



Addressing Climate Change by Promoting
Low Carbon Climate Resilient Development
in the UK Overseas Territories

Needs Assessment:

Bermuda

Department for International Development

July 2012

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Background and Purpose

Introduction

This report forms one of a suite of 16 individual needs assessments of the UK Overseas Territories (UKOTs) produced as part of the process of developing a DFID/FCO led cross HMG programme design to address climate change by promoting low carbon climate resilient development in the UKOTs. The purpose of this assignment was to identify the scope and best way to deliver an appropriate climate change programme for all UK OTs and develop a business case for it (contract duration Feb – June 2012).

The purpose of the reports was to provide a rapid synthesis of information contained within available documentation and frame this in a way which: helped to establish a clear rationale for a generic framework forming one business case for the UK OTs but not allowing this to exclude targeted and selective action to meet specific needs. They were also designed to provide an evidence base for the later comparative analysis across OTs and subsequent prioritisation of different approaches for the business case, which was going to be designed later in the consultancy

It was agreed in May 2012 by the client and the consulting team that the contract was not fully deliverable as expressed in the original Terms of Reference. Details of the full programme of work and consultation is available in the project Inception Report (29th March 2012) and End of Contract Report (11th June 2012).

These reports now form a standalone output of the abbreviated consultancy.

The Reports

The original purpose of the reports still holds and the reader should recognise that the design and level of analysis in this report was set to be achievable within the time available (2 days of evidence gathering, research and writing against over 150 specific data points) and for the original purposes specified and no other. This report provides a general overview to facilitate future potential decision making and does not constitute a comprehensive nor in-depth analytical climate change report.

In a process facilitated by the UK Overseas Territories Association, data content in this report has been reviewed by in-country stakeholders via a nominated point of contact, with feedback incorporated if appropriate.

The report is tailored to the data points required to complete a climate change vulnerability matrix (VAM) tool. The VAM is structured around an understanding of four main issues: the exposure of an OT to climate change (threat analysis); adaptation and resilience; low carbon development and UK exposure. Each issue contains a number of subsets and indicators.

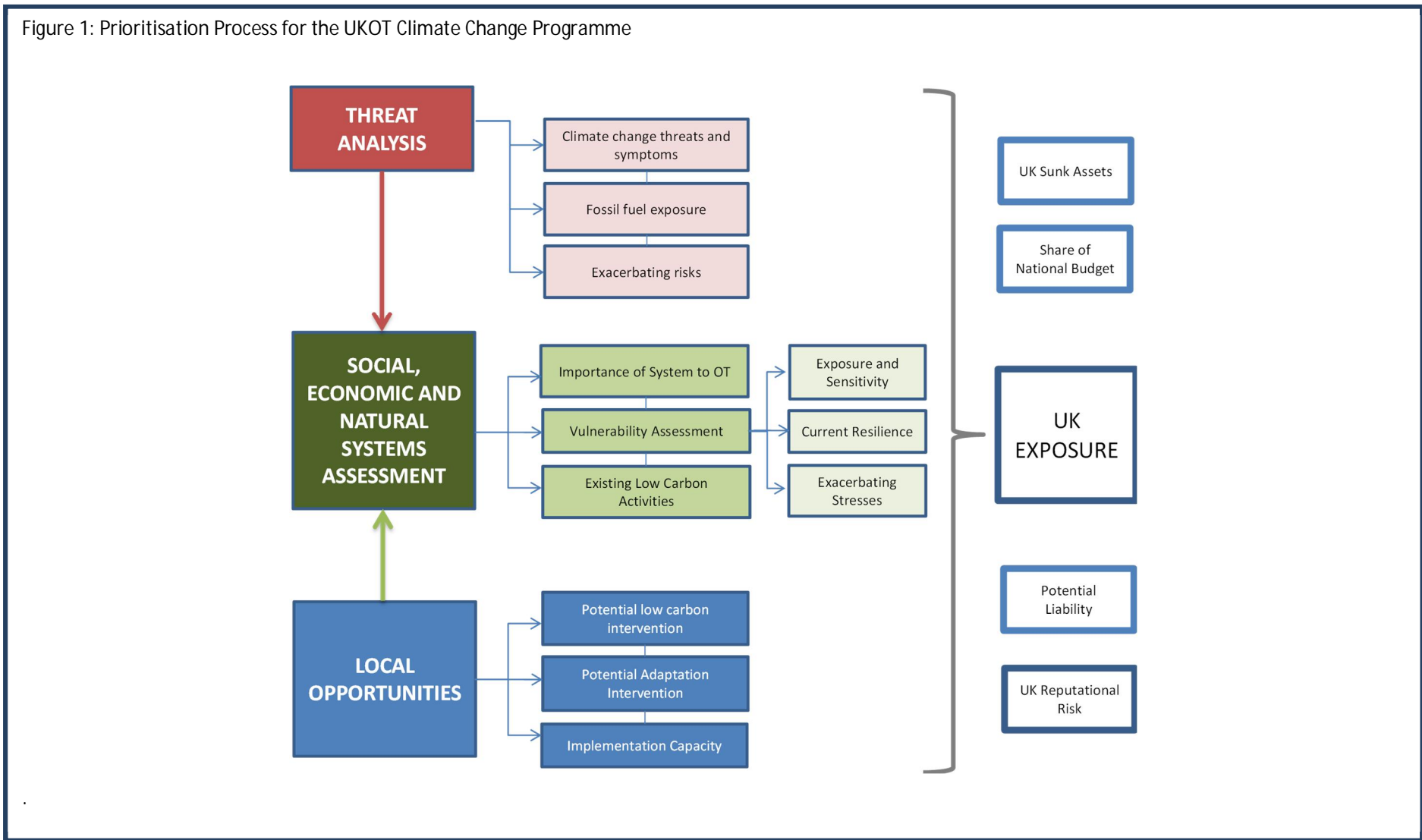
The completed VAM in this report uses a RAG colour coding system to provide a comparative analysis across all of the OTs to feed into the overall programme design. In most cases, data has been included specifically for the later appraisal and business case design process which would have followed.

Attached as annexes to this report are: an associated glossary of terms; a climate change VAM system definitions list; the VAM scoring system (which feeds into the coloured squares in the report text); the scored OT VAM; an initial programme approach table with preliminary sectoral and geographical analysis; and, if relevant, a greenhouse gas emission table.

Figure 1 overleaf illustrates how the data points in the VAM and in this report would have fed into the prioritisation process for a potential UKOT Climate Change Programme and DFID Business Case.

For a full understanding of how the data in this report and the VAM framework has been used, the reader is directed to the programme approaches which are elaborated in the programme Inception Report.

Figure 1: Prioritisation Process for the UKOT Climate Change Programme



Needs Assessment: Bermuda



KEY INDICATORS	
Population:	64,319 (2010 est.) ¹
GDP:	\$5.7 billion ²
Per Capita GDP:	US\$89,282 (2010) ³
ODA Entitled:	No
UK Annual Budget Support:	£338,000 (2005-2006)
Value of UK Sunk Assets:	N.A.
Key Economic Sectors:	Financial services, Tourism

Threat Exposure Analysis

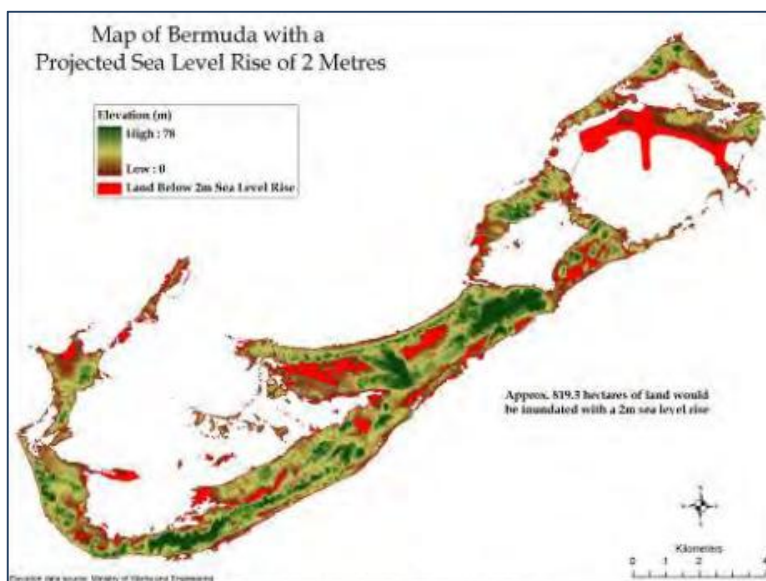
Climate Change Exposure



Bermuda is a low-lying oceanic archipelago (maximum elevation 79m) comprising a fishhook-shaped chain of four main islands which are surrounded by hundreds of islets (total land mass of 5,370ha).⁴ Located at the northern fringe of the tropics in the western North Atlantic and on the northern edge of the Sargasso Sea, this remote island group is more than 570 miles from the nearest landmass of mainland USA and almost 750 miles to the north of the nearest Caribbean Island⁵.

