existing £0.25M lease on the fuel farm

5. The implications for improved security of supply if pipelines were to be laid.

CHAPTER 13 – The Energy Market

Chapter summary

The price of energy is fundamental to the economy and ensuring social equality. It is a key role for the States to ensure that the correct market forces coupled with appropriate regulation are in place to ensure the reliable and stable supply of well priced energy.

There is a competitive market within the petroleum market and in recent years this has served to reduce prices for consumers. Wholesale gas and electricity normally works under a 'natural monopoly' arrangement given the high costs of infrastructure. Locally there is no competition in either the wholesale or retail of electricity or gas supply. Currently, regulation of the electricity and gas utilities is limited to application of the Competition (Jersey) Law by the Jersey Competition Regulatory Authority rather than by sector specific regulation.

In order to ensure that the energy market serves the needs of consumers and provides a secure base to the economy, the States will ensure that the structure of the energy market is sufficiently open, competitive and appropriately regulated to serve the needs of the economy and the customer.

To achieve this, the States will :

1. Build upon the existing work to identify the opportunities for efficiency savings in the electricity industry by increasing wholesale competition and/ or cross-Channel Island working. This could include a more formalised approach to the existing collaboration across the Channel Islands' wholesale electricity market. Such an approach might include the rationalisation of generating assets across the Channel Islands.

2. Build upon the existing work to clarify the necessity for regulation of the gas and electricity markets. Regulation is commonly accepted as a surrogate to competition in a monopoly situation. It drives down costs to that equivalent to a competitive market. It is unlikely there is scope for retail competition in the electricity or gas markets. This is due to the small size of the marketplace and associated insufficient profits for potential new entrants to be able to offer sufficient incentives for customers to switch supplier. However, if there is to be an encouragement to more towards increased electricity use in the long-term there is a role for a regulator to protect customers.

Introduction and aims

The role of energy prices and reliability of supply in influencing the local economy

1.261 The price of energy is fundamental to the economy and ensuring social equality. It is a key role for government to ensure that the correct market forces coupled with appropriate regulation are in place to ensure the reliable and stable supply of well priced energy. This is important from a number of dimensions

1.262 ***1. The States as a customer***
The States is a significant customer in the energy market, six percent of Jersey's final energy supply is consumed by government. Indirectly reduced energy costs filter back to the public since there is a reduced tax-burden as a result of the lower operating costs of public services.

1.263 ***2. The States as a shareholder in the Jersey Electricity Company***
As a shareholder in the JEC, if electricity prices fall, the dividend will be reduced with an associated revenue loss to the Treasury.

1.264 ***3. Revenues received to the economy from energy markets***
The profits of the energy utility companies are of course subject to taxation and provide revenue as does the import duty on fuel hydrocarbons.

1.265 ***4. Social equity***
Reduced energy prices deliver direct benefits to the public as customers and in particular the most vulnerable in society. Increased energy costs incur costs to indirectly as financial support must be provided to the low-income groups in order to meet increased tariffs. In turn this increases the tax-burden on the public who ultimately fund the welfare state.

1.266 ***5. Energy prices contribute significantly to inflation***
Rises in energy prices are inflationary, for example, on an annual basis the largest contributors to the change in the Retail Prices Index in 2006 were fuel costs. These increased by 16% compared to March 2005 as a result of global increases in energy prices. The consequence of this was an overall annual increase in the RPI[134] of 0.5 percentage points.

1.267 The States' Strategic plan outlines an "anti-inflation" strategy which is to keep RPI(X)135 at or below 2.5% coupled with 2% real growth in Jersey. RPI is linked to salary costs and increased RPI causes financial pressure on the public sector and business to meet elevated salary awards.

1.268 ***6. The States is responsible for ensuring secure supplies of energy***

The States has a responsibility to ensure that sufficient investment is being made by the energy market to make certain that supply can meet demand now and into

[134] The Jersey Retail Prices Index in March 2006 - States of Jersey Statistics Unit.
[135] RPI is the retail Price Index, RPI(X) is the RPI excluding the cost of house purchase

the future. However, the industry can only be confident in making significant capital expenditure if there is a long-term consistent policy framework within which to work.

The role of competition

1.269 The UK Energy Policy acknowledges that as in other markets, vigorous competition in energy stimulates innovation, ensures the efficient allocation of resources, driving down prices and improves service quality – especially in ensuring that supply meets demand. In Jersey the different sectors of the energy market operate at various levels of competition. Currently there exists cross-product competition – for instance one might choose to build a house with space and water heating powered from electricity, oil or gas. However if one were to choose to use electricity or gas then currently there is only one supplier as compared to three suppliers of heating oil products.

1.270 The argument can be used that the existing cross-product competition will keep consumer prices in check relative to one another. This section examines the different areas of the market and asks if this cross-product competition is enough to ensure that the energy market is operating to ensure that the pricing of electricity and gas are at the level of efficiency that would be consistent with a truly competitive environment or whether they should be liberalised or regulated further?

Competition within the EU

1.271 Before turning to the local situation, it is helpful to explore the approach that the European Union is taking which has provided itself with the most open and integrated single electricity and gas market in the world[136]. The aim for 2005 was that every citizen could choose his electricity and gas supplier and to achieve this, these sectors continue to introduce changes aimed at greater efficiency and improved services. The realised benefits of this choice are variable – for example, in the Republic of Ireland electricity market allows for full retail competition but, there are no retailers actively seeking to sell to domestic customers other than the existing incumbent[137].

1.272 Across the EU there is a common approach to liberalisation comprising gradual openness, essential transparency measures, public service obligations, official forums for regulatory bodies, common principles for transmission tarification and a pan-European infrastructure plan. Cross-border power arrangements have led to a convergence of previously disparate wholesale power prices in Europe and currently there is virtually a single market price. The price difference for example between wholesale suppliers such as France's Electricité de France and Germany's EON is the "suppliers margin over wholesale price", but this is usually only a few percent. Jersey purchases all it's energy from the European market and thus is a 'customer' within this liberalised regime.

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[136] 'Energy - Let us Overcome our Dependence' – EU Commission 2002

[137] Jersey Sector Energy Review ; A report regarding options and issues relating to the Channel Islands Energy Market. Design and Implement Consulting December 2006

Competition or regulation ?

The Current regulatory system in Jersey

1.273 The Jersey Competition Regulatory Authority (JCRA) was established under law in 2001, with responsibility for promoting competition and consumer interests through economic regulation and competition law. It is a statutory body corporate, with a Chairman appointed by the States, and the remaining two, or more, members appointed by the Minister for Economic Development after consultation with the Chairman.

1.274 The JCRA has specific licensing authority in relation to the postal and telecoms sectors, but not in relation to electricity or gas. Whilst these sectors would fall under its generic mandate, as would any other industry sector within the Island, there is no specific remit to ensure that electricity pricing is at a level of efficiency that would be consistent with a competitive environment.

1.275 The JCRA does not regulate the electricity or gas sector in Jersey in order to set prices at an efficient level. The JCRA would initiate an investigation into pricing if there was a complaint made about it under the provisions of competition law. JCRA could take action against a company if it could demonstrate that it had:

- abused its dominant position; or
- engaged in collusive behaviour.

