Solomon Islands

Second National Communication

Submitted in September 2017

By

Solomon Islands

To

United Nations
Framework Convention on
Climate Change

Supported by

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UNDP

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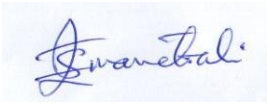
FOREWORD

As Minister of Environment, Climate Change, Disaster Management and Meteorology (MECDM), I am pleased to present the Solomon Islands Second National Communication (SNC) to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat,the people of Solomon Islands and our development partners. The report describes our national circumstances and high vulnerability context as a Least Developed Countries (LDC), our weak adaptive capacity, very low greenhouse gas emissions levels', and presents our efforts to enhance our adaptive capacity and measures that can reduce our emissions while at the same time contribute towards sustainable low-carbon economic and social development. It also describes our efforts to benefit from technology transfer for adaptation and mitigation actions, improve systematic observation and build our capacity at all levels to address climate change.

Our emission level from the energy sector is still low even when compared to other Non-Annex 1 Countries. Emissions from the waste sector are also still low and are expected to increase with rising population and economic growth. Limited national data and research capacity has made it difficult to measure emissions for a number of categories and sub-categories except in the forestry sector where emission levels from unsustainable levels of logging activities and forest degradation is high. The high level of exposure of many people in low lying islands, flood prone areas and high rainfall areas is placing pressure on government and community resources while the main sources of food and water supply together with coastal communities and infrastructures are under increasing threats from climate related hazards.

My Ministry has taken important steps to plan, coordinate programs and take actions to address the causes and impacts of climate change in Solomon Islands. The national government is pleased to see that civil society is also taking the lead on various fronts and that there is a rise in donor interest and support. The national government looks forward to more meaningful and fruitful partnerships as we work together to make Solomon Islands more resilient and prepare well to adapt to the predicted impacts of climate change.

I wish to express our Government and peoples' sincere gratitude to the Global Environment Facility (GEF) for funding the SNC project and the UNFCCC and Intergovernmental Panel on Climate Change (IPCC) for the guidelines provided. Appreciation and special thanks also goes to the United Nations Development Programme (UNDP) for being the Implementing Agency for this Project and for providing guidance in implementation. I sincerely hope that the SNC will be used to guide on-going partnerships and programs as we work together to address climate change.



Hon. Samuel Manetoali

Minister for Environment, Climate Change, Disaster Management and Meteorology

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A number of organizations and individuals contributed to the making of this SNC and the government hereby acknowledges and sincerely thanks them for their support, hard work and contributions:

i) The GEF for funding the SNC Project to build our capacity, raise awareness, undertake important climate change related assessments and produce this report.

ii) The Former Minister for MECDM, Hon. John Moffat Fugui for his leadership and guidance during the development of the SNC document.

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xi) Staff of Climate Change Division MECDM, for valuable inputs and ensuring the SNC is finalized and submitted.

Dr. Melchior MATAKI
Permanent Secretary
Ministry of Environment, Climate Change, Disaster Management and Meteorology

GHG Inventory Working Group (WG):

With coordination by the MECDM and the SNC Project Coordinator a number of GHG Inventory teams were established to gather, analyse data and carry out an inventory of GHG emissions in the following sectors; Energy, Agriculture, LULUCF, Waste and Industrial Processes.

Key Sources of Data:

Sectorial data for GHG estimation was compiled from various sources primarily using national data collected from annual reports, statistical reports, studies, concern private and government divisions and brochures of related department/institutions.

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ABBREVIATION

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
DNA	Designated National Authority
EIA	Environment Impact Assessment
EIS	Environmental Impact Statement
EGTT	Expert Group on Technology Transfer
ENSO	El Nino Southern Oscillation
FAO	Food and Agriculture Organisation
Gg	Gigagrams
GEF	Global Environment Facility
GDP	Gross Domestic Product
GCM	Global Circulation Models
GHG	Green House Gas
GPG	Good Practice Guidelines
HDI	Human Development Index
INC	Initial National Communication
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Products Use
KFPL	Kolombangara Forest Products Limited
KP	Kyoto Protocol
LDCs	Least Developed Countries
LDCF	Least Developed Countries Fund
LULUCF	Land Use Land Use Change and Forestry
MMERE	Ministry of Mines, Energy and Rural Electrification
MAL	Ministry of Agriculture and Livestock

MEAs	Multilateral Environmental Agreements
MECDM	Ministry of Environment, Climate Change, Disaster Management and Meteorology
MEHRD	Ministry of Education and Human Resources Development
MHMS	Ministry of Health and Medical Services
MID	Ministry of Infrastructure Development
NAPA	National Adaptation Program of Action
NAMA	Nationally Appropriate Mitigation Actions
NAP	National Action Programme
NBSAP	National Biodiversity Strategic Action Plan
NCSA	National Capacity Self Assessment
NCCCT	National Climate Change Country Team
NCRA	National Coalition for Reform Advancement
NDMO	National Disaster Management Office
NDRMP	National Disaster Risk Management Plan
NGOs	Non Governmental Organisations
ODA	Overseas Development Assistance
PACC	Pacific Adaptation to Climate Change Project
POPs	Persistent Organic Pollutants
PIFACC	Pacific Islands Framework Action on Climate Change
PCCSP	Pacific Climate Change Science Programme
PIGGAREP	Pacific Islands GreenhouseGas Abatement through Renewable Energy Project
REDD+	Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries
RE	Renewable Energy
RET	Renewable Energy Technologies
RIPEL	Russell Islands Plantation Estates Limited

SICAP	Solomon Islands Climate Change Adaptation Project
SIDS	Small Island Developing States
SIEA	Solomon Islands Electricity Authority
SIFIA	Solomon Islands Forest Industry Association
SIG	Solomon Islands Government
SIMS	Solomon Islands Meteorological Services
SPICE	South Pacific Climate Experiment
SIPL	Solomon Islands Plantations Limited
SIWSAP	Solomon Islands Water Sector Adaptaion Project
NDS	National Development Strategy
RWSS	Rural Water Supply and Sanitation
SNC	Second National Communication
SPREP	Secretariat of the Pacific Regional Environment Programme
SPCZ	South Pacific Convergence Zone
SPOL	South Pacific Oils Limited
SIWA	Solomon Islands Water Authority
SOLFRIS	Solomon Islands Forest Resource Inventory Survey
SOPAC	South Pacific Applied Geosciences Commission
SWoCK	Strongim Waka lo Community fo Kaikai
TDA	Tetepare Descendants Association
TNA	Technology Needs Assessment
UNFCCC	United Nations Framework Convention on Climate Change
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
V&A	Vulnerability and Adaptation Assessment
WMO	World Meteorological Organisation

EXECUTIVE SUMMARY

The authoritative Fourth Assessment Report of the IPCC is very clear in its determination that Least Developed Countries (LDCs) and Small Island Developing States (SIDS) like Solomon Islands will be amongst the most vulnerable in the world to the predicted impacts of climate change. Since becoming a Party to the UNFCCC in 1994 the people and government of Solomon Islands have become increasingly concerned about climate risks due to experiences with the far reaching impacts of extreme climatic events.

The SNC is presented as part of Solomon Islands" obligation to the UNFCCC. It communicates to the global community and alerts leaders, policy makers and public in the country that while its greenhouse gas (GHG) emissions remain extremely insignificant, its people, environment and economy are very vulnerable to climate risks and associated negative impacts. Measures to adapt to climate risks and strategies to contribute towards mitigating climate change are articulated in this communication including current and planned efforts and needs in the areas of research and systematic observation, technology transfer and capacity building.

The production of the SNC has been possible with funding support from the GEF through the UNDP under the Solomon Islands SNC Project. The project was executed by the MECDM in close partnership with a wide range of national stakeholders. The SNC involved a range of capacity building activities for national teams to undertake the assessment, awareness raising activities, wide stakeholder consultations and reviews of past assessments in various development sectors and compilation of findings based on guidelines provided by the UNFCCC and the IPCC.

National Circumstances

More than nine hundred volcanic and coral islands and atolls in a double chain archipelago between Papua New Guinea and Vanuatu make up the nation of Solomon Islands. The country has a wealth of natural resources and unique geographic features but its geographic location in the Pacific Ring of fire and cyclone zone makes it very vulnerable to natural disasters and extreme events. This vulnerability is exacerbated by its low socio-economic status which has also placed it in the UN list of Least Developed Countries. The population of 515,800 (2009) is growing at 2.4% while human development indices and per capita income are some of the lowest in the Pacific. More than 80% of the population reside in low vulnerable coastal rural areas relying heavily on subsistence agriculture and fishing for food and income. Most coastal and inland villages do not have access to electricity and roads and government services to the rural areas are often limited.

Forestry has been the main sector contributing to national revenue but the liquidation of this natural wealth has also come at a high environmental and social cost. With the stock of merchantable forests predicted to decline rapidly in the near future the country will need to turn to fisheries, mining and agriculture for alternative national revenue. Political instability coupled with weak government agencies impedes effective implementation of national programmes and the link between national government and sub-level provincial governments is very weak.

By way of creating an enabling environment to support implementation of the UNFCCC a range of legislation and policies that can contribute to guiding climate change mitigation and

adaptation are already in place. A National Adaptation Programme of Action (NAPA), a National Energy Policy Framework and a National Disaster Management Plan have been endorsed and the country is in the process of completing its National Climate Change Policy. The MECDM is the focal point for the UNFCCC, Kyoto Protocol, together with a host of Multilateral Environmental Agreements (MEAs) including the Hyogo Framework on Disaster Risk Management. A number of government Ministries have begun mainstreaming climate change into their sector policies and strategies while NGOs and churches have also begun implementing climate change programs. In 2008 the government established the Climate Change Division and in 2011 the National Disaster Management Office (NDMO) became part of the MECDM and providing a strong platform for strengthening the integration of Vulnerability and Adaptation Assessment (V&A) and Disaster Risk Reduction (DRR) at the operational level.

National Greenhouse Gas Inventory

Due to limitations in national data the GHG inventory was restricted to the energy sector (transportation and electricity generation), waste (solid waste disposal sites, waste water and sewage), industrial processes (food and drink) and agriculture (waste from livestock). Emission levels were not calculated and included in the report for: rice cultivation (due to the very small area of paddy rice in the country and also lack of appropriate data) and synthetic fertilizers (due to their low level of usage and also lack of appropriate data). Emission from LULUCF and product use was not assessed. Table A below summarizes the country‟s emissions and removals (level of CO_2 removed from the atmosphere by forests) for the years 1994 (from initial national communication), 2000 (base year), 2005 and 2010 (as per best possible available sectorial data).

Table A: Summary of Solomon Islands GHG Emissions (CO_2 equivalent) for 1994, 2000, 2005 and 2010

Sector	Gg CO_{2eq}			
	1994	**2000**	**2005**	**2010**
Energy	294	192.22	235.03	350.64
Industrial Processes	NE	-	-	-
Solvents and Other Products Use	NE	NE	NE	NE
Agriculture	NE	70.35	73.66	76.39
Land Use Change and Forestry (LUCF)	NE	NE	NE	NE
Waste	NE	159.71	184.33	191.58
Total GHG Emissions, excl. Removals	**294.28**	**422.28**	**493.02**	**618.61**

CO_2 is the dominant GHG emission and the trends in emissions without forestry over the coming years is expected to increase, albeit still at a globally low level, with rising populations and planned establishment of new mining, fishing and agriculture industries.

Vulnerability and Adaptation to Climate Change

The V&A component for the SNC began with training activities on the science of climate change and how to conduct V&A assessments. A number of the Thematic Working Group members had been involved in the development of the NAPA so it was a good continuation and reinforcing of knowledge and skills developed during the compilation of the NAPA. At the time of developing this V&A component a number of new V&A projects had begun in the country and developing a good critical mass of V&A practitioners. The V&A team undertook

a review of past V&A work in the country including those commissioned as part of other sectoral studies and not specifically targeting climate change e.g. agriculture and livelihood assessments, ecosystem assessments, water supply and demand assessments. The findings of the V&A reviews and assessments were presented to the V&A and SNC team in workshops and in a retreat where there was the opportunity for revisions. The SNC project also purchased the SIMCLIM software but had difficulties using it to generate scenarios for various islands and provinces in the country. This remains an on-going challenge.

The work of the Solomon Islands Meteorological Services with support from the Australian Government funded Pacific Climate Change Science Program contributed significantly to the assessment and description of current and future climate of Solomon Islands.

Meteorological records in the country over the past 50 years show a gradual rise in temperatures across the whole country, declining rainfall in some parts of the country and increasing intensity of rainfall in other areas causing severe flood damage to properties and loss of lives. The small low lying outer islands and low coastal areas are experiencing accelerated coastal erosion due to rising sea levels and salination of well water during storm surges and king tides. The El Nino phenomenon brings with it very low periods of rainfall and drought has been experienced in the country recently in 1997.

Vulnerability to climate change extends to ecosystems and water resources as a result of the relatively high exposure of parts of the country to increasing intensity of tropical cyclones, earthquakes, tsunamis and generally poor governance over use of natural resources. This is more pronounced in the forestry sector where despite a recommend sustainable yield for round logs at 350,000 m^3 the total volume extracted in 2010 was 1,428,211 m^3 (Central Bank of Solomon Islands, 2011). At this rate it is anticipated that the total area of loggable forest will all be gone by 2014.

With the support of the World Meteorological Organization (WMO) and the Australian Bureau of Meteorology the Solomon Islands Meteorological Service (SIMS) has been gathering weather data since the 1950"s at five locations in the country. This has been complemented by a number of voluntary recording stations with some providing data going back to the early 1900"s. Analysis of data collected so far show increasing trends in temperature and sea level rise that is in line with IPCC projections for the Pacific region. Rainfall trends vary for different parts of the country due to geographic and climatic factors.

Solomon Islands has presented its Initial National Communications (INC) to the UNFCCC. A NAPA was completed in 2008 and, in line with guidance from the UNFCCC, identifies the urgent adaptation needs using a number of established criteria. Following review of past assessments and community consultations the following sectors were identified as priorities:

(a) Agriculture and food security,	(b) Water supply and sanitation,
(c) Human Health,	(d) Human settlements,
(e) Fisheries and marine resources,	(f) Coastal Protection,
(g) Infrastructure,	(h) Waste Management,
(i) Tourism,	(j) Education, awareness and information.

The NAPA is sector oriented and does not prioritize any geographic area, island or community in the country. It is envisaged that the need for indicators and methods for determining and prioritizing geographically vulnerable areas will be addressed when the NAPA will undergo a review in the near future.

Complementing the NAPA and broader in its scope is the National Disaster Risk Management Plan (NDRMP) which was launched in 2009.

The NDRMP component on DDR has a strong focus on climate change hazards and risks. The NDRMP governance framework includes Provincial level Disaster Committees, Ward and Village Disaster Risk Committees and the national coordination mechanism includes the National Climate Change Country Team (NCCCT).

The first vulnerability and adaptation report by the government was through the INC to the UNFCCC. The report was based on limited national data sets, information at hand and qualitative assessments. The report recognized the limited understanding on the vulnerability of the country to climate change and sea level rise and the need to put in place „suitable plans, policies and measures". Priority vulnerable areas identified included; 1) Subsistence and Commercial Agriculture, 2) Human Health, 3) Coastal Environments and Systems, 4) Water Resources, 5) Marine Resources (Solomon Islands Government 1994). The INC V&A report presented „adaptation response strategies", a number of which have been recently implemented.

The ability of planners and policy makers to identify vulnerable geographic areas in Solomon Islands is now being enhanced with tools developed under the Pacific Catastrophe Risk Assessment and Financing Initiative funded by the World Bank and other donor partners.

To date a number of adaptation projects and activities have been planned and implemented based on the recommendations of the INC, NAPA, NDMO assessments and responses to disasters and also other assessments carried out by NGOs and through donor projects.

A range of challenges, opportunities and lessons are starting to surface given the experiences with climate change initiatives over the past few years and include:

i) Ability of government and national partners to addressing incremental costs derived from climate change programmes and actions
ii) Mainstreaming climate change and sustaining efforts and appropriate levels of resources within government and civil society organizations to continue work on climate change
iii) Defining indicators and criteria for prioritizing vulnerability and selecting most effective adaptation options
iv) Increasing understanding of the science of climate change
v) Aligning Climate Change Adaptation (CCA) and DRR at the policy and operational levels
vi) Determining scale and timing of adaptation interventions in a country where development challenges are inter-related.
vii) Data and information gaps making vulnerability assessments and adaptation planning difficult.
viii) Implementing mitigation actions that also contribute to reducing vulnerability
ix) Weak governance in coastal management and the decline in social capital in various parts of the country
x) Weak capacity to undertake economic assessments of adaptation options
xi) Limited data to undertake objective scientific assessments to determine types and levels of vulnerability

Mitigation

Based on the inventory assessments undertaken in the SNC the emissions from LUCF and the energy sector together make up more than 83% of the key source categories of emissions in Solomon Islands in 2000 and totalling 1737.4 Gg CO_2 eq. Next in the rankings are emissions from solid waste disposal sites and waste water and these are expected to

increase in the coming years. Emissions from cropping land are yet to be assessed and it is anticipated that this sub-category will also be a significant contributor to the rising emissions in Solomon Islands. More than 80% of the national population live in rural areas and rely heavily on subsistence agriculture for food and livelihood. As services to the rural areas improve these rural dwellers will also have better access to electricity and in-directly contribute to emissions. Large scale agriculture, fishing and mining industries are being planned and when established in the coming years will increase the demand for electricity generation and raise emission levels higher.

The Ministry of Mines, Energy and Rural Electrification (MMERE) is the lead agency for planning and coordinating energy use in Solomon Islands while the MECDM is the focal agency for the UNFCCC and Kyoto Protocol. By way of government political commitment in the area of climate change mitigation the ruling National Coalition for Reform Advancement (NCRA) government has established in its Policy Translation and Implementation document (2011) a range of goals and strategies which should contribute to climate change mitigation such as expanded reforestation, preparations for carbon trade, promote and implement renewable energy programs, establish a national energy balance database.

Solomon Islands has developed a number of national policies and strategies that when effectively implemented can contribute to mitigation or the reduction of emissions. The National Energy Policy Framework includes policies and strategies that can contribute to climate change mitigation including;

i) Fuel conservation and efficiency in the transport sector; ii) Promote and implement renewable energy programs and initiatives including research and development; iii) Use of energy resources in an environmentally sustainable manner and; iv) promotion and implementation of energy conservation and efficiency measures. The National Agriculture and Livestock Sector Policy (2009-2014) includes a policy objective to “mitigate the effect of climate change” and includes policy statements and focussed activities such as; i) Developing mitigation plans; ii) Conservation farming such as agro-forestry, and; iii) Discourage slash and burn methods (shifting agriculture). The National Solid Waste Management Strategy and Action Plan (2009-2014) include actions to establish proper sanitary landfills to minimize burning on site and provide the opportunity for methane capture. The National Development Strategy (NDS: 2011-2020) makes explicit reference to climate change as a threat to the livelihood of Solomon Islanders. Consequently, the NDS has a policy objective aimed at integrating national environmental issues in a holistic way so as to adapt to climate change and variability, halt deterioration of the eco-systems, restore damaged ecosystems and ensure their survival in the long term to benefit Solomon Islanders.

The Solomon Islands national Cabinet has also just recently appointed a Designated National Authority (DNA) to fulfil its obligations under the Kyoto Protocol and support implementation of investment projects in Solomon Islands that will lead to the reduction of greenhouse gases regulated by the Kyoto Protocol. The DNA is established in the MECDM supported by the National Clean Development Mechanism (CDM) Committee, an interdepartmental committee of senior officials from across government and mandated by the Cabinet of Solomon Islands Government as overseeing body to issue binding recommendations for the DNA. The above mitigation opportunities including REDD+[1] have been reiterated in the NDS.

[1] Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.

Solomon Islands is blessed with abundant sunshine, flowing rivers, biomass, sources of biofuel and regular wind flow that is still not effectively harnessed to generate electricity. The range of existing mitigation activities include small scale hydro schemes, widespread distribution of solar panels, a pilot bio-fuel project using coconut oil for power generation and use of agriculture biomass by-product as fuel for steam turbines to produce electricity. Solar panels is the most popular of the technologies with wide spread distribution in rural areas thanks to donors, local entrepreneurs and politicians. LPG gas powered air conditioners promoted as low emission technology is being marketed and still not widely adopted. It is estimated that total renewable energy use in the country is producing about 39,801MWh per annum of electricity and reducing emissions by about 13.466 Gg of CO_2 per annum.

Solomon Islands has the second largest land area (28,000 square kilo metres) and forest area in the Pacific after Papua New Guinea. An analysis of the potential for Solomon Islands to access revenue from international forest carbon markets (2008) reported a total national forest cover of 2.2 million hectares holding an estimated 272 million tonnes of carbon with huge emission off-set if properly assessed and verified. Unfortunately very little of this total forest area is under formal/legal protection and current extraction of logs is well above the allowable sustainable cut of 300,000 cubic meters per year. There are two large scale forest plantations in operation with an estimated 28,000 hectares and small scale planting of woodlots by communities continues with annual plantings ranging between 200-300 hectares. In many cases primary and secondary forest is cleared to make way for woodlots so the net sequestration levels may not be significant.

“In principle, the Solomon Islands could reduce emissions by 122 Gg per year within a decade, nearly 60% of current emissions and 40% of those a decade from now. This is based on proven technologies and known resources but does not consider economic, financial, political, social, technical, environmental or other practical constraints. About 90% of potential reductions would be from renewable energy (mostly biofuels and from hydro) and 10% from improved energy efficiency. Large-scale solar PV and wind combined would account for less than four percent” (Pacific Regional Energy Assessment – 2004)

A range of renewable energy and mitigation actions are currently being investigated and planned. These include; large scale hydroelectric dams, scaling up micro hydro schemes and introducing pico hydro technology, biomass gasification, bio-fuel production and wind energy.

In line with the UNFCCC Bali Action Plan the MECDM has begun preparations for developing a strategy for Nationally Appropriate Mitigation Actions through a concept paper intended to initiate consultations in the country. The objective is to establish a NAMA that can identify and prioritize actions that support implementation of the Renewable Energy Policy and other mitigation related policies and be used to mobilize technology financing and capacity building support in a measurable, reportable and verifiable manner. It is anticipate that activities to be part of the NAMA include, inter-alia; review and revising laws and regulations, economic incentives, research and development, demonstration projects, technology adaptation and transfer programs, energy efficiency measures and low carbon growth policy.

Other Relevant Information

The UNFCCC Conference of Parties Decision 4CP/7 defines the technology needs assessment process as a set of country driven activities that identify and determine the mitigation and adaptation technology priorities for developing country Parties. Technology development and transfer is an essential strategy for Solomon Islands to develop and use

environmentally sound technologies for climate change adaptation and mitigation. This begins with a Technology Needs Assessment (TNA). The purpose of the TNA is to "to identify, evaluate, and prioritize technological means for achieving sustainable development in developing countries, increasing resilience to climate change, and avoiding dangerous anthropogenic climate change" (Handbook for conducting Technology Needs Assessments for Climate Change, 2009)

The range of technology needs identified include soft technologies (policies, strategies, economic incentives, expertise, traditional knowledge etc.) as well as hard technologies (laboratories, sea walls, equipment etc.) Adaptation technology needs were derived from priority adaptation sectors and actions in the Solomon Islands NAPA and from findings of the SNC. Development and application of these technologies will contribute to enhancing resilience and adaptive capacity of people and the environment.

Priority mitigation technology needs are those that are needed to address the key categories of emissions determined in the GHG inventory and include the energy sector and managed forests (logging, forest disturbances and fuel wood extraction). Some of the range of mitigation technology needs include renewable energy technologies, sustainable forest management technologies, efficient wood stoves, development of energy database, development of mitigation strategies at provincial levels and low emission high sequestration agriculture practices.

A range of recommendations have been compiled to strengthen the role of government in planning and coordinating technology transfer

Climate related systematic observation in Solomon Islands is overseen by the SIMS and the Hydrological Unit of the Water Resources Division in the MMERE. The SIMS has a number of weather stations across the country, supported by a few volunteer weather stations, producing weather data that goes back to the 1950"s. A tidal gauge installed in 2004 has enabled the collection of sea level data while a number of river flow monitoring stations are located on the bigger islands. Date analysed by SIMS indicate rising temperatures and sea level and changing rainfall patterns in different parts of the country.

Maintaining conventional (manned) weather stations in the more remote or smaller islands has been very difficult given the costs and vulnerability to hydro-meteorological disasters. SIMS has only seven synoptic stations and the present observation network is inadequate and the existing climate data does not really represent the Solomon Islands climate. There is an urgent need to increase the network of manned and automatic weather stations around Solomon Islands to assist in the climate data distribution across the entire country. Currently SIMS Automatic Weather Station (AWS) network has only one AWS installed at Honiara.

Assistance from development partners will enable SIMS to enhance its capacity, perform its mandated functions and provide better services in the future. The global Adaptation Fund is assisting to strengthen SIMS agro-meteorological services including establishment of AWS and the Australian Government Bureau of Meteorology and other scientific bodies is assisting SIMS capacity to undertake climate predictions. With predictions that there will be more intense rainfall periods the network of hydrological monitoring stations urgently needs to be expanded and the capacity of the Water Resources Division strengthened.

There is an urgent need to strengthen capacity to implement measures that address the impacts of climate change in Solomon Islands. The SNC capacity assessment has found that there is an emerging "enabling institutional capacity" to address climate change impacts: appropriate government and community structures and regulatory frameworks are in place that can contribute to enhancing adaptation to climate change; understanding and

awareness of climate change mainly within central government agencies is rising; political commitment to global and regional climate change agendas has been established (though still needs strengthening); lead agencies have been established (albeit poorly resourced); and generally good progress is being made in the development of climate change policies and strategies.

However, there is currently very weak capacity to scale up and harness broad stakeholder involvement in the implementation of vulnerability, adaptation and mitigation assessments, conduct GHG inventories as well as plan and implement adaptation and mitigation actions. This includes: inadequate coordination mechanisms; very limited mainstreaming of climate change in sector policies and strategies; very limited capacity across a wide range of agencies and actors to undertake V&A and GHG inventory and mitigation assessments; limited understanding by the majority of the rural population of links between observed changes in weather patterns and climate change predictions; generally a narrow base and low level of participation and partnerships; limited scope of national adaptation programs; very limited knowledge management; limited access to tools for V&A and mitigation work; and limited sharing of western and indigenous knowledge, skills and experiences to enhance coping, adaptation and mitigation capacity.

A well-coordinated, sustained, incremental and catalytic approach to capacity development is needed to scale up efforts to address climate change work across sectors and different levels in society. The immediate and short-term options and opportunities include: Raising public awareness and understanding, strengthening capacity of national lead agencies, reviewing, revising and developing climate change adaptation and mitigation policies and strategies, strengthening coordination mechanisms, developing national programs, broadening and strengthening participation and partnerships, strengthening V&A capacity, mainstreaming climate change adaptation into national plans and budgets, and improving knowledge management.

The on-going options and opportunities include: strengthening links between government and communities for V&A work, strengthening political commitment, strengthening political commitment, enhancing participation in global agendas, and reforming and strengthening regulatory framework to enhance adaptation capacity.

CHAPTER 1

NATIONAL CIRCUMSTANCES

1. Geography and Geology

The Pacific Island nation of Solomon Islands comprises a scattered archipelago of 994 islands combining mountainous islands as well as low lying coral atolls within a tuna-rich and potentially mineral-rich maritime Economic Exclusive Zone (EEZ) of 1.34 million square kilometres. The land area of 28,000 square kilometres with 4,023 kilometres of coastline is the second largest in the Pacific after Papua New Guinea. The highest point in the country, Mt Makarakomburu is 2447m above sea level and is the highest peak in the insular Pacific. There are six main islands, Choiseul, New Georgia, Santa Isabel, Malaita, Guadalcanal and Makira, which are characterized by a rugged and mountainous landscape of volcanic origin. Between and beyond the bigger islands are hundreds of smaller volcanic islands and low lying coral atolls. All of the mountainous islands of volcanic origin are forested with many coastal areas surrounded by fringing reefs and lagoons.

Figure 1 Map of Solomon Islands

The islands are grouped into three different major „geological provinces"; the Pacific Geological Province (including Malaita, Ulawa and North Eastern part of Santa Isabel island); Central Geological Province (Makira, Guadalcanal and the Florida Islands, South-Western part of Isabel and Choiseul) and; the Volcanic Geological Province (New Georgia, Russell Islands, Shortland Islands and North Western tip of Guadalcanal and Savo). Guadalcanal is the largest of the bigger islands and the only one with a significant area of Grass land and rich alluvium soils. Most of the islands have highly weathered soils of low fertility with pockets of fertile areas mainly on volcanic islands and river valleys.