With a sub-tropical climate and two distinct winter (January to March) and summer (June to September) seasons, Bermuda receives average annual rainfall of around 140cm fairly evenly distributed throughout the year⁶ with average temperatures of 21.8°C and summer highs of around 29°C. The summer season broadly coincides with the June to November hurricane season. Tropical and subtropical depressions occur throughout this period, with a major hurricane hitting Bermuda once on average every 5 years.⁷

Under IPCC projections, temperatures in



¹ Government of Bermuda, Department of Statistics, 2011 "2010 Census Population and Housing Report", GoB, DoS
² Government of Bermuda, 2011. *National Economic Report of Bermuda*, Bermuda: Ministry of Finance.
³ Government of Bermuda, Department of Statistics, 2011 "Gross Domestic Product by Industry – 2010 Highlights", GoB, DoS November 2011, [online] http://www.seaexpress.bm/portal/server.pt/gateway/PTARGS_0_2_7251_227_1014_43/http%3B/ptpublisher.gov.bm%3B7087/publishedcontent/publish/cabinet_office/statistics/dept_statistics_gross_domestic_prod_/gross_domestic_product_2010_0.pdf accessed 20 07 2012
⁴ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda.*, Bermuda: The Bermuda National Trust
⁵ Government of Bermuda, Department of Environment, 2005 "State of the Environment Report, 2005", Department of Environment, GoB.
⁶ ibid
⁷ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda.*, Bermuda: The Bermuda National Trust

Bermuda are expected to rise by an average of 3.6°C over the next century (2.8°C-4.3°C). Annual rainfall is expected to increase by an average of 7% (5%-10%), but at less frequent and more intense downfalls

A sea level rise of 0.59m as predicted by the IPCC means that 186.6ha of land will be inundated with sea water. A 2m rise, believed to be the upper limit attainable this century, would result in 819.3ha of inundated land (red areas on map)⁸.

Since 1970 there has been a 7.5% increase in the number of category 4 and 5 hurricanes. Fewer hurricanes, but of greater intensity are expected due to rising temperatures. This in turn, may upset the heat transfer from the tropics to the pole, resulting in more winter storms.⁹

Resource Exposure

Bermuda is almost entirely dependent on the importation of fossil fuel to support its energy demand. In 2007 800,000 barrels of heavy fuel oil and 200,000 barrels of diesel oil were imported. 97% of the island's energy is provided and distributed by a plant located in Pembroke. The remaining 3% is generated through the Bermuda Government's waste to energy plant. The cost of electricity in 2008 was equal to 39cents/KWh.¹⁰ More details are reported in *Current Abatement Activities*.

The current Government water supply system produces 200 million gallons of water each year by abstracting from fresh and brackish groundwater. Water is then treated at 4 treatment plants provided with reverse osmosis systems.¹¹ Most households are provided with rainwater roof catchment systems. By law each house must have 80% of its roof area guttered to collect rainwater and a storage tank.¹² Hotel developments, the hospital and businesses depend on supplemental groundwater and treated sea water distributed by pipelines and water 'truckers'.¹³

Adaptation and Resilience

Importance to OT

Importance of System to OT

Natural systems

Geographically isolated, Bermuda's terrestrial environment is characterised by a relatively low levels of species endemism (3%) and high levels of human disturbance. Bermuda has 218 ha (539 acres) of terrestrial areas that are protected as nature reserves. This equates to just over 4% of Bermuda's land area which have been set aside strictly for the protection of flora and fauna¹⁴. Many of Bermuda's endemic species are found in its delicate systems of caves and ponds. 25 of these organisms have been placed on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Animals.

A great variety of birds and animals are also supported in Bermuda, including the Bermuda petrel (*Pterodroma cahow*), locally known as the cahoware, which is endangered, and the Bermuda skink (*Eumeces longirostris*), which is critically endangered^{15 16}.

⁸ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda*. , Bermuda: The Bermuda National Trust

⁹ Glasspool, A. F., 2008. *Ibid*

¹⁰ Glasspool, A. F., 2008. *Ibid*

¹¹ Government of Bermuda, 2012. *Water and Sewage*. [Online] Available at:

http://www.gov.bm/portal/server.pt?open=512&objID=221&&PageID=302&mode=2&in_hi_userid=2&cached=true. Accessed on 20th July 2012.

¹² Government of Bermuda, 2005. *State of the Environment Report*. Bermuda: Department of Communication & information

¹³ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda*. , Bermuda: The Bermuda National Trust

¹⁴ Government of Bermuda, 2005. *State of the Environment Report*. Bermuda: Department of Communication & information

¹⁵ JNCC, 2011. *Overseas Territories and Crown Dependencies Training and Research Programme Work Plan 2010-2012*, s.l.: JNCC.

¹⁶ Government of Bermuda, 2005. *State of the Environment Report*. Bermuda: Department of Communication & information

Areas of the coastal system which have not yet been developed are characterised by important mangrove and salt marsh ecosystems which not only support important and endangered species but offer protection from stormy weather¹⁷. The largest remaining mangrove at Hungry Bay is 2.9 ha. Salt marshes are limited to few small areas but they support an unusual number of rare and endangered plants and animals. The inland marine ponds of Bermuda are considered one of the Island's national treasures because they support a globally rare high biodiversity of marine and brackish-water organisms.¹⁸

One of Bermuda's most attractive features is its spectacular sandy beaches and dunes which are a critical feature of its important tourism industry.¹⁹

Unlike its' terrestrial environment, Bermuda's marine environment is characterised by high levels of endemism and are an important component in its tourism product. Bermuda possesses the most northerly coral reefs and mangroves in the world. Since the plant and animal communities comprising these ecosystems live at their limits, Bermuda is seen as a very important location in which scientists can monitor global environmental trends. Bermuda has 34 hard coral species and 24 soft coral species. Although its diversity may be lower, Bermuda's coral coverage is higher in comparison to many Caribbean reefs. Bermuda also hosts four species of seagrass²⁰.

Economic systems

In 2010 GDP was \$5.7)²¹. The following table presents GDP by economic sector for 2010. This outward looking economy is dependent on international business (almost 25% of GDP) (insurance and re-insurance are the biggest sectors) and luxury tourism which are the major sources of foreign exchange for Bermuda. Both are vulnerable to external shocks. The last two years have seen the contribution of the international business sector fall, largely as a consequence of natural disasters in other parts of the world which have impacted the insurance industry²² while tourism has been affected by the financial crisis in the United States of America. Over the period 2008 and 2009 air arrivals fell by over 10% in each year as the financial crisis in the US took hold²³.

Two key characteristics of the important tourism sector are the importance of the cruise ship market (in 2010 415,711 passengers visited Bermuda) and the importance of the United States (US) as a primary market for short and longer stay tourist visitors – in 2011 two thirds of all passengers were from the US.

With few natural resources all consumable goods are imported.

Industrial Sectors	Value of GDP ²⁴ (\$ 000s)	GDP %
Agriculture, forestry, fishing	47 896	0.9
Manufacturing	79 613	1.5
Electricity, gas, water supply	69 655	1.3
Construction & Quarrying	241 516	4.4
Wholesale and retail, repair serv.	356 728	6.5
Hotels and Restaurants	231 954	4.2
Transport and Communications	267 603	4.9
Financial intermediation	704 129	12.9
Real estate and renting activities	904 601	16.6

¹⁷ Government of Bermuda, 2005. *State of the Environment Report*. Bermuda: Department of Communication & information

¹⁸ Government of Bermuda, 2005, *ibid*

¹⁹ Government of Bermuda, 2005, *ibid*

²⁰ Government of Bermuda, 2005. *ibid*

²¹ Government of Bermuda, 2011. *National Economic Report of Bermuda*. Ministry of Finance.

²² Government of Bermuda, Department of Statistics, 2011 "Gross Domestic Product by Industry – 2010 Highlights", GoB, DoS November 2011, [online]

http://www.seaexpress.bm/portal/server.pt/gateway/PTARGS_0_2_7251_227_1014_43/http%3B/ptpublisher.gov.bm%3B7087/publishedcontent/publish/cabinet_office/statistics/dept_statistics_gross_domestic_prod_/gross_domestic_product_2010_0.pdf accessed 20 07 2012

²³ Government of Bermuda, 2011. *National Economic Report of Bermuda*. Ministry of Finance.