1.276 In respect of pricing, the remit of the JCRA would be subject a sector to an "*excessive pricing*". Under such an excessive pricing test, it would not be sufficient for the JCRA to demonstrate that prices were too high based on benchmarking assessments of similar jurisdictions. Nor would it be sufficient to demonstrate that there was a large difference between a sector's cost base and the prices it charges. In order to demonstrate excessive pricing, the JCRA believes that prices would have to be 'out of *all reasonableness* to the price that a customer is prepared to pay'.

Sector regulation in Guernsey and the UK

1.277 The Jersey situation is in contrast to Guernsey where the Office of Utilities Regulation (OUR) currently regulates the postal, telecoms and electricity sectors. The manner in which this remit is exercised in relation to Electricity is set out within the Regulation of Utilities (Bailiwick of Guernsey) Law, 2001 and the Electricity (Guernsey) Law, 2001. The Director General of Utility Regulation is a statutory official, appointed by the States of Guernsey, reporting directly to the States of Guernsey, (although their reports are submitted via the Commerce & Employment Department) and receiving direction from the States of Guernsey. The Commerce and Employment Department is responsible for advising the States on the appointment of the Director General and on any directions to be given to the Director General.

1.278 In the UK, OFGEM protect the interests of consumers to secure that all reasonable demands for electricity are met and to secure a diverse and viable long-term energy supply. OFGEM do this by setting licence conditions on industry participants and the price reviews of the monopoly infrastructure providers. The aim is that should energy supplies be disrupted or if energy demand exceeds expectations in the short-term, the problem could be swiftly resolved.

The market structure

1.279 Diversity and flexibility are characteristics of efficient and competitive markets. There is no fundamental incompatibility between energy market competition and security, but, the States will have to set the framework within which the market operates. The UK Energy Policy notes that 'for markets to work, firms need to be confident that the Government will allow them to work'. Energy supply problems in other countries have demonstrated the risks of not doing so. It is widely accepted that s should not to intervene in the market except in extreme circumstances, such as to avert, as a last resort, a potentially serious risk to safety. Locally provisions are in place for this emergency eventuality within the Emergency Powers and Planning (Jersey) Law 1990.

1.280 In the UK OFGEM (Office of Gas and Electricity Markets) and the Government have duties to secure that all reasonable demands for electricity and gas are met. This is the regulatory framework that gives high priority to reliability. Locally specific legislation has been designed for both the Electricity and Gas Companies that protects the consumers and gives the industry a framework to work within.

Electricity

1.281 Within the Channel Islands, the electricity network comprises the "transmission" system i.e. the main interconnections between Jersey, Guernsey and France and the "distribution" system i.e. the remainder of the network. An electricity network is usually considered to be a natural monopoly[138] and regulated as such.

1.282 The Channel Island Electricity Grid ("CIEG") is the transmission network that provides for the delivery of French electricity to Jersey and onwards to Guernsey (illustrated in Chapter 12). The delivery of electricity across the CIEG is described the importation / exportation of energy. The JEC owns and maintains the distribution infrastructure for electricity both on-Island and from the Continent via the two existing interconnectors.

1.283 The retailing of electricity describes the regime for the sale of energy to customers. Where retail competition exists in electricity and gas (e.g. as in the UK) customers can exercise choice and sign up with any licensed retailer. At present in Jersey (and Guernsey) this choice is not an option. Where retail competition does exist elsewhere, the competing retailers will pay common delivery charges to utilise the

[138] A "natural monopoly" is where fixed capital costs are so high that it is never profitable for a second firm to enter and compete typically because economies of scale exist so that a single firm is needed and any segmented ownership would be less efficient e.g. if a second firm constructed a competing electricity network in Jersey the overall network costs would rise.

network / pipelines over which the energy is delivered rather than install any competing network / pipeline infrastructure.

1.284 A review of the current regime[139] in Jersey and Guernsey noted that The Jersey Electricity Company is 62% owned by the States of Jersey and its' shares have been listed on the London Stock Exchange since 28th February 1964. The presence of independent shareholders should bring to bear a degree of commercial pressure onto JEC's management that may not be applied to GEL by the States of Guernsey. Whilst the Treasury and Resources Departments within both Jersey and Guernsey assume the role of JEC and GEL shareholder respectively; it is important to recognise that the States of Jersey has no formal power to give JEC explicit instructions unlike the States of Guernsey which issues States' Directions to GEL from time to time.

1.285 The Jersey Electricity Company (JEC) operates under the Electricity (Jersey) Law 1937 and subordinate legislation Fuel And Electricity (Control) Act 1973 (Jersey) Order 1973 (which reflects the UK Act). The Electricity Law accords rights and privileges and obligations to the JEC to determine electricity tariffs and to specify the manner in which tariffs are to be set, if it appears necessary to do so in the public interest[140]. The Minister for Economic Development has delegated responsibility under the Law for safeguarding the public interest. Hence, the Minister has backstop power to regulate electricity pricing[141], but there is no guidance within the Law as to what circumstances would cause this right to be exercised. The Electricity Law obliges the JEC to allow the use of their infrastructure to transmit electricity Island wide if another supplier were to enter the market. There has never been a second incumbent that has expressed interest in entering the Channel Island electricity market.

1.286 The argument commonly given as to why this is so, is that the ability of Jersey to buy from the very competitive European electricity market means that electricity costs to Islanders remain relatively low (See Appendix C). This has the effect of creating a barrier to entry into the Island to other potential suppliers since there is such a low profit margin for others to come in and undercut but still make a profit. It could be argued that the fact that no other company has attempted to enter the Jersey electricity retail market would suggest that this argument holds and that the JEC is operating at a level consistent with effective competition.

Gas

1.287 The Jersey Gas Company imports, makes and distributes gas and operates an effective monopoly for the provision of Liquefied Petroleum Gas (LPG).

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[139] Jersey Energy Sector Review : a Report regarding options and issues relating to the Channel Islands Energy Market (Dec 2006) Design and Implement for the States of Jersey

[140] Article 22.

[141] Design & Implement were unable to identify any instance where this power has previously been invoked.

1.288 Babcock & Brown Infrastructure, (Australian investment firm that focuses on the purchase and subsequent management of utility asset businesses), owns both Jersey Gas and Guernsey Gas via its ownership of IEG (http://www.i-e-g.com). The Company has been owned by the International Energy Group since 1992. Guernsey Gas operates a gas network in and around St Peter Port.

1.289 Clearly these gas firms do not (nor would not start to) compete with each other across the Channel Islands. However, competition is viewed as existing in the form of competition from alternative energy choices i.e. oil or electricity. Indeed, there is reasonable competition in Jersey for new developments / builds between both the electricity and gas firms seeking to offer heating infrastructure. Furthermore, customer switching (e.g. from gas to oil for central heating) is considered a longer term activity (i.e. over an investment cycle) given the associated capital costs.

1.290 Gas prices within each Channel Island are very similar and significantly higher than the UK. For example a medium[142] direct debit gas customer in Southampton would face an annual gas bill[143] of £511 (including VAT at 5%) if switched to Southern Electric compared with a Super Economy 24 customer who would pay £1,400 in Jersey and £1,388 in Guernsey (Appendix D). However, these price comparison are not "like for like" given the specific nature of the LPG product in the Channel islands compared to piped natural gas in the UK.