The country"s location within the earthquake belt or „Ring of Fire" makes earthquake a normal occurrence and makes the country extremely vulnerable to the effects and impacts of earthquakes. A major earthquake measuring 8.1 on the Richter scale occurred in the Western Province in 2007 causing a major tsunami that affected the Western and Choiseul provinces and causing 52 deaths and scores missing. About 40,000 people were affected. Many islands have subsided whilst a few have been uplifted a few metres. Extensive damage was experienced throughout the two provinces costing hundreds of millions of dollars. The country and many communities and individuals are still recovering from this double disaster event.

2. Climate Profile

Solomon Islands climate is tropical, though temperatures are rarely extreme due to cooling winds blowing off the surrounding seas. Temperature is the least varied of climate parameters with daytime temperatures fluctuating between 25 to 32^{o} C. The rainy season occurs between November to April and the dry seasons are from June to October during the year. Most islands have a mean annual rainfall of 3,000 to 5,500 mm with two-peak rainfall during the year. The highest rainfall recorded in Solomon Islands is an annual average of 8,304 mm at 430 m above sea level at Koloula on Guadalcanal (Hansell and Wall 1970). Daily rainfall of over 250 mm is normal. For example 15 daily totals of more than 200 mm were recorded in the past 25 years by the Solomon Islands Meteorological Services. High rainfall intensity events occur during tropical storms and often result in flooding of most river systems. The highest recorded rainfall of 281mm over a 12 hour period was recorded in 2009 resulting in destructive flooding and loss of lives. Rainfall trends vary across the country and are influenced by geographic differences.

3. Biodiversity

Solomon Islands biodiversity is ranked very highly in terms of global importance and is need of urgent planning and management as part of the country‟s climate change adaptation and mitigation strategy.

Solomon Islands rich Biodiversity

The country‟s biodiversity is of global significance. Its reefs contain one of the highest diversities of coral and fish found anywhere in the world placing the country in the coral triangle of the world‟s most important marine biodiversity area. The country‟s terrestrial biodiversity has been described as “globally outstanding” (Olsen and Dinnerstein, 1998) with its forests containing 4500 species of plants and recognized as one of the world‟s great centres of plant diversity. In marine biodiversity Solomon Islands has recorded the 2nd highest diversity of coral species in the world after Raja Ampat in Indonesia (TNC 2004)

This rich globally significant biodiversity together with the population and economy of the country is now facing the threats of climate change. Solomon Islands also boast the biggest saltwater lagoon in the world (Marovo Lagoon), the biggest raised coral island and fresh water lake in the insular Pacific (Rennell Island) and the biggest uninhabited island in the Pacific (Tetepare Island)

Source: Solomon Islands State of Environment Report 2008

Rare and Endemic Species

- 57% of palms and 50% of 230 species of orchids are endemic
- Highest number of Restricted Range bird species of the world Enlisted Bird Areas
- 5 new species of mammals discovered
- 20 of 53 known species of mammals are endemic
- 19 of 41 species of bats are endemic
- 4 of 8 species of rats are endemic and the country has the largest rats in the world
- Largest prehensile skink in the world
- 80 species of reptiles recorded
- 2 of 21 species of frogs are endemic
- 25 endemic snail species
- 30 of 31 cicada species are endemic
- 10 species of sea grass making up 80% of known species in the world
- 35 of 130 species of butterflies are endemic

Source: Solomon Islands State of Environment Report 2008

3.1. Human impacts on biodiversity

Logging and land clearance for agriculture purposes pose the biggest threat to terrestrial biodiversity while over-harvesting of marine resources and mangroves is threatening the integrity and stability of coastal marine ecosystems. A number of forested areas have been designated terrestrial conservation areas but have not been formalized. The Forest Resources and Timber Utilization Act (1969) and the Code of Logging Practice (2002) designates all forested land above the 400m contour as protected areas and can only be entered for logging purposes after formal approval by the Commissioner of Forests. On the face of it the forestry legislation and regulations pertaining to areas above the 400m contour basically places 11,167 square kilometres of forested land as protected area or, for the UNFCCC purposes of reporting of emissions and removals of CO_2 by forests, as „managed forests". The realities however are different and cause for serious concern. Many cases have been reported of logging companies breaching the rules and operating in areas above the 400 metre contour, within buffer areas along rivers and in close proximity to coastlines.

Limited financial and human resources have been the main reasons why the Forestry Division has not been able to effectively enforce the Forestry Act and Code of Logging Practice. An area of grave concern is the possible deterioration of many of the country"s watersheds due to logging practices. Watersheds are units of land or drainage area (catchment) containing productive processes that combine very complex, interrelated and spatially and temporally variable natural, social, economic, political and institutional factors (FAO 1995). An assessment of the condition and susceptibility to deterioration of watersheds in Solomon Islands (Aldrick 1993) identified 80 of the 147 land systems described by Hansell and Wall (1976) i.e. 54% as being very susceptible to deterioration.

A number of environmental laws have been enacted which can contribute to conservation if enforced effectively. The Environment Act (1998) lists logging as a prescribed development activity that can be subjected to Environmental Impact Assessments (EIA) and there is the Wild Life Protection and Management Act (1998), River Waters Act (1978) and the Protected Species Regulations (1990). The effectiveness of these laws and regulations has been questioned by members of the public following the unbridled growth in illegal logging activities and occasional illegal exports of rare and endangered species. In 2010 the national parliament passed the Protected Areas Act which provides the legal framework for establishing protected areas in the country. Time will tell if this new legislation will contribute effectively to conserving the nation"s rich and precious biodiversity.

A number of community-based forest protection initiatives stand out as leading the way in forest conservation. These include the Tetepare Conservation area (Tetepare Island), West Bauro Conservation (Makira Island), West Rennell Heritage site (Rennell Island) and Kolombangara forest conservation programmes organized by indigenous landowners and KFPL.

There has been steady growth in conservation initiatives targeting marine ecosystems. A network of Locally Managed Marine Areas (LMMA"s) and Marine Protected Areas (MPA"s) is well established in a number of provinces with the support of NGOs and institutions such as the Nature Conservancy (TNC), WWF, World Fish, UQ, UCSB and the Coral Triangle Initiative (CTI) funded by the GEF, World Bank, USAID and AusAID.

TNC has successfully organized and united three communities in Isabel and Choiseul Provinces to conserve the Arnavon Islands Turtle Sanctuary, one of the world"s important nesting sites for leather back turtles. TNC is also collaborating with SPREP and communities in Isabel, Rendova and Choiseul to protect nesting beaches for the endangered leatherback

turtles. Solomon Islands is one of the few countries in the world where the leatherback turtle‟s nest.

4. Demography

The national population count during the recent 2009 census totalled 515,870 people with an annual growth rate of 2.3% per annum and about 30% of the total population below the age of fourteen. Solomon Islanders make up a diverse population of Melanesians (80%), Polynesians (5%) and Micronesians (5%). Ninety five different languages are spoken including ninety Melanesian, four Polynesian and the Kiribati language spoken by descendants of i-Kiribati people brought to the Solomon Islands by British colonial government in the 1950‟s. About 80% of the population live in rural areas and continue to rely on the subsistence economy with supplementary income from agriculture, forestry and fishery and remittances from relatives working off-island. Around 80% of the national population live on low lying coastal areas. The capital city of Honiara is the only major area of economic activity and attracts increasing numbers of youth and adults per year from other islands seeking employment and income. Urban migration is estimated at 4% and the current rate of growth the national population is expected to double by 2020. The diversity of cultures with as many as ninety five spoken languages and dialects makes it very challenging to communicate development messages and foster national unity and identity while modernisation is placing pressures on traditional cultures resulting in the decline in traditional knowledge and value systems.

The Solomon Island‟s Human Development Index (HDI) was 0.510 in 2011, and is one of the lowest in the Pacific, and it ranked 142 out of 187 countries (UNDP, 2011). On the achievement of Millennium Development Goals (MDGs) a range of social indicators show that the country is likely to meet Goal 2 (Achieve universal primary education) and Goal 5 (Improve maternal health). Females still have less access than males to secondary and tertiary education while women have poor access to health and family planning services in the rural areas. According the most recent ADB report on the economy of Solomon Islands (ADB 2010) much of the improvements in the HDI was the result of significant overseas financial and technical assistance, with aid levels increasing from 22% of GDP in 1990 to 66% of GDP in 2005. An analysis of household income and expenditure data collected in 2005/06 shows that situations of hardship and poverty is rising with 11% of the population experiencing difficulties in acquiring basic needs.

5. Economic Profile

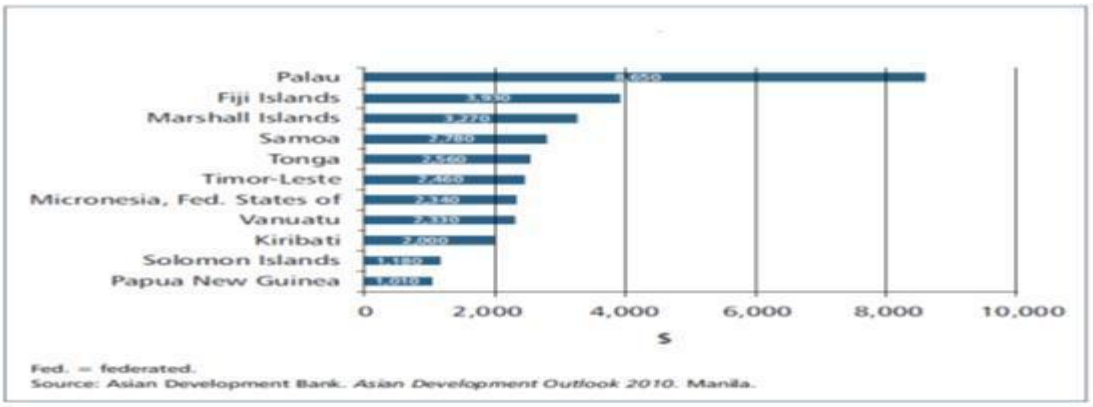
According to a recent report by the Asian Development Bank on the economy of Solomon Islands (ADB, 2010), the wellbeing of the bulk of the country‟s population hardly improved since the country attained political independence in 1978. Real per capita income has declined as a result of population growth (3.1%) being higher than economic growth (2.5%) for the period 1978-2008. Solomon Islands now has the second lowest average per capita income in the Pacific region (ADB, 2010).

Much of the root causes of the economic decline can be attributed to poor management and governance of natural resources, weak political leadership and an ill-equipped public service. This deteriorating situation worsened during the period of 1998-2002 ethnic unrest when militants from two warring factions controlled most of the capital city of Honiara and the island of Guadalcanal. About 200,000 people were displaced and up to 200 killed (UNDP 2004). The break down in law and order had a devastating effect on the economy resulting in GDP contracting by 45% due to closure of major industries such as the Solomon Islands Plantations Ltd owned oil palm plantations and the Gold Ridge gold mine. By 2002 the government was basically insolvent as a result of the sharp decline in government revenue coupled with the loss of control over expenditures.

While the ethnic unrest severely damaged the formal economy of Solomon Islands it was the informal subsistence and rural economy that sustained the majority of the population. Rural families reverted to family and clan-owned coconut areas to make and sell copra, cocoa beans were harvested, processed and sold and a host of small scale land and marine based entrepreneurial activities flourished to support the basic needs of families. Food security was maintained through the support of the thousands of family food gardens across the islands.

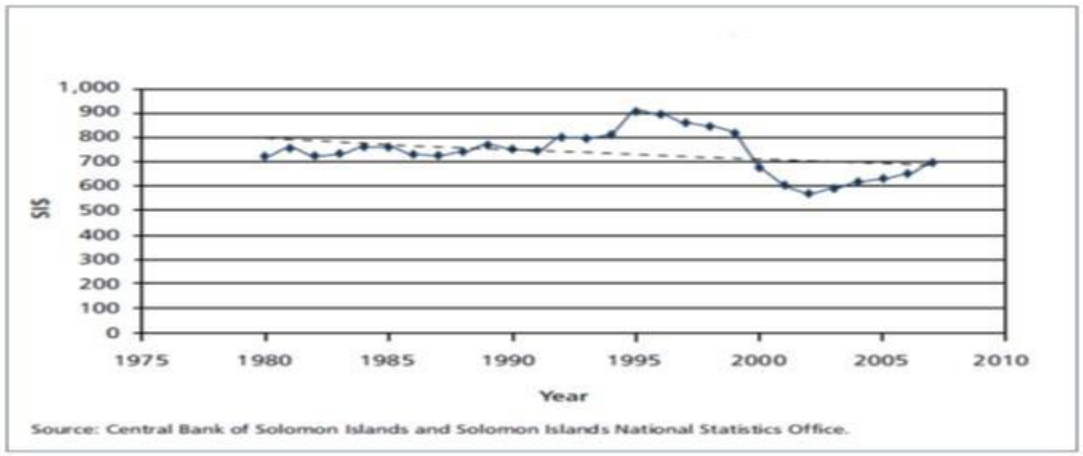
The escalating lawlessness and economic meltdown led to the national government endorsement and Pacific Islands Forum facilitating the establishment of the Australian government led Regional Assistance Mission to Solomon Islands (RAMSI). The RAMSI intervention in 2003 and subsequent programmes over the past years has been providing the government and people of Solomon Islands the opportunity to rebuild the economy, improve essential services to the people and provide the enabling environment for the improvement of livelihoods. To date RAMSI is the largest source of donor support to Solomon Islands providing much needed assistance to various government ministries, provincial governments, communities and non-state actors. By 2007 RAMSI support constituted 64% of total Overseas Development Assistance (ODA) to Solomon Islands (MOF, 2008), resulting in the very high GDP growth rate of 7.18% during 2003-2007 and a restoration of per capita income levels to that of the previous decade because improved revenue collection, and financial systems/budgetary control.

Figure 2 National Gross Domestic Product per Capita, 2008



Fed. = federated.
Source: Asian Development Bank. *Asian Development Outlook 2010*. Manila.

Figure 3 Real Domestic Product per Capita (1985 prices)



Source: Central Bank of Solomon Islands and Solomon Islands National Statistics Office.

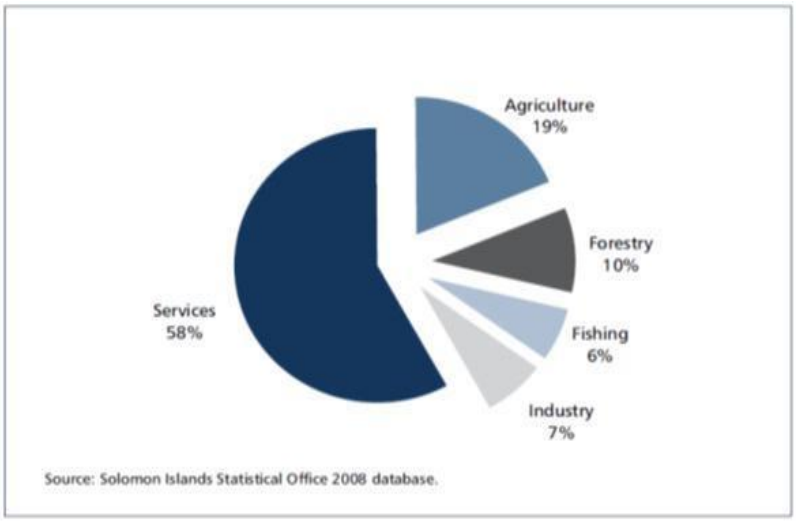
Much effort is needed to rebuild the nation‟s economy and distribute benefits across society. Coupled with the relatively low income levels is its unequal distribution nationwide and by geographic region. In 2005/06 the gini coefficient for income distribution was 0.39 with the wealthiest 20% of the population spending 69 times more than the poorest 20%. (MOF HIES, 2009). The provinces of Choiseul, Makira and Malaita had relatively lower expenditure levels amongst rural households. Reviews and assessment by the government of Solomon Islands, ADB and World Bank reveal that much of the growth in the national economy over the recent years can easily be attributed to aid and log exports with additional contributions from the expansion in agriculture exports (palm oil, palm kernel, cocoa and copra). During 2006 the total ODA to Solomon Islands was one of the highest in the world (IFP, 2009).

Table 1 Incidence of Poverty (% below food and basic needs poverty lines)[2]

	Households		Population	
	Food	Basic Needs	Food	Basic Needs
National	8.6	18.8	10.6	22.7
Honiara	1.7	24.6	2.6	32.2
Provincial urban	0.6	11.2	0.8	13.6
Rural areas	6.4	15.2	8.7	18.8

[2] Final report on the estimation of basic needs poverty lines, and the incidence and characteristics of poverty in Solomon Islands, ANALYSIS OF THE 2005/06 HOUSEHOLD INCOME AND EXPENDITURE SURVEY

Figure 4 Composition of Gross Domestic Product (current prices, 2006)



A recent Discussion Note by the World Bank (Solomon Islands Growth Prospects 2010) recommends that it will be difficult for Solomon Islands to make the transition from an agriculture based economy to an industrial and services based economy as history has shown with most countries. According to the World Bank this transition will be difficult to achieve due to the geographic scatter of islands and the weak governance and regulatory mechanisms currently in practice. It is predicted that future economic growth of Solomon Islands will be derived from four main areas including;

- Improved productivity of the smallholder agriculture sector where more than 80% of the population can participate in.
- Well managed and regulated natural resource industries that have positive and sustained multiplier effects
- An internationally mobile workforce
- Strengthening international partnerships to mobilize aid and enhanced public administration, political accountability and stimulate private sector growth

The report goes further to recommend how the country can maximize the benefits from the identified sources of growth. These include;

- Building efficient connections between centres of economic activity and to surrounding populations including reducing cost of moving people and goods from rural to urban areas and improving communication links
- Facilitating concentration of population and production in urban centres including improved urban land administration and improving water and electricity supply.

6. Overview of sectors

6.1. Forestry

Forests cover a large portion of the 28,000 square kilometres of land in Solomon Islands with the logging industry comprising the single biggest industry in the country (Integrated Framework Partnership, 2009). As with species and incidences of biodiversity, the stocking rate of merchantable forests decreases eastwards along the chain of islands with the Western and Choiseul Provinces having the higher stocking rates of hardwood trees per hectare.

Table 2 Summary of Forest Areas hectare (ha)

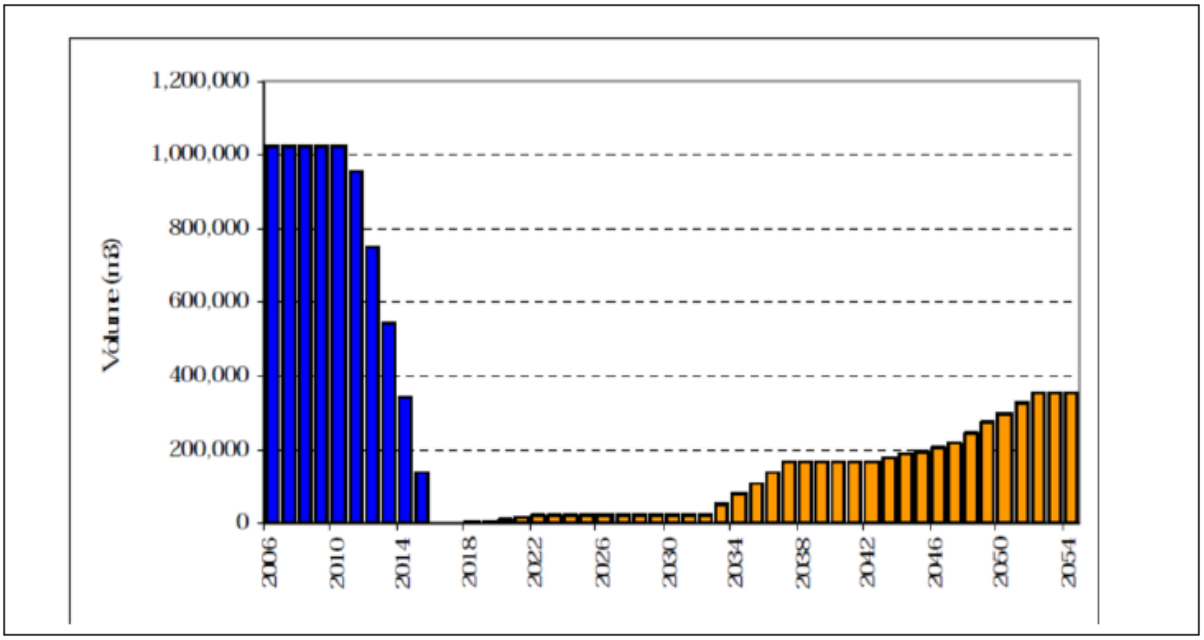
Province	Non-commercial forest and cleared land	Unlogged commercial natural forest	'Protected' areas(*)	Logged-over commercial natural forests	Plantations	Total
Guadalcanal	158,790	40,200	301,810	37,600	300	538,700
Western	248,452	49,500	111,048	120,700	21,800	551,500
Isabel	167,813	56,700	130,087	68,800	300	423,700
Malaita	373,200	28,900	162,929	18,600	1,300	584,929
Choiseul	133,048	82,900	95,252	18,600	400	330,200
Makira	74,975	17,400	220,425	9,000	100	321,900
Temotu	41,847	19,900	21,253	1,500	3,200	87,700
Rennell	41,900	24,000	0	0	0	65,900
Central	49,400	5,700	6,733	3,600	100	64,500
TOTAL	1,289,425	325,200	1,049,537	278,400	27,500	2,806,000

Source: URS Sustainable Development, 2006

(*) Figure based on Total Forested areas above 400m contour and on slopes greater than 30˚

Models generated by Solomon Islands National Forest Inventory Project (SOLFRIP) in 1995 established a sustainable (non-declinging) forest yield of 320,000 cubic metres given the rates of logging at that time. Between 1995 and 2000 the annual harvest rate was exceeding 600,000 cubic meters and and new sustainable forest yield of 200,000 cubic meters per year had to be set. After 2000 the annual harvests had reached more than 1,000,000 cubic meters. It is now estimated that the country"s area of merchantable forests is expected to be exhausted by 2015, or sooner if annual harvesting rates escalate to higher levels. This outcome will significantly affect national revenue given that the forestry sector has been the single most important industry contributiong to the economy of Solomon Islands. The diagram below shows a rapid decline in timber stocks which also means a concommitant reduction in removal of Carbon and reduction of CO2 emissions. The projected downturn in log exports will be detrimental for the economy but will also result in a significant reduction in CO2 emissions as forest regrowth contributes to increased carbon sequestration.

Figure 5 Projected wood flows from natural forests



Source: URS Sustainable Development, 2006

A worrying trend in the forestry sector is the increasing number of licenses sought and issued for re-entry into post-logged areas. With the estimated recovery period of forty years after logging, increasing incidences of re-entry logging operations means that smaller trees will be harvested and the regeneration and regrowth period will be longer than forty years. The minimum diameter of logs allowed for felling and export is 60cm at basal height and there are indications that the Solomon Islands Forest Industry Association (SIFIA) is seeking to have this minimum requirement further reduced.

6.2. Agriculture, Agro-Processing and Livestock

Agriculture is the backbone of the Solomon Islands rural economy with strong implications for future economic growth and human development. In the plantation sector cocoa, copra and palm kernel oil accounted for 18.5% of GDP in 2007 with cocoa fast becoming a very important commodity given its increasing contributions to national exports. For example in 2007 cocoa contributed USD 51.5 million dollars to the economy with most producers falling in the smallholder category. Subsidy schemes in the 1960‟s and 1970‟s gave rise to large areas of coconuts planted throughout the islands. The national coconut survey in 1986 counted a total of 70,000 hectares of coconuts in the country and a recent estimate puts the total area planted to cocoa at 14,000 hectares with about 80% on the islands of Guadalcanal and Malaita. The height of the ethnic tensions in 2000 coupled with poor management led to the closure Russell Islands Plantations Ltd (RIPEL), Solomon Islands‟ largest coconut, cocoa and cattle holding in the Central Province. The period of unrest also saw the closure of the largest palm oil plantation, Solomon Islands Plantations Ltd (SIPL) and the destruction of the
government‟s prize agriculture research station and livestock breeding farm. SIPL has since changed owners and is in full operation again while there are yet no signs of RIPEL being resurrected. Across the islands are a number of large plantations of coconuts on alienated land.

Soils of Solomon Islands make up one of the country‟s most important resources that is also

very fragile and requires careful management and protection. A nationwide reconnaissance level assessment of soil types in 1976 (Hansell and Wall 1976) classified soil types according to the U.S. soil classification scheme and described the physical geography, climate, soils, vegetation and agriculture opportunity areas of the country. Generally the soils of much of the country have good structure but are deficient in potassium. Soils on sloping land are very prone to leaching and erosion and are vulnerable to rapid degradation if located in areas of high rainfall and human occupation. (Pacific Horizon 2009). The SI National Disaster Management Office (NDMO) has in the past had to respond to emergency food deficit situations where communities in the windward side of the main islands cannot grow enough sweet potato (*Ipomea batatas*) due to abnormally prolonged periods of high rainfall causing excessive vegetative growth and very minimal tuber formation.

Large scale agro-processing is linked to the larger plantations and limited to cocoa fermentation and drying, drying of copra and pressing to make coconut oil and the pressing of palm kernels for oil. Smaller scale processing includes cold press coconut oil facilities, small scale coffee and ground nut processing and drying and processing of root crops and fruits.

The livestock industry, particularly cattle numbers, have declined significantly over the past years from a total national herd of around 25,000 in 1975 to just over 3,000 in 2005. Cattle numbers were higher in the RIPEL and church-owned plantations and community-managed land purchase cooperatives and community projects.

The informal agriculture smallholder sector has always been the foundation of food security in Solomon Islands. With a heavy reliance on ecosystem services such as soil conditions, water resources and forests this system has provided food and shelter for most of the nation‟s population and has been the main safety net during difficult times such as the ethnic unrest during 1999-2003 when law and order broke down and the main formal economic activities in the country came to a grinding halt. Extrapolating from the work carried out by Bourke (2004) on calorific values and amounts of root crops consumed by people in neighbouring Papua New Guinea a local firm has estimated that the production of root crops in Solomon Islands, using the national population and the equivalent calorific values, quantities and price for imported rice, is a conservative 1.189 billion Solomon Dollars (USD 148,625 million) per annum (Solomon Islands State of Environment Report, 2008). Disturbances to the smallholder system by unsustainable land use practices and climate change will reduce the capacity of this system to feed the country and will place significant cost burdens on the government.

Much of the work in crop diversity is targeted at improving diversity and production per unit area of land and not designed to enhance resilience against future climate change. A local NGO the KGA is making good progress in promoting and demonstrating organic farming and use and distribution of local varieties. The limited number of Ministry of Agriculture and Livestock (MAL) field staff with limited resources at their disposal is not able to extend their work from improving production to that of enhancing resilience of farming systems to adapt to climate change.

6.3. Water Resources

The quality and supply of water resources in Solomon Islands is increasingly becoming threatened by development activities including logging, large scale agriculture and the fast expanding land clearing for subsistence agriculture. On many of the large islands such activities are undertaken without regard for future demand for clean and sustainable supply of water. In some villages on the islands of Malaita, Vella la Vella, Makira and Choiseul communities are having to cope with situations where some rivers are frequently dirty while others flow rate have been reduced considerably. Community based water catchment and watershed management has not been carried out in the country and is becoming an urgent need now that there is increasing population pressure on land resources. Provincial governments have begun to consider establishing ordinances to protect water resources with support from the national government.

Water resources assessment, planning and management falls into the mandates of the following government ministries: Ministry of Mines, Energy and Rural Electrification (MMERE), Ministry of Health and Medical Services (MHMS) and Ministry of Infrastructure Development (MID). MMERE has established a water division while the MHMS oversees the quality of water through the Rural Water Supply and Sanitation (RWSS) Programme. These Ministries together with MAL, MOF, MECM and Meteorology Services are yet to experience collaborative work to support communities plan and manage water resources considering agriculture, aquaculture needs and climate change. This is a totally new area of work which requires training and field equipment. A water policy drafted in 2007 is still under development and will need to be reviewed to incorporate climate change considerations and to date legislation to protect water resources include the following Acts:

- Water Resources Management (conservation and development);
- River Waters Ordinance 1969: Watershed control in relation to the rivers only and regulates the use of designated river water through permit applications;
- Environment Act 1998: makes provision for protection, preservation and conservation of the environment, prescribes an EIA process for development purposes;
- Public Health Ordinance 1969: provides for inspections to be conducted for the regulation of water pollution;
- SIWA Act 1992: Overseeing the management and development of urban water resources and services and sewerage services

6.4. Fisheries

As an oceanic state, the Solomon Islands has a coastline of about 10,000km of coastline, 1.34 million square kilometres of exclusive economic zone and productive ecosystems such as mangrove forests and coral reefs and endowed with rich inshore and offshore fishery resources. Consequently, fisheries is major contributor to the formal economy and generates about SBD 50M a year in revenue to the national economy. Inshore fisheries produce about 10,000 tonnes per annum for subsistence and local cash income for rural dwellers and artisanal fisher folks.