²⁴ Government of Bermuda, 2011. *ibid*

Business activities	446 477	8.2
Public administration	291 452	5.3
Education, health and social work	402 845	7.4
Comm, social and personal serv.	102 090	1.9
International business activity	1 311 773	24.0

Human Systems

Bermuda is one of the most isolated but densely populated countries in the world (3,097 people per square mile). In 2010 its population of 64,319 (a 4% increase over the year 2000) comprised 50,565 Bermudians and 13,516 non-Bermudians²⁵. The level of urbanism continues to rise with an average of 294 dwellings constructed each year between 2000 and 2010. Life expectancy is 80.82 years but Bermuda has an ageing population, the median age increased from 37 to 41 between 2000 and 2010. The population profile in the 2010 Census shows that migration from non-Bermudians is offsetting an ageing Bermudian population²⁶.

Per capita GDP in 2010 was US\$89, 282²⁷, the third highest in the world²⁸. Preliminary data from the 2011 Employment Survey indicates a rising level of unemployment – a rise of 1.9% between 2010 and 2011 from 38,097 to 37,379, marking a decline of 718 jobs. Overall the Island has lost 2,834 jobs since 2008, a reduction of 7.0%²⁹.

Vulnerability

Sensitivity to Climate Exposure



A detailed study of the effects of climate change exposure on Bermuda is contained within the work of Glasspool (2008) commissioned by the Bermuda National Trust³⁰. This includes detailed vulnerability and flood risk mapping. A brief summary is provided below:

Biodiversity and Ecosystem: Sea level rise (SLR) is likely to lead to the loss of beaches and dunes, as well as of habitats for endemic or endangered species. It is also likely to favour the erosion of seagrass beds. Rising temperatures could produce an increase of mass coral bleaching and a shift in the distributional patterns of seagrass. Storms of increased strength could damage reef structures from wave action.³¹

Hydrology and water resources: Steeply inclined shoreline minimises the impact of SLR on the freshwater lenses up to 0.59 m above present. SLR of 2m, would affect 143.6 ha of the land area of freshwater collection and drainage and cause saltwater contamination of household tanks. High winds experienced during more intense storms may drive salt, debris and potential contaminants into storage tanks. Increasing temperatures will result in higher evaporation, more water usage and higher levels of bacterial contamination.³²

Tourism: Hurricane activity and SLR will affect local tourism in a number of ways. Most critically through damage to infrastructure and the marine environment (described above and in infrastructure below). Many hotels and supporting amenities are located in coastal areas³³.

²⁵ Government of Bermuda, Department of Statistics, 2011 “2010 Census Population and Housing Report”, GoB, DoS 2011,

²⁶ Government of Bermuda, Department of Statistics, 2011 “2010 Census Population and Housing Report”, GoB, DoS 2011,

²⁷ Government of Bermuda, Department of Statistics, 2011 “Gross Domestic Product by Industry – 2010 Highlights”, GoB, DoS November 2011, [online]

http://www.seaexpress.bm/portal/server.pt/gateway/PTARGS_0_2_7251_227_1014_43/http%3B/ptpublisher.gov.bm%3B7087/publishedcontent/publish/cabinet_office/statistics/dept_statistics_gross_domestic_prod_/gross_domestic_product_2010_0.pdf accessed 20 07 2012

²⁸ World Bank, 2010: “Gross national income per capita 2010, Atlas method and PPP” World Bank [online]

<http://siteresources.worldbank.org/DATASTATISTICS/Resources/GNIPC.pdf> accessed 20 07 2012

²⁹ cited in Government of Bermuda, 2011. *National Economic Report of Bermuda*. Ministry of Finance.

³⁰ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda*. , Bermuda: The Bermuda National Trust

³¹ Glasspool, A. F., 2008. *ibid*

³² Glasspool, A. F., 2008. *ibid*

³³ Glasspool, A. F., 2008. *ibid*

Transportation: A 2m SLR would mean the airport would no longer be functional. The structural integrity of ports in Hamilton and St. George's as well as roads would be compromised. Several bridges link the main islands. The vulnerability of the longest, the Causeway was highlighted during Hurricane Fabian which breached the bridge and left the east end of the island stranded, and the airport inaccessible to residents west of the Causeway. More widely, saltwater intrusion could lead to the degradation of road and runway foundations, bridges and ports. Increased storm intensity may contribute to material failure and floods from storm surge.³⁴

Agriculture and Fisheries: Although not a key economic sector, agriculture and fisheries play an important cultural role. Salt water intrusion from SLR is already reducing the land available for arable farming. Heavy rainfall threatens soil stability and affects crop production. Storms cause direct destruction of crops, interfere with planting seasons and crop and honey output. As regards fisheries, SLR and more intense storm activity will impact fisheries mainly through loss of nursery habitat. However, as many species found in Bermuda are at their northern limits, warming oceans may have a favourable impact, extending the fishery for migratory species and increasing species diversity on the reef.³⁵

Energy Supply and Use:³⁶ SLR could inundate the electric utility's central power plant located in Pembroke and submerge parts of the transmission network. Increased frequency and severity of storms may cause interruptions to fossil fuel deliveries and lead to more frequent damage to electrical distribution infrastructure. Rising temperatures are likely to increase demand for electricity as a result of increased demand for air conditioning, as well as to reduce the efficiency of transmission.^{37 38}

Livelihoods: Almost 2000 buildings would be affected by flooding if the sea level rises by 2m.³⁹ Moreover, revenues from tourism and agriculture/ fisheries could be affected by climate changes. Any increase in the intensity of hurricane storms would affect the whole economy.

Human Health: the Bermuda has a well-developed health care system, but changes in weather and climatic conditions may influence the rate respiratory infections and heat related diseases. Flooding, storm surges and tropical cyclones bring risk during and post event, with increased risk of injury, risk of contamination of water with hazardous substances and water-and food-borne disease (diarrhoea, food poisoning and salmonellosis). Secondary impacts are then loss of income and productivity, population displacement and social disruption, diminished quality of life, psychological stress and an increase in the costs to health care.⁴⁰

Current Resilience Activities

The Sustainable Development Strategy and Implementation Plan 2008-12 (SD Plan) includes 137 concrete actions organised into 5 themes. Theme 2 Living Within Bermuda's Limits incorporates the issue of climate change. Actions relate to assessment and protection of the coastline, while Action 6 specifically identifies the importance of monitoring possible impacts of climate change on Bermuda with the view to an improved response to climate change effects.⁴¹

The Bermuda Biodiversity Action Plan – Activity report (2010), details a wealth of resilience activities that have been carried out. The over-arching Biodiversity Action Plan outlines comprehensive objectives to which these activities align⁴². Bermuda also has 218 ha of terrestrial areas that are protected as nature reserves.⁴³

The Bermuda Plan 2008⁴⁴ aims to effectively manage the natural and built environment, resources and development in a sustainable way - providing for the environmental, economic and social needs of the

³⁴ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda*. , Bermuda: The Bermuda National Trust

³⁵ Glasspool, A. F., 2008. *ibid*

³⁶ Glasspool, A. F., 2008. *ibid*

³⁷ Government of Bermuda, 2011. *2011 Bermuda Energy White Paper: A National Energy Transition*.

³⁸ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda*. , Bermuda: The Bermuda National

³⁹ Glasspool, A. F., 2008. *ibid*

⁴⁰ Glasspool, A. F., 2008. *ibid*

⁴¹ Sustainable Development, 2010. *Theme 2: Living within our limits*. Available at: <http://www.sdbermuda.bm/sd-plan/theme-2-living-within-our-limits> [Accessed 30 05 2012].

⁴² Government of Bermuda, 2010. *Bermuda Biodiversity Action Plan Activity Report* , Digital: Department of Conservation Services.

⁴³ Government of Bermuda, 2005. *State of the Environment Report*. Bermuda: Department of Communication & information

community. The Plan is based on 3 inter-related strategies, a Conservation Strategy, a Development Strategy and a Social Strategy:

Natural variability in recruitment and productivity is typical of any fisheries sector so management practices have already developed an adaptive approach. Marine resources will be more resilient to CC impacts if additional pressures (harvesting, loss of habitat, pollution, disturbance, invasive species) can be minimized.

Progressive development and implementation of biological and health surveillance measures is already practiced by the Ministry of Health and is essential to adaptation to CC⁴⁵.