1.291 Jersey Gas is the only privately owned Channel Island Company to be the subject of specific legislation and the Jersey Gas Company (Jersey) Law 1989 outlines provisions concerning the constitution, organisation, powers and duties of the Jersey Gas Company Limited. The Law sets out *inter alia:*

- Parameters and monitoring arrangements to ensure the quality of gas;
- The procedure for setting gas tariffs;
- Gives the States' provision to intervene in the determination of tariffs should it become necessary to do so in the public interest whilst paying due attention to the operational and financial requirements of the Company itself.

1.292 The pricing structure is also regulated by the JCRA in the same way as electricity.

Petroleum products – a competitive market ?

1.293 Three companies share the market in petrol and oils: Total, owned by CI Market; Esso, owned locally by PDJ and Shell owned by Fuel Supplies. The market structure has arisen purely as a result of market forces so if another company could fulfil the criteria and wanted to enter the market place then there are no other barriers to them.

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[142] Energy Watch (http://www.energywatch.org.uk) assumes a medium gas customer uses 20,500kWh p.a.

[143] http://www.energywatch.org.uk/uploads/Southern_Price_Comparison_Standard_December_20061.pdf

1.294 Fuel oils are stored in 'The Tank Farm' at La Collette. This joint storage facility is shared and owned by the La Collette Consortium which comprises Shell and Esso – there is a 60:40 equity share to Shell. Total do not have a share in the consortium but they have a supply contract with Esso. Replenishment is on a 60:40 split that mirrors the consortium. Regardless of the supplier, the raw product is the same and is not separated in transport process.

1.295 There is no specific legislation to cover the supply of oil, instead the La Collette Consortium work under a lease arrangement for the tank farm with the States of Jersey. The lease covers the operator's requirements to supply fuel oil and maintain infrastructure as well as outlining the conditions of entry in the La Collette Consortium. A current lease is newly signed and terminates in 15/20 years.

1.296 For many years concern was expressed over the relative higher prices of fuels in Jersey compared to equivalent costs in the mainland UK[144]. Further study in 2004[125] attributed and investigated these to the elevated cost elements of the supply chain as listed below as opposed to excessive company profits compared to their UK counterparts :

- **Primary Distribution** – Shipping and freight costs between refinery and La Collette;
- **Port and Harbour Dues** – Costs incurred by importation of fuels to Jersey;
- **Terminal Costs** – Costs associated with the throughput of fuels through the Consortium Operating Agreement on La Collette Fuel Farm;
- **Secondary Distribution** – Costs associated with the distribution and delivery to end-users, in particular the retail petrol station and domestic heating oil markets.

1.297 In respect of motor fuel, up until the end of the 1990s it was perceived that retail margins were unreasonably high in Jersey even accounting for increased costs of forecourt operation, elevated lease rentals and higher staffing costs. Retailers had passed on supply cost increases and all increases in Impôt Duty to the customer whilst retaining their 20% gross margin. Despite high retail margins and speculation of collusion in the pricing and competitive behaviour of the three oil companies on the Island, research carried out in 2004[145] could find '*no evidence of oil company profiteering at Islander's expense'*. It was also concluded that '*the introduction of another fuel competitor would accure no consumer benefits'.*

1.298 Since that report was published, increased competition between retailers and the introduction of various loyalty schemes has resulted in a substantial drop in pump prices as a result of reduced gross margins. If consulted it is very likely that the public would agree that the result of this competition has been better value for the

[144] 'Fuel Prices in Jersey: A report to the Industries Committee for the States of Jersey' (October 2001) Oxera Consulting

[145] 'Review of the Current Arrangements for the Importation, Storage, and Supply of Petroleum Products to the Distribution and Retail System in Jersey'. (2004) Consultancy Solutions for the Oil Industry 2004 for the Economic Development Committee

customer and has seen petrol prices drop from a peak of £1 a litre in late 2005 to c.86p per litre in February 2007.

Actions in relation to the market's structure

1.299 In order to ensure that the energy market serves the needs of Islanders and provides a secure base to the economy, with energy available at predicable prices there is a need to ensure that the structure of the energy market is sufficiently open, competitive and appropriately regulated to serve the needs of the economy and the customer. The Island's best defence against price shocks involves ensuring a well structured, efficient and regulated energy market which can deliver adequate energy supplies at affordable and predictable prices.

MAKING THE CHANGE

Decarbonising the economy in the long term

1.300 Jersey is vulnerable because of the dependency on the importation of energy, particularly petroleum products, as well has having a low level of energy diversity. In the long term fossil fuels are finite and as they become increasingly scare and difficult to extract, their price will rise. An economy that bases future long-term strategy solely on energy derived from fossil fuels will not be competitive. Part 3 has discussed the future opportunities for Jersey to exploit its indigenous resources such as tidal, solar biomass and wind power and these sources could make an increasingly significant contribution to future energy diversification.

1.301 However, the reality is that 'decarbonising' the local economy will not happen overnight and so energy policy must make plans for the medium term. Security and diversity of supply are key determinants of energy prices and will affect Jersey's bargaining power and flexibility in absorbing price shocks.

Structuring the market for the best outcomes for customers in the short-term

1.302 A current analysis might suggest that the energy market is working satisfactorily. There is good retail and wholesale competition in the petroleum products market. Whilst the gas market is relatively small, there is inter-sector competition to give customer choice. The JEC, another monopoly in both the retail and the wholesale market appears to be behaving with a high public-good ethos. Their choice of low-price and low-carbon electricity has maintained low electricity prices and helped Jersey to achieve significant reductions in green house gas emissions. Their continued investment in infrastructure gives the market confidence in the trend for an increasingly electricity-dominated energy market.

1.303 However, it may not be that this status quo remains. The future is likely to bring enormous challenges for the energy market with expected rising prices and in the long-term a diminishing stock of fossil fuels. The market can only be expected to

operate, forward plan and respond to the challenges within a coherent long-term policy framework.

1.304 In order to assist policy development, the options for gaining efficiencies for both the industry in ensuring appropriate security of supply and planting and for the consumer in creating the most effective market and consequent optimum price have been explored in a report commissioned for the States of Jersey[146].

1.305 It is important to note that the remit for this work was to examine the options for efficiency savings, competition and regulation across the energy utilities between the Channel Islands. This first level of analysis was intended to inform energy policy about potential ways forward and the barriers or enabling steps required. Naturally any further exploration of the results of this analysis would require inter-Island discussion and negotiations to explore the acceptability of the options within current and future policy frameworks. However, at this stage, Energy Policy has sought to identify what 'might be possible' in order to inform the debate at this first stage of consultation.

1.306 A summary of the options are presented in the next two sections.

Competition for the wholesale electricity market

1.307 The term "wholesale" describes the generation of electricity and its subsequent trading between energy companies. Within the Channel Islands, this will be the production of electricity by on-Island power stations, the importation of power and trading of power between electricity companies. Furthermore, it is important to recognise that mains electricity is the ultimate "just-in-time" product. Accordingly, the wholesale electricity market is strongly linked the associated retail market.

1.308 There are four models for wholesale competition within the CI electricity market that have been identified :

1. Maintain existing arrangements i.e.

- The joint purchasing arrangements that exist between JEC and GEL for heavy fuel oil and high voltage cable;
- No co-operation on decisions regarding optimising the mix of plant across the Islands;
- No co-operation on the procurement of the new Jersey/France link which is scheduled to be undertaken solely by the JEC.