Tuna, especially skipjack, has always been a culturally significant, highly valued and nutritionally important fish in the Solomon Islands. Its harvesting is currently the only form of industrial fishing and accounted for approximately over %14 of the GDP. Soltai Fishing Company employs 600 locals with females forming majority of the workers. As shown in

Table 3, for the past 9 years, most of the tuna caught within the Solomon Island‟s EEZ was done by foreign owned vessels, whereas prior this period, most of the tuna were caught by

domestic fishing fleets led by the predecessor of Soltai Fishing Company: Solomon Taiyo Ltd.

Table 3 Total catch of tuna from domestic and foreign vessel in Solomon Islands

Year	Domestic Catch (MT)	Foreign Vessel Catch (MT)	Grand Total (MT)	Compare Catch (%)	
				Domestic %	Foreign %
2010	12,967	81,527	94,498	14	86
2009	17,801	76,122	93,923	19	81
2008	16,412	89,275	105,687	16	84
2007	19,692	72,122	91,814	21	79
2006	29,615	65,993	95,608	31	69
2005	20,168	80,178	100,346	20	80
2004	25,148	77,675	102,823	24	76
2003	27,468	36,092	63,559	43	57
2002	17,437	5,799	22,985	76	25

Ecological assessment carried out by TNC in 2004 noted the intactness of the marine environment and the abundance and diversity of marine resources. The same report also observed that the state of marine habitats and resources were largely determined by land-based activities including the logging of natural forests, and the mode and rate of harvesting of resources inland and offshore.

With a growing population, overharvesting of inshore resources and climate change, aquaculture has been pointed out as a possible option to cater for an increase in demand for fish in the face of loss of productivity in inshore fishery and enhance fish stock for subsistence. Preliminary efforts to research and optimise aquaculture operations in the Solomon Islands had started. One such initiative about to be completed is the “Aquaculture and Food Security in the Solomon Islands” project that was carried out by the Australian Centre for International Agriculture Research (ACIAR).

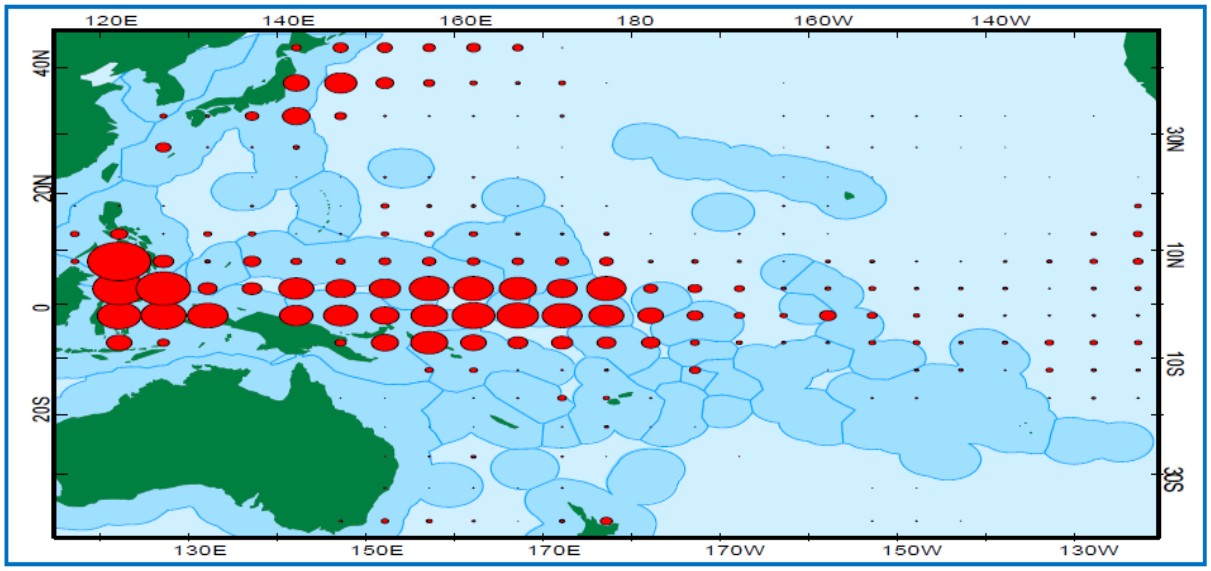
Because of the lack of data, it is difficult to realistically assess the impacts of climate change on the fisheries sector of the Solomon Islands. Nevertheless, the 4th IPCC assessment report stated with high confidence that coral reefs, fisheries and other marine resources are likely to be heavily impacted by climate change by way of the following effects:

- Increased sea surface temperatures resulting to higher risks of coral reef bleaching;
- Irregular severe weather patterns leading to heightened potential for reef damage from wave action; and
- Alteration of calcification chemistry in coralline and other calciferous exoskeleton biota caused by CO_2 driven oceanic acidification.
- larval dispersal, pattern alteration
- Recruitment processes, survival and growth, and reproduction of fish species will be impacted.
- Re-distribution and migration of tuna in the Pacific region. There is a likely hood that

the warm waters of over the western Pacific could shift to the central and eastern bringing the tuna stock with it (see Figure 6 for the current distribution of tuna).

- Major ecosystem as corals, mangroves, Sea grasses will be threatened
- Reduce Structural and biological complexity of Corals (demise of coral reefs).

Figure 6 Tuna distribution relative to warm waters in the Pacific



The above impacts were reiterated by preliminary regional studies recently carried out by SPC and its partners.

6.5. Energy

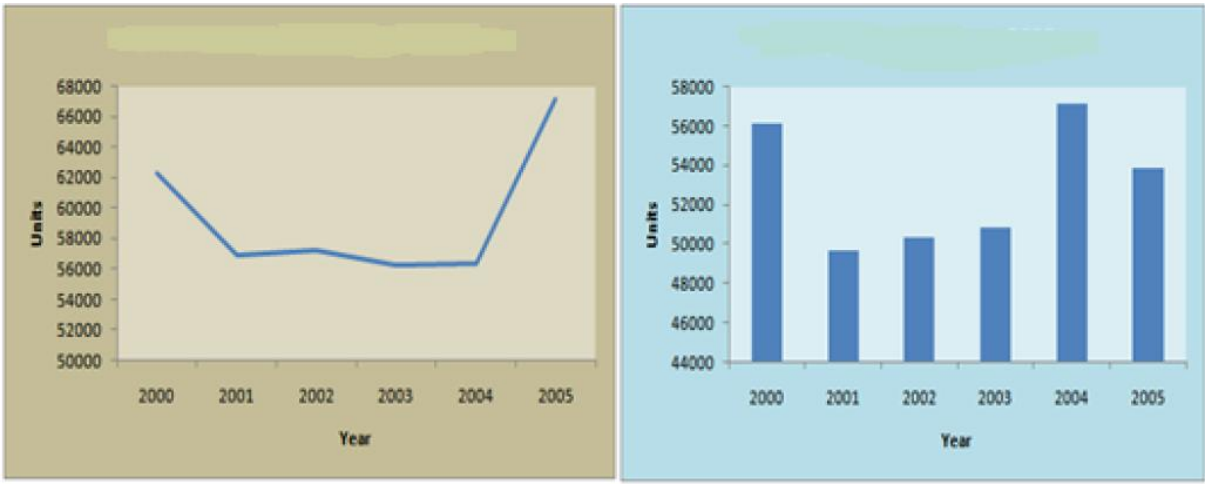
Different forms of renewable energy sources are available in Solomon Islands but their use is not as extensive as they should be. This is probably due to the lack of technology and finance to turn these sources into fully usable sources for a large part of the country‟s population.

These renewable sources are biomass, solar, hydro, wind and thermal. Non-renewable energy is basically imported in the form of petroleum products for electricity generation and for the transport sector.

In the rural areas, where the bulk of the country‟s population is, biomass is probably the most common source of energy used in cooking for food and drying of agricultural products such as copra and cocoa. There is recently an increase trend of solar power use for lighting in the rural areas which is slowly reducing the use of kerosene in the rural communities. Some of the communities also have some mini-hydro systems but these are ridden with technical problems.

In the urban centres of Honiara and other provincial centres or capitals, energy use is based on imported petroleum products for both electricity generation and the road and transport sector. In Honiara demand for energy has outpaced supply putting existing systems under extreme pressure. For many years now, Honiara has been experiencing power cuts. Many private establishments have standby generators because of this problem. These are the main sources of $C0_2$ emissions in Solomon Islands.

Figure 7 Generation (left) & Sales (right) of Electricity, 2000-2005



Below Table 5 shows the electricity scenario of Solomon Islands.

Table 4 Electricity Sector Scenario of Solomon Islands

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Consumption (MWh)	74,000	73,000	85,862	71,086	73,892	78,471	84,509	89,522	94,834	98,693	102,709	106,890	111,241	115,771
Gross generation (MWh)	87,742	88,344	86,798	88,725	85,057	90,040	96,972	102,725	108,819	110,439	114,933	119,610	124,478	129,546
Peak demand (MW)	18.03	17.95	17.80	17.77	17.06	18.03	19.55	20.71	21.93	22.27	23.18	24.13	25.11	26.14
Capacity requirement (MW)	18.03	17.95	17.80	17.77	17.06	18.03	19.55	20.71	21.93	22.27	23.18	24.13	25.11	26.14
Total capacity (MW)	33.28	35.28	35.28	37.25	54.55	53.15	53.45	53.80	66.80	38.42	43.90	64.26	51.26	51.26
Total Hydro	0.24	0.24	0.24	0.20	0.20	0.23	0.23	0.23	0.23	15.23	20.71	21.08	21.08	21.08
Total diesel	32.75	34.75	34.75	36.75	54.05	52.52	52.82	52.82	65.82	22.18	22.18	22.18	9.18	9.18
Total Geothermal	-	-	-	-	-	-	-	-	-	-	-	20.00	20.00	20.00
Total biofuel/ Biomass	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.50	0.50	0.65	0.65	0.65	0.65	0.65
Total solar	-	-	-	-	-	0.10	0.10	0.25	0.25	0.35	0.35	0.35	0.35	0.35
Capacity balance (MW)	15.25	17.33	17.48	19.48	37.48	35.12	33.90	33.10	44.87	16.15	20.72	40.14	26.15	25.12

7. Enabling Environment to Support Implementation of the UNFCCC

Since the INC report, Solomon Islands government has made good strides in building the enabling environment to support implementation of the UNFCCC and reflects the government's efforts at addressing climate change as a sustainable development issue. In 2008 the then Coalition for National Unity and Rural Advancement government established the Ministry of Environment, Climate Change and Meteorology and a dedicated Climate Change Division. A Ministry Strategic Plan and Corporate Plan was developed with specific climate change targets incorporated and a National Climate Change Country Team (NCCCT) was put in place under the SNC project, chaired by the Permanent Secretary of MECM and comprising membership from government agencies, NGOs and other organizations. In 2010 the NCRA government approved the integration of the NDMO, then under the Ministry of Home Affairs, to be part of the MECM and changed the name of the ministry to be the MECDM.

The merging of the NDMO within MECDM marks an important first step by the government to operationalize the integration of climate change vulnerability and adaptation with disaster risk reduction. The establishment of Thematic Working Groups to support the implementation of the SNC has also strengthened linkages and collaboration between the government and other stakeholders. On-going effort is needed to mainstream Climate Change into government Ministries, NGOs and institutions involved in the various development sectors of the country. Table 5 outlines a range of strategies addressing climate change in the MECDM Strategic Plan.

Table 5 Strategic Result Area 2 - Climate Change (MECDM Strategic and Corporate Plan 2010-2012)

Key Issues/Problems	Priority Outputs
Policy and legislation framework development • Lack of overarching policy and related legislation	1. Develop a climate change policy and related legislation thereafter. 2. Establish DNA for CDM 3. Develop strategy for implementation 4. Support awareness and enforcement
Adaptation Loss of land from sea level rise/incl. coastal erosion?? • Food security-marine and land-based agriculture • Availability/Access fresh water supplies ¡V salination; climate variability and change; • Livelihoods affected through disasters • Lack of data & research/analysis of available data	1.Mainstream climate change in National Development Plan, Medium Term Development Strategy, and line ministry policies 2. Undertake vulnerability and adaptation assessments, in identified provinces and communities in collaboration with relevant agencies and stakeholders. 3.Identify adaptation options for implementation through collaboration with relevant agencies and stakeholders. 4.Establish a strategy for data and information collection and analysis 5.Develop and implement a strategy for information dissemination for wider

• Lack of technology for adaptation • Inadequate capacity and funding	community awareness
Mitigation • Uncontrolled logging-lack of knowledge of alternatives • Lack of proper plans and mitigation strategies • Lack of community awareness regarding climate change impacts and possible mitigation solutions • Inadequate coordination /networking among agencies • Lack of financing for mitigation projects • Non-functional policies and legislation under relevant line ministries.	Collaborate with relevant local agencies and stakeholders and those of regional and international to: 1.Identify mitigation options and targeted priority areas 2.Conduct Greenhouse Gas inventories as and when required 3.Develop mitigation plans and implementation strategy 4.Secure resources, including financial, for mitigation actions and implementation. 5.Develop a national strategy for carbon financing alternatives 6.Conduct activities relating to Land use, Land use Change and Forestry 7.Conduct readiness activities for Reducing Emissions from Deforestation and forest Degradation (REDD). Help inform line ministries about REDD and carbon financing alternatives to logging. 8.Engage with NGOs and Community Based Organisations on REDD-compatible projects.
International representation • Inadequate funding to support International obligation • Needs for skills development in advocacy, lobbying, negotiating and media • Inadequate international networking	1.Prioritise international meetings and fora 2.Identify strategic partnerships (LDCs, AOSIS, etc.) 3.Summarise international agreement requirements and disseminate to line agencies 4.Training to enhance staff skills in negotiation and advocacy

National coordination of climate change program and projects is overseen by the NCCCT chaired by the Permanent Secretary of MECDM. This coordination mechanism is currently under review. A Draft National Climate Change Policy is being developed with coordination from the Climate Change Division of the MECDM. The policy will be presented to a national stakeholder consultation at the end of 2011. The policy includes, inter-alia; establishing a national high level coordinating mechanism, mainstreaming of climate change into all levels of government and development sectors and their related legislation, policies and strategies; integration of CCA and DRR at the policy and operational levels; promoting and building capacity for valuation of ecosystem services as part of the Reduced Emissions from Deforestation and Degradation (REDD+) mechanism. Vertical linkages between MECDM and Provincial governments are weak as well as the horizontal linkages between the Ministry and other government Ministries, NGOs and institutions.

Solomon Islands has presented its INC in September, 2004 to the UNFCCC. A NAPA was completed in 2008 and, in line with guidance from the UNFCCC, identifies the urgent adaptation needs using a number of established criteria including; a) Severity of adverse

effects and the underlying vulnerability b) Urgency of actions to vulnerable sectors, c) Complementarities with existing projects, national development efforts, multilateral environmental agreements and sustainable development, goals including poverty reduction, d) Culturally acceptable and owned by those affected, e) Cost-effectiveness, feasibility and viability, f) Increases community resilience to climate change and improves livelihoods and income generation, g) Enhances adaptive capacity of communities and sectors to climate change, h) Equity – gender and resources, i) Long term sustainability.

Following review of past assessments and community consultations the following sectors were identified as priorities:

a) Agriculture and food security, b) Water supply and sanitation, c) Human Health, d) Human settlements, e) Fisheries and marine resources, f) Coastal Protection, g) Infrastructure, h) Waste Management, i) Tourism, j) Education, awareness and information

The NAPA is sector oriented and does not prioritize any geographic area, island or community in the country. It is envisaged that the need for indicators and methods for determining and prioritizing geographically vulnerable areas will be addressed when the NAPA will undergo a review in the near future. Complementing the NAPA and broader in its scope is the NDRMP which was launched in 2009. The NDRMP component on DDR has a strong focus on climate change hazards and risks. The NDRMP governance framework includes Provincial level Disaster Committees, Ward and Village Disaster Risk Committees and the national coordination mechanism includes the NCCCT. The NDMO has a stronger reach at the Provincial government with a Provincial Disaster Officer posted in each Province. With the support from a range of donors the NDMO has been actively assisting government agencies, provincial governments and communities undertake disaster risk reduction assessments and develop risk reduction strategies.

CHAPTER 2

NATIONAL GREENHOUSE GAS INVENTORY

2.1 Background

As per Article 4 (paragraph 1) and Article 12 (paragraph 1) of the United Nations Framework Convention on Climate Change (UNFCCC), each party is required to report to the Conference of Parties (COP) information on its emissions by sources and removals by sinks of all Greenhouse Gas Emissions (GHGs) not controlled by Montreal Protocol. Solomon Islands prepared and submitted its Initial National Communication in 2004.

As required by decision 17/CP.8 of COP, "For the second national communication, non-Annex I Parties shall estimate national GHG inventories for the year 2000. The least developed country Parties could estimate their national GHG inventories for years at their discretion". As a non-Annex I country and a least developed country. Solomon Islands chose 1994 as base year for the initial national communication and considered 2000 (selected base year for the second national communication) to 2010 (final year) for the second national communication GHG inventory.

The Solomon Islands Initial National Communications GHG Inventory focused on the Energy Sector alone based on the Reference Approach (Tier 1) due to unavailability of data from energy users. It recorded 294 Gg in total emissions of CO_2 in 1994, about 0.0008 Gg CO_2 emissions per capita. In the SNC the inventory was expanded, albeit in a few sub-categories only, to include the following sectors: Energy, Industrial Processes, Agriculture and Waste.

2.2 Methodology

This GHG inventory is prepared using methodology developed in the revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. The UNFCCC software "Non Annex 1 National Greenhouse Gas Inventory Software" has been used for the estimation of GHG.

The preparation of GHG inventory in Solomon Islands was coordinated by the concern Divisions like Ministry of Environment, Climate Change, Disaster Management and Meteorology, Solomon Islands Ports Authority (SIPA) and Solomon Islands Electricity Authority etc. through data compilation and reporting. The key steps carried out in inventory preparation include:

- Team Formation to work on Inventory
- Team Capacity Building/Training
- Data Collection for sectors covered under the Inventory
- Identification of Gaps
- Documents / Data Review for quality assurance
- Report (inventory) writing

Sectorial data for GHG estimation was compiled from various sources primarily using national data collected from annual reports, statistical reports, studies, concern private and government divisions and brochures of related department/institutions. Where no formal data was available, are not considered in the study.

The lack of national activity data and emission factors in many of the sectors meant that IPCC and other sources of data from countries with similar conditions were used as default. All the assumptions and emission factors were obtained from recommended range of IPCC default parameters with the Tier 1 method used in most cases.

2.3 Sectors and Gases Assessed

This section presents information on Solomon Islands' emissions by sources and removals by sinks of all anthropogenic GHGs. As per the revised 1996 IPCC guidelines, the inventory estimates the GHG emissions from the following sectors which are relevant for Solomon Islands:

- Energy
- Industrial Processes (Only Food & Drink)
- Agriculture (Livestock)
- Waste (Solid Waste Disposal Sites and Waste water)

In addition to the sectorial approach, the reference approach is also used to estimate CO_2 emissions from the energy sector. Emissions from international bunker are estimated and included as memo items in the inventory. The direct GHGs whose emissions are estimated in this national GHG inventory are:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)

The indirect GHGs whose emissions are estimated in this national GHG inventory are:

- Oxides of nitrogen (NOx)
- Carbon monoxide (CO)
- Non-methane volatile organic compounds (NMVOC) and
- Sulphur dioxide (SO_2)

Where no formal data was available, emissions from those categories/subcategories are not estimated in this inventory but, in future inventory submission those categories will be assessed and included.

Sectors and categories and the gases covered in the Solomon Islands SNC GHG Inventory are summarised in below Table 6.

Table 6 Assessed sectors, their categories and gases

Sectors	Categories	Gases
Energy	Energy Industries (electricity), Transport (road), Others (commercial, industrial and residential)	CO_2, CH_4, N_2O, NO_x, CO, NMVOC, SO_2
Industrial Processes	Other Production (Food & Drink)	NMVOC
Agriculture	Cattle and Pig Waste – Enteric fermentation, manure management, agricultural soils	CH_4 and N_2O
Waste	Solid Waste Disposal Sites and Waste water	CH_4 and N_2O
Memo Items		
International Bunkers	Aviation	CO_2

In this report, Solomon Islands has reported emissions mainly in Giga grams (Gg). The aggregated GHG emissions and removals are expressed in Gg CO_2 equivalents (Gg CO_2e) using the Global Warming Potential (GWP) provided by the IPCC. The concept of GWP has

been developed to allow the comparison of the ability of each greenhouse gas to trap heat in the atmosphere relative to carbon dioxide (CO_2) over a specified time horizon. The greenhouse gas emissions are calculated in terms of how much CO_2 would be required to produce a similar warming effect over the chosen time horizon. This is called the carbon dioxide equivalent (CO_2e) value and is calculated by multiplying the amount of gas by its associated GWP. Table 7 provides the GWP of GHGs assessed in the inventory report.

Table 7 Global Warming Potential (GWP)

Global Warming Potential (IPCC 1996)					
Species	**Chemical Formula**	**GWP**	**Species**	**Chemical Formula**	**GWP**
CO_2	CO_2	1	HFC-23	CHF3	11,700
Methane	CH_4	21	HFC-236fa	C3H2F6	6,300
Nitrous Oxide	N_2O	310	HFC-143a	C2H3F3	3,800
Perfluoroethane	C2F6	9,200	HFC-134a	CH2FCF3	1,300
Perfluoropentane	C5H12	7,500	HFC-134	C2H2F4	1,000
Perfluorohexane	C6H14	7,400	HFC-32	CH2F2	650
Sulphur hexafluoride	SF6	23,900	HFC-41	CH3F	150

2.4 Uncertainty Assessment

Although the 1996 IPCC Guidelines provides a comprehensive overview and categorization of all potential sources of GHG emissions, not all of them are relevant to Solomon Islands. Furthermore, there is insufficient data on certain sources for them to be included in this inventory exercise and has been described in the sections below. A detailed assessment of each IPCC category was carried out as part of Solomon Islands' second GHG inventory, including each category's relevance to Solomon Islands and the availability of data required to estimate emissions from these categories. The 1996 IPCC guidelines provide guidance for an advance and technical uncertainty analysis. Such a detailed analysis is beyond the scope of Solomon Islands' second GHG inventory.

In Solomon Islands, key uncertainties are associated with data availability, lack of comprehensive information, data archiving and lack of country specific emission factors. It is recognized that having country specific emission factors and more detailed activity data will help reduce uncertainty in future inventory. For example, in the energy sector there is data available on fuel imports into the country but there is lack of information on end usage. Similarly, for Agriculture and LULUCF currently there is no comprehensive national data available. Waste sector in Solomon Islands is one of the sectors that lack regularly compiled activity data on waste generation, composition and management, no comprehensive waste data covering all waste types and treatment techniques are available, therefore availability and quality of data in the waste sector is not comprehensive and consistent. It can be concluded that with adequate training and capacity building on GHG inventory requirements, Solomon Islands can provide more detailed and accurate information in subsequent GHG inventories.

2.5 Summary of Greenhouse Gas Emissions

For the energy sector, it was difficult to use the sectorial (bottom-up) approach as private firms and fuel suppliers were not prepared to provide information on distribution and use of fuels, however on the basis of some reports (e.g. *Pacific Regional Energy Assessment report on Solomon islands by SPREP*) and discussion with stakeholders, the percentage distribution of the imported fuel among the different categories (energy industries, transport and others) was considered. The Energy Division also found it difficult to enforce measures to collect the data given the limitations in legislation to do so. Quality assurance and control was undertaken on a very limited basis giving rise to high levels of uncertainty in the estimates of emission levels.

The total GHG emissions in base year 2000 is estimated to be 422.28 Gg $CO_{2eq.}$.

Table 8 shows the trend of Solomon Islands' GHG Emissions (Gg CO_2 equivalent) for 2000, 2005 and 2010.

Table 8 Summary of Solomon Islands GHG Emissions (Gg CO_2 equivalent) for 1994, 2000, 2005 and 2010

Sector	Gg CO_{2eq}			
	1994	**2000**	**2005**	**2010**
Energy	294	192.22	235.03	350.64
Industrial Processes	NE	-	-	-
Solvents and Other Products Use	NE	NE	NE	NE
Agriculture	NE	70.35	73.66	76.39
Land Use Change and Forestry (LUCF)	NE	NE	NE	NE
Waste	NE	159.71	184.33	191.58
Total GHG Emissions, excl. Removals	**294.28**	**422.28**	**493.02**	**618.61**

CO_2 is the dominant GHG and the trends in emissions without forestry over the coming years is expected to increase, albeit still at a globally low level, with rising populations and planned establishment of new mining, fishing and agriculture industries.

Table 9 Total GHG emissions (Gg $CO_{2\ eq.}$)

GHG Sources & Sinks (Categories/Sub categories)	1994	2000	2005	2010
Energy Industries (Electricity production)	53.26	44.76	48.29	59.41
Transport (Road)	192.8	88.68	112.59	176.91
Other Sectors (Commercial, Industrial & Residential)	48.33	58.78	74.15	114.32
Industrial Processes (Food & Drink)	NE	0	0	0
Enteric Fermentation (Animal Waste)	NE	19.61	20.39	20.96
Manure Management (Animal Waste)	NE	32.09	33.83	35.36
Agricultural Soils (N20 from animal waste)	NE	18.65	19.44	20.07
Solid Waste Disposal on Land (Domestic)	NE	120.22	138.75	144.21
Wastewater Handling (Domestic)	NE	39.49	45.58	47.37
Total GHG Emissions, excl. Removals	**294.38**	**422.28**	**493.02**	**618.61**

A key category analysis of the country's emissions in 2000 was done to identify key categories and sub-categories that will need more detailed assessment in the next planned inventory. Qualitative considerations were used to determine key source categories in accordance with IPCC 1996 Guidelines and based on the following criteria:

- Anticipated mitigation techniques and technologies: It is expected that emissions from the energy sector and LULUCF Sector will be reduced in the coming years with the planned large hydro-electricity scheme and large scale forest regeneration when most of the merchantable forest areas are logged out.
- High expected growth of removals over the coming years under managed forests as a result of an expected marked decline in logging and increase in forest regeneration from post-logged areas
- High uncertainty in estimation emissions from the categories
- Incompleteness of the inventory given that LULUCF, industrial processes and product use sectors were not assessed.

Table 10 Key Source Categories for year 2000 using the qualitative approach

Sub Category	2000	%
Energy Industries (Electricity production)	44.76	10.60%
Transport (Road)	88.68	21.00%
Other Sectors (Commercial, Industrial & Residential)	58.78	13.92%
Industrial Processes (Food & Drink)	0.00	0.00%
Enteric Fermentation (Animal Waste)	19.61	4.64%
Manure Management (Animal Waste)	32.09	7.60%
Agricultural Soils (N20 from animal waste)	18.65	4.42%
Solid Waste Disposal on Land (Domestic)	120.22	28.47%
Wastewater Handling (Domestic)	39.49	9.35%
Total GHG Emissions	**422.28**	**100%**

2.6 GHG Emissions by Sector

2.6.1 GHG Inventory - Energy Sector

With coordination by the MECDM and the SNC Project Coordinator a number of GHG Inventory teams were established to gather, analyse data and carry out an inventory of GHG emissions in the following sectors; Energy, Agriculture, Waste , Industrial Processes. The GHG teams were assigned the following broad Terms of Reference to accomplish:

1. Undertake national GHG inventories for the year 2000, according to the guidelines for the preparation of National Communication
2. Report on the GHG emissions and sinks for the different sectors
3. Recommend ways to strengthen institutional arrangements for the archiving of the required data and to make this process an on-going process for SNC project in the future.
4. To compile an overall report for each of the sectors.