By law (Water Storage Regulations, 1951), every house in Bermuda must have 80% of its roof area guttered to collect rain water and a storage tank with a capacity of at least 454.6 litres/per m² collection area.⁴⁶

Exacerbating Stresses



Bermuda's population growth and economic prosperity have brought about significant losses of terrestrial habitats through land development. Moreover, Bermuda's coral reefs are thought to be at 'high risk' due to the island's high population density and potential threats from vessels. Both coastal and marine environments are vulnerable to floating pollutants especially particularly oil.⁴⁷ Tourism is also a major contributor to greenhouse gas emissions⁴⁸.

In summer, on average one hurricane approaches Bermuda every year, and a severe hurricane is expected every 4-5 years.⁴⁹

Future Opportunities

Potential Adaptation Interventions



Bermuda is currently planning to set up a National Infrastructure Plan (NIP) which is expected to incorporate the necessary preparations for adaptations to infrastructure elements in response to the effects of climate change. A Request for Proposals was launched by the Government of Bermuda in November 2011.⁵⁰

Other foreseen interventions include: more stringent water conservation practices (ensuring that water demand does not exceed supply), maintenance of healthy natural ecosystems which ultimately influence groundwater resources, more environmentally-sound desalination operations and better weather forecasting.⁵¹

A comprehensive coastal zone management plan is needed building on the Draft Planning Statement (2008)⁵² which deals with both SLR and the other impacts of global CC. Such a plan should ensure that risks to people are minimized, while recognizing the need to protect and maintain important coastal ecosystems.

Implementation Capacity



In 2010, the Cabinet approved the establishment of an Ad Hoc Working Group on Climate Change (AHWGCC) to serve as a coordinating body to oversee the development and implementation of mitigation and adaptive measures in response to the potential effects of climate change. It is important that the AHWGCC provide a

⁴⁴ Government of Bermuda, 2008. *The Bermuda Plan 2008 Planning Statement (DRAFT)*, Digital: Department of Planning.

⁴⁵ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda*. , Bermuda: The Bermuda National Trust

⁴⁶ Glasspool, A. F., 2008. *ibid*

⁴⁷ Government of Bermuda, 2005. *Op cit*.

⁴⁸ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda*. , Bermuda: The Bermuda National Trust

⁴⁹ Glasspool, A. F., 2008. *ibid*

⁵⁰ Government of Bermuda, 2011. *Request for Proposal (RFP) for A National Infrastructure Plan (NIP)*. Bermuda: Ministry of Environment Planning and Infrastructure Strategy.

⁵¹ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda*. , Bermuda: The Bermuda National Trust

⁵² Government of Bermuda, 2008. *The Bermuda Plan 2008 Planning Statement (DRAFT)*, Digital: Department of Planning.

cohesion of efforts initiated by relevant government departments, enhancing cross-departmental collaboration.⁵³

Moreover, NGOs, such as Bermuda National Trust, GreenRock and Bermuda Institute of Ocean Sciences (BIOS) and Community Clubs, such as the Garden Club, Botanical Society and Bermuda Audubon Society, are involved in activities related to climate change adaptation in Bermuda.⁵⁴

Low Carbon Development (Source)

Current Emissions

Share of Current Emissions

Bermuda's emissions per person are relatively high at 14.44 metric tonnes per capita, more than twice the worldwide average⁵⁵ over half of which is from energy use⁵⁶. See distribution below⁵⁷.

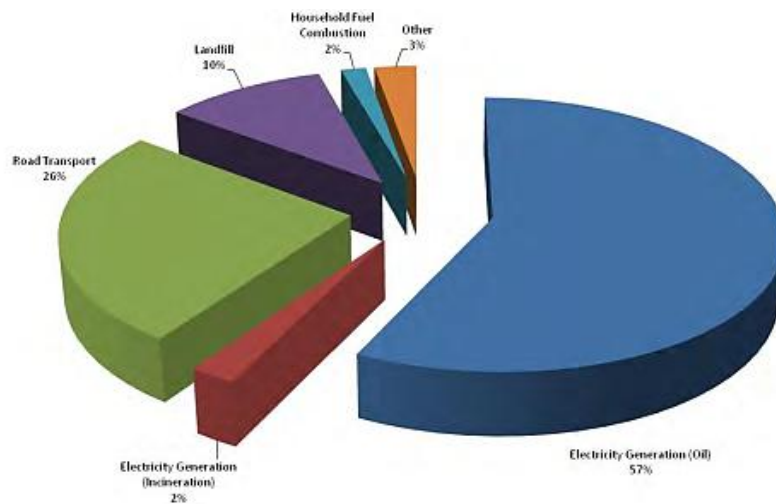


Figure 2.1 – Sources of Bermuda's greenhouse gas emissions in 2008 (Department of Energy³³, 2011)

GHG Abatement

Abatement Potential

The *Energy White Paper*⁵⁸ outlines the short-term goals of halting emissions growth by 2013 and reducing emissions to less than 10 metric tonnes CO₂ equivalent per capita by 2020 (a 30% reduction in GHG emissions from 2008 levels). It also sets out a subsequent target of reducing emissions by 56% below 2008 levels by 2030 and emissions to less than 1 by 2050. The Government has established an internal target of reducing fossil fuel consumption for the bus and ferry services 30% below 2008 levels by 2020. This target will be achieved through the gradual replacement of less efficient buses and ferries with more efficient models and careful route planning.

⁵³ Sarkis, S., 2012. Personal Communication

⁵⁴ Sarkis, S., 2012. Personal Communication

⁵⁵ Government of Bermuda, 2011. *2011 Bermuda Energy White Paper: A National Energy Transition*,

⁵⁶ Glasspool, A. F., 2008. *The Impact of Climate Change on Bermuda*. , Bermuda: The Bermuda National Trust

⁵⁷ Government of Bermuda, 2011. *2011 Bermuda Energy White Paper: A National Energy Transition*,

⁵⁸ Government of Bermuda, 2011. *2011 Bermuda Energy White Paper: A National Energy Transition*,

Current Abatement Activities

3% of the electricity produced in Bermuda is generated through a waste to energy plant located at Tynes Bay.⁵⁹ Moreover, a Solar Photovoltaic Rebate Initiative was launched in 2009 to provide a rebate of \$1 per installed watt for residents who have solar photovoltaic generating systems installed on their properties. A Solar Water Rebate Initiative was then launched in 2010 to provide a rebate of up to \$1,500 for residents who have solar water heating systems on their properties.⁶⁰ Researchers are also in place for the development of alternative energy based on algal biodiesel.⁶¹

Moreover, information has been made available to educate the public on the issues behind energy supplies and the solutions available, and Bermuda's first public opinion survey on energy, has provided much needed understanding for a subject that was previously little understood.⁶²

Low Carbon Opportunities

Potential LCD Intervention

The *Energy White Paper*⁶³ reports a list of actions the Government is going to conduct in order to reduce GHG emissions and its dependency from fossil fuel. They include:

- Expand the Tynes Bay Waste-to-Energy Facility to 7.5MW generation capacity;
- Work to ensure at least 5,000 homes are powered with on-site solar photovoltaic technology by 2020;
- Develop a multi-megawatt offshore wind farm that will provide over 18% of electrical energy requirements by 2020;
- Develop ocean energy technologies that will contribute to the production of 5% of electrical energy by 2020;
- Introduce legal requirements for the priority use of electricity generated from the lowest emission source;
- Allocate development zones for large-scale renewable energy generation projects, such as public lands and seabeds;
- Manage the solicitation process for large-scale renewable energy generation projects;
- Issue licences for electrical generators; and
- Amend the building code to include requirements for the proper installation of distributed small scale renewable energy generators;

Implementation Capacity

A new Energy Act would transfer regulation responsibility to an independent authority and provide comprehensive authority to regulate the energy industry⁶⁴.

The Bermuda Institute of Ocean Sciences is a leading authority conducting researches on algal biodiesel.⁶⁵

⁵⁹ Government of Bermuda, 2011. *2011 Bermuda Energy White Paper: A National Energy Transition*,

⁶⁰ Government of Bermuda, 2011. *ibid*

⁶¹ Government of Bermuda, 2011 *ibid*.

⁶² ⁶² Government of Bermuda, 2011. *2011 Bermuda Energy White Paper: A National Energy Transition*,

⁶³ Government of Bermuda, 2011. *2011 Bermuda Energy White Paper: A National Energy Transition*,

⁶⁴ Government of Bermuda, 2011. *2011 ibid*

⁶⁵ Government of Bermuda, 2011 *ibid*.

UK Exposure

UK Sunk Assets

Unknown.

Absolute Value of UK Transfer

FCO allocated £338,000 to Bermuda in 2005-2006.⁶⁶

Share of National Budget from UK Transfer

A low percentage of the national budget comes from UK Transfer.