2. Formalised co-ordinated approach i.e.

- Harmonised approach to generation planning across both Islands – currently Jersey operates its generation security to n-1 (currently La Collette provides the back-up and by 2012, the third interconnector will) whilst Guernsey has a policy of far greater strategic independence;

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[146] *'The Structure of the Channel island Energy Market'* January 2007 a report by Design and Implement commissioned by the States of Jersey.

- Thus incur savings for both Islands by deferring future investments in generation;
- Bring forward generation closures.

3. Jersey/Guernsey Energy Market i.e.

3a Competiting generators

- Opening up both the JEC and GEL generation capability to competition with each other as well as potentially third parties in the form of new entry generators. This could be achieved by :
    1. Allowing or creating competitor companies to the current incumbents or
    2. By creating a larger (CI) market effectively allowing JEC and GEL to compete inter-island.

In practice there are significant barriers to new entry generation :

a) **Cost base** – the high volumes of on-Island demand met through importation and the costs of importation mean that it is unlikely that an on-Island generator could compete on cost;
b) **Planning** - there are also likely to be significant barriers to developments on the planning front;
c) **The existing structure** - in practice (even if not in theory) there are likely to be significant perceived barriers to any potential new entrant dealing with a vertically integrated incumbent, with States' ownership/significant shareholding.

3b. Creating a larger (Jersey/Guernsey) market

1.309 Given the significant barriers to alternative 3a, it may be that the development of competition at a wholesale level depends on creating competition between GEL and JEC. However wholesale electricity market design is complex and specialised and there is no one generally adopted model. However, regardless of the market design, this option applies market pressures to the short term use, and long term investment in generation assets and other sources of energy – notably importation. Assuming effective regulation, suppliers would only be able to pass on efficiently incurred costs.

4. The Creation of One Company

1.310 Creating one company across both Islands would create economies of scale as the generation assets would be run on a combined portfolio basis, with retail costs being rationalised and allocated across all customers. However, this is a sensitive option that could occur in a number of ways e.g. merger, takeover of one by the other or else purchase of both firms by another company.

1.311 In summary, wholesale competition could be described as a 'big market solution for a little market' and it has to be asked whether it is it applicable and appropriate for Jersey? Nevertheless, there are some scope for savings under wholesale market :

- Capacity build and rationalise generating plant across both islands;
- Operation and Maintenance costs of existing plant;
- Effective economic dispatch[147];
- Reduced environmental impact;
- Central staffing costs;
- Regulatory costs.

1.312 However it may be that these objectives could be similarly met by alternative (simpler) models such as introducing retail competition and the opportunities for this are explored in the next section.

Retail competition for the electricity market

1.313 Some of the objectives of introducing retail competition are the same as those for introducing competition at a wholesale level – others are supply competition specific. This includes:

- **Efficiency pressures** – a reduction on the overall price paid by customers;
- **Downward pressure on inflation**;
- **Tariff innovation** - To reduce consumption at certain times through changes to the load shape as well as to allow for more effective competition between substitute energy products;
- **Increased customer choice**.

1.314 There are broadly three options regarding retail supply

1.315 ***1. Single buyer/seller***

There is no retail competition within this option which represents the existing arrangements in Jersey and Guernsey. JEC is the purchaser of its own, and potentially any other generator's electricity[148] as well as the seller of electricity to end customers. Under the present Jersey arrangements, the price for supply to end customers is determined by JEC. Any pricing control would be solely a result of any JCRA investigation, and determination on excessive pricing. In Guernsey this is also the model presently adopted, but prices to end customers are subject to specific price controls determined by the Office of Utility regulation.

1.316 ***2. Limited competition (Large customer competition)***

Some markets adopt a model where retail competition is open to only some larger customers. Often this is a transitional arrangement between the monopoly (single buyer/seller) arrangements and full competition – for example, the arrangements in the UK introduced competition for different sizes of customers in 1990, 1994,

[147] Economic dispatch is the method of determining the most efficient, low-cost and reliable operation of a power system by dispatching the available electricity generation resources to supply the load on the system. The primary objective of economic dispatch is to minimize the total cost of generation while honouring the operational constraints of the available generation resources

[148] From within Jersey or imported across one of the interconnectors

and ultimately for all customers in 1998 and France also adopted a phased approach. Similar arrangements apply across the EU and also in a range of markets across the world. Under this model, JEC would allow competition for some customers – the threshold for which would need to be determined. It is likely that there would be other qualifying criteria for a customer taking its electricity from a supplier other than JEC, specifically that it (or its new supplier) would be responsible for its direct costs (including metering). Such a model requires that transport costs are determinable on an individual customer basis, and that wholesale market interval metering is in place.

1.317 ***3. Full Competition***

Under this model, any customer regardless of size, would be eligible to take supply from a company other that the host supplier (JEC and/or GEC). This does not necessarily require wholesale market interval metering, but if this is not in place, it does require equitable arrangements for the allocation of wholesale costs to customers based on variations in customer load shape and the time varying wholesale price.

Retail competition is a viable model in many jurisdictions, but its effective adoption requires that a number of structural, technical and economic building blocks are in place as shown in the Table 28.

Table 28 Essential parameters for retail competition and their application to the Channel Islands

Criteria for retail competition	Application to the Channel Islands
a) *Critical mass of customers to spread fixed costs across*	There is unlikely to be such a critical mass in the small CI market, the Republic of Ireland electricity market of approximately 2 million customers is deemed 'too small' for any other entrant other than the existing incumbent. E.g. if a retailer made 4% return on customer sales (at an average of £500 per customer per year) it would create revenue of £20.00 per customer. Assuming 10,000 customers, this only creates a profit of £200,000 per annum.
b) *Realisable cost savings* i.e. sufficient for customers to incentivise them to switch retailers	These are reported as between £45[149] and £78[150] per annum. The Director General of the OUR in Guernsey notes that both these figures exceed the absolute levels of retailing in Guernsey.
c) *Credible and willing competitors*	These are likely to be limited in small markets. In addition the CIEG regime provides for a non-compete agreement between GEL and JEC until its termination in 2012. Of the existing incumbents, GEL is a disadvantage since it cannot access generation from France to the same extent as the JEC.
d) *Effective third party access* i.e. non-discriminatory (price and terms) access to natural monopoly transport assets	There is no scope for third party access across the CIEG until 2012. In the context of Jersey, this means that JEC would have to offer network access to competitors at the same price as it pays. This is likely to also require the effective business separation in the incumbent utility between generation, supply and transport functions.
e) *Risk allocation* i.e. the ability to determine customers' take (as metered) and reconcile against the wholesale market position of the retailer. This accounts for the volatile nature of the electricity market within which the costs of generation vary greatly over time. This is reflected in short pricing periods (generally 30 to 60 minutes).	To measure and bill customers under these conditions there will be set up and ongoing operational costs.
f) *Cost allocation* i.e. an equitable allocation of the costs of retail competition so that there is no inherent cost barrier to individuals switching supplier.	A significant barrier to competition may be allocating the costs of competition *only* to customers that switch. This is avoided if costs were allocated across the whole eligible customer base and removes any such barrier to switching. However, if these costs are incurred, and competition does not develop, not only will customers incur unnecessary costs, but the incurring of such costs by Government and/or any regulatory body, would (rightly) be subject to scrutiny and potential criticism.