Whilst other ODS(s) are required to be reported, the Energy sector was only able to accomplish reporting on the carbon dioxide (CO_2) emissions in the country through the burning of fossil fuels, due to limitations in accessing data. Furthermore, due to unavailability of some data and important country constants to be used in calculations, the energy sector team was only able to undertake inventory on the following significant contributors to the GHG emissions in Solomon Islands:

1. Diesel/Distillate Fuels
2. Petroleum
3. Motor Spirit
4. Other kerosene and white spirit
5. Jet fuel and aviation kerosene
6. Aviation Gasoline
7. LPG
8. Other

2.6.1.1 Methodology

The top-down approach was the basis of this inventory report. With this approach, the energy sector is responsible for petroleum fuel combustions and thus, tracks records from petroleum fuel imports, use (combustion) and exports. With virtually no re-exports of fossil fuel by The Solomon Islands or the manufacture or production of fossil fuel or any other vegetable fuel oil in the country, this sector merely deals with data of fuel entering the country and for the combustion of fuel in the country plus fuel combusted by the international bunkers.

2.6.1.2 Data collection approach, analysis and assumptions

Data were sourced records from the Statistic Division based on the overall fuel imports by type for the different years. The statistics division was chosen as these data were directly taken from the Solomon Islands Ports Authority (SIPA) which is the only national arm monitoring incoming goods to the country.

Solomon Islands Electricity Authority (SIEA) the only power utility supplied all the data

needed for the electricity provision in the country although there exist small self-run home/industry generators which cannot be recorded as data associated with their consumption were not properly recorded. A number of assumptions were adopted in the computations, even to the extent of fuel consumption allocation to the different sectors of the energy source category contained in the template.

2.6.1.3 Data Collection Approach

With considerations of few difficulties in the data collection process, the energy sector has adopted the top-down approach as the most proximate approach to gather data that might be more representative to the real situation in the Solomon Islands in terms of fossil fuel combustion.

Following failed attempts to collect data from the fuel retailers and end users in the country, the inventory data collection process then adopted the following:

i) Data collection from government bodies mandated to monitor imports - Statistics and SIPA
ii) Electricity provision data were then obtained from The Solomon Islands Electricity Authority

2.6.1.4 Data Collection Constraints

The failure in acquiring information from relevant bodies in the supply chain of fossil fuels is a major hindrance to the bottom up. South Pacific Oils Limited (SPOL) and Markwarth Oils the only two fuel importers in the country refused to provide their sales and import data to the team. Even with the current approach being adopted, some important data sources were found to have very poor archiving systems which again could lead to some important data being over looked during the computation of emissions.

The earlier year's records could not be used as they are not reliable and representative as during 2000 to 2006 the country was recovering from an ethnic turmoil and proper data keeping was not guaranteed.

2.6.1.5 Assumptions

The inventory incorporated a number of assumptions including:

- As there were no more recorded re-exports or manufacture of petroleum products in the country all fuel imports are assumed to be used in the country with little to the civil aviation and marine division for international bunker fuel recording.
- Generally for the following results of GHG emissions or source category, imports have been used as a proxy for consumption.
- It needs noting also that all imports are assumed to be consumed in the same year alone although sales and imports can differ substantially which can be noted only if sales from the distributors are taken to note their stock levels at the end of the year so that fuel consumed can be calculated.
- The two importers (SPOL & Markwarth Oils) are responsible for the international banker fuels for the marine and the aviation sectors. These data as previously stated could not be accessed from their records as well. As such, this sector is ignored in the entire inventory except consideration of jet fuel and kerosene and aviation gasoline for aviation sector.

- Fugitive emissions were not considered in this inventory. All fuel is assumed to be combusted.
- From the following calculation in Annex A, nearly all the default emission factors were used for the calculation. This is because, for Solomon Islands we still have to determine our local values.
- Imported petroleum fuels distribution among the sectors is considered on the basis of details from report i.e. *Pacific Regional Energy Assessment report on Solomon Islands by SPREP*.

2.6.1.6 Emissions – Source Category

Due to unavailability of certain data, entries were made for electricity, others and transport source categories only.

- For the electricity source category, SIEA the only power utility in the country was used for this sector.
- The Transport source category was assumed to be made up of aviation, navigation and road transport. Transportation is poorly monitored in terms of fuel consumption. A closer proximity can be attained if fuel from retail outlets is taken into account which for this case was not done. As such, the remaining fuel from electricity consumption under diesel oil is assumed to be used by road transport.
- Fugitive emissions were not considered in the fuel volumes dealt with in this inventory and as such the emission source category for this section under the energy sector is left blank.
- Other fuel types that could not fit in within the provided source categories were recorded under this section. Some were classified under residential and the remaining as “others”. This step was done as a consequent of the “top-down” approach.

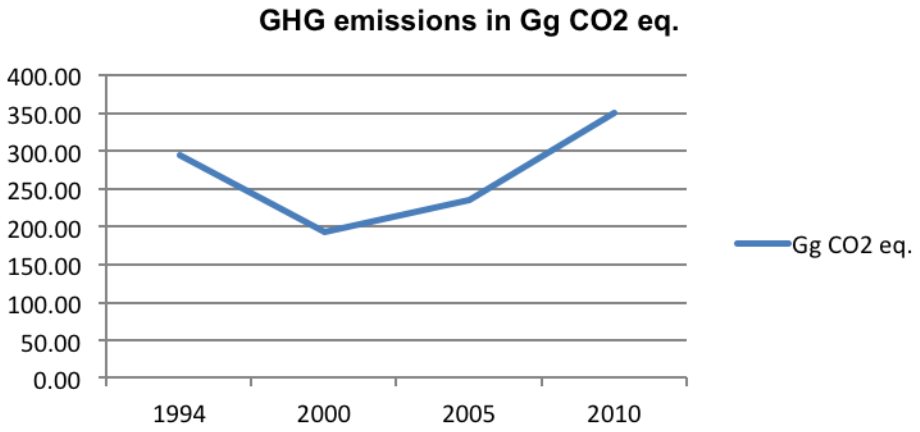
2.6.1.7 GHG Emissions/Source Results

There was a decrease till 2000 from 1994 (due to country specific turmoil) then increase from 2000 to 2010 as can be seen in the trend from 1994 up to 2010. Table 11; is self-explanatory. As the figures used in the emission calculations are derived from import statistics from the Customs Division, the dip in emissions during 2010 may be due to large quantities of fuel for 2010 brought into the country at the end of 2009.

Table 11 GHG emissions from energy sector in the Solomon Islands

Years	1994	2000	2005	2010
Gg CO2 eq.	294	192	235	351

Figure 8 GHG emissions from the energy sector: 1994 – 2010



Energy use is directly related to economic growth and population growth. Solomon Islands economy grew at a very slow pace since it gained political independence from Britain in 1978 and took a dive during the years between 1999 and 2003 when the country went through a period of ethnic unrest and lawlessness. These years are reflected in the above Graph by the relatively lower levels of emissions. This period also saw a significant level of duty remissions and tax exemptions on imports benefiting individuals linked to national politicians and militant leaders.

Emissions were mainly categorized as coming from the electricity sector, transport sectors and other sectors. Emissions from the electricity sector were computed from the data supplied by SIEA. During 2000 36% of the total diesel oil imports were used for generation of electricity. Data on the use of distillate for smaller generating units throughout the country could not be obtained and the illegal import and transshipment of distillate from log ships to logging camps has been observed. This introduces a degree of uncertainty.

2.6.1.8 Data Archiving

Due to poor data archiving by government departments and the fear of compromising business activities in the private sectors, detailed emissions for the respective fossil fuel types could not be noted. However, following such important initiatives, the energy division has taken extra step to make this an ongoing activity and has liaised with the SOPAC Petroleum Section to continually monitor yearly fuel imports to the country and supply necessary data to the Division. This means that until a system is in place Solomon Islands will continue to retrieve information on fuel consumed in the country using a Top-Down Approach.

The energy sector can be more representative in its reporting but for the moment this is yet to be achieved as private sectors are still very cautious about the situation not until a well-defined system is put in place by the various concerned bodies. Whilst a top-down approach was followed to give the 192.21 Gg volume of $CO_{2\ eq.}$ emissions for 2000, a more representative result can be achieved if the bottom –up approach is adopted. There are obvious data gaps requiring improved data management systems in the Energy Division and other government agencies.

Default values were used in the computation of the emissions as set out in the IPCC guidelines 1996.There were major assumptions in the fuel usage under the different Source category which are based from previous reports and the failure to have proper recording systems in the allocated columns of the source category in the IPCC template.

With current attempts by the energy division under the Ministry of Mines, Energy and Rural Electrification to come up with a system for the archiving of the fuel supplies within the pacific in collaboration with SOPAC Petroleum Section, this process will still take the form of top- down approach. Not until all stake holders are linked up and be part of the system, national communications to UNFCCC will always take assumptions which will at times contain misleading information for the future planning of development in the Solomon Islands

2.6.2 GHG Inventory – Industrial Processes

In the country due to limited data availability, only from food & drink industrial processes' emissions has been assessed and shown in this inventory, further in future inventory Solomon Islands will perform more rigorous approach to calculate and show the complete emissions from all available categories of industrial processes and Product use sector.

Below table shows the food & drink industrial processes' emissions:

Table 12 Emissions from Industrial Processes (Gg)

Industrial Processes (Food & Drink)				
Year	**1994**	**2000**	**2005**	**2010**
NMVOC emissions in Gg	NE	0.0451	0.1886	0.1934

In this food & drink industrial processes GHG emissions assessment considered (as per available data), are alcoholic beverage production (beer) and bread and other food production (meat, fish, margarine and solid cooking fats and cakes, biscuits and breakfast cereals).

Above table shows that, NMVOC emissions from food & drink industrial processes increased with slow pace (as relatively this emission is very less).

2.6.3 GHG Inventory – Land Use, Land Use Change and Forestry

The GHG emissions and sink from land use, land use change and forestry (LULUCF) has not been estimated and reported in this inventory (due to uncertainity/unavailability of data).

Solomon Islands has very limited data and information on land use change and estimating the amount of land being converted from one land use type to another has been very difficult. The SNC LULUCF team made numerous attempts at gathering information from various government agencies and private sector organizations and found that the uncertainties were very high.

The only major reconnaissance work undertaken in the country took place in 1993/94 under the AusAID –funded Solomon Islands Forest Resource Inventory Survey (SOLFRIS). Since then another survey was conducted in 2006 by URS to assess the state of forests in Solomon Islands.

The total area of forests will need to be reviewed during the Third National Communications as it is very likely that the total area of forests would increase. The new Protected Areas Act (2011) would also make it possible to include some of the areas above the 400m contour and 30˚ slope as protected areas. In fact under the current Code of Logging Practice of Solomon Islands these areas are deemed as sensitive areas that need to be protected.

The Solomon Islands SNC missed out on the opportunity to conduct sample surveys on use of fuel wood in the country and report on a firewood survey carried out in the 1980‟s with funding from UNDP could not be found.

Carbon lost as a result of forest disturbances included collateral damage brought about by logging practices.

Logging has been the dominant economic activity in Solomon Islands over the past decades. Despite the sound advice on the need to maintain a sustainable level of harvesting the actual extraction rates have now more than doubled in the recent years, raising much needed revenue for the government but also accelerating the depletion of biodiversity and stands of merchantable timber. By 2018 most of the merchantable forests would have been logged and there now needs to be urgent and accelerated actions by the government to establish plantations and rehabilitate natural forest area

Plate 1. Logging on the island of Marovo (Photo: Terence Titiulu)

When factoring in emissions from the forest sector the country's total emission level is worthy of attention. Considering all aspects of the country and total emissions, it makes Solomon Islands one of the largest GHG emitter per capita in the Pacific. This level of emission and removal has important implications for forest management in Solomon Islands because of the role forests play in sequestering carbon and contributing to enhanced resilience of terrestrial ecosystems and communities. The rate of depletion of timber stocks in merchantable forest areas is expected to slow down considerably over the next few years resulting in a significant drop in national revenue but will also give rise to a turnaround in levels of carbon sequestration levels (removals). According to established projections this is

predicted to happen after 2021. An increase in plantings of large scale forest plantations and small woodlots can also contribute to increased forest re-growth. In theory this means that CO_2 removal (sequestration) rates will be higher than emission rates for managed forests in the coming decades. In practice however, this may be more difficult to achieve given the growing rate of logging licenses issued for areas already logged (referred to as re-entry logging).

Recent information obtained indicate that most of the merchantable forest areas will be exhausted prior to 2021 as annual exports of logs over the past few years have increased well beyond the 1,000,000 cubic meters per annum level.

2.6.4 GHG Inventory - Agriculture

The IPCC Revised 1996 Guidelines lists the main sources of emissions from agriculture as:

i) Enteric fermentation

ii) Animal manure

iii) Rice cultivation

iv) Agriculture soils

v) Prescribed Burning of Savannas

vi) Field Burning of Agricultural Residues

The Solomon Islands SNC was only able to assess emissions from i), ii) and iv). Without any reliable data it was not possible to calculate emissions for iii, v and vi. The total emissions from enteric fermentation was 19.614 Gg $CO_{2\ eq.}$, from manure management was Gg $CO_{2\ eq.}$ and from agricultural soils (N_20 from animal waste) was 18.65 Gg $CO_{2\ eq.}$ given the number of cattle and pig, estimated at 13,000 cattle and 50,000 pigs in 2000 and slowly increasing, and the figures are included in the inventory. Table 13 & 14 show the emissions from assessed categories of agriculture sector and gas wise.

Table 13 Agriculture sector GHG emissions in Gg $CO_{2\ eq.}$

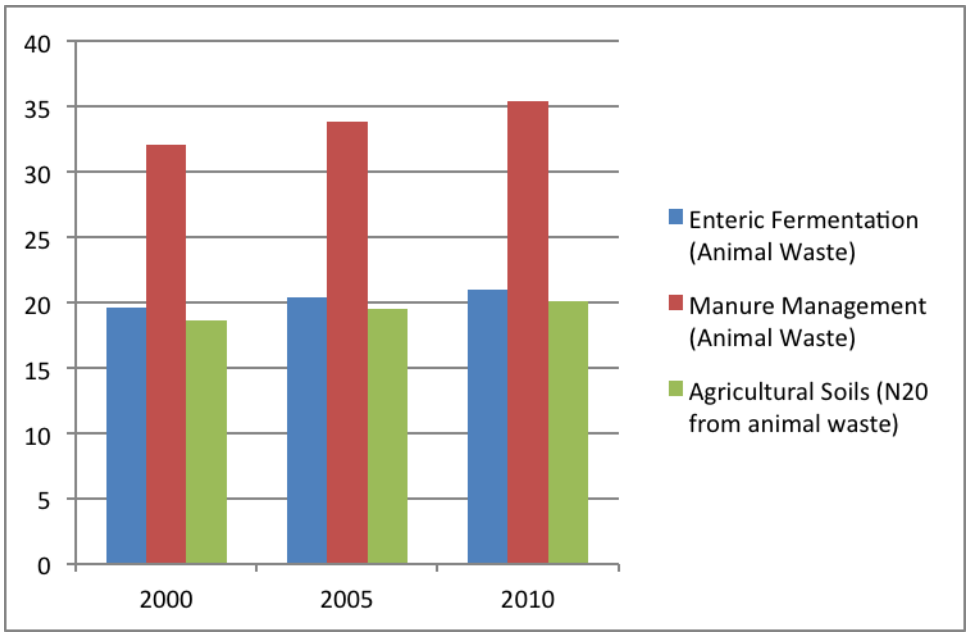
Category	2000	2005	2010
Enteric Fermentation (Animal Waste)	19.61	20.39	20.96
Manure Management (Animal Waste)	32.09	33.83	35.36
Agricultural Soils (N20 from animal waste)	18.65	19.44	20.07

Table 14 Agriculture sector gas wise GHG emissions in Gg, in 2000

Agriculture Sector	$CO_{2\ eq.}$	CH_4	N_2O
Enteric Fermentation (Animal Waste)	19.61	0.93	-
Manure Management (Animal Waste)	32.09	1.43	0.01
Agricultural Soils (N20 from animal waste)	18.65	-	0.06
Total	**70.36**	**2.36**	**0.07**

Data on total number of livestock (cattle and pig) in the country was obtained from the FAO database.

Figure 9 Agriculture sector GHG emissions in Gg $CO_{2\ eq.}$



Emissions from forest land conversion to croplands will need to be assessed in the next national inventory when more data becomes available. The common practice of slash and burn agriculture emits high levels of GHGs and needs to gradually change to organic and permaculture systems given the increasing population pressure on land and shortened fallow periods. What was originally proposed to the government to be the country's second large scale oil palm plantation on the island of Vangunu in the Western Province turned out to be a cover up for a large logging operation.

The main perennial crops planted in Solmon Islands over relatively large areas of land include coconuts, cocoa and palm oil. Plantings of coconuts slowed down since the late 60"s and into the mid 70"s while there has been a steady increase in land conversion for planting of cocoa.

Around 6,000 hectares of oil palm is planted on the grasslands of Guadalcanal Plains by the Guadalcanal Plains Palm Oil Ltd with an additional 500 ha of out-grower plots established in the recent years. The company plans to expand its plantings in the coming years in areas of grassland and secondary forest. Per hectare emission and sequestration levels from oil palm plantations have been determined by the Roundtable on Sustainable Palm Oil 2009 (Fox et al, 2009). The Third National Communication should be able to include assessment of emissions and sequestration levels for the oil palm plantings on the grasslands of Guadalcanal.

2.6.5 GHG Inventory – Waste Sector

2.6.5.1 Introduction

Waste sector in Solomon Islands is one of the sectors that lack regularly compiled activity data on waste generation, composition and management. No comprehensive waste data covering all waste types and treatment techniques are available. Therefore availability and quality of data in the waste sector is not comprehensive and consistent.

There are four main sources of GHGs in the waste sector as follows; (i) Solid Waste Disposal Sites (ii) Wastewater Treatment and Discharge (iii) Biological treatment of Solid Waste and (iv) Incineration and Open Burning of Waste.

Biological treatment of Solid Waste is not practiced in Solomon Islands and is not assessed together with incineration and open burning of waste, due to lack of data. Only Solid Waste Disposal Sites and Wastewater Treatment and Discharge are assessed and reported in this inventory.

2.6.5.2 Solid Waste Disposal Sites

2.6.4.2.1 Methodology

Using the 1996 IPCC Guideline, the IPCC methodology was chosen as the most appropriate method to use in this waste sector GHG inventory. Therefore, waste composition and generation rate (kg/person/day) data were taken from Honiara Waste Characterization Audit Report 2011. The surveys were conducted in Honiara only and the summary of survey data is as follows;

Table 15 Waste generation rate

	Waste generation rate (kg/person/day)
Domestic	0.86
Commercial	0.09

Source: Honiara Waste Characterization Audit Report 2011

Table 16 Waste composition in Honiara

Waste Composition	Weight in %
Organics	94.4
Plastics	1.7
Paper	2.3
Metals	1.3
Textiles	0.1
Others	0.2

Majority of the waste composition comes from pieces of organic materials that could be vital for composting. This was also mentioned in the findings conducted by Sinclair in 1999, Mataki in 2009 that organic waste is the major composition of waste tipped off at the Ranadi Dumpsite.

The considered population of the Solomon Islands for GHG Inventory has been shown in below table.

Table 17 Population in Honiara

Year	2000	2005	2010
Population	466194	538032	559198

Source: http://www.indexmundi.com/g/g.aspx?c=bp&v=21

2.6.4.2.2 Results

Table 18 Summary of GHG emissions from the waste sector (all in Gg)

Year	Total $CO_{2\ eq.}$	SWDS* CH_4	Domestic waste water CH_4	Domestic waste water N_2O
2000	159.7	5.7	1.5	0.027
2005	184.3	6.6	1.7	0.031
2010	191.6	6.9	1.8	0.032

*SWDS – Solid waste disposal sites

2.6.4.2.3 Analysis and Discussions

Emissions from year 2000 – 2010 clearly show an increasing trend. The total annual volume and weight of household wastes disposed to SWDSs is also increasing. This can be attributed to the increasing population over the years and the changing consumption pattern of individuals and households. In the past most of the goods consumed and used by people were biodegradable whereas today imported goods such as plastics and tins, papers and other materials are increasing. This contributes to the increasing amount of waste generated and disposed.

Collection System

Not all the waste generated by the total urban population is collected and disposed to SWDS. Only the capital city of Honiara has a scheduled collection system for residential (household) and commercial areas. However, not all wastes generated in Honiara are collected because only areas with good road access are regularly serviced, and households illegally dump their wastes. Squatter settlements at the outskirts of the town and areas without road access are not included in the collection system with many resorting to burning and dumping at roadsides, bushes and drains. Moreover, squatter settlements are outside of HCC‟s jurisdiction and therefore the latter is not obliged to collect wastes from the former. Other larger provincial urban centres do not have a collection system for residential areas while smaller provincial centres such a Munda in the Western Province has no collection system at all.

Disposal System

Waste collected in Honiara is disposed at the Ranadi open dumpsite and are not separated. In the past, wastes are tipped merely on a large expanse of land and are covered after a few weeks. Since 2008 the dumpsite is with covering of wastes taking place more often. Separation of bulky waste is also now being practiced on site by scavengers. In addition, medical wastes and combustible wastes are burnt often uncontrollably on daily basis. The dump has been used since the 1970s and the total area of the dumpsite is approximately four hectares.

Larger provincial towns have a designated dumpsite where market and commercial wastes are disposed. In 2009, it was estimated that Honiara main market generates about 720 tonnes of wastes (94% arising from organic wastes) on annual basis. Smaller provincial centres often do not have a collection system have their wastes burned, buried or thrown at the sea, river or piled at the backyards or anywhere.

Wastewater Treatment and Disposal Sludge

Some industries remove sludge separately from wastewater and dispose at the landfill. However, there is no appropriate statistics available due to no proper recording. Sludge is therefore not assessed separately in this inventory. Emissions from sludge and wastewater are estimated together.

Uncertainties

Available data used in the inventory cover only certain types and sources of waste. Municipal waste data used mainly include household and commercial wastes. Clinical waste and industrial solid wastes are not covered in the inventory. Volumes of sludge from industries are often disposed at the landfill but not recorded.

2.6.6 Total GHG Emissions (Gg $CO_{2\ eq}$)

Table 19 Total GHG Emissions by Sector

Sector	Gg CO_{2eq}			
	1994	**2000**	**2005**	**2010**
Energy	294	192	235	351
Industrial Processes	NE	-	-	-
Solvents and Other Products Use	NE	NE	NE	NE
Agriculture	NE	70	74	76
Waste	NE	160	184	192
Total GHG Emissions, excl. Removals	**294**	**422**	**493**	**619**

Figure 10 2000 GHG Emissions (Gg $CO_{2\ eq.}$)

2.6.7 General Trends

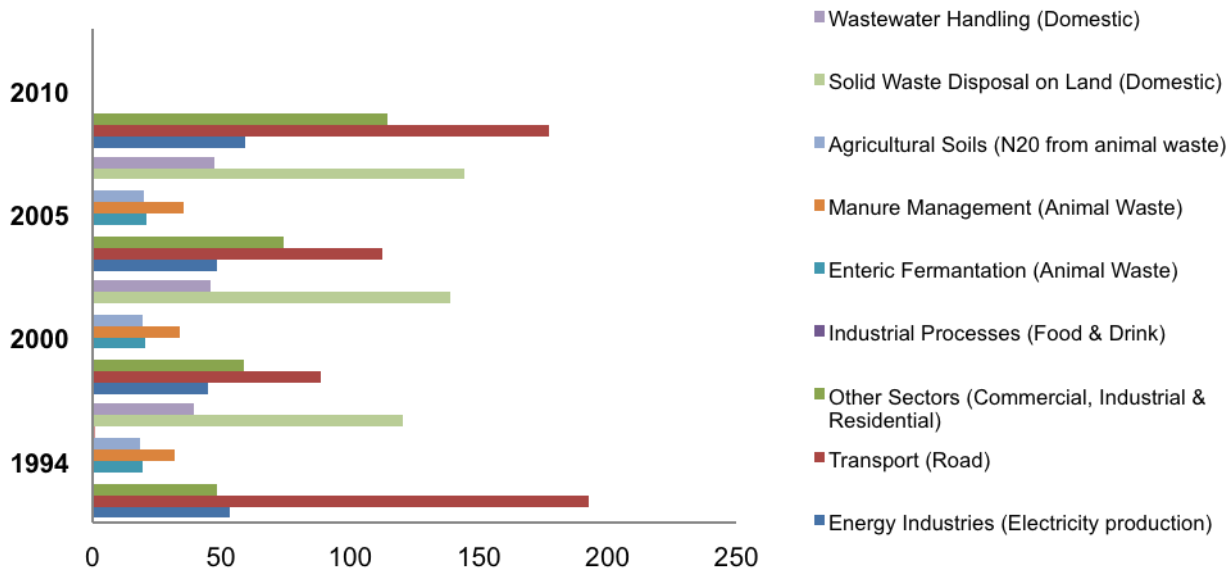
The general trend in $CO_{2\ eq.}$ emission (in below table) shows, from 1994 to 2000 emissions were gradually decreased and then since 2000 to 2010 emissions from all the sectors gradually increased.

Major change came in Energy sector, due to more imported fuel consumption in the energy sector.

Table 20 Category wise total emission (Gg $CO_{2\ eq}$)

GHG Sources & Sinks (Categories/Sub categories)	1994	2000	2005	2010
Energy Industries (Electricity production)	53.26	44.76	48.29	59.41
Transport (Road)	192.8	88.68	112.59	176.91
Other Sectors (Commercial, Industrial & Residential)	48.33	58.78	74.15	114.32
Industrial Processes (Food & Drink)	NE	0.00	0.00	0.00
Enteric Fermentation (Animal Waste)	NE	19.61	20.39	20.96
Manure Management (Animal Waste)	NE	32.09	33.83	35.36
Agricultural Soils (N20 from animal waste)	NE	18.65	19.44	20.07
Solid Waste Disposal on Land (Domestic)	NE	120.22	138.75	144.21
Wastewater Handling (Domestic)	NE	39.49	45.58	47.37
Total GHG Emissions, excl. Removals	**294.38**	**422.28**	**493.02**	**618.61**

Figure 11 Category wise trend in GHG emissions (in Gg $CO_{2\ eq.}$)



As discussed earlier the emissions from managed forest is expected to decrease in the coming decades as the total area of merchantable forest and total volume of log exports will decline.

Trends in GHG emissions from the energy sector is predicted to rise after 2015 when a number of large scale mining and plantation industries enter the economy, however total per capita GHG emissions without LUCF will still be relatively insignificant in terms of the global emissions scenario.

2.7 Conclusion and Recommendations

The GHG inventory was limited in scope with high uncertainty levels particularly in the Energy, Agriculture and Waste Sectors. The inventory revealed a relatively low level of emission in the agriculture sector but a worrying rise in emission from the energy and waste, respectively. Due to limited data emissions from crop land was not estimated. This is potentially a high emission sub-category given the widespread use of shifting agriculture system in the country. Emissions from the waste sector were not well assessed and will need to be addressed in the next communications. Solomon Islands has few major industries in the agriculture, food and beverage production sector however emissions from Industrial Process, (Only Food & Drink) has been assessed due to limited data availability (which give only less amount of NMVOC emission). LULUCF, Solvent, Industrial Products and Product Use were not carried out, due to high uncertainility/unavailability of specific data. A decision will need to be taken in the future on whether to focus resources in this sector given the potentially high/low emission levels anticipated. A number of recommendations are presented below to guide and prepare for future GHG inventory work:

i) Review and revise Petroleum Act to provide stronger powers for the Energy Division to obtain and demand information on energy supply and use in the country particularly from industries and businesses

ii) The Energy Division to ensure on-going gathering of data and information that can inform a top-down as well as bottom-up GHG inventory process

iii) Strengthen capacity of the Climate Change Division to plan and coordinate future GHG Inventory work in Solomon Islands including archiving of data and information

iv) Strengthen capacity of the Ministry of Forestry to undertake carbon assessments in forests

v) Strengthen the capacity of land use, land use change and forectry sector specific surveys, data collection, analysis and management for future inventories.

vi) Strengthen research capacity within Forestry Division, MAL, Water Resources Division and related NGOs and institutions to support national GHG inventory work.

vii) Establish centralize data base management system, which will timely procure, store and manage all relevant data from all the applicable categories in the country.

viii) Undertake a detailed national survey on use of fuel wood, livestock, population, waste and industrial process and their resources consumption (in respect to GHG emissions)

ix) Strengthen capacity of the Environmental Health Division within MHMS, Environment Division of MECDM and Honiara City Council to conduct regular waste characterization studies and assess performance of landfills.