Potential Liability

Bermuda is among the signatories of the following multilateral environmental agreements⁶⁷ (DEFRA, 2012):

- The Convention on International Trade in Endangered Species (CITES)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS)
- The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter: The London Convention (LC) and London Protocol (LP)
- Ramsar Convention on Wetlands of International Importance
- Vienna Convention for the Protection of the Ozone Layer
- Montreal Protocol on Substances that Deplete the Ozone Layer

Reputational Risks

Key risks for Bermuda identified by the Government, Governor and NAO in 2007⁶⁸ include economic and hurricane/tsunami risk. The NAO identified that sustained efforts are required to ensure that Bermuda maintains its positive international reputation and competitive edge. Over a period of years Bermuda could become less attractive to expatriate workers and foreign companies and less competitive as a financial centre.

⁶⁶Carey, N. et al., 2007. *National Audit Office: Managing Risk in the Overseas Territories*, Belfast: TSO.

⁶⁷DEFRA, 2012. *The Environment in the United Kingdom's Overseas Territories: UK Government and Civil Society Support*. , Digital: DEFRA.

⁶⁸Carey, N. et al., 2007. *National Audit Office: Managing Risk in the Overseas Territories*, Belfast: TSO.

Annex One: UKOT Climate Change Vulnerability Analysis Matrix
Glossary of Terms

UKOT Climate Change Vulnerability Analysis Matrix Glossary of Terms

Abatement Potential	(Cost effective) technical potential for reducing emissions within sector.
Absolute GHG Emissions	Annual amount of greenhouse gases (GHG) produced by an Overseas Territory. It is measured as metric tonnes of CO ₂ generated per year.
Absolute Value of UK Transfer	Total amount of funding from UK to an Overseas Territory per year.
Adaptation	The extent to which existing initiatives and measures (projects and programmes) are expected to reduce the vulnerability of natural and human systems against actual or expected climate change effects.
Adaptive Capacity	The ability of a social or natural system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change.
Carbon sink	A natural or artificial reservoir that accumulates and stores some carbon-containing chemical compound for an indefinite period. Natural: Absorption of carbon dioxide by the oceans via physicochemical and biological processes and photosynthesis by terrestrial plants. Artificial: include landfill and carbon capture and storage.
Climate Change	A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.
Climate Change Impact	Consequences of climate change on social, economic and natural systems without considering adaptation.
Climate Change Exposure	The change in climate with a potential adverse effect on social, economic and natural systems.
Current Abatement Activities	Any action that reduces the emissions or emissions intensity (per unit output) of a given sector on-going or completed in UK Overseas Territories as of March 2012.
Current Resilience Activities	Resilience activities on-going or completed in UK Overseas Territories as of March 2012.
Energy Efficiency	Ratio of energy output of a conversion process or of a system to its energy input: measures taken to reduce demand for energy for the same projected level of development.
Energy Import Dependence	Percentage of energy imported from abroad by the single Overseas Territory.
Exacerbating Stresses	Natural or human factors which in isolation or combination have the potential to lead to a change in the severity or frequency of a climate change threat. This may include inter alia a natural hazard, an extreme weather event, social tension or conflict, demographic trends and population characteristics and institutional and/or societal capacity constraints.
Exposure	The sum of the character, magnitude and rate of climate change variation to which a system is influenced by.
Fossil Fuel Dependence	The percentage of total fuel consumption derived from carbon-based fuels from fossil carbon deposits (including coal, oil, and natural gas) and the percentage of that fuel that is imported.
Frequency and Severity	Occurrence and magnitude of an event in UK Overseas Territories.
Future Opportunities	A territory's ability to reduce greenhouse gas emissions or to enhance carbon sink (Potential LCD Intervention) coupled with its potential to plan adjustment interventions in response to the effects of climate change (Potential Adaptation Intervention).
GHG Abatement (Current)	Potential for reducing emissions within sector coupled with any action already in place that reduces the emissions or emissions intensity of a given sector.

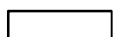
Implementation Capacity	Current (March 2012) capacity to design, implement and monitor all related low carbon / adaptive capacity activities. This includes all current resource constraints (i.e. funding, local personnel capacity, lack of personnel, supportive infrastructure etc.) and opportunities.
Importance of system to OT	The value that society and people in an UK Overseas Territory place on the significance of impacts and vulnerabilities (see Vulnerability) on social, economic and natural systems.
Low Carbon Development (Source)	Actions which include making a contribution towards stabilising levels of CO ₂ and other greenhouse gases at a level that will avoid dangerous climate change, through cuts in emissions, demonstrate a high level of energy efficiency, use low-carbon energy sources and/or utilise and enhance carbon sinks.
Magnitude	The area or number of people likely to be affected as a proportion of total population or land area.
Potential Liability	Legal, Financial, Moral and Political exposure arising from the activities of the UK Overseas Territories. This includes UK commitments to legal treaties that extend to the OTs (e.g European Convention on Human Rights) and response to natural and man-made disasters and terrorist events.
Potential LCD Intervention	A territory's ability to reduce anthropogenic CO ₂ and other greenhouse gas emissions or to enhance carbon sinks, where ability refers to skills, competencies, fitness and proficiencies that a territory has attained and depends on technology, institutions, wealth, equity, infrastructure and information.
Potential Adaptation Interventions	The potential for a planned intervention which constitutes or contributes to an adjustment in natural, social or economic systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.
Reputational Risk	Reputation is defined as the social evaluation of the public towards HMG. Risk is the probability that a failure to act will produce harm to that reputation. This reputation may be defined in terms of the potential: loss of HMG ethical (moral) reputation for safe guardianship of its citizens) disruption or distortion of HMG relationship with its citizens in the OTs withdrawal of private sector investment in UK Overseas Territories (investor flight).
Resilience	The ability of a social or natural system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change.
Resource Exposure	Degree at which a system is influenced by a variation in the availability or the price of resources (specifically water and energy).
Resource Use Efficiency	The effective use of energy and water resources – limiting wastage and maximising usable resources.
Sensitivity to Climate Exposure	Affects the magnitude and/or rate of a climate related perturbation or stress and is the degree to which a system [exposure unit] is affected, either adversely or beneficially, by climate variability or climate change. The effect may be direct (e.g. a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).
Share of Current Emissions	Percentage of OT's Absolute GHG Emissions generated by each sector.
Share of National Budget from UK Transfer	Percentage and amount (at 2011 prices) of the total Overseas Territory Budget which comes from HMG budgetary support.
System (Social, Economic and Natural)	A set of functionally inter-related elements subdivided into Natural (ecosystems and biodiversity) and Social and Economic (Human) elements.
Threat Exposure Analysis	Identification of the threats that may affect a system and evaluation of their frequency and severity.
UK Exposure	Risk to the UK arising from activities in the UK Overseas Territories. It includes UK Sunk Assets, Share of National Budget from UK Transfer, Potential Liability and Reputational Risk.

UK Sunk Assets	UK investments in physical infrastructure in the Overseas Territories which cannot be recovered.
Vulnerability	The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Key:



Voice reported in VAM



Additional voice

Annex Two: UKOT Climate Change VAM Systems Definition

SOCIAL, ECONOMIC AND NATURAL SYSTEMS DEFINITIONS	
Biodiversity and Ecosystems (Marine and terrestrial)	<p>Ecosystems – A community of living (plants and animals) and non-living things (climate, landscape) which interact together and affect each other.</p> <p>Biodiversity – The variety of plant and animal life found in an ecosystem and the variation in their genetic makeup. It is a measure of the health of an ecosystem, with healthy ecosystems having greater variety and variation in plant and animal life than unhealthy ones.</p> <p><i>Source: Brown, 2008ⁱ</i></p>
Hydrology and Water resources	<p>Hydrology - The various systems that are involved in the hydrological cycle (water evaporation, atmospheric circulation of water vapour, cloud formation, precipitation, interception by plant life, land surface runoff, soil infiltrations, groundwater recharge, discharge into streams etc).</p> <p>Water resources – The availability of useful water, often a limiting factor for social and economic development. Sources include groundwater, rainwater and surface reservoirs or rivers.</p> <p><i>Source: Gray, 2010ⁱⁱ; Parry et al., 2007ⁱⁱⁱ</i></p>
Tourism	<p>Comprises the activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purpose</p> <p><i>Source: UNWTO, 2011^{iv}</i></p>
Transportation	<p>A system of conveying people, goods, etc., from one place to another.</p> <p>The definition includes water, air, and land transport.</p>
Agriculture and Fisheries	<p>Agriculture- The science or practise of cultivating the soil and rearing animals</p> <p>Fisheries – The occupation of catching or rearing fish</p>
Forestry	<p>All economic activities that mostly depend on the production of goods and services from forests including commercial activities that are dependent on the production of wood fibre. It also includes activities such as the commercial production and processing of non-wood forest products and the subsistence use of forest products</p> <p><i>Source: FAO, 2004^v</i></p>
Energy Supply and Use	<p>Energy supply - Extraction, conversion, and transportation of fuels and electricity to ultimate end use</p> <p>Energy use - The amount of fuels and electricity utilized during a period of time to provide a useful service such as heating, cooling, or transportation</p> <p><i>Source: Wilbanks et al., 2008^{vi}</i></p>
Industry and Commerce	<p>Industry - Industry includes manufacturing, mining, construction and related informal production activities. Other categories, such as transport, energy supply & demand and processing of forest products have been included in other sectors.</p> <p>Commerce – Commerce is the exchange or buying and selling of commodities. In our definition it includes trade, retail and other commercial activities.</p>
Human Health	<p>Human health includes physical, social and psychological well-being.</p> <p>Society – Society includes <i>infrastructures, human settlements</i> and <i>social issues</i>.</p> <p><i>Infrastructures</i> are systems designed to meet relatively general human needs, often through largely or entirely public utility-type institutions. <i>Infrastructures</i> for settlements and society include both ‘physical’ (sanitation and communication systems) and ‘institutional’ (shelter, health care, food supply, security and fire services and other forms of emergency protection). <i>Human settlements</i> comprise physical capital (buildings) where most of the world’s population live. <i>Social issues</i> include all the factors relating to human society and its members, concerning the way of life of the local population (livelihoods and welfare).</p> <p><i>Source: Parry et al., 2007</i></p>

HDI/ Livelihoods/ Poverty	<p>HDI (Human Development Index) - A summary composite index that measures a country's average achievements in three basic aspects of human development: longevity, knowledge, and a decent standard of living.</p> <p>Livelihoods - A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living.</p> <p>Poverty – A state or condition in which a person or community lacks the financial resources and essentials to enjoy a minimum standard of life and well-being that is considered acceptable in society.</p> <p><i>Source: Chambers and Conway, 1991^{vii}</i></p>
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Note: The sectors considered as potential sources of greenhouse gases in the Low Carbon Development section are the ones reported by Department of Energy and Climate Change, 2009^{viii}.

ⁱ Brown, N., 2008. *Climate Change in Overseas Territories: An Overview of the Science, Policy and You*, Peterborough, UK: Joint Nature Conservation Committee

ⁱⁱ Gray, G. A. L., 2010. *Montserrat National Climate Change Issue Paper*, Montserrat: Ministry of Agriculture, Land, Housing and the Environment

ⁱⁱⁱ Parry, M., Canziani, O. & Palutikof, J. P., 2007. *Climate Change 2007: Impacts, adaptation and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge, UK: Cambridge University Press.

^{iv} UNWTO, 2011. *World Tourism Organisation UNWTO*. [Online] Available at: <http://statistics.unwto.org/en>. [Accessed 12 03 2012].

^v FAO, 2004: Trends and Current Status of the Contribution of the Forestry Sector to National Economies, Rome: FAO, available on <http://www.fao.org/docrep/007/ad493e/ad493e05.htm>

^{vi} Wilbanks T. J. et al., 2008. *Effects of Climate Change on Energy Production and Use in the United States*, Washington, US: US Climate Change Science Programme

^{vii} Chambers, R., & Conway, G. (1991). *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century*. [Online] Available at: <http://www.smallstock.info/reference/IDS/dp296.pdf> [Accessed 28 03 2012].

^{viii} Department of Energy and Climate Change, 2009. *5NC - The UK's Fifth National Communication under the United Nations Framework Convention On Climate Change*. London

Annex Three: UKOT Scoring Matrix

ANNEX III: RAG SCORING FOR UKOT VAM

#		Red	Red/Amber	Amber/Green	Green
Threats Exposure Analysis					
	Exposure: Frequency and Severity of climate effects	Current: High Impact 2050: Impact + Confidence	Current: Medium Impact 2050: Impact + Confidence	Current: Low Impact 2050: Impact + Confidence	Current: No impact 2050: No impact
Resource Exposure					
	Exposure: Fossil Fuel and Energy Import Dependence, Resource Use Efficiency and GHG Emission	High Dependency, Emissions and Low Resource Use Efficiency	Medium Dependency, Emissions and low Resource Use Efficiency	Low dependency, emissions and medium resource use efficiency	Low (or No) dependency, emissions, and high resource use efficiency
Importance to Overseas Territory					
1	Importance of System to OT <i>Natural Systems</i> <i>Economic Systems</i>	Bio-diversity characterised by high levels of endemic / endangered species and / or territory with internationally recognised environmental designation ¹ Critical levels of water stress Dominant contribution to OT GDP (>20%)	Bio-diversity characterised by presence of endemic / endangered species and internationally recognised environmental designation Moderate levels of water stress Significant contribution to OT GDP (5%-20%)	Bio-diversity characterised by low levels of endemic / endangered species and no internationally recognised environmental designation Limited levels of water stress Limited contribution (<5%) to OT GDP	Bio-diversity characterised by very low levels of endemic / endangered species and no internationally recognised environmental designation No water stress No contribution (0%) to OT GDP

¹ As identified by IUCN redbook.

#		Red	Red/Amber	Amber/Green	Green
	<i>Social Systems</i>	Per capita GDP (<\$6000) Low life expectancy / High infant mortality rates	Per capita GDP (\$6001 - \$20000) Medium life expectancy / Medium infant mortality rates	Per capita GDP (\$20001 - \$50000) Medium life expectancy / Low infant mortality rates	Per capita GDP (\$50000 +) High life expectancy / Low infant mortality rates
Vulnerability (Current)					
2.1	Sensitivity to Climate Exposure	High sensitivity to climate change exposure/high potential for irreversible impacts	Medium sensitivity to climate change exposure/medium potential for irreversible impacts	Low sensitivity to climate change exposure/low potential for irreversible impacts	No sensitivity to climate change exposure/no potential for irreversible impacts
2.2	Current Resilience Activities	No resilience planning and/or very limited adaptive capacity	Weak resilience planning and/or adaptive capacity	Moderately effective resilience planning and/or adaptive capacity	Strong resilience planning and/or adaptive capacity
2.3	Exacerbating Stresses	Significant exacerbating stresses	Moderate exacerbating stresses	Limited exacerbating stresses	No exacerbating stresses
Future Opportunities					
3.1	Potential Adaptation Interventions	No technical/programmatic opportunities available.	Limited technical/programmatic opportunities available, and significant work/investment required to develop bankable projects or programmes	Technical/programmatic opportunities exist, but only as pilot projects/strategies and require further investment to develop bankable projects or programmes	Technical/programmatic opportunities exist and bankable investments/projects are available for immediate funding
3.2	Implementation Capacity	No technical, political and financial capacity to	Limited technical, political and/or financial capacity to	Moderate technical, political and/or financial capacity to implement and	Strong technical, political and financial capacity to implement

#		Red	Red/Amber	Amber/Green	Green
		implement and monitor adaptation activities, with full UK input required.	implement and monitor adaptation activities, with significant UK input required.	monitor adaptation activities, with moderate UK input required.	and monitor adaptation activities, with limited UK input required
Current Emissions					
4.1	Share of Current Emissions	High (>30%)	Medium (15%-30%)	Low (5%-15%)	None/Marginal <5%.
GHG Abatement					
5.1	Abatement Potential	No abatement potential <10%	Limited abatement potential identified 10%-25%	Moderate abatement potential identified 25%-50%	Significant abatement potential identified E.g. >50% of current levels
5.2	Current Abatement Activities	No low carbon development planning or investment	Weak low carbon development planning and investment	Moderately effective low carbon development planning and investment	Strong evidence of effective low carbon development planning and investment
Future Opportunities					
6.1	Potential LCD Intervention	No technical/programmatic opportunities available.	Limited technical/programmatic opportunities available, and significant work/investment required to develop bankable projects or programmes.	Technical/programmatic opportunities exist, but only as pilot projects/strategies and require further investment to develop bankable projects or programmes.	Technical/programmatic opportunities exist and bankable investments/ projects are available for immediate funding.
6.2	Implementation Capacity	No technical, political and financial capacity to implement and monitor low carbon activities, with full UK input required.	Limited technical, political and/or financial capacity to implement and monitor low carbon activities, with significant UK input required.	Moderate technical, political and/or financial capacity to implement and monitor low carbon activities, with moderate UK input required.	Strong technical, political and financial capacity to implement and monitor low carbon activities, with limited UK input required.