1.318 If the correct structure is in place, the creation of a retail market gives scope for business savings :

[149] Office of Gas and Electricity Markets; Giving Domestic Customers a Choice of Electricity Supplier, 5 January 2001.

[150] "Experience in the competitive domestic electricity and gas markets" conducted by MORI for Ofgem, November 2001

- Operation e.g. cheaper billing, customer support;
- Purchase energy at lower cost and pass savings back to customer.

1.319 These are examined in more detail -

1.320 *Reduced costs in operating the retailing function*
The Office of Utility Regulators (OUR)[151] estimated that the operational costs of GEC's supply business in 2002 were around £33 per customer (off a customer base of c22,000 customers) – giving a cost base of around £726,000 pa. A similar estimate for the operational costs of the JEC's supply business is approximately £45 per annum – slightly higher than GEC as a result of a more comprehensive customer care service in Jersey.

1.321 Of these figures, it was concluded[152] that 'electricity retailing costs are in the order of £20-£30 per customer per year. Assuming the OUR calculation is correct, and a new entrant into any market could provide these services (to at least some customers) for £10.00 per year, the potential savings to customers would only amount to £10.00 - £20.00. It is very unlikely that this level of realisable saving would provide sufficient incentive for customers to switch.

1.322 It seems therefore that a competitive wholesale market is a requirement to underpin any retail competition introduced[153]. Thus, a significant proportion of savings would need to be delivered from electricity purchase costs.

1.323 *Reduced wholesale purchase costs*
The potential for saving arises if one retailer can buy at a sufficient discount to provide sufficient cost savings to end customers as a consequence. This requires price differentials to be seen at a wholesale level and in theory could result from purchasing from different generation sources with different cost bases. Quantification of the potential cost savings in a competitive environment (one where JEC, GEL and potentially others compete) would require further investigation in this area.

Available options

1.324 The number of options available is more limited than the number of potential combinations suggests. This is because the viability of the retail competition options discussed is strongly linked to the ability of competing suppliers to offer sufficient price savings by switching. Broadly, a competitive price advantage can arise in two ways:

1. A supplier can buy energy at a lower price than its competitor(s) and passes these savings onto customers which requires:

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[151] Office Utility Regulator 02/35
[152] '*The Structure of the Channel island Energy Market*' January 2007 a report by Design and Implement commissioned by the States of Jersey.
[153] For completeness, this conclusion is also based on an assumption that regulatory costs in the order of those reported by GEL are (a) not attributable to retailing, (b) unlikely to provide a sound cost basis against which assumed savings could be calculated.

a. alternative sources of generation to procure energy from. This could be from generation in the same market (consequently requiring either diverse generation ownership); and / or

b. access to importation sources via importation; and / or

c. a competitive wholesale market, and / or

2. A supplier can carry out the supply activities (customer service / billing / metering data collection / debt management) more efficiently.

1.325 If there is no ability for a competing supplier to source energy more effectively, it would need to carry out the retail function in a more cost effective manner. However, being more efficient in the provision of retail supply services may not be a sufficient basis to encourage customer switching. This arises because the overall costs of the supply function are less than the monetary saving required by customers to switch.

1.326 Clearly, a supplier could compete on the basis of lower energy purchase costs *and* effective supply business management and offer savings based on efficiencies in both these functions.

1.327 However, if it appears unlikely that the management of the retail function would derive sufficient savings to induce customer switching, the viability of retail competition rests on there being wholesale market competition in place as a precursor. Thus, it can be seen from Table 29 that, in the absence of wholesale competition, retail competition would not be a sufficiently viable option to consider in isolation[154].

Table 29 Consistency of the options

		Retail Options		
		No Retail Competition	**Limited Retail Competition**	**Full Retail Competition**
Wholesale Options	**Existing arrangements**	Y	N	N
	Formalised planning co-ordination	Y	N	N
	Competitive wholesale market	Y	Y	Y
	One merged entity	Y	N	N

[154] *'The Structure of the Channel island Energy Market'* January 2007 a report by Design and Implement commissioned by the States of Jersey.

Source 'The Structure of the Channel island Energy Market' January 2007 a report by Design and Implement commissioned by the States of Jersey.

In summary :

- Retail competition would be unlikely to be viable in the absence of a contestable market at the wholesale level;
- A competitive retail market is not necessary for there to be a competitive wholesale market;
- Retail competition is unlikely because there are not sufficient profits available in markets as small as the CI market to encourage another entrant.

Assessment of the viability of retail / wholesale competition scenarios

1.328 Although there are several options in applying retail and wholesale electricity competition in the Channel Islands, not all are viable. A high level assessment is as follows :

1. The existing arrangements present significant barriers to the introduction of retail competition on a cross–Island basis until 2012;
2. The potential exists to introduce retail competition in Jersey alone, but in the absence of competition in Guernsey, there would be (a) a lack of reciprocity of arrangements, and (b) a lack of likely / credible competitors;
3. There are insufficient cost savings in the retail function alone to induce customers to switch. Retail competition would thus be technically possible, but offer no realistic possibility of customer benefit, in the absence of wholesale competition. There is insufficient data available to determine the level of cost savings that could arise at a wholesale level.
4. A cross-Island wholesale market arrangement would allow for the OUR to re-visit its decision on retail competition in Guernsey. In the absence of a wholesale market, a retail market across the Channel Islands is (a) subject to a regulatory barrier, and (b) there would be insufficient potential for cost savings to induce customers to switch.

1.329 It is possible to conclude from this that retail competition is very unlikely to be viable alone within the Channel Islands.

The benefits of wholesale competition and / or regulation

1.330 Regulation can be used to artificially create the efficiencies that might be gained from the competition models. Given the assessment that retail competition would not be viable without a contestable market at the wholesale level and even then there may be significant barriers to its effective introduction, it appears that it is the wholesale models alone that merit further investigation.

1.331 Regulation can be used to artificially create the efficiencies that might be gained from any of the competition models and thus is included alongside the options for wholesale competition.

1.332 The next section considers the potential efficiency savings that could arise under each of the options on a Jersey-Guernsey basis. Whilst all the options set out are viable, there are significant differences in:

1. compliance with the objectives of the States of Jersey;
2. the potential costs of implementation;
3. increased customer benefits;
4. barriers to adoption (commercial, legislative, stakeholder); and
5. enabling steps required, including any regulatory changes.

1.333 A high level assessment is made against the existing market, and assessments are relative to the existing arrangements (Table 30). Note: not all criteria would be equally weighted.

Table 30 High Level Assessment of wholesale and regulation models

Wholesale Models	Existing Collaboration	Enhanced Regulatory Collaboration	Formalised Co-ordination	Competitive Wholesale Market	One Firm
Meeting States of Jersey's objectives	Medium	High	High	High	High
Potential costs of implementation	Low	Medium	Medium	High	High
Increased benefits to customers	None	Low	Medium	High	High
Barriers to adoption	None	Low	Medium	High	High
Enabling steps required	None	Medium	Multiple	Multiple	Multiple

Source 'The Structure of the Channel island Energy Market' January 2007 a report by Design and Implement commissioned by the States of Jersey.

Existing Collaboration

1.334 Under this option, the existing monopolies on each Island would continue[155]. The CIEG arrangements would continue in their present form and purchases of most of Jersey's electricity would be from France. Both Jersey and Guernsey allow for new entry in generation as a route to introducing competition.

[155] Noting that only changes in Jersey are within the influence of the States of Jersey.