CHAPTER 3

VULNERABILITY AND ADAPTATION ASSESSMENT

3.1 Introduction

The findings presented in this component of the SNC report are the outcome of;

i) Reviews of literature on climate change, vulnerability and adaptation assessment, disaster risk reduction, Solomon Islands development issues,

ii) Review of the NAPA

iii) Summarising V&A assessments carried out during and prior to the SNC project and after the INC

iv) V&A consultations carried out in Solomon Islands and meetings with a range of key informants.

The V&A component for the SNC began with training activities on the science of climate change and how to conduct V&A assessments. A number of the Thematic Working Group members had been involved in the development of the NAPA so it was a good continuation and reinforcing of knowledge and skills developed during the compilation of the NAPA. At the time of developing this V&A component a number of new V&A projects had begun in the country and developing a good critical mass of V&A practitioners. The V&A team undertook a review of past V&A work in the country including those commissioned as part of other sectoral studies and not specifically targeting climate change e.g. agriculture and livelihood assessments, ecosystem assessments, water supply and demand assessments. The findings of the V&A reviews and assessments were presented to the V&A and SNC team in workshops and in a retreat where there was the opportunity for revisions. The SNC project also purchased the SIMCLIM software but had difficulties using it to generate scenarios for various islands and provinces in the country. This remains an on-going challenge.

The approach taken for the V&A component included;

i) Describing current and future climate change projections and trends

ii) Review of climate change vulnerability and adaptation reporting

iii) V&A and DRR Assessment work carried out in Solomon Islands over the recent years

iv) Overview of exposed and vulnerable geographic areas in the country

v) Risk assessment and adaptation planning

vi) Progress in planning and implementing disaster risk reduction and adaptation actions

vii) Challenges, opportunities and lessons learned

viii) Vulnerability case studies

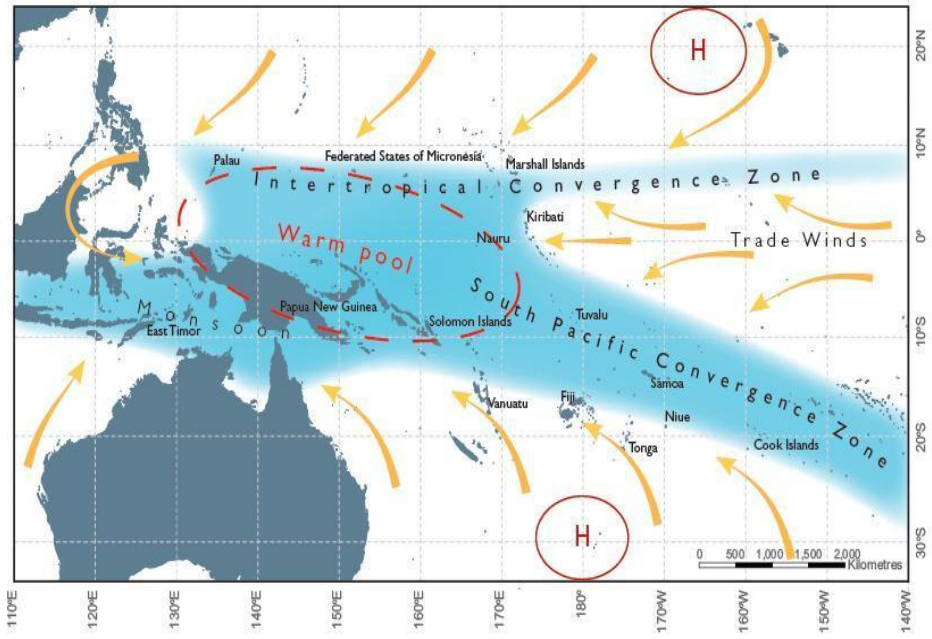
ix) Summary of potential adaptation projects

3.2 Climate Projections

A range of global climate models and projections have been generated by the IPCC and other international scientific organizations however much work needs to be done to downscale the models and projections to the national level. With the support of the WMO and the Australian Bureau of Meteorology the SIMS has been gathering weather data since the 1950"s at five locations in the country. This has been complemented by a number of voluntary recording stations with some providing data going back to the early 1900"s. Analysis of data collected so far show increasing trends in temperature and sea level rise. If these trends continue, then these will be in line with IPCC projections for the Pacific region. Rainfall trends vary for different parts of the country due to geographic and climatic factors.

The inter annual climate of Solomon Islands is basically driven by natural drivers (Figure x)such as the Inter-Tropical Convergence Zone (ITCZ), the South Pacific Convergence Zone (SPCZ), the West Monsoon and the El Nino Southern Oscillation (ENSO). The wet season is generally driven by the ITCZ and the West Monsoon resulting in strong northwestly winds and seas affecting mostly the northern part of the country. Associated heavy and long rainfall periods usually influence agriculture activities in the northern parts of the country during this time. The SPCZ typically drives the weather and the climate of the southern part of Solomon Islands during the dry season where strong southeast trades brings onshore heavy rainfall that disturbs agricultural activities as well.

Figure 12 Average positions of the climate drivers during wet season



Note:

- Arrows – directions of near surface winds;
- blue band shade-bands of rainfall convergence zone;
- dashed red oval – West Pacific Warm Pool;
- H – typical positions of moving high pressure systems

Source: www.pacificclimatechangescience.org

During an El Nino ocean surface waters over the western Pacific (including Solomon Islands) are usually cooler than normal and warmer than normal from central to eastern of the Pacific. Hence, in most cases, prolonged dry periods could escalate from meteorological drought to agricultural drought in the western Pacific. Solomon Islands experiences drought conditions during El Nino events such as that occurring in 1997 causing water shortages on many islands. The divergence results in nutrient rich waters rising to the ocean surface in the eastern Pacific causing outbreaks in plankton growth which is followed by tuna stocks.

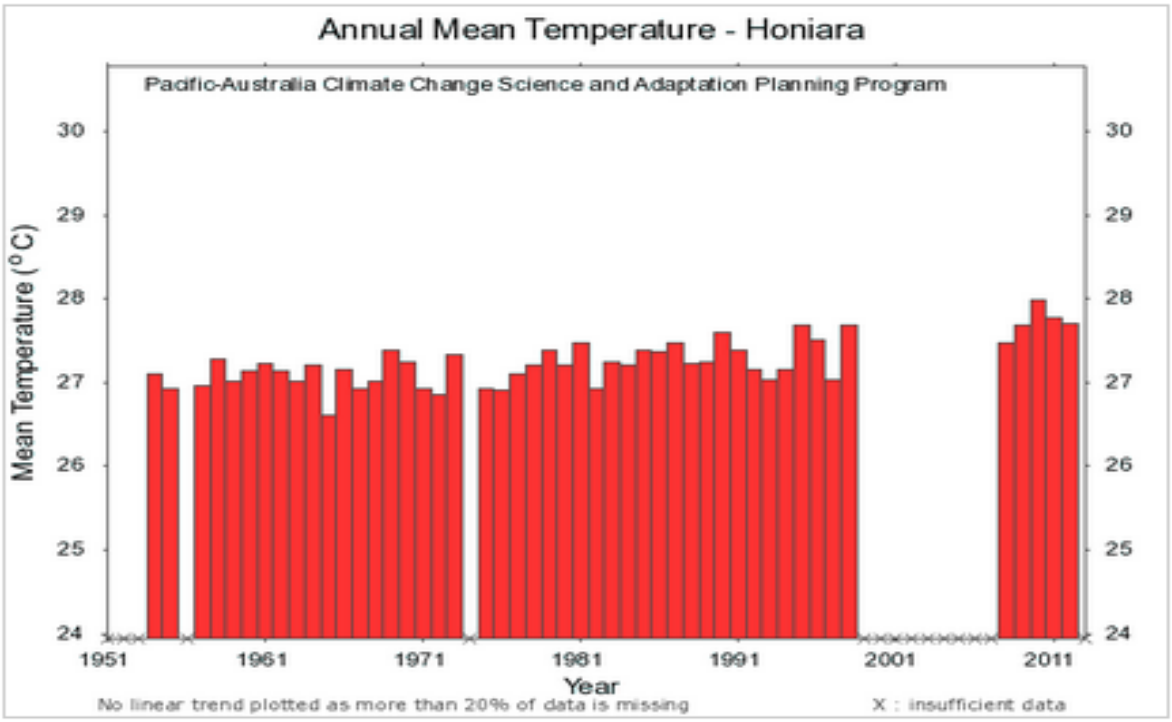
During a La Nina event the opposite seems to happen, where waters over the western Pacific (including Solomon Islands) are warmer than normal hence causing more cloud formation resulting in prolonged and high rainfall periods. Cyclones and high rainfall events are associated with the La Nina periods in the western Pacific. The future of ENSO events is still not clear but it is expected that it will continue to be an important driver of Pacific Islands climate into the future.

3.2.1 Temperatures

Records of temperature across the country over the past decades show an increasing trend. This is consistent with observations shared by women and farmers on Choiseul (MECDM Climate Change Consultations, 2010) and Malaita (SI Red Cross, 2010).

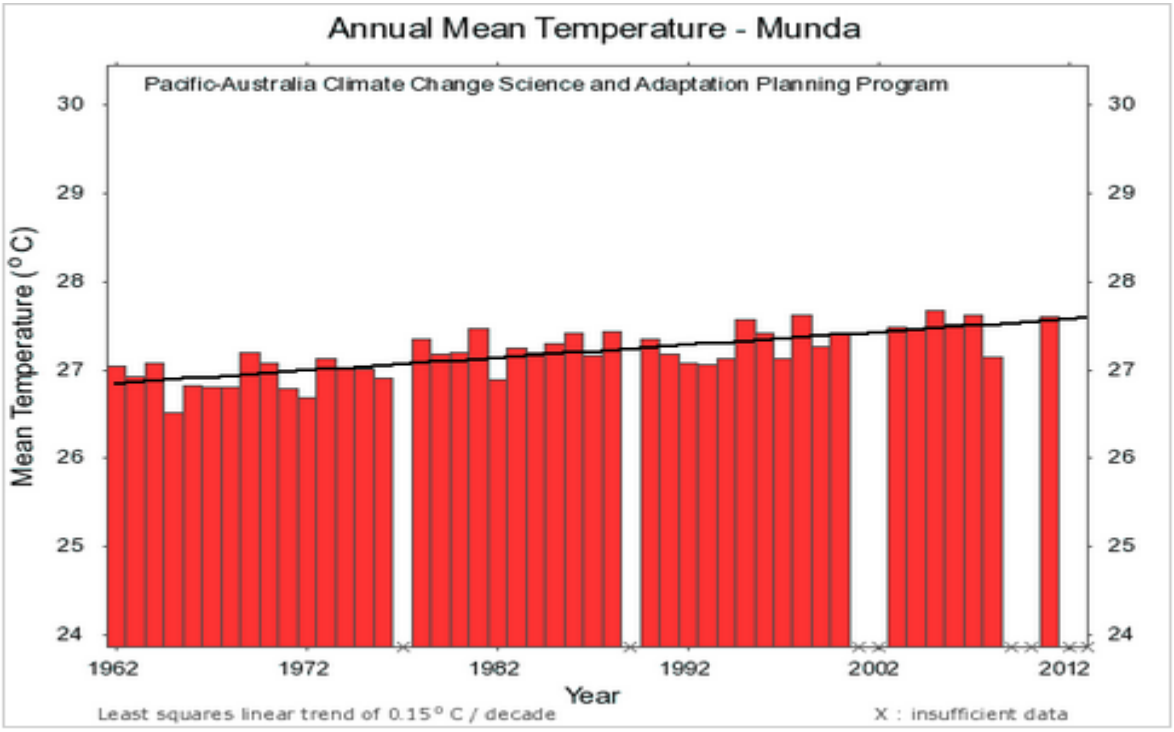
According to the Solomon Islands meteorological data, Annual surface temperature for the western, central and eastern regions of Solomon Islands has shown an increasing trend during the last 30 to 50 years (Figures x1-x3). The range of increase in mean air temperature for most provinces is between 0.14ºC and 0.17ºC/decade.

Figure 13 Annual temperature for Honiara (central region), 1951 – 2011



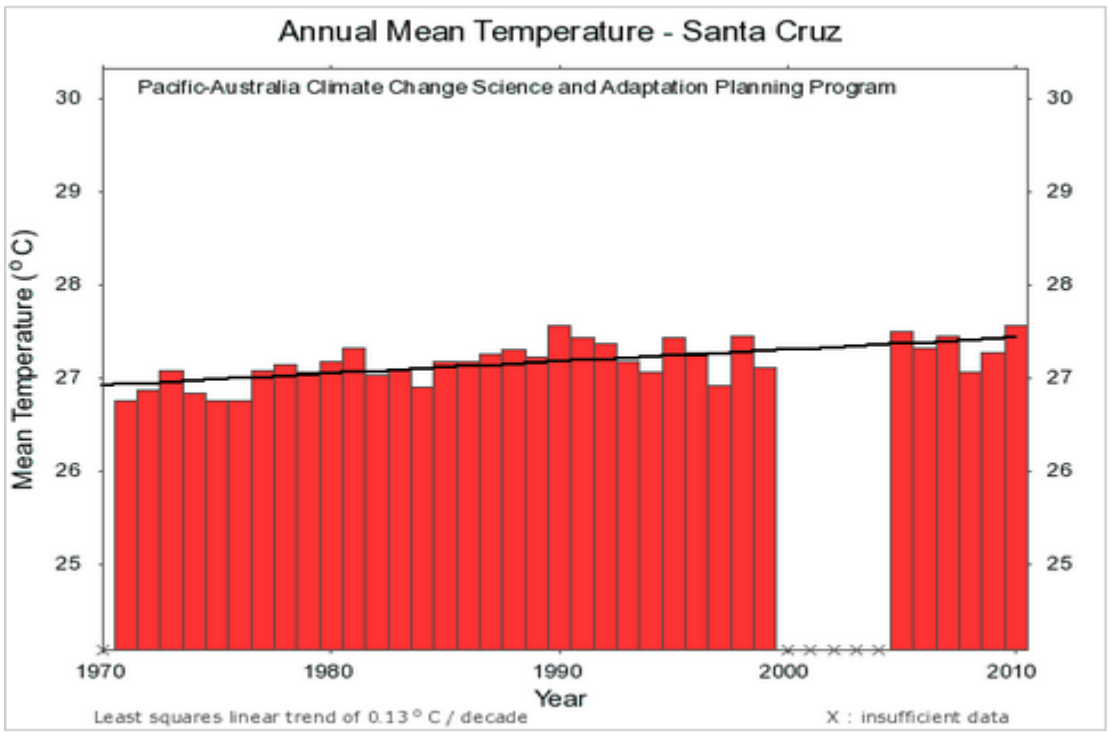
Source: http://www.bom.gov.au

Figure 14 Annual temperature for Munda Western Province (western region), 1962 – 2012



Source: http://www.bom.gov.au

Figure 15 Annual temperature for Lata, Temotu Province (eastern region), 1970 – 2010



Source: http://www.bom.gov.au

According to global projections in the latest IPCC Report (AR4, 2007), surface air temperature for all small island states will increase. Latest regional studies had also shown that the air temperature in the Pacific region including Solomon Islands will continue to rise.

One such study is the latest study carried out by the Pacific Climate Change Scientific Programme (PCCSP, 2011) under Australian Government support through its scientific institutions (CSIRO, BoM, and others) for all the Pacific island countries. In this study, projections for future temperatures and rainfall for individual countries in the Pacific were developed based on eighteen Global Climate Models (GCMs). Table 21 summarizes the projected future annual temperature changes for Solomon Islands

Table 21 Projected future annual temperature changes for Solomon Islands

Projected annual air temperature changes for Solomon Islands (for three emission scenarios and three time periods. Values represent 90% of the range of the models and changes are relative to the average of the period 1980 -1999)			
Scenario	**2030 (°C)**	**2055 (°C)**	**2090 (°C)**
Low emissions scenario	0.2-1.0	0.7-1.5	0.9-2.1
Medium emissions scenario	0.4-1.2	0.9-1.9	1.5-3.1
High emissions scenario	0.4-1.0	1.0-1.8	2.1-3.3

Source: www.pacificclimatechangescience.org

According to this study, it has been projected that annual surface temperature will continue to increase under all emission scenarios (Low, Medium & High) for the three time periods, 2030, 2055 and 2090.

Other studies[3] (Leisz, 2009; Hay et al, 2003; and Hoegh-Guldberg & Bruno, 2010) had developed projections for future land surface and sea surface temperatures (Table 22 and Figure 16).

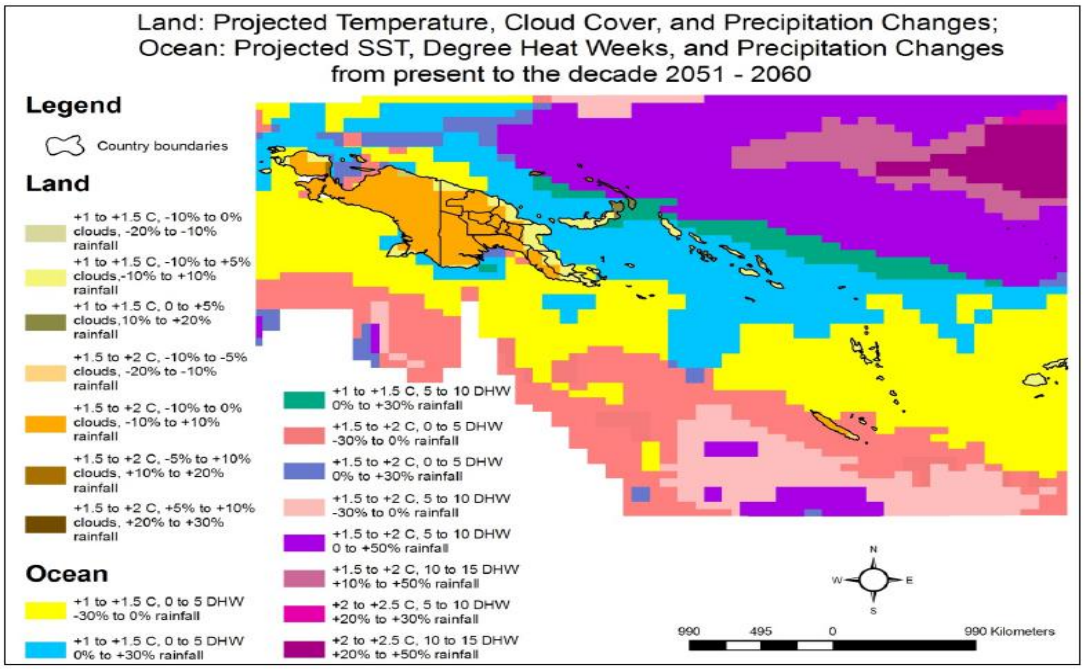
Table 22 Past Trend and Future Projections for Temperature

Projected Changes	**Source**
Higher in Pacific than other regions (0.6 - 0.8˚C warmer)	Hay et al. (2003)
Approximately .2˚C hotter over the last 40-50 years for islands of Malaita, Guadalcanal, Makira and Choiseul	Solomon Islands Meteorological Services
Western and Temotu Provinces show little increase in Temperatures	
Increase of 2.0 and 2.8°C by 2050 compared to 1990	Tompkins et al. (2005)
Increase of 3.1 and 4.3°C. by 2080 compared to 1990	

Note: Global projections for the Pacific region are in line with trends observed by the SIMS

[3] Study "Locations In Melanesia Most Vulnerable To Climate Change, 2009" conducted by Stephen J. Leisz, Colorado State University.

Figure 16 Projections from current decade to 2051-2060 (Leisz, 2009)



Note: Projections show Land Temperatures in Solomon Islands rising by 1-1.5˚C and -20% to 10% rainfall. Oceans will have -30% - 0 rainfall

3.2.2 Sea Surface Temperatures (SST)

Table 23 Global trends for SST

Projected Changes	Source
Increase by 0.4 – 0.6˚C between (1911-1920) and (1981-1990)	Hay et al (2003)
Increase of 0.2˚C in the last 40-60 years	Hoegh-Guldberg & Bruno, 2010
Increase of 2 – 2.5˚C by 2080 but islands in the middle of the chain (Guadalcanal, Malaita, Isabel) will have lower rates of increase	Leisz (2009)

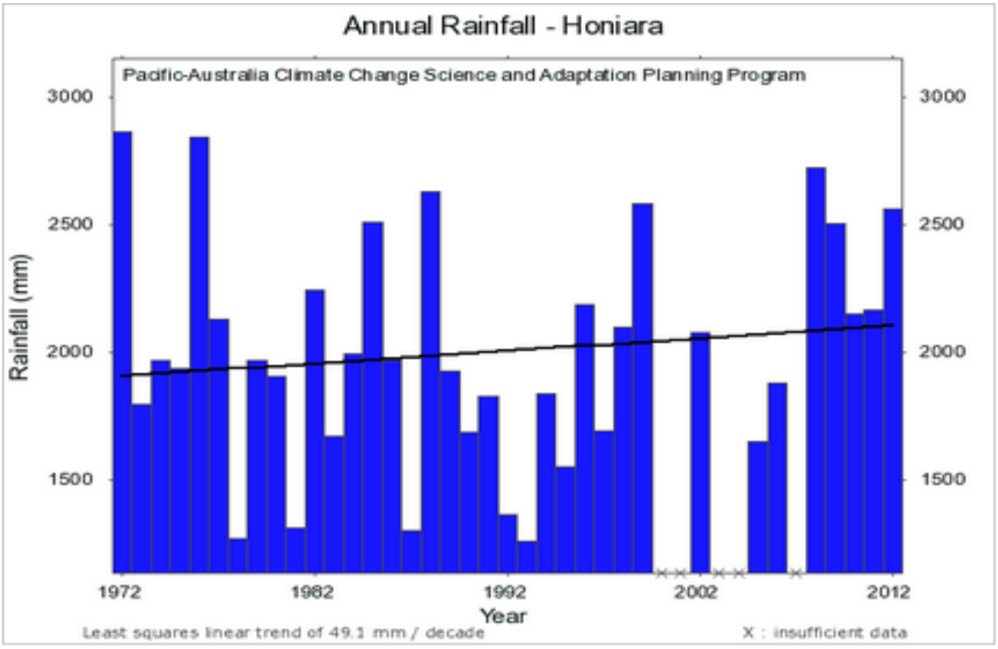
Land Temperature (Figure 16) and SST (Table 23) are all projected to increase in the next 30 -70 years in Solomon Islands. These studies results are all consistent with the projected temperature changes for the South Pacific region.

3.2.3 Rainfall

Data analysed to date shows no clear indication on the tendency of the annual rainfall for the whole country. Data gaps make difficult the construction of linear relationships between all stations. As seen (Figures 18 –20) below annual rainfall in the three regions (western, eastern and western Solomon Islands) is mostly varied mainly due to the geography of the

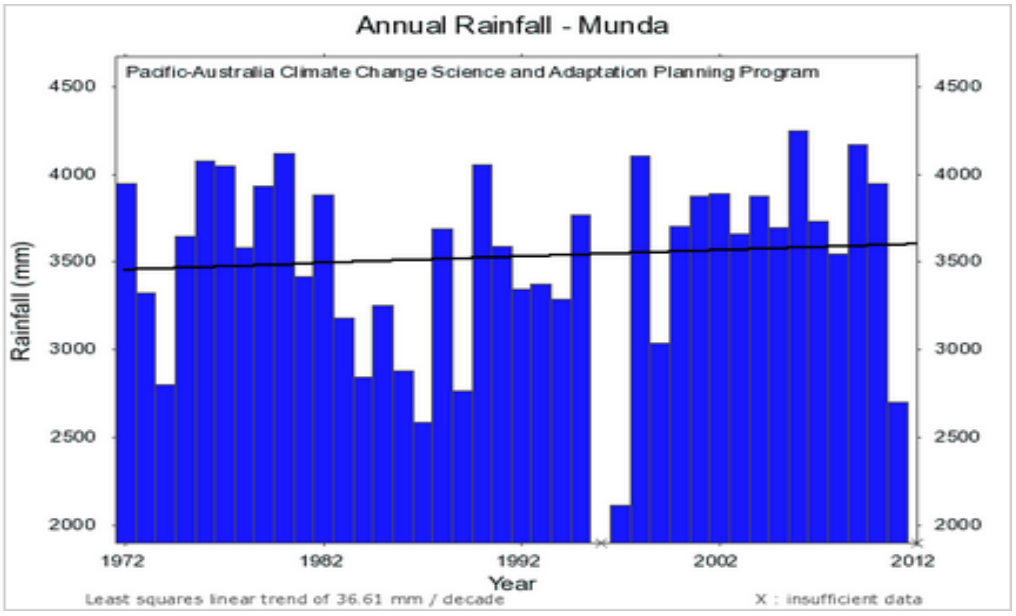
different islands, their relative position with each other, the direction and duration of prevailing winds and drivers of climate in the Pacific. However, it can be clearly seen that there were sharp declines around mid-1990s for all the three regions. These declines correlated with the severe El Nino event between 1997 and 1998 that affected most parts of the country. The general trends however show that in the central region (Figure 18) there was a decrease in rainfall and a slight increase for the western and eastern region (Figure 19 & 20) in the past 30 – 50 years.

Figure 17 Annual rainfall trend for Honiara (central region), 1972-2012



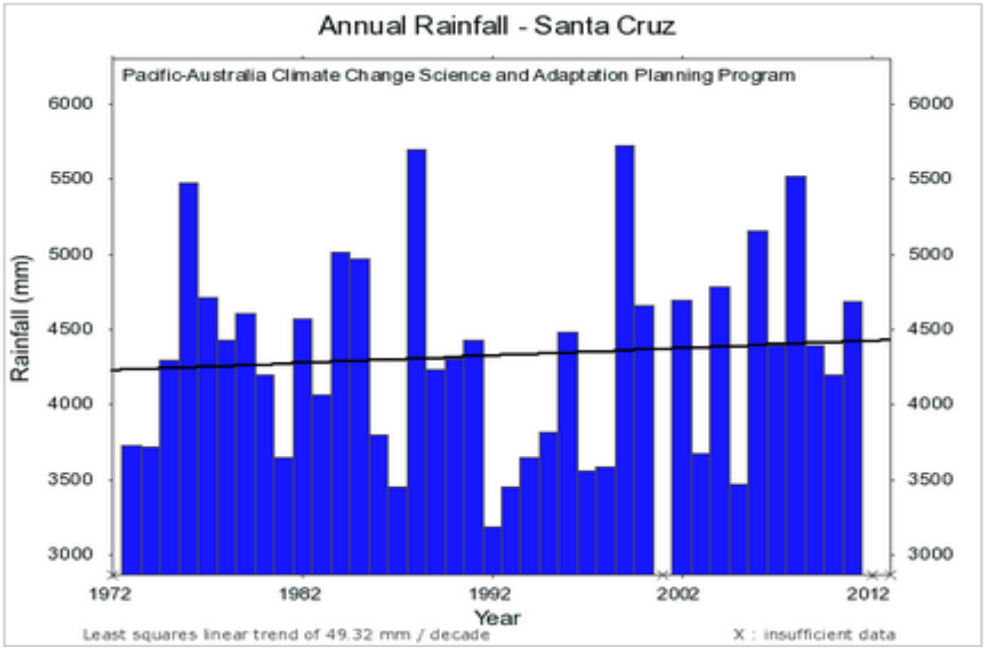
Source: http://www.bom.gov.au

Figure 18 Annual rainfall trend for Munda, Western Province (central region), 1972-2012



Source: http://www.bom.gov.au

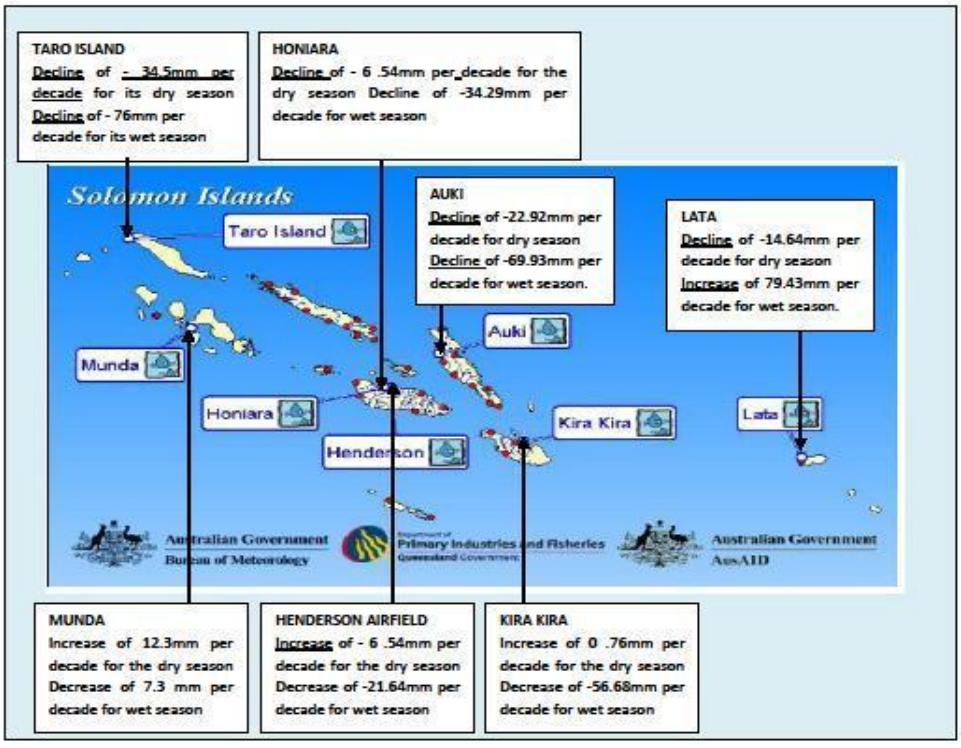
Figure 19 Annual rainfall trend for Santa Cruz (eastern region), 1972-2012



Source: http://www.bom.gov.au

Rainfall trends for other stations within the country are summarised in Figure 21 below.