UK Exposure (2012)					
7.1	UK Sunk Assets	>£100m	£20-£100m	£5-£20m	£0-£5m
7.2	Absolute Value of UK Transfer	£500,001 - £1,000,000	£250,001 - £500,000	£100,001 - £250,000	>£100,000
7.3	Share of National Budget from UK Transfer	75%> of national budget for specific system from UK transfer	51% to 75% of national budget for specific system from UK transfer	26% to 50% of national budget for specific system from UK transfer	25%< of national budget for specific system from UK transfer
7.4	Potential Liability	Cost of honouring and implementing legal treaties and other HMG commitments (>£200m)	Cost of honouring and implementing legal treaties and other HMG commitments (>£50m)	Cost of honouring and implementing legal treaties and other HMG commitments (>£10m)	Cost of honouring and implementing legal treaties and other HMG commitments (<£10m)
7.5	Reputational Risks	Irreparable reputational risk in terms of loss of: HMG reputation for safeguarding citizens / climate change and ecosystems; HMG disruption to the relationship with its citizens; and potential to severely disrupt private sector investment in the UKOTs related to specific system.	Serious but not irreparable reputational risk in regards to loss of HMG safeguarding reputation, HMG relationship with citizens or private sector investment related to specific system.	Limited reputational risk in regards to loss of HMG safeguarding reputation, HMG relationship with citizens or private sector investment related to specific system.	No reputational risk in regards to loss of HMG safeguarding reputation, HMG relationship with citizens or private sector investment related to specific system.

Annex Four: Bermuda - Scored VAM

RED
RED/AMBER
GREEN/AMBER
GREEN

Threat Exposure Analysis		
	Frequency and Severity	
	Current	2050
Climate Change Exposure		
1 Increase in temperature		
2 Increase/decrease/variability in precipitation		
3 Decrease in snow cover and ice		
4 Heat waves		
5 Heavy precipitation events/floods		
6 Extreme storm events		
7 Rising sea levels		
8 Ocean acidification		

Resource Exposure	Current
1 Fossil Fuel Dependence	
2 Energy Import Dependence	
3 Resource use efficiency	X
4 Absolute GHG emissions	X

Low Carbon Electricity Resource Potential	Share of Current Electricity Production	Potential
1 Wind	X	High
2 Hydro	X	X
3 Solar PV	X	High
4 Geothermal	X	X
5 Biomass	X	X
6 Waste (solid, liquid)	3%	High
Low Carbon Heat Potential		
% of buildings		Potential
1 Solar Thermal	X	High
2 Biomass	X	X
Liquid Fuels		
% of consumption		Potential
1 Bioethanol	X	X
2 Bio diesel	X	Medium

Bermuda

Summary
<p>Bermuda is a low-lying oceanic archipelago comprising a fishhook-shaped chain of four main islands which are surrounded by hundreds of islets (total land mass of 5,370ha) with a maximum elevation of 79m. In summer, on average one hurricane approaches Bermuda every year, and a severe hurricane is expected every 4-5 years.</p> <p>Threat Exposure Analysis</p> <p>Temperatures expected to rise between on average by 3.6°C over the next century (2.8°C-4.3°C). Precipitation is expected to increase on average 7% (5%-10%), (less frequent events but heavier). A sea level rise of 0.59 m means that 186.6ha of land will be inundated with sea water. A 2 m rise, believed to be the upper limit attainable this century, would result in 819.3ha of inundated land. Since 1970 7.5% increase in category 4 and 5 hurricanes and hurricanes of greater intensity expected due to rising temperatures.</p> <p>Adaptation and Resilience</p> <p>Systems: Presence of endangered and endemic (14) species; GDP equal to \$ 5.7 billion in 2010; Importance of financial sector and tourism; life expectancy of about 80 years. Vulnerability: Serious effects of climate change (mainly of sea level rise and increased temperatures) on natural, economic and social systems. Resilience activities in place to protect biodiversity, fisheries and human health. Plans to develop a National Infrastructure Plan and a coastal management plan, incorporating adaptation interventions. Interventions foreseen also in the fields of water resources and biodiversity & ecosystem.</p> <p>Low Carbon Development</p> <p>GHG emissions equal to 14.44 metric tonnes per capita. Emissions to be reduced to 10 metric tonnes per capita by 2020 and less than 1 by 2050. 3% of electricity provided by a waste-to-energy plant. Plans to expand it and to develop photovoltaic and wind technologies. Researches ongoing on algal biodiesel.</p> <p>UK Exposure</p> <p>£338,000 allocated by FCO to Bermuda in 2005-2006. Low percentage of the budget from UK transfer. Bermuda signatory of multilateral environmental agreements. Key risks from economic situation and hurricane/tsunami.</p>

Additional Potential Classification

High	High levels of cost effective technical potential identified, with strong evidence of associated planning and investment
Medium	Medium cost effective resource potential identified, with medium evidence of associated planning and investment
Low	Limited cost effective technical potential identified, with limited evidence of associated planning and investment
None	No cost effective technical potential identified.

Adaptation and Resilience		Importance to OT	Vulnerability (Current)			Future Opportunities	
		Importance of System to OT	Sensitivity to Climate Exposure	Current Resilience Activities	Exacerbating Stresses	Potential Adaptation Interventions	Implementation Capacity
Natural							
	Biodiversity and Ecosystems						
Economic	Hydrology and Water resources						
	Tourism						
	Transportation						
	Agriculture and Fisheries						
	Energy Supply and Use						
Social Systems	Industry and Commerce						
	HDI/Livelihoods/Poverty						
	Human Health						

UK Exposure (2012)				
UK Sunk Assets	Absolute Value of UK Transfer	Share of National Budget from UK Transfer	Potential Liability	Reputational Risks
X			X	
X			X	
X			X	
X			X	
X			X	
X			X	
X			X	
X			X	

Low Carbon Development (Source)	Current Emissions	GHG Abatement (Current)		Future Opportunities	
	Share of Current Emissions	Abatement Potential	Current Abatement Activities	Potential LCD Intervention	Implementation Capacity
Energy Supply					
Transport					
Public		X			
Business		X			
Residential		X			
Industrial Processes		X			
Agriculture		X			
Waste management		X			
Land Use, Land Use Change and Forestry		X			

Annex Five: UKOT Potential Programme Approaches – Preliminary Sectoral and Geographical Analysis

	Programme Approach	Sectoral and OT Relevance		Activities	
		Sectors	OTs	Current	Potential
1	Adaptation: Needs Focus	Energy Supply and Use	Gibraltar	Replacement of power plants with a power station powered by diesel engines.	n/a
2	Adaptation: Effectiveness Focus	Biodiversity and Ecosystems	Bermuda	Bermuda Biodiversity Action Plan - Activity report 2010; The Bermuda Plan 2008	Stringent water conservation practices; environmentally-sound desalination operations; better weather forecasting; coastal zone management plan (building on Draft Planning Statement (2008))
			Gibraltar	Management and Action Plan for the conservation of Sites of Community Importance enforced; Marine Special Area of Conservation designated; Catalogue of living resources; Habitat and Species Action Plans.	Dolphin study; climate change studies.
3	Mitigation: Needs Focus	Energy Supply	Bermuda	Electricity for the entire Island is produced at BELCO's Pembroke location.	Public land/seabed allocated for utility-scale renewable electricity generation projects; generation licences for power producers and comprehensive interconnection standards; quality standards specifically for distributed renewable energy systems included in building codes; expedited planning processes for small-scale renewable generation; efficiency standards; energy auditing.
			Gibraltar	Replacement of power plants with a power station powered by diesel engines.	The use of biofuels to be encouraged by selling at lower price in petrol stations; adopt biofuels for Govt fleet.
		Transport	Gibraltar	New bus transport system introduced; free to children.	Reduction in the energy used for road transport (9% target for 2016); Car park and park and ride bus shuttle service construction planned; Increase in public transport times/routes; More free public transport.
4	Mitigation: Emissions Reduction Potential Focus	Energy Supply	Gibraltar	New power station has the capability to run on biofuels.	Adoption of renewable energy resources: wind, energy from waste and tidal current all considered technically viable.
			Montserrat	2008 Montserrat Sustainable Development Plan; shortly be upgrading its diesel based power station to more reliable 1.5 MW source	Exploitation of geothermal energy is a stated aim of the National Energy Policy; test drilling 2012; Geothermal energy is proved to be feasible, there is potential to generate up to 50MW of energy, with export of around 40MW to a neighbouring island; potential wind turbine sites at locations within the Blakes Estate although the new National Physical Development Plan for North Montserrat 2012-2022 zones this land for residential and recreational tourism;
		Transport	Gibraltar	Use of private vehicles discouraged	Car park and park and ride bus shuttle service constructed; increase in public transport times/routes; more free public transport.
		Business	Montserrat	New port development at Carr's Bay	Development of new town at Little Bay creates potential for incorporation of passive design principles; GoM Infrastructure Plan includes suite of potential low cost measures: energy efficient fans, water pumps, cooking appliances and behavioural change.
		Land Use, Land Use Change and Forestry	Montserrat	2008 Montserrat Sustainable Development Plan; New National Physical Development Plan for North Montserrat	National Physical Development Plan for North Montserrat 2012-2022
5	Mitigation: Effectiveness Focus	Business	BVI	National Tourism Policy & Development Master Plan; strengthening Building Regulations; Climate Change risk management protocols, Disaster Relief Fund, micro insurance schemes and mutual/cooperative insurance schemes, financing options for renewable energy installations.	Climate Change Trust Fund - funds would meet costs associated with diversifying tourism product; sub-regional/domestic emissions trading scheme that will ensure benefits are flowing from the UK and European carbon trading scheme; Carbon Levy on guests of hotels and charter yachts; Climate Change Financial Risk Management Levy on foreign registered companies and ships
		Residential	BVI	A National Physical Development Plan, Local Area Plans	Medium/long term implementation A National Physical Development Plan, Local Area Plans
		Waste Management	BVI	Energy & water conservation/efficiency standards;	n/a
		Land Use, Land Use Change and Forestry	BVI	National Tourism Policy & Development Master Plan; expanded protected areas; building & disaster management criteria; National Physical Development Plan; Local Area Plans	Medium/long term implementation A National Physical Development Plan, Local Area Plans