1.335 The existing arrangements are successful in many respects. It can be argued that the level of political independence of JEC has enabled it to operate in a way that broadly balances JEC's commercial drivers, and delivers reasonable prices to customers.

1.336 *Conclusion :* By 2012, three significant events will have occurred:

1. The existing CIEG contract which ties purchases into EdF will fall away, allowing purchases from other parties in France;
2. The existing retail supply monopoly in Guernsey will lapse (if not overturned in advance of that date);
3. The third Jersey-France interconnector would be commissioned / imminent.

Enhanced regulatory collaboration

1.337 As with the present position, the existing monopolies on each Island would continue, and the CIEG arrangements would continue in their present form. However, as a means of driving efficiency in the absence of any formal introduction of competition, regulation in the style of the OUR could be introduced in Jersey to allow the JCRA to regulate the electricity market with high levels of collaboration across islands. There is a developing relationship between the JCRA and the OUR which is currently limited to telecoms.

1.338 In the absence of a joint market, or one entity, the roles and responsibilities of each regulatory body differ markedly but if regulation were extended to the Jersey market, possible areas of savings could extend to staffing and accommodation costs – in addition to sharing the costs of regulating the one market, or consultancy and intellectual capital in regulating one company in two jurisdictions. However, an initial assessment is that regulatory costs are unlikely to fall.

1.339 An alternative model could be where the States of Jersey "outsource" the regulation of JEC to the OUR or any other similar body. However, this option would require the States of Guernsey's agreement given the strict framework and statutory duties that fall onto the Director General in Guernsey.

1.340 *Conclusion :* The States of Jersey would need to secure the States of Guernsey's agreement to either option.

Formalised co-ordination

1.341 This option would involve creating a harmonised approach to generation planning across Jersey and Guernsey. The stakeholders would agree that a level of transmission linkage, and planting, would be the most optimal across the Islands. It would require an acceptance that existing assets are rationalised, remaining plant adequately rewarded, and new investment logically located and rewarded. This would include paying costs of energy, capacity and carbon on a pre-agreed basis.

1.342 This would provide for increased efficiency and thus customer costs should be consistent with the States of Jersey's low inflation objective. Furthermore,

optimised cross-Island plant should allow for La Collette closure as per JEC's assessment.

1.343 A barrier to adoption may arise from Guernsey's n-2 policy and the single link between the islands gives rise to a requirement for on-island planting on Guernsey. Therefore the most likely outcome of this policy would be to have on-Island generation predominately on Guernsey. However, the increased carbon footprint may not be universally welcomed by all stakeholders in Guernsey as there will undoubtedly be resistance to Jersey "exporting pollution" especially given Guernsey's stated objective of "*reducing the Island's carbon footprint*[156]". This option may lead to GEL reopening the existing CIEG funding regime thereby increasing JEC's costs. Finally, this option would be potentially difficult if capacity requirements (and location of capacity) are subject to individual jurisdictional requirements / policies.

1.344 In order for the full benefits of this option to be realised network enhancements will be required to reduce the restriction on exporting power from Guernsey to Jersey. There would need to be joint planning between JEC and GEL to determine the appropriate mix and location of on-Island planting (e.g. fast start, slow start plant) with some public reporting[157]. In conjunction with this planning, formal agreement on the rewards to the providers of capacity and energy will be needed to ensure that both JEC and GEL are fairly compensated for the services each provides.

1.345 It is likely that both Governments would need to issue policy statements (perhaps captured as formal "States Directions") to capture the agreement to harmonise the electricity sector across the Channel Islands and the formal protocol for cross-Island support. In particular the States of Guernsey may need to review its instructions to the OUR if this option were taken forward.

1.346 ***Conclusion*** - Whilst this option would not require formal changes to legislation, it would require the agreement of both Governments.

Competitive wholesale market

1.347 This option would involve opening up both Jersey Electricity and Guernsey Electricity generation capability to competition with each other across the Channel Islands, and potentially to third parties – i.e. new entry generators.

1.348 This option should deliver production cost reductions and pricing efficiency although short term price rises in Jersey may be an initial outcome. This option should allow JEC to make the plant closures it seeks as more formal reliance on GEL's plant would be secured, and hence Jersey's carbon footprint would be reduced in line with environmental objectives.

1.349 There are some significant barriers to the implementation of this option *inter alia*:

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[156] States of Guernsey Business Plan, Billet XIX 2006 Priority 10

[157] GEL prepares and publishes a "Statement of Opportunity" in accordance with Licence Condition 33.1 covering similar matters (see http://www.electricity.gg/publicinfo/statementofopportunity.asp for details).

- the design (and subsequent implementation) of electricity markets is not a trivial exercise - there are major policy choices to be made on the form and nature of trading;
- it would be costly to implement (there are both legal, IT and business process impacts) and the allocation of these costs across the small number of within the Channel Islands could increase prices in the short to medium term;
- electricity markets are complex;
- a regime would be need to control the scheduling and dispatch of plant;
- a high level of regulatory harmonisation would be needed to avoid discrimination and secure the effect operation of the marker;
- third party access costs would need to be to be transparent across both islands supported by detailed regulatory accounting (this happens to some degree in Guernsey at present);
- the limited interconnection between the islands may need reinforcement (especially for flows from Guernsey to Jersey) which would require funding and the allocation of these costs (typically this would be in proportion to the benefit accruing and GEL would argue that JEC should pay the majority of costs);
- whilst the market could be created, the scope for vibrant competition is limited158 given the size of the market and as such the market would give JEC and GEL the scope to exercise of market power (although they may chose not to exercise it);
- the current long term CIEG regime would appear to limit the scope for additional trading before 2012.

1.350 In order to advance this option a scoping exercise would be needed including (a) forward price projects; (b) a high level cost / benefit assessment; and (c) an outline of the chosen market design. Following this scoping exercise, the market rules would need to be developed prior to the subsequent IT implementation. There would also need to be a single market operator entity created to control the market. Within Jersey the JCRA would need to be given an explicit regulatory role for electricity and the OUR's remit adjusted to account for the wider Channel Island market. It is likely that this option would need to be supported via a formal treaty between the States of Jersey and States of Guernsey.

1.351 ***Conclusion :*** This is the international "standard approach" and consistent with various EU directives, however, further work would be needed to confirm that this

[158] There is very limited scope for third party new entry given the planning issues and availability of suitable land within both islands.

option will deliver net benefits given the scope for significant implementation costs. Furthermore, the allocation of benefits between stakeholders in Jersey and Guernsey would need to be agreed.

One firm

1.352 Under this option it is assumed that one company is created to own and control the electricity companies on Jersey and Guernsey. This firm would internalise the costs of the business effectively and reduce costs and there would be some economies of scale and would run a combined portfolio. It would be necessary to ensure that these economies were passed onto customers.

1.353 This option would appear to provide for increases in efficiency across the Channel Islands and hence lower prices, however, it is not clear that the benefits would fall to Jersey customers and it is not inconceivable that customers in Guernsey gain the majority of benefits from this option. Locating a Channel Island power station within Guernsey would reduce Jersey's carbon foot print but would impact negatively upon Guernsey's. If the majority of manpower efficiency savings were made in one Island there could be considerable sensitivities to the acceptability of such an option.