Figure 20 Rainfall trends recorded by weather stations across the country



Source: SIMS (SCOPIC Project)

As shown in Figure 21 rainfall trends for the two seasons (wet and dry) in Solomon Islands recorded at a number of weather stations shows varying behaviour due to the geography of

the different islands, their relative position with each other, the direction and duration of prevailing winds and drivers of climate in the Pacific. The observed rainfall trend has implications on future vulnerability projections that will require appropriate adaptation actions in various parts of the country:

- Rainfall trends in the area around the capital city of Honiara are showing a general decline per decade while the population is growing at a rate of approximately 6% per annum. To ensure adequate water supply for the growing population of the city a robust and well enforced Integrated Water Resource Management strategy and programme needs to be put in place. Conservation and effective management of the forests surrounding Honiara is essential and increasing numbers of bore holes will need to be established over the coming years to supplement the Kongulae water source in the longer term.

- In other reviews for rainfall in Honiara (Manton et al. 2001), the proportion of annual rainfall from extreme rainfall has increased significantly. The continuation of this trend could result in longer drought periods in the dry season and more severe flood events in the rainy season. In 2009 flooding destroyed infrastructure in West Guadalcanal and lives were lost. The rainfall of 251.8mm recorded for Honiara weather station within twelve hours during the night of the flooding was the highest daily rainfall ever recorded for Honiara in its 30 year record. (MECDM)
    - Auki town in Malaita province is recording a decline in rainfall for both the dry and wet seasons. Measures recommended for Honiara will need to be put in place in Auki as well.

    - Taro Island headquarters of Choiseul Province is showing similar trends to Auki. The plan to relocate the provincial headquarters and town from Taro Island to the mainland area of Choiseul Bay is also a good adaptation strategy that needs to be complemented with an Integrated Water Resource Management strategy and programme.

3.2.4 Sea Level Rise

The report of the IPCC Working Group II (Climate Change 2007: Impacts, Vulnerability and Adaptation provides a number of important policy messages on future climate impacts on coastal systems and low lying areas with very high confidence that „coasts will be exposed to increasing risks, including erosion, over coming decades due to climate change and sea-level rise" (Climate Change 2007, pp 317).

According to Hoegh-Guldberg & Bruno (2010), satellite altimetry readings indicate that Solomon Islands is experiencing the high end of global sea-level rise (Figure 21) at a rate of 8-10 mm per year. This observed phenomenon is already being experienced by people in various locations in the country e.g. Ontong Java atoll (NDMO, MECDM 2009) and the outer Reef Islands (Solomon Islands Red Cross (2011)

Table 24 Global and National Trends in Sea Level Rise

Projected Changes	Source
Global average of 3.3mm ± 0.4mm per year (satellite altimeter data)	Cazenave & Llovel, 2010
0.5 – 1.4 meters by 2100	Rahmstorf 2007, Cazenave & Llovel, 2010

Figure 21 Average rate of global sea level rise (1993–2010) from TOPEX/Poseidon and Jason satellite altimetry data, showing Solomon Islands in the zone of higher sea level rise (Hoegh-Guldberg & Bruno 2010)

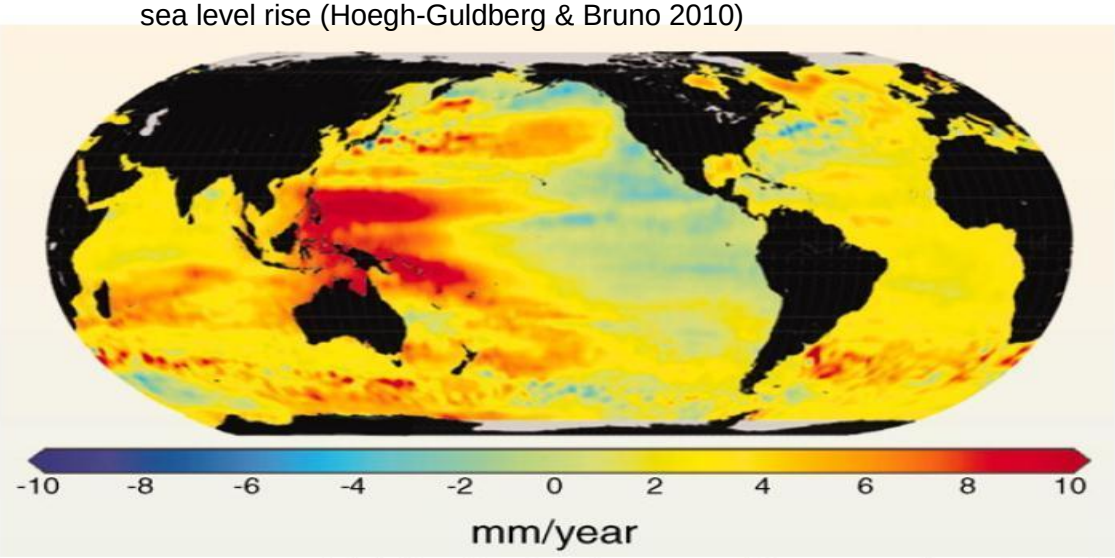
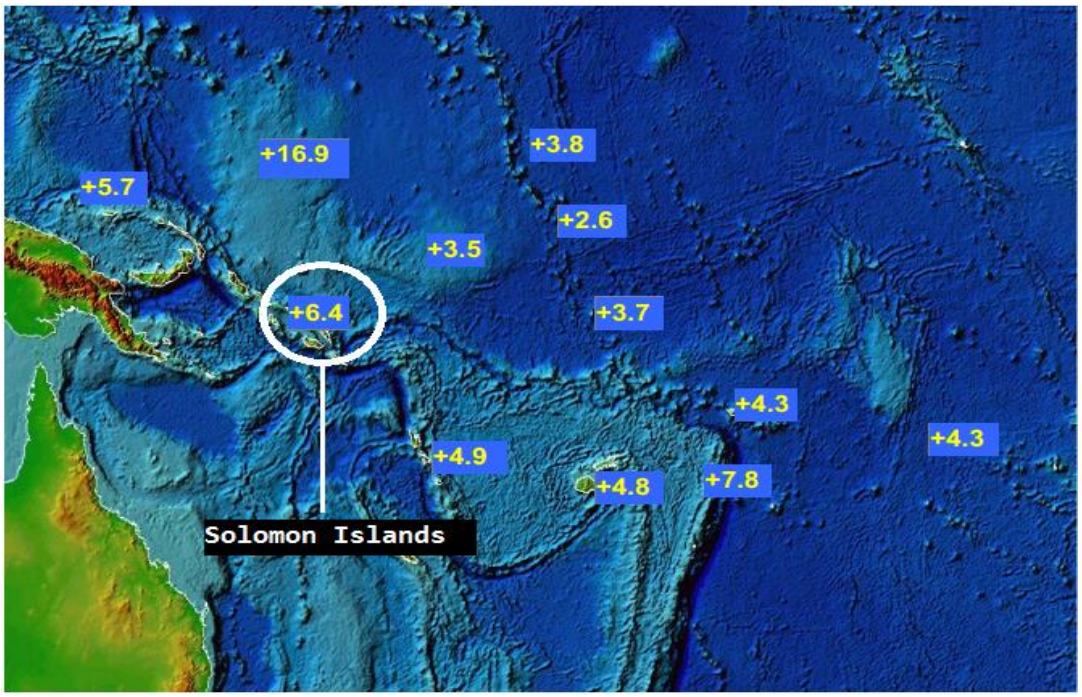


Figure 22 Recordings of Sea Level Rise in the Pacific Solomon Islands



Source: http://www.bom.gov.au/ntc/IDO60031/IDO60031.2010.pdf

The image in Figure 22 was obtained from the South Pacific Sea Level and Climate Monitoring Project (SPSLCMP; "Pacific Project") shows sea-level readings from various Pacific countries and the relatively high levels for Solomon Islands.
Accurate sea level/tidal readings began in Solomon Islands during 1994 with the instalment of the South Pacific region, a SEAFRAME (Sea Level Fine Resolution Acoustic Measuring Equipment) gauge was installed in Honiara, Solomon Islands in July 1994. (http://www.bom.gov.au/pacificsealevel/picreports.shtml).

Figure 22 shows, net relative sea level trends (in mm/year) after subtracting the effects of the vertical movement of the platform and the inverse barometric pressure effect, utilising all the data collected since the start of the project up to the end of December 2010.

3.2.5 Extreme Events

Tropical Cyclones

Tropical cyclones pose a serious threat to the people, economy and environment and result in flooding and wind damage in the Solomon Islands. There have been severe floods on Guadalcanal, Malaita, Makira and Santa Isabel in recent years with a number of lives lost, and severe damage to agriculture and Infrastructure.

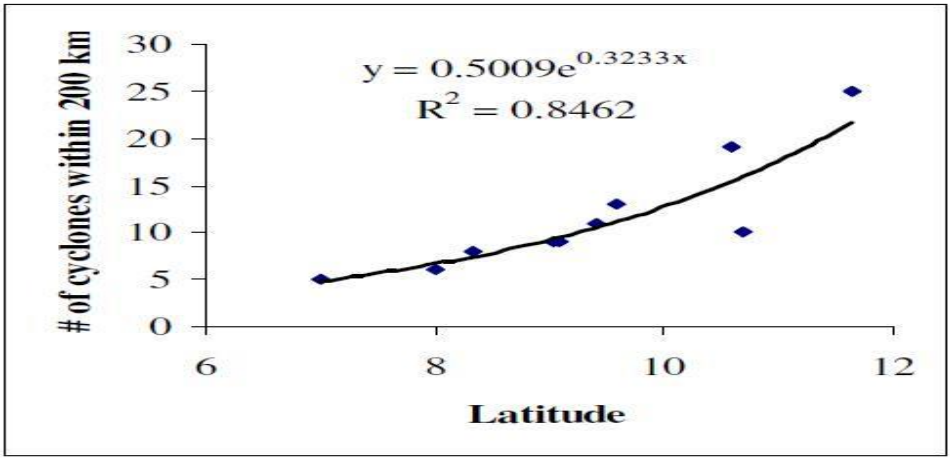
The IPCCC FAR predicts that cyclones will intensify into the future although their frequency may not increase. In 2002 the remote island of Tikopia was hit by a Category 5 cyclone Zoe, the most intense ever recorded in the Pacific.

Table 25 Number of cyclones in vicinity of the Solomon Islands' provinces between 1969-2007 (Data is relative to a point in the middle of each province)

Province	Latitude	Longitude		Number of cyclones within	
	(^{0}S)	(^{0}E)	50 km	100 km	200km
Choisuel	7	156.9	1	1	5
Isabel	8	159	3	3	6
Western	8.33	157.27	0	1	8
Central	9.1	160.15	2	5	9
Malaita	9.05	161	1	4	9
Temotu	10.7	165.8	0	3	10
Guadalcanal	9.6	160.15	2	6	13
Makira - Ulawa	10.6	161.8	2	10	19
Rennell - Bellona	11.65	160.3	5	12	25

Source: World Fish 2011

Figure 23 Correlation of frequency of cyclones with latitude



Source: World Fish 2011

Figure 23 shows the correlation between the numbers of tropical cyclones within 200 km (1969-2007) to the latitude of Solomon Islands' provinces.

The frequency of cyclones grows exponentially with latitude with the southernmost provinces the most cyclone-prone (Table 25; Figure 23).

The recent review by the draft World Fish report (World Fish, 2011) on trends of cyclones in the Pacific has the following summary:

- The dissipation force of a cyclone is correlated to SST and will probably increase with increasing sea surface temperature. (Emanuel 2005)

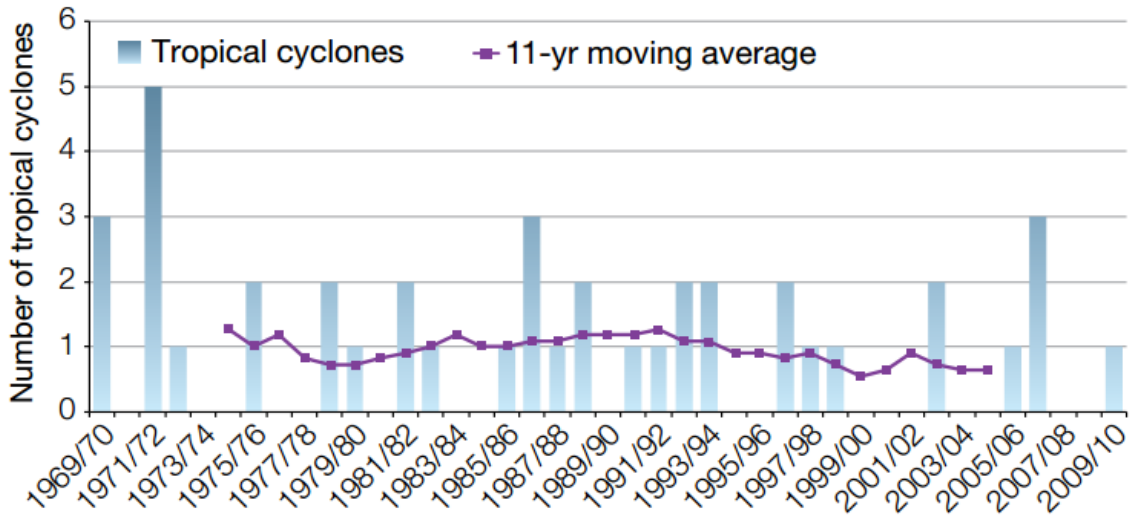
- Number of high intensity cyclones (categories 4 and 5) in the Western north Pacific has gone up in the last 30 years (Webster et al. 2005) and will continue increasing regardless of a general decrease in cyclone frequency (Oouchi et al. 2006, Knutson et al. 2010).

- A recent study, has shown that for the South Pacific region there is no significant trend in cyclone frequency nor intensity (Kuleshov et al. 2010)

- Records of cyclones compiled by the NDMO indicate a gradual shift in the location of cyclones from Northern parts of the country (i.e. north of the capital city of Honiara) towards the South-eastern parts of the country. Cyclones in the early 1900‟s to the 1950‟s caused destructive winds and damages to sites at Ontong Java atoll, the northernmost part of the country.

Tropical cyclones affect the Solomon Islands between November and April. In the 41-year period between 1969 and 2010, 41 tropical cyclones passed within 400 km of Honiara, an average of one cyclone per season (Figure 24). The number of cyclones varies widely from year to year, with none in some seasons but up to five in others. Over the period 1969–2010, cyclones occured more frequently in El Niño years.

Figure 24 Number of tropical cyclones passing within 400 km of Honiara



Source:http://www.pacificclimatechangescience.org/wpcontent/uploads/2013/06/13_PCCSP_Solomon_Islands_8pp.pdf

On a global scale, the projections indicate there is likely to be a decrease in the number of tropical cyclones by the end of the 21st century. But there is likely to be an increase in the average maximum wind speed of cyclones by between 2% and 11% and an increase in rainfall intensity of about 20% within 100 km of the cyclone centre.

In the Solomon Islands' region, projections tend to show a decrease in the frequency of

tropical cyclones by the late 21st century and an increase in the proportion of the more intense storms.

As per Pacific Climate Change Sciene Progarm (Australian Government), by the end of this century projections suggest decreasing numbers of tropical cyclones but a possible shift towards more intense categories.

Drought

Solomon Islands is vulnerable to droughts and many parts of the country have been affected many times over the past years. Droughts are usually associated with the El Nino phenomenon. The 1997/98 El Nino caused severe drought conditions in many parts of the country. Many food gardens were affected and the government and donors through the NDMO distributed food supplies to affected areas. One of the major prolonged droughts occurred in the eastern part of the country in the Temotu province in 2004 causing food and water shortages.

Extreme Rainfall and Flooding

Intense and prolonged rainfall continues to be a major problem in the country affecting various sectors and ecosystems. Such heavy rainfall caused severe flooding and landslides in Guadalcanal, Central Islands, Western, Malaita and Makira in 2008. In 2010, another bout of flooding in West Guadalcanal resulted in the deaths of nine people and caused extensive damages to infrastructure, agriculture, health and education facilities worth tens of millions of dollars. A recent example is the flooding incident that occurred on west Guadalcanal early this year that devastated several villages and killing nine people. The rainfall recorded for Honiara weather station within twelve hours during the night of the flooding was the highest daily rainfall ever recorded for Honiara in its 30 years record (standing at 251.8mm). Another major problem associated with extremely high rainfall or prolonged rainfall periods is the big decline in the yields of sweet potato, the main staple crop in rural areas, due to increased vegetative growth and less growth of tubers. On numerous occasions the NDMO has had to supply food to areas of high and prolonged rainfall in the windward areas of the bigger islands.

King Tides and Sea Level Rise

Flooding can also occur as a result of a combination of factors, including king tides, areas associated with low atmospheric pressure, and rising sea levels[4]. When these factors are combined with heavy rainfall, coastal flooding and inundation can result, as occurred in December 2008 across areas of the Pacific, including parts of the Solomon Islands.

In 2008 king tides struck northern Choiseul, Ontong Java and other parts of the country. These came in the form of high swells never before experienced in the islands. The tides caused more coastal erosion, considerable damage to coral reefs, coastal inundation, pollution of water sources, damage to coastal infrastructures and formation of new land forms.

Many coastal communities have experienced the loss or erosion of their coastal areas by rising tides with the loss of properties including coconut stands and taro plots, houses, cultural properties such as grave yards, and land in general. In the communities of the Western province where the 2007 earthquake and Tsunami occurred, islands subsided and have now put an increase part of their land at the mercy of rising tides. Today more of their

[4] GFDRR, 2011. Solomon Islands Climate Change and Disaster Risk Profile.

coastal areas are being exposed to effects of rising tides.

King tides bring unusually high water levels, and they can cause local tidal flooding. Over time, sea level rise is raising the height of tidal systems. Average daily water levels are rising along with the oceans. As a result, high tides are reaching higher and extending further inland than in the past. King tides preview how sea level rise will affect coastal places. As time goes by, the water level reached now during a king tide will be the water level reached at high tide on an average day.

King tides provide a glimpse of future everyday water levels, and they are a way to communicate local sea level rise impacts over long time periods. Low-lying shoreline development is at increased risk of flooding because of rising seas, and public investments in infrastructure, housing, and habitat restoration projects are often expected to last for decades. Highlighting king tides at decision can raise awareness of potential sea level rise impacts and identify flood-prone locations. The increased understanding of how sea level rise will impact local resources is valuable information for decision-makers.

Sea level rise will make today's king tides become the future's everyday tides[5].

[5] http://www2.epa.gov/cre/king-tides-and-climate-change

3.3 Climate change vulnerability and adaptation reporting

The first vulnerability and adaptation report by the government was through the country‟s INC to the UNFCCC. The report was based on limited national data sets, information at hand and qualitative assessments. The report recognized the limited understanding on the vulnerability of the country to climate change and sea level rise and the need to put in place „suitable plans, policies and measures‟. Priority vulnerable areas identified included; 1) Subsistence and Commercial Agriculture, 2) Human Health, 3) Coastal Environments and Systems, 4) Water Resources, 5) Marine Resources (Solomon Islands Government, 1994). The report also highlighted the need to monitor and improve the nation‟s socio-economic situation and that future V&A work needs to be cognizant of the nation‟s socio-economic context and trends. Much of the sectoral adaptation measures recommended in the INC are maintained in this SNC. The INC V&A report presented „adaptation response strategies‟, a number of which have been recently implemented (see Table 26).

Table 26 Adaptation Strategies Recommended in the INC and Measures taken to date

Recommended Adaptation Strategies	Measures taken to date
National Policy Framework	
1. Develop a sustainable land management plan	Draft National Action Plan (NAP) to address Land Management completed
2. Develop an Integrated Coastal Zone Management plan	Ridge to reef conservation planning introduced by TNC in Choiseul Province
3. Develop a Fisheries Management Plan	National Fisheries Management Plan and strategy in place National Tuna Management Plan completed Marine protected areas and Locally Managed Marine Areas network established
4. Undertake effective environmental and social impact assessments	EIA Act in place but no work on social impact assessments has started.
Capacity building and Institutional Strengthening	
1. Establishment of a National Climate Change Unit	Climate Change Division established as part of the Ministry of Environment, Climate Change and Meteorology in 2009
2. Strengthen capacity of institutions involved in implementing adaptation measures	Range of capacity building activities implemented across a range of stakeholders over the years since the INC
Public Awareness and Education	
1. Raise awareness of the public about climate change	A range of public awareness programs have been conducted in the capital, provincial headquarters and communities however more work needs to be done in this area.
2. Ensure community and public participation in climate change programs and actions	Community-based V&A assessments and participatory consultations have been undertaken and needs scaling up.

Since the INC a number of V&A and DRR Assessments have been undertaken over the recent years and are documented in this SNC report. These are varied in methods used and the extent of scientific investigations and can be found in a range of reports and studies. Table 27 below summarizes some of the V&A work carried out in the past.

Table 27 V&A and DRR Assessment work carried out in Solomon Islands over the recent years

Climate Risks	Scope/sectors	Location	Organization	Period
Extreme high rainfall	Food security/agriculture	Central Malaita	KGA	2007
		Weather coast of Guadalcanal	KGA	2007
		Weather coast of Makira	KGA	2007
Sea level rise, low rainfall		Lau lagoon	SI Red Cross	2010
Sea level rise	Food security Coastal infrastructure Water	Ontong Java Atoll	PACC project	Current
			NDMO/MECDM/MAL	2009
			Copenhagen University	2007
Cyclones, low rainfall	Food security Infrastructure Water	Bellona Island	Copenhagen University	2006
			NDMO	2007
Sea level rise	Food security	Tuo – Reef	UNICEF/MEHRD	2010
	Water, Health Infrastructure	Islands		
Sea level rise	Food security Water Infrastructure	Taarutona - Malaita	MECDM/NDMO	2009
Sea level rise High rainfall	Marine ecosystems Food security Water	Roviana lagoon – Western Province	GoA, UQ, UCSB, RCF, KGA, WWF	Current
Sea level rise Extreme events	Marine ecosystems Food security	Gizo and surrounding islands	WWF	2009
High rainfall Flooding	Food security Coastal infrastructure Water, Health	West Guadalcanal	ADB, MID, SI Red Cross	2010-2011
High rainfall Flooding	Infrastructure Food security Water	Lunga river delta - Guadalcanal	SOPAC, NDMO	2006
Sea level rise High rainfall	Ecosystems Food security Water	Coastal areas in Choiseul Province	TNC, Lauru Land Conference	2010
Sea level rise Inundation of food gardens	Food security Water	Sikaiana Island	NDMO, MAL, Malaita Provincial Government	2009
Sea level rise Inundation of food gardens	Food security Water	Ontong Java Atoll	PACC Project, NDMO MAL	2011

3.4 Overview of a number of vulnerable geographic areas in the country

Table 28 below is a summary of some of the main vulnerable geographic areas in Solomon Islands based on past assessments and experiences with extreme events. The summary was compiled during a national SNC stakeholder workshop in 2011.

The vulnerability and adaptation assessment has followed IPCC, UNFCCC and Pacific-community-based vulnerability and adaptation methodologies adapted for Solomon Islands. The assessments were built upon the considerable body of existing information (e.g. recent sector policies, plans and strategies, the Solomon Islands Climate Risk Profile) and used a risk-based approach based on up-to-date, factual and often quantitative information, wherever possible.

The V&A assessment data collection consisted of inputs, data and information through adapted methodhology, approach and stakeholder engagement (e.g. ministries, government bodies, officials, local governing boadies and NGOs) through interviews and workshops.

The assessment team comprised members of the SNC team, officials and local representatives. Prior to the assessment, held a workshop to train the team members on the assessment methodologies and tools.

The methodology was as per IPCC technical guidelines. It examined the present conditions and generated scenarios for possible future changes in climate and sea level in Solomon Islands. These scenarios are then used to examine the possible effects of climate and sea level changes on the various areas and sectors.

The assessment involved the following steps: (1) delineate the case study area; (2) inventory study area characteristics; (3) identify the relevant socioeconomic development factors; (4) assess the physical changes; (5) formulate response strategies; (6) assess the vulnerability profile; and (7) identify future needs.