6	Standardised Policy Focus	Relevant to all sectors	Relevant to all OTs	Possibilities are: FCO sponsored pilot on environmental mainstreaming; Scaling up of FCO approach to	Mainstream climate change into existing policies and plans
7	Capacity Building Focus	Relevant to all sectors	Relevant to all OTs	Possibilities are: BAT: provision fo staff education under the Carbon Reduction Strategy. DFID support via	Prioritise interventions in the draft climate change policy and develop programme of capacity support to take forward
8	Next Step Approach	Relevant to all sectors	Relevant to all OTs	Possibilities are: Falklands: scale up wind farm technologies; Gibraltar: renewable energy legislation.DFID support via the ECACC programme and	Prioritise interventions in the draft climate change policy and develop programme of capacity support to take forward
9	UK Exposure Approach	Biodiversity and Ecosystems	Anguilla	Designation of one nationally protected (wetland) area and allocation of 7.5acre demonstration area for Department of Environment; draft climate change policy drafted and to be adopted in 2012;	Conserve existing wetland (saltpond) ecosystems and encourage wetland migration strategies; approve and implement a National Wetlands Policy; continuous monitoring and development of comprehensive bio-diversity baseline; development of an integrated coastal zone management plan which includes understanding the risk of flooding due to sea level rise and improvements to the national coastal monitoring system and system of beach profile data collection ; implement schemes for re-vegetation and re-nourishing beaches
			BAT	26 Specially Protected Areas and Marine Protected Area designated; Penguin distribution study; Wildlife awareness manual; Toolkit for the management of Protected Areas; Identification of important bird areas; Polar Science for Planet Earth project	Proactive management of key Protected Areas; Continuation of the penguin distribution study
			Falklands	Bio-diversity strategy in place. FIG sponsored environmental research, awareness raising, conservation and management activities. OTEP projects to conserve or collect species or restore plant habitats.	Species monitoring and species action plans in place.
			Montserrat	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention); Vienna Convention for the Protection of the Ozone Layer;	protected areas/zoning; in situ conservation of endemic species and control of invasive species; revise port legislation re discharge; ensure protection of ghauts and vegetative strips and enforce all aspects of land use planning
			Gibraltar	Management and Action Plan for the conservation of Sites of Community Importance enforced; Marine Special Area of Conservation designated; Catalogue of living resources; Habitat and Species Action Plans.	Dolphin study; climate change studies
			SBAs	Special protection Areas designated; Turtle projects; Acacia Control Project	Designation of Special Areas of Conservation; MoU for Conservation of Migratory Birds of Prey in Africa and Eurasia
		Hydrology and Water Resources	Anguilla	New desalination water plant	Water harvesting, increased water storage and more effective maintenance of distribution network to reduce leaks; promote the use of water savings devices (low flush toilets etc); develop and implement national outreach and educational programmes; bring efficiencies to water desalination as technology improves and bring renewable energy sources on stream (wind and solar).
			BAT	Introduction of more efficient reverse osmosis plants; Introduction of water saving flow reduction valves	Implementation of a programme of water efficiency technology changes
			Falklands	n/a	Climate change modelling based on collected data.
			Gibraltar	Modernisation of fresh water distribution (saving of energy during desalination; seawater used for conveyance of sewage and other non-domestic purposes; Replacement of sea defences	Flood defences; Improvement of drainage infrastructure.
			Montserrat	Some adhoc water harvesting, (minidams, roof rainwater harvesting). Many assets not maintained and now in disrepair.	Protect groundwater sources from pollution; develop better water resource management and allocation systems; Opportunity for all new build at Little Bay and Carr's Bay.
			SBAs	n/a	Adoption of Concentrating Solar Power technologies for water desalination

		Tourism	BAT	n/a	Enhancement of UK expertise on tourism management
			Montserrat	Potential investments in the new town at Little Bay and the construction of a new port, if affected, would not reflect well in the international press.	Fiscal incentives to encourage sustainable tourism; integrate mainstream CC issues (impact, responses, opportunities) into tourism development strategy; recommended design speeds increased for new tourism-related structures; enhanced reef monitoring systems to provide early warning alerts of bleaching events, and; artificial reefs or fish-aggregating devices
			Gibraltar	n/a	n/a
		Transportation	SBA	n/a	n/a
			Montserrat	Potential investments in the new town at Little Bay and the construction of a new port, if affected, would not reflect well in the international press.	Integrate CC issues into current port design and the master plan development at Little Bay and other infrastructural development projects.
			Gibraltar	New bus transport system introduced; free to children.	Car park and park and ride bus shuttle service construction planned; Increase in public transport times/routes; More free public transport.
		Energy Supply and Use	Anguilla	n/a	Enhance efficiency of diesel power generation. Link into regional sources of energy arising from potential geothermal networks on Nevis and Montserrat. Customer educational policies to encourage energy efficiency; promote energy efficient technologies such as energy efficient light fittings and solar hot water heaters.
			BAT	Solar heating systems installed at 2 stations; Introduction of sub-metering more effective monitoring of energy consumption; Introduction of LCD screens	Adoption of renewable energy sources: wind turbine and solar photovoltaic systems; Energy efficient retrofits for research ships; use of unmanned aerial vehicles
			Montserrat	2008 Montserrat Sustainable Development Plan; shortly be upgrading its diesel based power station to more reliable 1.5 MW source.	Exploitation of geothermal energy is a stated aim of the National Energy Policy; test drilling 2012; Geothermal energy is proved to be feasible, there is potential to generate up to 50MW of energy, with export of around 40MW to a neighbouring island; potential wind turbine sites at locations within the Blakes Estate although the new National Physical Development Plan for North Montserrat 2012-2022 zones this land for residential and recreational tourism.
			Gibraltar	Replacement of power plants with a power station powered by diesel engines.	The use of biofuels to be encouraged by selling at lower price in petrol stations; adopt biofuels for Govt fleet; Adoption of renewable energy resources: wind, energy from waste and tidal current all considered technically viable.
		Industry and Commerce	BAT	All infrastructures constructed with best practices in low energy design.	n/a
			Montserrat	Potential investments in the new town at Little Bay and the construction of a new port, if affected, would not reflect well in the international press.	n/a
			Gibraltar	n/a	Incentives for import and use of highly efficient equipment.
		Livelihoods/Poverty	Anguilla	n/a	n/a
			Montserrat	Invested heavily in irrigation infrastructure, training of farmers, livestock production units and a farmer's resource centre.	Government is investing in improved fisheries infrastructure and training to improve the quantity, quality and presentation of produce.
			Falklands	n/a	n/a
			Gibraltar	n/a	n/a
		Human Health	Anguilla	n/a	n/a
			Montserrat	n/a	Public education and outreach; forecasting systems for Dengue Fever and other vector-borne diseases.
			Falklands	n/a	n/a
			Gibraltar	n/a	n/a
10	Do Nothing Approach	n/a	n/a	n/a	n/a

Annex Six: Emissions Data