1.354 The main barrier to any merger of JEC and GEL is likely to be political acceptability in Guernsey. The NAO recently recognised that a merger of GEL and JEC would result in "a number of risks and drawbacks[159]". The sort of concerns mooted included Guernsey losing influence over a key utility, Jersey becoming dominant, undermining Guernsey's position, and GEL being forced to shed staff.

1.355 Nevertheless, the NAO recommended that the potential for a merger was worth exploring by the States of Guernsey, as it "would bring clear efficiency savings" However, within the covering report to the States, the response was:

"Whilst the possibility of merging the … electricity operations of Guernsey and Jersey at some time in the future…. should not be discounted, neither of the [Treasury & Resources and Commerce & Employment] Departments consider that such a review should be given priority at this time."

1.356 The question remains whether any proposal for JEC to take over GEL would attract a similar reaction as the merger discussed above. In addition, it is likely that the States of Guernsey would mandate tariff equalisation across the Channel Islands which could result in price increases in Jersey.

1.357 Finally, this would require further interconnection between Guernsey and Jersey which may not be cost effective compared with enhanced plant on Jersey.

1.358 Importantly, any instruction to JEC to carry out such an action can only come from its shareholder. However, regardless of the mechanism for achieving a combined

[159] NAO Review of Commercialisation and Regulation in the States of Guernsey

entity, any take over or merger would require alignment of the regulatory environments in the two Islands.

1.359 ***Conclusion :*** There would need to be regulation alignment and a move towards specific efficiency driven regulation in Jersey (i.e. change in role of JCRA) under this option. However, there are political sensitivities around these issues in both Islands are this could only be taken forward with a joint approach.

POLICY OPTION 58 : The States of Jersey will begin discussions with the States of Guernsey (and GEL and JEC) to explore the potential for increased efficiencies across the Channel Islands by creating a wholesale electricity market.

These discussions will explore the different models proposed for a wholesale market and the benefits :

1. **Existing collaboration;**
2. **Enhanced Regulatory Co-ordination;**
3. **Formalised Co-ordination;**
4. **A competitive wholesale market.**

Discussions will address how these models might achieve efficiency savings across the islands whilst maintaining each island's objectives in terms of :

1. **Security of supply;**
2. **Environmental objectives;**
3. **Other considerations such as the ownership of strategic assets, workforce relationships.**

Regulation of the utilities industry

1.360 Regulation can replace competition in terms of achieving price protection for customers and efficiency savings. The Channel Islands operate very differently to one another with the heavily regulated Guernsey model compared to the lack of sector specific regulation in Jersey. Therefore, Jersey should consider if there is role for cross Channel Island regulatory collaboration.

POLICY OPTION 59 : The States will investigate the role that sector specific regulation might play in the energy utilities market in Jersey in acting as an external surrogate for competitive pressures. Regulation would have the aim of setting JEC's revenues to the levels that would exist in a competitive environment.

In addition, the role of the regulator might be to :

1. **Set allowable revenues;**
2. **Set mandatory levels of environmental performance.**

The States will investigate the most cost effective mechanism to achieve regulation including discussions with the States of Guernsey and the Office of Utility Regulation. These discussions will explore the opportunities for potential efficiency savings to be derived from cross Channel Island regulatory collaboration.

Appendices

Appendix A

Statement from the JEC re distributed "microgeneration" / renewable energy

1.361 Jersey Electricity's policy is to minimise the carbon content of the energy it supplies and to encourage its efficient use, both with the aim of supporting Jersey in its obligations under the various Climate Change Protocols. It has been highly successful in this endeavour. Jersey's energy-related carbon emissions have fallen by more than 35% since 1991, due entirely to the displacement of oil used for electricity generation in the Island, with electricity imported from sources which are free from fossil fuels (principally nuclear and hydro energy).

1.362 Although there is very little carbon used in the production of the electricity supplied in Jersey. The Company recognises that there is merit in exploiting renewable energy resources where this can be done economically. Even though renewable energy generation is generally much more expensive to produce than conventional energy (even at today's high fossil fuel costs) because of the capital costs involved in capturing and converting the energy, financial incentives offered through such mechanisms as the European Emissions Trading Scheme have been successful globally, in attracting investment in large-scale renewables. To a much lesser extent, grants have also stimulated interest in small-scale renewables. However, the economics remain poor and Jersey Electricity recognises that many of those individuals who do invest, do so for reasons other than economy.

1.363 The amount of micro-generation connected to electricity networks around the world is extremely small, but in the long term could become significant. As a consequence, the electricity industry in consultation with the various Regulatory Bodies has established standards to ensure such generation can be accommodated, without compromising safety and the security and quality of electricity supplied from distribution network

1.364 Distribution networks have historically been designed to be "passive" networks which convey energy "top-down" from high voltage transmission networks to end users. The presence of "embedded" micro-generation presents some challenges relating to power flow management, voltage control, fault level (safety) management, electrical safety during network maintenance and supply restoration, supply distortion and stability.

1.365 Subject to compliance with the safety and technical standards in use in the wider electricity industry, (which equipment manufacturers are generally adopting) Jersey Electricity will allow connection of distributed generation to its network. It will pay for any significant quantities of "surplus" electricity provided by such generation, the same price it would otherwise have paid for power imported or when appropriate, generated in Jersey (the "avoided cost").

1.366 Because electricity supply is such a capital-intensive utility, the cost of electricity transmission and distribution infrastructure represents a significant element of the total cost of a unit of electricity supplied to the end user. As a result, the cost of energy production typically makes up a little less than half the total cost of a kilowatt-hour with the result that even though being paid the avoided cost of generation, a customer selling surplus power to an electricity supplier will generally be paid less than half the rate they themselves are charged for every unit of electricity.

1.367 Whilst Jersey Electricity encourages the use of renewable energy on a small as well as large scale, it points out that it was hugely successful in promoting methods for exploiting natural energy resources which are considerably more economical than the micro-generation technologies recently entering the market. Heat pumps are used to provide heating and cooling to more than one million square feet of commercial premises in Jersey using the energy in ambient air and Jersey Electricity are seeing success in promoting a variation of the technology to harvest energy from the ground. Its environmental consultancy “Jersey Energy” is well versed in “ground source heat pumps” and other applications and is helping a number of organisations and individuals to find the best way of expressing their environmental objectives for energy supplies. Jersey Electricity is hopeful that an Energy Policy for Jersey, launched in 2007 will provide strong policy direction for environmental sustainability and the Company pledges to remain a strong partner with the community of Jersey in its delivery.

Appendix B

Methane Calculations

Table 31 Calculation of Methane emissions as of 2005

Methane from animal wastes in 2005				x23	/ 3.792
livestock	**emission rate kg/a**	**numbers in 2005**	**tCH4/a**	**tCO2e/a**	**tCarbon e/annum**
cattle-dairy in milk	54.8	3169	173.7	3994.2	1053.3
cattle - other (heifers and beef)	24.9	2238	55.7	1281.7	338.0
pigs	2.47	478	1.2	27.2	7.2
poultry	0.11	22300	2.5	56.4	14.9
sheep	3.81	334	1.3	29.3	7.7
horses	30.4	465	14.1	325.1	85.7
TOTAL			**248.4**	**5713.9**	**1506.8**
methane from animals in 2005					
livestock	**emission rate kg/a**	**numbers in 2005**	**tCH4/a**	**tCO2e/a**	
cattle-dairy in milk	95	3169	301.1	6924.3	1826.0
cattle - other (heifers and beef) average emission rate 65+51	58	2238	129.8	2985.5	787.3
pigs	1.5	478	0.7	16.5	4.3
poultry	0.05	22300	1.1	25.6	6.7
sheep	8	334	2.7	61.5	16.2
horses	18	465	8.4	192.5	50.8
TOTAL			**443.7**	**10205.9**	**2691.4**
					6890
				Total additional tCarbon/ annum	89354
				Plus other carbon	96244

Appendix C

Tariff Comparisons for Electricity[160]

1.368 This Appendix presents the JEC's comparisons for the "standard" 3300 kWh domestic customer as provided to the Consultants in December 2006. They do not show the increases in price as of January 2007.