Table 28 Vulnerable Geographic Areas in Solomon Islands

Examples of vulnerable locations	**Vulnerability of natural systems and people of Solomon Islands to the impacts of Climate Change**				**Past assessments documented**
	Exposure	***Sensitivity Factors***	***Existing adaptive capacity***	***Potential adaptation actions***	
Rennell and Bellona Islands Santa Cruz and Reef Islands Tikopia South	In the path of cyclones El Nino drought events	Soils already poor High reliance on imported food Low Govt funding for medicine Low remittances Very limited	Traditional agriculture practices Traditional design of houses Out-migration Traditional food storage Water	Soil management and increasing productivity of food gardens Water catchment and storage Climate proofing of infrastructure	Copenhagen University studies NDMO MECDM Live and Learn

Makira		surface water sources Limited water storage capacity Limited alternative income generating activities Limited government support Loss of traditional practices Poor transportation system Coastal erosion	catchment and storage	Food storage Improving educational facilities Improving health facilities Improving banking services Improving communications Climate proof evacuation centres Revive traditional food preservation and storage	
Weather coast – Guadalcanal, Makira, Rendova, South Choiseul,	High mountain areas near the sea facing prevailing winds Very high rainfall Flood prone areas	Steep slopes, poor soils, limited flat areas Low remittances Poor/irregular shipping services Limited alternative income generating activities High cost of service delivery by Govt Limited alternative income generating activities	Limited government support Traditional adaptation practices	Improving farming systems and soil conservation Climate proofing of infrastructure Hazard mapping and integrated water shed management	KGA NDMO MECDM reports
East Guadalcanal, North-West Guadalcanal, South Isabel, North and East Malaita	Flat flood areas prone to flooding during extreme rainfall events and cyclones	Poor or limited drainage Areas of large mono-cropping (oil palm) Gardening near river banks	Traditional agriculture practices Small infrastructure	Climate proof infrastructure Hazard mapping Integrated water shed management Improving hillside agriculture	NDMO reports, ADB reports, Red Cross Reports

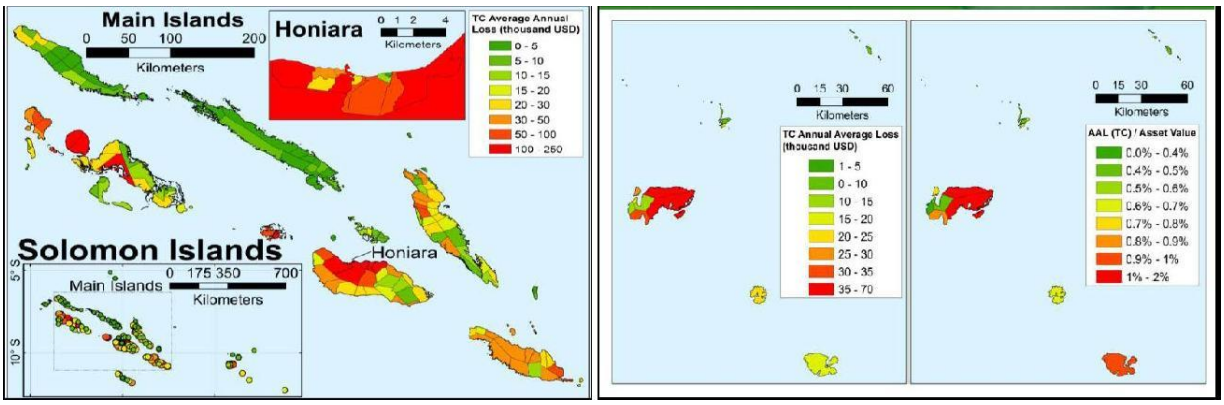
		Very high reliance on subsistence agriculture High population density			
Low lying outer islands of Ontong Java Atoll, Outer Reef Islands, Sikaiana	Very low coastlines particularly areas facing south-easterly and north-westerly winds	Small islands No high areas High population density High cost of service delivery by Govt Shallow water table Poor soils Decline in traditional preservation and storage of food Limited alternative income generating activities	Traditional agriculture practices Increase rainwater catchment and storage Improved varieties of Reliance on marine resources Preservation of agriculture and marine products	Water catchment and storage Improved communication system Improving agriculture production Sustainable harvesting of marine resources Food preservation and storage Fortification of islands through sea walls and mangrove planting	NDMO, UNICEF, Red Cross, Live and Learn, MECDM reports
Low lying coastal areas of big islands	Very low coastlines No barrier reefs Facing prevailing winds	No access to alternative land areas Limited alternative income generating activities Species of mangroves and trees very sensitive to salinity levels	Education and employment in Honiara Move to higher ground Raise buildings on longer stilts Low-cost sea-walls	Mangrove replanting Sea walls Marine protected areas Soil management and improving productivity of land Climate proofing infrastructure Minimize health risks Fortification of low coastal areas through sea walls and mangrove planting	NAPA MECDM NDMO
Lau and Langa Langa lagoon with	Very low islands	No access to alternative land areas	Passing on of traditional knowledge	Water catchment and storage	Red Cross NAPA studies SNC

low „artificial. or man-made islands.		Limited alternative income generating activities Limited source of stones to keep raising islands High population density	re building of islands Traditional barter system Education and employment in Honiara Water catchment and storage Pursue alternative livelihoods	Improved financial services Marine protected areas Planting of mangroves Backyard organic agriculture	
Interior of large island of Malaita on high altitudes with high populations	High rainfall areas	Poor soils Increasing population density Limited technologies to improve production on sloping lands	Traditional agriculture practices Education and employment in Honiara and Provincial centres	Soil conservation and increasing food production on hillsides Integrated water catchment management Processing and storage of root crops	KGA assessments MAL reports
North Guadalcanal North Malaita	Rain shadow (leeward) areas with potential to experienc e very low rainfall situations	Very high population Limited alternative income generating activities	Water catchment and storage Out-migration Traditional farming practices	Up-scale water catchment and storage Integrated water shed management	MAL reports MMERE reports SIWA reports NDMO reports
Honiara	Cyclone Storm surge Intense rainfall El-Nino drought	Dense population	Livelihood activities Water catchment and storage	Water conservation measures Back-yard „sup-sup. gardening	MAL reports KGA reports

3.5 Risk Assessment and Adaptation Planning

The ability of planners and policy makers to identify vulnerable geographic areas in Solomon Islands is now being enhanced with tools developed under the Pacific Catastrophe Risk Assessment and Financing Initiative funded by the World Bank and other donor partners. Figure 25 presents some of the maps generated under this initiative which shows the areas that have had higher economic losses to infrastructure due to past cyclones and extreme events and Figure 26 shows future exposure of islands to increasing wind intensity.

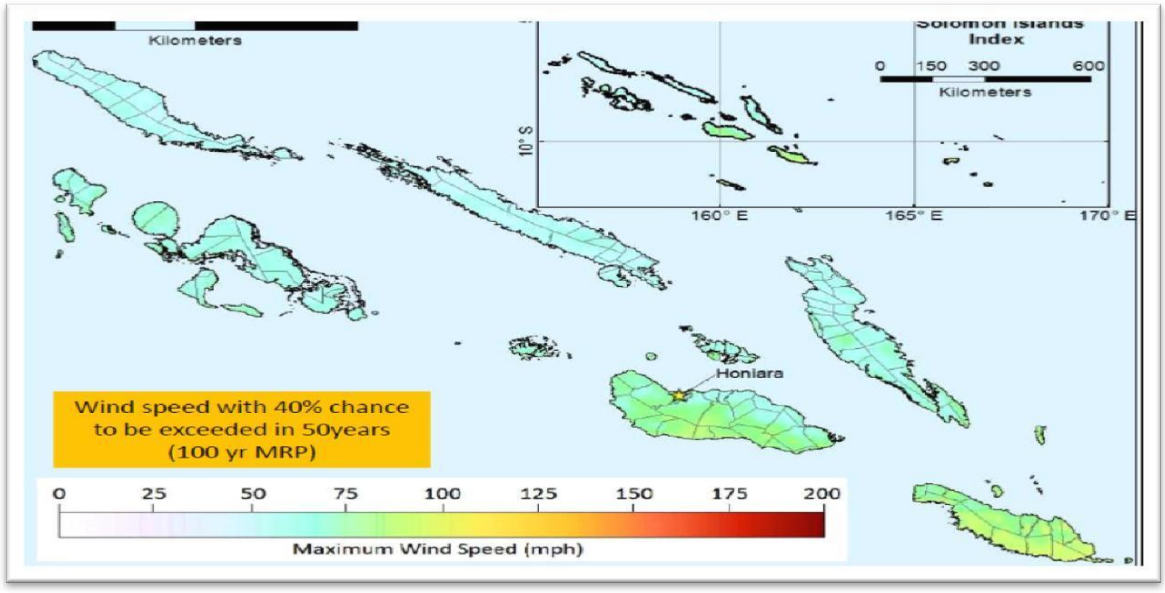
Figure 25 Areas showing average annual losses due to tropical cyclones



Solomon Islands excluding Santa Cruz Islands Santa Cruz Islands

Source: Pacific Catastrophe Risk Assessment and Financing Initiative

Figure 26 Future exposure of islands to increasing wind intensity



Source: Pacific Catastrophe Risk Assessment and Financing Initiative

While there many small low lying islands across the double chain archipelago are exposed to sea level rise and coastal erosion the areas that will be most vulnerable to cyclones in the coming years include; South Guadalcanal, South and South-eastern coast of Makira, Rennel and Bellona Islands and all of Temotu Province. Other areas of exposure are the flood plains, rain-shadow areas and high mountainous areas of the larger volcanic islands.

3.6 Progress in planning and implementing adaptation actions

To date a number of adaptation projects and activities have been planned and implemented based on the recommendations of the INC, NAPA, NDMO assessments and responses to disasters and also other assessments carried out by NGOs and through donor projects. Table 29 summarizes some of the adaptation projects under implementation or being planned in the country:

Table 29 Matrix of Adaptation Projects

Project	Targeted sectors and vulnerabilities	Location	Donor	Amount (USD)
Projects under implementation				
Pacific Adaptation to Climate Change (PACC)	Agriculture, water and sanitation	Ontong Java Atoll Sikaina Atoll Fenualoa Island	GEF through SPREP	800,000
Enhancing social and ecological resilience to climate change in Roviana, Solomon Islands	Food security, coastal infrastructure, coastal ecosystems	Roviana Lagoon	Government of Australia for funding the project through the Australian Department of Climate Change and Energy Efficiency	400,000
Strongim Waka blong Climate Change and Kaikai (SWoCK)	Agriculture, food security Institutional capacity building Agro-meteorological services	North Malaita, South Guadalcanal, South Choiseul, Lau and Langalanga lagoons, South Makira, Honiara, Central Maringe (Isabel)	Adaptation Fund Board	5,000,000
Solomon Islands Climate Change Adaptation Project (SICAP)	Coastal communities and infrastructure Relocation guidelines	To be confirmed	EU – Budgetary support	500,000
Provincial Government Infrastructure projects	Coastal infrastructure (sea wall)	Isabel Province	Solomon Islands Government	150,000
Coral Triangle Initiative	Coastal Ecosystems Food security	Western Province Central Province Malaita Province	GEF 5, USAID, AusAID, ADB	
Disaster Risk Reduction	Flood prone areas	All provinces	AusAID, EU, JICA	

	Cyclone prone areas Vulnerable coastlines		Australia Red Cross World Bank	
Climate Change Adaptation (name tbc)	Infrastructure	Honiara, Guadalcanal	ADB	
Solomon Islands Water Sector Adaptation Project (SIWSAP)	Water and sanitation Watershed management	Taro Island, Santa Catalina Island, Gizo Island, Manaoba Island, Reef Islands, Rennel and Bellona	GEF (LDCF) SIG	5,000,000
Climate Change and Disaster Risk Management (name to be finalized)	Coastal infrastructure Water and sanitation Food security Institutional strengthening and integration of DRR and CCA.	Santa Cruz Island and Reef Islands North Guadalcanal	GEF (LDCF) and GEFDR World Bank SIG	7,250,000
Integrated Forest Management (name to be finalized)	Forestry	To be confirmed	GEF 5 (Trust Fund) FAO SIG	5,000,000
National Adaptation Projects	To be confirmed in 2012	To be confirmed	SIG	300,000
Supporting the Global Climate Change Alliance (GCCA) through Capacity Building, Community Engagement and Applied Research	Water sector Coast infrastructure Livelihoods	To be confirmed	EU Global Climate Change Alliance	tbc

3.7 Progress in mainstreaming of V&A planning and implementation

Mainstreaming of V&A planning and implementation continues to be at a relatively slow but steady pace in the country. Already a number of important stakeholder organizations are

integrating climate change into their work. Within government the Ministry of Planning and Aid Coordination has integrated climate change into the recently produced National Development Strategy (2011-2020) and for the first time, the national cabinet has endorsed budget provision for climate change adaptation actions within the 2012 National Development Budget.

A number of line Ministries have begun to integrate climate change considerations into their work plans and strategies. The Ministry of Agriculture has integrated risk reduction measures in the National Agriculture and Livestock Policy and their research and extension divisions are now planning and implementing vulnerability assessments and adaptation interventions. The Water Resources Division of the Ministry of Mines, Energy and Rural Electrification as well as the Ministries of Health, Forestry, Infrastructure, Tourism and the Provincial Governments are integrating climate change into their planning, policy discussions and development projects.

Within civil society there is good progress. NGOs such as the Nature Conservancy, WWF, Lauru Land Conference, Roviana Conservation Foundation, and Solomon Islands Red Cross are now actively assisting communities and families undertake V&A and DRR assessments and implement adaptation actions. The Solomon Islands Christian Association is involved in a regional climate change program and the Anglican and United Churches are doing similar work as the NGOs with communities. Private sector organizations such as engineering and consulting firms and hardware suppliers are now actively involved in vulnerability assessments and adaptation planning.

3.8 Challenges, opportunities and lessons learned

A range of challenges, opportunities and lessons are starting to surface given the experiences with climate change initiatives over the past few years and are discussed below:

Incremental costs

There is no doubt that climate change agenda is creating more work for the government and stakeholders in the country. The result being that officers are taking on extra responsibilities for reporting, meeting with overseas consultants, consulting with national stakeholders, designing new programs, not to mention the growing number of workshops and meetings taking officers away from their core functions. Most if not all donor projects require in-kind or cash co-financing and this also stretches government capacity to the limit. The real costs to the government need to be carefully assessed and there is the danger that institutional capacity of organizations may be weakened if they are required to take on more climate change related work. Apart from project funded personnel there is little growth in new recruits into the public service and provincial governments cannot afford to expand their workforce with the level of grants currently received from the national government.

Mainstreaming

MECDM is making good progress in aligning donors with stakeholders. Over the past months the Climate Change Division has facilitated consultations between donors and stakeholders in the Water, Forestry and Agriculture Sector and catalysing the mainstreaming of climate change. Much training and awareness raising is needed to mainstream climate change across stakeholder organizations, provincial governments and communities.

Prioritizing vulnerability

Prioritization of vulnerability has been more sector oriented as was the approach taken with the NAPA. While these sector priorities remain relevant there are other issues and challenges that may need to be included and given more attention in future national adaptation strategies e.g. vulnerability of marine and terrestrial ecosystems and species. There are currently no nationally agreed indicators for prioritizing vulnerable locations and communities (social vulnerability) and it is planned that this will be the subject of future research and consultation.

Increasing understanding of the science of climate change

With the assistance of donor projects the MECDM and particularly the SIMS‟s ability to raise awareness amongst the public on the underlying science of climate change is improving over time. The Curriculum Division of the Ministry of Education and Human Resources Development is actively collaborating with MECDM to obtain information and new knowledge that can be integrated into the primary and secondary school curricula and the School of Natural Resources of the Solomon Islands College of Higher Education has launched a Certificate Program which includes a course on climate change. NGOs, churches and community based organizations are well placed to raise awareness about climate change at the community level however many of these organizations have very weak capacity and need support to expand their work. The project „Enhancing social and ecological resilience to climate change in Roviana, Solomon Islands‟ is a fitting pilot project that establishes a practical example of how to build capacity amongst NGOs and communities to assess social and ecosystem resilience and plan adaptation strategies in light of the predicted changes in climate. The project is proving to be effective in raising awareness and on climate change

and the relationship between climate and ecosystem resilience.

Aligning CCA and DRR

This challenge is being addressed by the MECDM and presents a good opportunity for maximizing synergies between the two paradigms. The Climate Change Division and the NDMO are holding discussions to find an appropriate home-grown approach to operationalizing the integration of the two in the programs and annual work plans. The alignment of V&A and DRR into national policies and programmes is now imperative for Solomon Islands given the nations extreme vulnerability to climate hazards. The importance of linking V&A and DRR is recognized by both the UNFCCC Bali Action Plan and the Hyogo Framework for Action on Disaster Risk Management. The Bali Action Plan calls for enhanced action on adaptation including consideration of DRR strategies and means to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change. The World Bank-implemented GEF5 full size project targeting coastal infrastructure and livelihoods has a dedicated component aimed at strengthening integration of CCA and DRR in government at the policy and operational level.

Determining scale and timing of interventions

Climate variability and change cuts across sectors and geographic locations and poses a challenge for sizing programmes and projects particularly for island situations. The PACC project in Ontong Java atoll has shown that while household food security is a growing problem the answers are not only confined to improving agriculture productivity on the island but also addressing the people‟s ability to trade and earn income, having effective transport and communication and better education and skills training. In other words there is the growing recognition of the need for a longer term programmatic approach to addressing vulnerability rather than a project based approach that deals with only a few aspect of vulnerability over a short period of time. These calls for national and provincial governments to start considering having development plans that integrate climate change at the island, constituency or Ward levels.

Data and information gaps

There is a growing amount of data from the national census, surveys and assessments that need to be digitized and geo-referenced but there is still a very big need to build the country‟s capacity in the area of Geographic Information Systems for use in vulnerability and disaster risk assessments as well as adaptation planning. To date this technology is only available with limited use in the Ministry of Lands, Forestry and government statutory bodies such as the Solomon Islands Electricity Authority. As demonstrated in a number of climate change projects in the country, having high resolution satellite imagery available and trained personnel makes assessments and development and adaptation planning easier for all. There is also the need to take stock of the available socio-economic data and determine data gaps that are essential for V&A assessments.

Implementing mitigation actions that contribute to reducing vulnerability

There are a number of mitigation actions that can contribute to reducing GHGs emissions while at the same time contribute to reducing vulnerability. Solomon Islands will soon be benefiting from a UN-REDD project and FAO support aimed at establishing a governance framework and building capacity of the government to engage in reducing emissions due to deforestation and degradation (REDD). This is a much needed initiative given the very high rate of logging in the country and its attendant problems. Forest degradation due to logging

reduces the resilience of ecosystems and their ability to provide needed ecosystem services. Many species are put at risk and people‟s dependency on the forest for their livelihood is threatened.

Low emission agricultural practices can also contribute significantly to soil fertility conservation and increased food crop productivity. Maintaining good levels of household subsistence food production will be one of the biggest test of the nation‟s resilience. A local firm has estimated that the production of root crops in Solomon Islands, using the national population and the equivalent calorific values, quantities and price for imported rice, is a conservative 1.189 billion Solomon Dollars (USD 148,625 million) per annum (Solomon Islands State of Environment Report, 2008).

Weak governance in coastal management

Perhaps one of the biggest challenges in maintaining and/or enhancing adaptation and resilience to climate change in Solomon Islands is the relatively weak governance in the area of integrated coastal management and the weakening social capital in parts of the country. The ethnic unrest during the late 90‟s and early 2000‟s has impacted negatively on governance while corruption in the extractive industries such as logging continues and is causing disharmony within communities and discontentment amongst the younger generation. An evaluation of strategic governance issues in coastal management during 2008 (Lane 2005) has highlighted, inter-alia, that performance of the governance system in relation to the implementation of integrated coastal management is poor and being inhibited by the lack of effective mechanisms for inter-governmental and inter-institutional coordination, lack of clarity about the respective responsibilities of central and national government and also about the role and rights of customary landowners and limited capacity of the key actors in environmental governance.

On-going observations on social trends in country also point to a decline in respect for traditional leadership and traditional rules amongst the younger generation such as in the Roviana lagoon of the Western Province (authors‟ interview with key informants in Roviana). There is a growing recognition in the country that social resilience of communities including strengthening social capital must be addressed if ecological resilience is to be assured. This is a challenge that future donor and government projects must deliberately address.

3.9 Vulnerability Case Studies

3.9.1 Artificial Islands of the Lau lagoon, Malaita Province

Artificial or built islands are found in the Lau and Langalanga lagoons of Malaita Province. Dwellers on these islands have lived in these conditions for many years and most do not have access to land on the mainland due to historic tribal wars and migration patterns. Community-based V&A Assessments facilitated by the Solomon Islands Red Cross show that artificial islanders are experiencing sea level rise and increasing intensities of storm surges battering their islands which are usually 1-2 metres high. The dwellers have been innovative in using organic material and soil from the mainland to grow vegetables. Water is collected in large containers from the mainland and, where resources permit, from roof catchments and storage tanks. Changing rainfall patterns have resulted in water shortages affecting food and water security. Sea level rise has meant that the islanders continually need to raise their islands by gathering more rocks from the reefs often causing damage to ecosystems and habitats.

Plate 2. Replanted mangroves as source of food

Plate 3. Islands built from coral rocks

Plate 4. Crowded conditions on some of the islands **Plate 5**. Women gathering coral rocks to build islands

Adaptation and survival strategies include: on-going raising of coral islands, increasing water catchment and storage, replanting of mangroves species whose fruit is used as a staple diet (*koa*), delineating and declaring marine protected areas, migration to urban centres in the country, taking up small business activities to supplement family income, securing rights to

farm and gather water from landowners on the mainland and pursuing education and skills training for future employment and income.

3.9.2 Aruligo Flood Prone Areas –West Guadalcanal

The Aruligo flood areas is located on West Guadalcanal covering an estimated area of 400 sq km and is populated by a majority of resettled weather coast people who relocated to the current sites following natural disasters of the 1977 earthquake and the 1986 cyclone Namu. The areas affected are characterized by settlements within sensitive catchment and low coastal areas. The rivers and streams in these areas have been running low for many years. Most of the streams have dried up for most of the time. The assessment done in the Aruligo area of west Guadalcanal was carried out following a series of natural disasters caused by extremely high and intense rainfall which consequently caused disastrous flash floods that resulted in considerable damage to properties and loss of lives. The assessment followed a risk reduction exercise and gathered information from extensive consultation with the communities of various villages in the Aruligo area. A total of 14 villages were consulted for the risk reduction exercise and came up with action plans to address various issues identified with the villagers or communities. The main issues, climate risks, and impacts identified in the assessment and consultations include;

Agriculture and food security – The flash floods destroyed food and market gardens, agro-forestry plots, cocoa and coconut plantation, and livestock facilities (piggery and chicken farms) causing loss of food security and income for both the affected area and people of Honiara city. *Infrastructure* – Important coastal infrastructure such as the economically important road of west Guadalcanal, 4 bridges, 2 school buildings, 3 water supply systems, 1 clinic and aid posts, 6 feeder roads with culverts were destoryed.

Shelter and settlements – Many residential buildings of the communities were destroyed during the floods. These included locally made residences and those made of permanent materials. Settlement areas or villages of the communities have unfortunately been in the way of the flood paths and have to be relocated.

Water supply and sanitation – Water supply systems were destroyed, including boreholes that were blocked or filled with mud and cannot be rehabilitated without costly repairs. Sanitation pits were also completed destroyed with many completed covered. The destruction of the toilets had led to unhealthy sanitation behaviour which would increase health risks to the communities leading to poor living standards.

Education – A number of educational facilities were affected or destroyed in the area by the floods. These include early childhood centres, primary schools, community high schools and a vocational training centre. The damage to teachers‟ accommodation and classrooms means teachers and students lost time in schools which affect the students learning.

Human health – Health facilities in the areas could not escape the wrath of the floods. The facilities include clinics, aid posts, and dispensaries. The immediate effects of the floods also add risks to the human population such as contaminated water sources and spread of diseases. *Transport* – Road transport had been affected due to damage of the road and bridges. This had led to loss of business and income. The lack of access immediately had affected other services and assistance to reach the communities quickly. The west Guadalcanal region is an important economic area with a number of social establishments and the lack of road access affects the activities within the region.

Other services – A number of other important services have also been affected in the area by the floods. Retails stores were affected due to damage to facilities or cargoes could not get to them due to the damaged road and bridges. General trading in copra, cocoa and timber etc. were also affected for the same reasons above resulting in the communities decreasing income and thereby further hardships. When there are difficulties in access,

other problems such as law and order also increase as law enforcement personnel could not get to the areas.

Plate 6. Bridge damaged by flood waters **Plate 7**. Temporary drinking water from portable water purifier

(Photos courtesy of SI Red Cross)

Adaptation and Risk Reduction measures

The West Guadalcanal floods and disasters have given rise to stronger efforts by communities, government and donor partners to collaborate and develop risk reduction and adaptation measures and is an example of the need for a holistic, integrated catchment wide and ridge to reef risk reduction and adaptation strategy. A feasibility study funded by the ADB and implemented through the MID and MME Water Resources Division has initiated this process followed by infrastructure development and relocation activities involving villages, schools and clinics. The national government has identified the Aruligo flood prone areas as potential site to benefit from GEF LDC NAPA implementation funding targeting adaptation actions and risk reduction planning and implementation strategies. Adaptation and risk reduction measures already identified during preliminary consultations include;

- Community based and catchment wide V&A assessments and risk assessments
- Modelling water flows under different rainfall scenarios
- Developing a catchment wide, reef-to-ridge adaptation and risk reduction strategy involving awareness raising, re-location of communities and infrastructure, strengthening buffer zones, replanting degraded areas, monitoring water flow and quality.

3.9.3 Low lying, densely populated Reef Islands of Temotu Province

The Reef Islands are located towards the eastern end of Solomon Islands and comprise many small low lying coral islands inhabited by Polynesian and Melanesians. A Solomon Islands Red Cross team carried out a community-based participatory Vulnerability Capacity Assessment (VCA) on the low lying coral islands of Pileni, Nukapu, Nifiloli, Nupani and Matema that are part of the Reef Islands. Findings of the assessment have highlighted the high level of exposure of the low lying islands to coastal erosion and salt water intrusion into underground wells from rising sea level and storm surges. The islands are also in the path of cyclones and have suffered losses over the past years. Many of the inhabitants have left the islands to the neighbouring high island of Santa Cruz as well as to other parts of the country. The remaining population is still relatively denser than other parts of the country and people are now experiencing hardships such as water shortages, loss of land and food shortages. The Reef Islands is one of the priority areas for further study as part of the national governments plan to re-locate people as a longer term last resort measure.

Plate 8. Severe coastal erosion

Plate 9. Well water exposed to salt water intrusion

(Photos courtesy of SI Red Cross)

3.9.4 High rainfall (weather coast) areas of Guadalcanal Province

A double wet season results in rainfalls of 5000 to 8000mm per annum with up to 13,400mm in the hinterland (recorded at Koleula in 1972 [Tedder & Tedder 1974]), making the Weather Coast among the wettest places in the world (People on the edge, 2005)

These areas are also isolated and have very minimal support from the national government by way of basic services and have been the target of disaster relief programs in the past years due to food shortages during periods of extreme rainfall. Increasing pressure by the government to expand monocultures of copra or cocoa with no emphasis on the maintenance of arboreal diversity is accelerating agro-deforestation on the weather coast and will play a major role in the decline of arboreal diversity and self-sufficiency and the loss of knowledge of traditional agro-forestry systems among the young generation. Over the past five years these areas have been the focus of food supplies from the NDMO to approximately 20,000 people. A V&A assessment of these areas by the NGO, KGA has found that increasing rainfall is causing excessive soil nutrient loss, flooding along river banks and flat areas and reduced production of sweet potato discouraging families to work their gardens. No new or improved farming technologies and varieties have been applied and the low productivity is increasing the reliance of families on food relief supplies.


Plate 10. Narrow beaches and steep slopes **Plate 11**. Crops cultivated on steep slopes near the sea

(Photos by KGA)

The V&A report by the KGA has identified a range of adaptation initiatives including, inter-alia, introduction of new and improved planting material, establishing germplasm collection centres, training in livestock husbandry and improvements to support services by the national government.

3.9.5 Vulnerable low-lying township of Buala, Isabel Province

The township and provincial headquarters at Buala in Isabel Province is the lowest elevation township in the country with much of the important coastal infrastructure located on flat areas around 1-1.5 metres above sea level during high tides. Sea level rise is evident. The main wharf built in the 1980‟s is now submerged during high tides and the recently completed concrete sea walls are commonly breached by strong waves during storm surges and high tides.

Community based consultations and discussions with key informants highlight a number of vulnerability issues that need to be addressed including:

- The unplanned and ad-hoc construction of sea walls disregarding wave dynamics along the Buala coastline is causing more damage than good with areas adjacent to sea walls eroding at a faster rate than that prior to the construction of sea walls.

- Buala village adjacent to the township is now regularly experiencing inundation during high tides with sea water washing through the village and killing plants.


Plate 12. Buala village inundated with salt water **Plate 13.** Buala wharf submerged

The increasing vulnerability of Buala Township in the medium to long term future is one for serious consideration by the provincial and national governments, given the sea level rise predictions and current experiences with wave over-topping the wharf and sea walls.

A cost-benefit analysis will need to be carried out on the adaptation options of either relocating important infrastructure such as the provincial headquarters, provincial hospital, police station and headquarters of the Church of Melanesia at Jejevo, or, climate-proof and build a new sea wall that can protect the infrastructure from the rising sea level and its associated negative impacts.

3.9.6 Vulnerable small islands in the AreÁre lagoon

A Community-based V&A assessment took place at Taarutona island in the Are"Are lagoon during February 2009 and facilitated by Climate Change and Malaita Provincial Disaster Officer of the MECDM. The assessment was in response to requests by community leaders and representatives working in Honiara following cases of extremely high tides, salt water intrusion into the village and damage to food crops and personal belongings. A range of participatory V&A tools were used including semi-structured interviews, seasonal calendars, transect walks, key informant interviews and observation of damages caused.

Old men and women described the extreme high tide event as unprecedented in living memory and expressed fear about future recurrences and the negative impacts on the island community. Food crops were destroyed and personal property damaged during the extreme high tides with many houses needing to be re-sited elsewhere. The community also identified a range of vulnerabilities including very low elevation of the island, exposure to strong currents that funnel in the king tides, limited space on the island to move houses to, limited resources available to build houses on high stilts and on-going threat of small food gardens being affected by salt water.

Adaptation actions identified included: relocating the village to the mainland, digging proper drainage, setting up proper water and sanitation systems, building new houses and essential community infrastructure, replanting of mangroves to mitigate force of strong king tides and establishing a Marine Protected Area to ensure future sustainable supply of marine resources.

Plate 14. Houses on Taarutona island **Plate 15**. One of the tools used for the V&A exercise **(**Photos by Piason Simi – NDMO Malaita Province)

3.9.7 Proposed Adaptation Projects

Summary of Proposed Adaptation Projects

Summarised in this section are a range of adaptation projects that have been identified through the NAPA process and which are still to be implemented, together with those recently identified during the SNC project. The projects are grouped into thematic areas linked to the priority sectors established in the NAPA as well as some recently identified priorities.