Table 32 Tariff Comparison - September 2006

	Typical annual bill (£)	% differential
JEC	**329**	
Guernsey Electricity	**373**	**+13.4%**
Manx Electricity	**438**	**+33.1%**
Average across Europe in 2005	**385**	**+17.0%**
UK	**428**	**+30.1%**

1.369 Notes:

1. Jersey prices rose by 9.7% from 1.1.06 and a commitment given not to have a subsequent rise for 2006.

2. Guernsey data from their website (www.electricity.gg). Prices rose by 5.5% on 1.1.06 and 5% on 1.4.06 i.e. 10.8% cumulatively in 2006.

3. IoM data from website (www.gov.im/mea). IoM prices are 33% higher than Jersey but would be even higher had the IoM Government not picked up the standing charge cost for customers of £42 p.a. from September 1st 2005 i.e. a subsidy has been created for consumers.

4. UK comparison is for an electricity only customer on the standard Centrica/ British Gas tariffs (largest UK supplier) and is an average of the charges offered to the customers over the 14 regions in the UK (www.house.co.uk). Prices have risen in March 2006 by 22% and in September 2006 by 9.4% i.e. by a cumulative 33% in 2006 to date.

5. European comparisons from work performed by an external consultancy (IPA) and compares Jersey to an average % differential against nine counties. Comparisons are comparing European and Jersey prices at 2005 levels (no data for 2006 yet available).

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[160] *'The Structure of the Channel island Energy Market'* January 2007 a report by Design and Implement commissioned by the States of Jersey.

6. VAT charges of around 5% are embedded in the UK, European and IoM comparisons.

7. The average bill shown above is illustrative as a typical Jersey customer actually uses more electricity because of our higher share of heating load than the UK. The figures however are still robust as we have merely re-based a typical Jersey domestic customer back to a UK/European counterpart.

Appendix D

Gas tariff comparisons

Table 33 Tariff comparisons for gas[161]

Tariff	Jersey Gas	Guernsey Gas
Commercial	7.51 (p/kWh) below 1643.8 kWh/day 7.34 (p/kWh) 1643.8 – 3287.6 kWh/day 6.99 (p/kWh) 3287.6 – 4931.5 kWh/day 6.84 (p/kWh) over 4931.5 Units per day	9.64 (p/kWh) (standard) 6.97 (p/kWh) over 50,000 kWh/yr
Super Economy 24	7.06 (p/kWh) below 54.79 kWh/day 6.34 (p/kWh) over 54.79 kWh/day 27.7p per day	6.97 (p/kWh) below 54.79 kWh/day 6.28 (p/kWh) over 54.79 kWh/day 27.54p per day
Standard 24	10.80 (p/kWh) up to 6.03 kWh/day 7.34 (p/kWh) 6.03 – 164.38 kWh/day 6.99 (p/kWh) over 164.38 kWh/day	11.06 (p/kWh)
Pre Payment	10.80 (p/kWh) via coin meter	11.69 (p/kWh) via coin meter

Source: Jersey Gas and Guernsey Gas September 2006 Tariff Leaflets

[161] *'The Structure of the Channel island Energy Market'* January 2007 a report by Design and Implement commissioned by the States of Jersey.

Appendix E

A full description on the derivation of each column from Table 16 - 'Summary of potential carbon savings for key measures in Jersey'

1.370 **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.

1.371 **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.

1.372 **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%.

1.373 **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 0.05kgC/KWh for electricity9, 0.074 kgC/KWh and 0.068kgC/KWh for gas.

1.374 **Estimated Jersey Dwellings** – This is an estimate of the number of dwellings in Jersey that could benefit from each of the measures.

1.375 **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.

1.376 **Cost/Annual kg Saved** - The costs per kg Carbon saved is the cost per measure divided by the carbon saved for each measure. For electricity, 10.18p/KWh is used for normal tariff and 5.6p per KWh for the heating only tariff.

Appendix F

Energy policy steering group, acknowledgements and a list of consultancy and inputs

1.377 The Environment Department would like to thank the following for their assistance in the development of Energy Policy:

Energy Policy Steering Group

- Senator Philip Ozouf, Minister for Economic Development
- Senator Freddie Cohen, Minister for Planning and Environment
- Senator Stuart Syvret, Minister for Health and Social Services

Energy Policy Advisory Group

1.378 **Officers**

- Chris Newton, Director, Environment Division
- Louise Magris, Assistant Director for Policy, Environment Division
- Sarah Le Claire, Assistant Director for Policy, Environment Division
- Mo Roscuet, Assistant Director – Building Control, Planning and Building Services
- Mike King, Chief Executive Officer Economic Development
- Kevin Pilley, Assistant Director – Policy and Projects, Planning and Building Services
- Dougie Peedle, Economic Advisor, Chief Minister's Department
- Carl Mavity, Director of Estate Services, States of Jersey Housing Department
- Duncan Millard, Head of Statistics, Chief Minister's Department

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- Mike Liston, Chief Executive, Jersey Electricity Company
- David Padfield, Operations Director, Jersey Electricity Company
- Ian Wilson Managing Director Jersey Gas
- Bob Staddon, Chief Executive Jersey Gas
- Mike Mitchinson, General Manager, Fuel Supplies CI Ltd
- Peter Cadiou, Jersey Energy
- John Howard, Jersey Water

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- Chick Anthony, Chairman, Environment Section, Société Jersiaise
- Paul Harding, Chairman, Association of Jersey Architects

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- Economic Development Department
- Transport and Technical Services Department
- Jersey Dairy for the provision of data relating to waste stocks

Consultancy Input

1. ''Jersey energy sector review' - Design and Implement (http://www.designandimplement.com/) Registered in England and Wales No. 4488692, Registered office: 80, High St, Coleshill, Birmingham, B46 3AH

2. *'An investigation into the feasibility of importing hydrocarbons into Jersey by pipelines'* - Pöyry Energy (Oxford) Ltd, (www.ilexenergy.com) Registered in England No. 2573801, King Charles House, Park End Street, Oxford OX1 1JD, UK

3. '*An investigation into indigenous energy sources in the Channel Islands'* AEA Energy & Environment, (http://www.aea-energy-and-environment.com/) Fermi Avenue, The Gemini Building, Harwell International Business Centre, Didcot, Oxfordshire, OX11 0QR. AEA Energy & Environment is a business name of AEA Technology plc.

4. *' Energy Efficiency Study'* - KEMA Consulting Europe (http://www.kema.com/) , KEMA Limited, Regent's Place, 338 Euston Road, London, NW1 3BT. This study assessed the potential and suitability of microgeneration technologies in Jersey