Projects identified in the NAPA

- Agriculture and Food Security, Water and Sanitation, Human Settlements and Human Health, Education Awareness and Information - 6,500,000.00
- Low lying and artificially built-up Islands - 3,500,000.00
- Waste Management - 1,500,000.00
- Coastal Protection - 1,750,000.00
- Fisheries and Marine Resources - 1,500,000.00
- Infrastructure Development - 2,000,000.00
- Tourism - 500,000.00

Sub-total: 17,250,0000

(All costs in USD)

Projects identified during the SNC Project

- Strengthening social and ecological resilience in targeted regions of the country – 5,000,000
- Adaptation through enhancing Integrated Forest and Water Resources Management – 10,000,000
- Strengthening Geographic Information Systems for V&A Assessments and Adaptation Planning – 2,000,000
- Reforestation and rehabilitation of post-logged areas as an adaptation and mitigation strategy – 10,000,000
- Establishing climate compatible development plans for low lying remote islands – 2,000,000
- Enhancing ecosystem resilience of the East Rennell World Heritage site – 2,000,000
- Identification and monitoring of montane biodiversity and ecosystem services – 3,000,000
- Review NAPA and develop a National Adaptation Programme (NAP) including provincial adaptation medium to long term strategies – 400,000
- Coastal management plans and climate proofing of coastal infrastructure in low coastal areas – 10,000,000
- Strengthening community social institutions –5,000,000
- Improving water supply and sanitation in rural communities – 10,000,000
- Relocation of vulnerable communities – 50, 000, 000

(All costs in USD)

3.9.8 Conclusion and Recommendations

The SNC provides a snapshot of vulnerability and adaption context in Solomon Islands, highlights the main vulnerabilities, progress in addressing vulnerabilities and enhancing adaptive capacity. With the support of development partners the Solomon Islands Meteorological Service is in a better position to undertake assessment of future climate scenarios as well as improve meteorological data collection and management. The country is moving towards integrating vulnerability and adaptation (V&A) and disaster risk reduction (DRR) which should result in the realization of synergies and minimize duplication of efforts between two strong complementary approaches. While experience is being built to assess vulnerability of sectors there is still limited capacity to prioritize vulnerable geographic areas and peoples. More work needs to be done to generate empirical data to inform vulnerability and adaptation assessments and to identify and agree on social indicators for use in vulnerability assessments. V&A work now needs to be scaled up and mainstreamed into sector ministries, community organizations, NGOs and institutions. With the rising level and scale of V&A work in the country comes the need for better coordination amongst donors, government agencies and stakeholders to ensure that scarce resources are effectively used to build adaptive capacity of the nation. The recommendation below is intended to guide on-going planning and implementation of V&A assessments and implementation of adaptation programs and actions:

i) Strengthen capacity of MECDM to play a lead role in guiding and coordinating planning and implementation of V&A and DRR programs and actions

ii) Complete the national climate change policy and include guidelines on V&A and DRR integration and implementation

iii) Build capacity of provincial governments and communities to plan, implement and monitor V&A work and adaptation actions

iv) Strengthen capacity of government agencies and NGOs to mobilize and manage financial resources to support V&A work.

v) Review and revise the NAPA and develop a national adaptation strategy

vi) Plan and implement actions to gather and analyze socio-economic data to support V&A work and prioritize vulnerable communities and populations

vii) Mainstream V&A work into all sector ministries, NGOs, institutions and community based organizations

viii) Build capacity of SIMS to provide on-going climate and weather predictions to sector ministries and stakeholders for planning of V&A work and adaptation actions.

ix) Implement joint planning actions by MECDM and National Statistics Office to plan for inclusion of V&A related questions in future national surveys and census.

x) Establish V&A learning network amongst V&A practitioners

xi) Develop database and cased studies of V&A work and distribute widely nationally

CHAPTER 4

MITIGATION MEASURES AND ANALYSIS

4.1 Background

Solomon Islands is overwhelmingly dependent on imported refined petroleum fuels for national energy needs with more than 4 million liters imported fuel on average per month for electricity generation, for transport by land, sea and air and for lighting Biomass provides more than 61% of gross national energy production, petroleum products about 38%, and hydropower and solar perhaps one percent.

Approximately 60% of the country's imported oil is consumed in power generation by the national electricity authority, Solomon Islands Electricity Authority (SIEA) or by institutional and private sector generation plants. The remaining 40% of the oil import is consumed in roughly equal measure by the transportation sector (22%) and the household sector (18%) in the form of kerosene or petrol for power and cooking in villages. Essentially all transport fuel and the majority of power generation relies on imported petroleum products. There are two private producers of biofuel, selling to the Honiara market, but at very low volumes. There is considerable potential for coconut based biofuel production because of the massive plantings of coconut throughout the country.

The electrification rate in Solomon Islands is very low compared to other neighboring island countries in the Pacific. Only 20 % of the Solomon Islands population has access to electricity. Almost all electricity generation is confined to Honiara and the provincial centres which are basically based on imported diesel fuel and supplied and regulated by Solomon Islands only power utility and a subsidiary body of the national government, the Solomon Islands Electricity Authority (SIEA). Outside of the urban centres only about 5% of the rural population has access to electricity through a small number of off-grid and individual household systems. In addition, in the rural areas where almost 85% of Solomon Islands population is, the use of biomass (fuel wood) for cooking and other activities is common.

There is however, a developing trend in terms solar energy use particularly for lighting in homes, and institutions such as in rural schools and clinics. A number of micro‐hydro power stations are in operation in three provinces, with plans for the installation of two more. There is very significant potential for further hydroelectricity development throughout the country, with more than 330MW of generation potential, more than 70% of it identified on Guadalcanal where the capital is located.

There is yet no studies to quantify the amount of biomass being used by rural households, hence the difficulty in estimating the corresponding amount of GHG emitted by this practice. Use of kerosene for lighting and petrol for transportation in the rural areas is also common but at a much smaller scale. Data on how much of these fuels is being used in the rural areas is also lacking. With regards to fuel use data in Solomon Islands, only data for annual fuel imports (from Statistics office) and fuel used by the only power utility (SIEA) is archived and accessible. Fuel data from fuel depots are difficult to obtain and closely guarded due to competition.

It is not clear how much of the total petroleum imports is used for electricity generation (however the fuel consumed only by SIEA has been shown along with emissions in table 30); transportation (land, sea & air) and various other sectors. However, it is estimated that around 28% is used from electricity generation and 56% is used for transportation (Pacific Regional Energy Assessment). The rest is used for other sectors.

Since end of the Civil War in 2003, Solomon Islands' fuel consumption has been increasing quickly. Its 2011 fuel consumption is 48% higher than the level in 2003, resulting in significant increases in greenhouse gas emissions. Table 30 shows the GHG Emission from SIEA’s Power generation.

Table 30 SIEA's Fuel Usage and Emissions

Year	Fuel Consumption (MT)	GHG emissions (Gg $CO_{2\ eq.}$)
2000	14,009	45
2005	15,112	48
2010	18,643	59

The table below shows the total petroleum imports to Solomon Islands from 2000, 2005 and 2010 as recorded by the statistics office.

Table 31 Total Petroleum Imports to Solomon Islands and its equivalent GHG Emissions

Year	Total petroleum imports (MT)	GHG emitted (Gg $CO_{2\ eq.}$)
2000	53,020	192
2005	62,349	235
2010	107,663	351
TOTAL	**223,032**	**778**

As can be clearly seen in Figure 27 there is an increasing trend in the amount of petroleum imports into the country since 2000.

Figure 27 Trend of Petroleum imports into Solomon Islands for 2000-2025

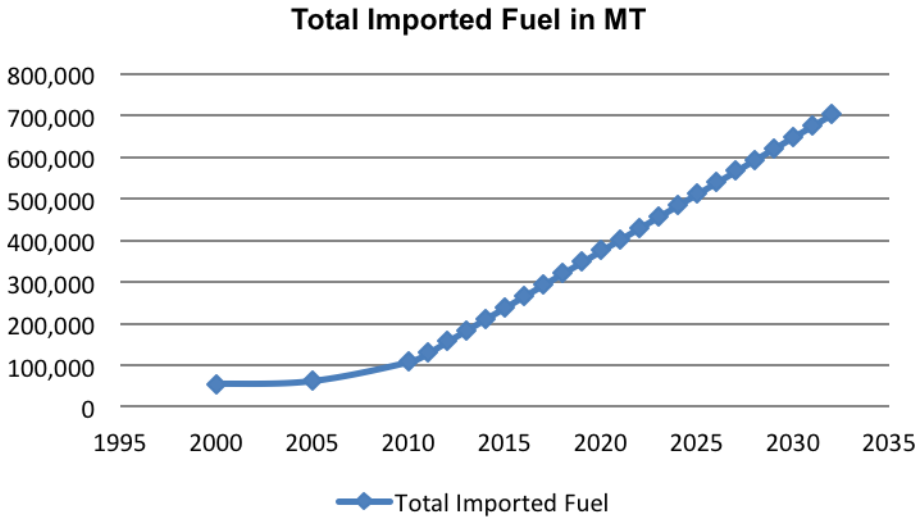
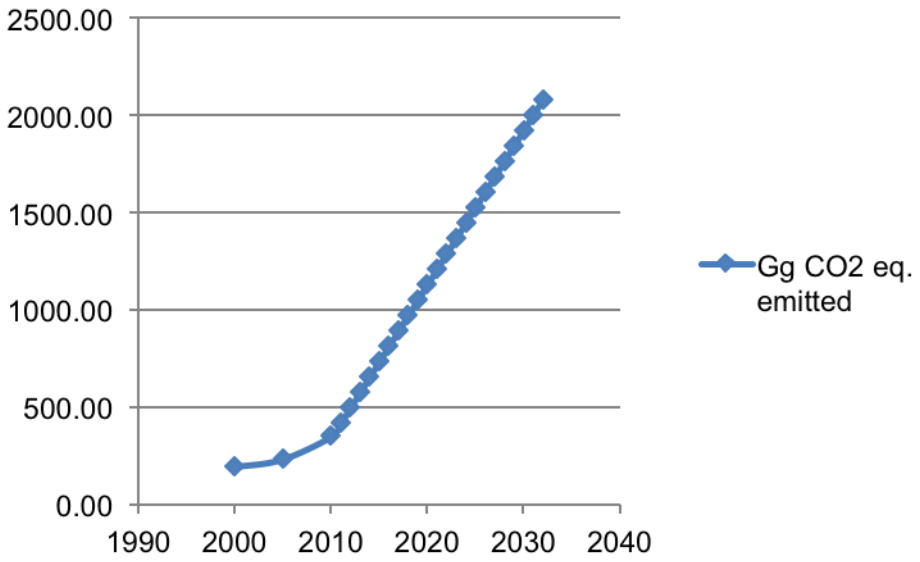


Figure 28 Gg CO_{2eq} emitted from 2000 to 2025 respective to total imported fuel



It can be seen from Figure 27 that if the reliance on imported fossil fuel continues (without considering introduction of RE & EE options) along this trend, Solomon Islands on a "business as usual scenario" is expected to consume increased imported petroleum each year.

As shown in Figure 28 in terms of GHG emissions, the trend shows that approximately Gg CO_{2eq} emissions will increase every year by 9% (average), in 'business as usual' case, the country would emit increased emissions from petroleum use alone.

The general increase in fuel imports throughout the successive years implies the great demand for energy from imported petroleum as the country continues to expand in population and development.

4.2 Potential Climate Change Mitigation Sectors

The following section includes the mitigation assessment of the main GHG emission sectors, various technologies, national and sectoral policies and practices with aim to present Solomon Islands' capacity to mitigate climate change and long-term mitigation scenarios.

4.2.1 Energy Sector

Petroleum: The Solomon Islands is almost completely dependent on imported petroleum for its commercial energy needs although biomass still accounts for about 40% of gross national energy production, with other renewables representing about 1% and the rest coming from petroleum. In 2011, the major energy consumption sectors were residential at 44.1%, transport 42.1% and industry 10.8%.

The share of oil products in the country's energy consumption has increased from 47.5% to 52.7% mainly at the expense of biomass, the share of which fell from 47.4% to 43.1%, and electricity which fell from 5.1% to 4.2%. Virtually all of the Solomon Islands' electricity is generated from imported diesel. The forecast for 2020 predicts a continuing trend for oil (up to 56.3%) and biomass (down to 39.5%), and the share of electricity to remain unchanged.

Electricity generation and demand: There were few major plans to develop renewable energy systems in Solomon Islands in the past. A classic example is the plan to develop a hydropower system in Komarindi, on Guadalcanal to provide reliable power for Honiara city based on a study funded by UNIDO in 1986.Lack of commitment and vision on the part of successive governments resulted in the programme not continuing even though the feasibility study by the World Bank has shown that Komarindi Hydropower Project is technically viable and economically justifiable*. (ADB, 1989)*

In the recent years Solomon Islands has started to put a lot more emphasis on renewable energy development with growing support from donors and private entrepreneurs. The main force behind this shift towards renewable energy was evident after the global fuel crisis and then the global economic crisis that almost crippled the nation with its various devastating effects. The World Bank and other financial institutions such as ADB has stepped in to strengthen the power generation sector in Solomon Islands, strengthen the management of SIEA and develop renewable energy power generation scheme.

Like the other Pacific island countries and for Solomon Islands, the driving force behind the shift from petroleum dependency for power generation to potential renewable energy is the unstable international fuel prices and cost on the national economy. With a fragile economy the country cannot sustain an increase in fuel price which contributes to inflation and directly affecting livelihoods. In the power generation sector it has been very difficult to maintain supply of sufficient fuel for generator units. Recurrent Governments of Solomon Islands have developed strategies to build plants such as hydroelectric plants and basic solar lighting in the rural areas to reduce the use of kerosene which is becoming unaffordable by a growing number of households in the rural population. Solomon Islands has now started to develop renewable energy such as solar, hydro, biomass, biofuel and has commenced wind mapping and collection of data. These activities reflect the positive response of the Government to harness renewable energy sources to replace petroleum products as the main energy source especially in the power generation sector.

As on 2013, Solomon Islands had total installed capacity of 31.8 MW under Solomon Islands Electricity Authority (SIEA) against the grid connected demand of 15.18MW. The demand is met by diesel based power generators along with some renewable energy projects (solar and hydro).Green electricity generation is enhanced further by mixing coconut oil (CNO) with

diesel in thermal generation. Table 32 represents the installed power generation capacity and demand of Solomon Islands.

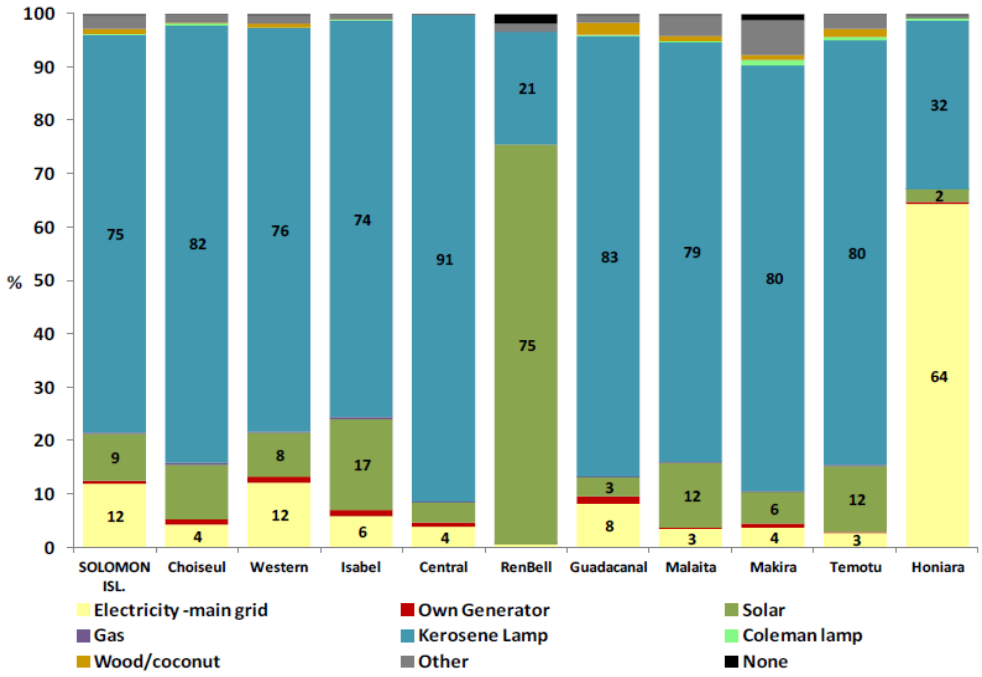
Table 32 Power Generation Capacity in Solomon Islands (as of 2013)

Power Station	Capacity	Customers	Demand
Honiara	26 MW	11,411	13.6 MW
Auki	1120 kW	1,067	360 kW
Malu'u	60 kW	207	20 kW
Gizo	780 kW	815	400 kW
Noro	2400 kW	466	500 kW
Munda	300 kW	530	Stand by
Tulagi	296 kW	239	80 kW
Lata	296 kW	247	70kW
Kirakira	296 kW	366	60 kW
Buala	250 kW	366	90 kW
Total	**31.8 MW**	**15,714**	**15.18 MW**

SIEA is solely responsible for the generation, transmission, distribution and sale of electricity to both domestic and commercial customers having power stations in Honiara, Auki, Maluu, Munda, Gizo, Noro, Buala, Tulagi, Lata and Kirakira. There is currently no private sector participation in power generation; however, the Government has indicated a preference for private sector development of generation assets.

As per the 2009 Census survey report, 12% of households had access to main grid and used electricity for lighting. About 9% got their energy from using solar panels, about 75% households were using kerosene lamps for lighting (exception of Rennell-Bellona province where solar energy was used by 75% of all households) and rest were using other sources like own generation, Coleman lamp, wood/coconut, Gas or none. The capital city Honiara has the highest usage of electricity (64%) from main grid. The proportion of private households by place of residence and main source of lighting (%) in Solomon Islands during the year 2009 is presented in the Figure 29.

Figure 29 Private households by place of residence and main source of lighting (2009)



High electricity tariff rate is one of the major barriers for electrification in Solomon Islands. SIEA charges different but uniform national tariff for domestic, commercial and industrial customers. The tariff rates are determined and fixed every three months and have two main components (i) The Base Tariff Adjustments (90% of the Retails Price Index of 5.75%) adjusted every five years and (ii) Fuel Price Adjustment (95% of the in-crease in fuel price) averaged over the past three months (Based on the fuel prices supplied by South Pacific Oil Limited). The existing tariff from April-2014 onwards is SBD 6.4839 per kWh for residential customers and SBD 6.9684 per kWh for commercial clients. Even at this high electricity tariff rate SIEA is facing difficulties in recovering full cost of renewable energy generation projects.

There are two small hydropower plants in provincial centres totaling 182 kW of capacity but all the rest of SIEA generation is diesel. Although larger-scale hydropower has been considered for years, to date there is no large hydropower plant on line. Guadalcanal accounts for over 80% of total generation in the Solomon Islands and is therefore the primary target for hydro development. Although projects were begun in the past on the Lungga and Komarindi rivers, the current focus is on hydro development on the Tina River where it is hoped to provide around 60 GWh each year for the Honiara grid, which would cut diesel use by about half. The development is intended to have a minimal environmental effect and cause little disturbance to local communities. An initial feasibility study concentrating on the technical and economic aspects of the project was completed in 2011 and recommended proceeding with the project. However, the project is still in the preparatory stage and social and environmental assessments are still being undertaken. A major hurdle, as experienced by past project proposals, will be land access.

There are no reliable data on sectoral energy demand for the Solomon Islands. Table 33 shows SIEA's sale of lighting) 1%. About 89% of all households rely mainly on biomass for cooking. Fuel wood burning probably totals about 110 ktoe, with additional biomass used for copra and cocoa drying.

In 2011, SIEA sales were 67 GWh of which domestic consumers accounted for 19%,

commercial/industrial 65% and government 16%. Honiara accounted for over 80% of the total installed meters. For the past 20 years, peak demand in Honiara has usually exceeded load supply so losing two generators causes a blackout. Figure 30 shows Honiara daily load curves. Outages were frequent during the past although with the recent upgrade of the power system that has ceased to be the case.

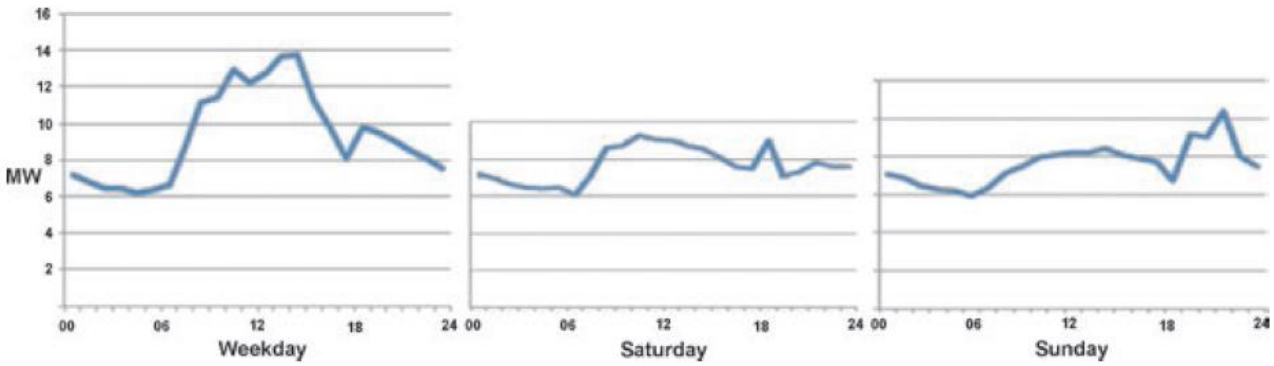
There are 198 streetlights connected to the grid. All are unmetered so SIEA subsidises their use.

Table 33 Electricity sales in kWh

Year	Sector	Sales In MWh
2007	Residential	12 932 316
	Commercial/Industrial	39 752 528
	Government	8 662 573
	TOTAL	61 347 417
2008	Residential	9 789 661
	Commercial/Industrial	37 865 914
	Government	13 182 745
	TOTAL	60 838 320
2009	Residential	9 856 957
	Commercial/Industrial	37 372 213
	Government	12 762 138
	TOTAL	59 991 308
2010	Residential	10 661 361
	Commercial/Industrial	41 733 984
	Government	10 694 661
	TOTAL	63 090 006
2011	Residential	12 877 942
	Commercial/Industrial	43 854 698
	Government	10 280 809
	TOTAL	67 013 449

Source: SIEA (2012)

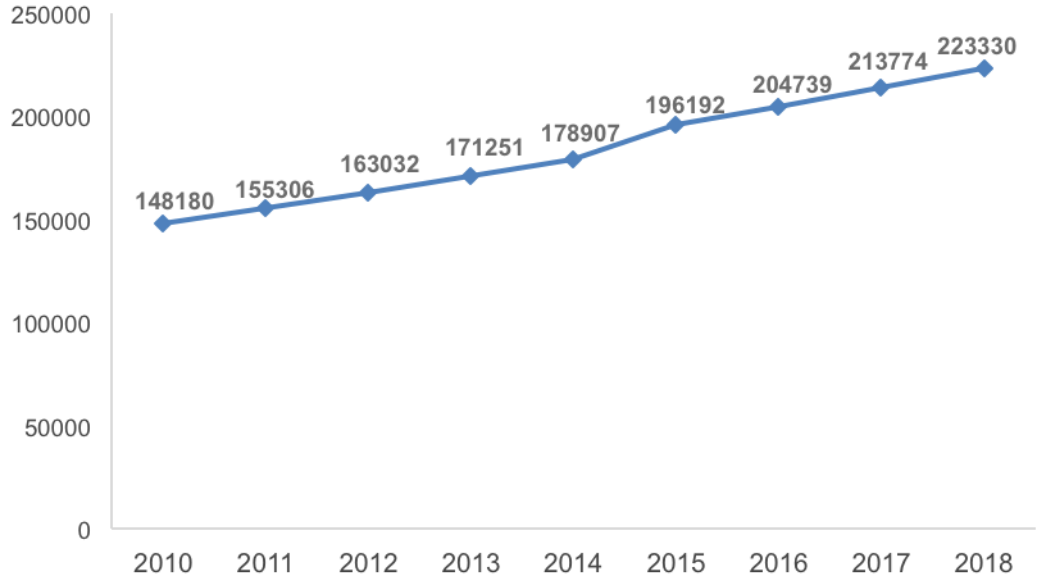
Figure 30 Load Curves



Source: Tokyo Electric Power Company, Inc. (2009)

The Solomon Islands has a very complex electricity consumption and demand profile mainly due to its geographical location. The electricity demand is estimated to increase in the near future due to existing grid infrastructure improvement/expansion, new connections and installation of new isolated systems. However, it is unlikely to have a unified grid in the Solomon Islands. Further, the electricity demand pattern is expected to be different in each of the province, urban and rural areas. Based on the historical data and available information electricity demand forecast for the Solomon Islands is presented in the Figure 31.

Figure 31 Electricity Demand (MWh) Forecast for Solomon Islands (2010-2018)



The electricity demand forecasts for each province Honiara, Auki, Noro, Gizo, Buala, Kirakira, Lata, Tulagi, Choiseul and Rennel are different and varies based on the estimated population increase and grid expansion.

4.2.2 Renewable Energy Schemes

The calculation of CO_2 offsets by current and upcoming Renewable Energy Schemes is based on the baseline assumption that these energy schemes will replace mostly diesel fuel use. This is because Solomon Islands gets most of its electric power from the burning of diesel. Table 34 summarizes the renewable energy generation potential in Solomon Islands

Table 34 Potential Renewable Energy Sources in Solomon Islands (as on 2012 assessments)

Renewable Energy	Capacity (MW)
Hydro (Small/Micro)	49 MW
Solar	4 MW
Biomass Gasification	4 MW
Biofuel	1 MW
Wind	7 MW
Total	**65 MW**

Hydro power

A study carried out by the Tokyo Electric Power Services CO Ltd with MEMM and SIEA under JICA (ref: JICA, MEMM, SIEA, Master Plan Study of Power Development in Solomon Islands, Progress Report, March 1999, Tokyo Power Services, Ltd, IC NET Limited) has shown that there is potential for Solomon Islands to venture into hydro power technology. It is estimated that a total output of around 326 MW could be harnessed from hydro power alone. This is summarised in Table 37 below. Note that 73% of the total potential is reportedly on Guadalcanal, possibly because the resource has been more thoroughly investigated on the island with the bulk of national electricity demand.

Small hydro, assumes about half of mini potential identified by JICA (Table 35) is developed and all of the micro potential. Assumes hydro (not base load except Komarindi) replaces 60% of fuel currently used for power generation for electricity generation: 60% of 19.4 ML = 11.6 ML or 31 Gg of $CO2$[6].

Table 35 Summary of hydro potentials in various parts of Solomon Islands

Island	Number of potential sited	Number and types of hydro plant recommended	Total Plant Output (Capacity) MW
Guadalcanal	49 sites	1. 7 PON 2. Reservoir (Dam) 3. 40 ROR	237.31
Malaita	23 sites	1. 1 PON 2. 22 ROR	30.79
Isabel	6 sites	All sites are ROR type	4.71
Western Province (Kolombangara, New Georgia, Rendova, Vangunu, Vella Lavella)	23 sites	All sites are ROR type	5.16
Santa Cruz	2 sites	All sites are ROR type	0.31
Choiseul	15 sites	1. 1 PON type 2. 14 ROR type	22.2
Santa Cristabal	12 sites	1. 7 PON type 2. 5 ROR type	25.891
Total hydro-potential capacity in Solomon Islands			**326.371**

NB: ROR means Run-Off-River systems which means no dam required.
PON means Run-off- river with pondage which means dam is required.
RES means Reservoir which means a system which requires dam construction.

As shown in Table 35, Solomon Islands has a very high potential (326.371 MW) for hydroelectric power. This means for one year, this is equivalent to 2,859,009.96MWh per annum that can be generated from all hydro power potentials in the country per annum.

[6] SOLOMON ISLANDS National Report , Volume 12, Pacific Regional Energy Assessment 2004, Pacific Islands Renewable Energy Project

Existing hydro schemes in the Solomon Islands

Currently only community based micro-hydro schemes are installed in eight communities in the Solomon Islands. The table below summarises the location, year of installation, turbine capacity, generation and the funding sources of these hydro schemes.

Table 36 Summary of Existing Hydro Schemes in Solomon Islands

Location	Year Installed	Turbine Capacity(kw)	Generation	Funding	Comments
Iriri (Kolombangara, Western Province)	1983	10kw	3-4kw (average =3.5 kw)	UNIDO	Not operating due to weir and penstock failures, etc.
Vavanga (Kolombangara – Western Province)	1994	12kVA (9.6kw)	4-5kw (now 8 kw)	AusAid + Australian citizens	Reconstructed on a new site with a new 8 kw turbine/ genset. Commissioned June 2006. Currently operating reliably.
Ghatere (Kolombangara – Western Province)	1997	12kw	(average=7kw)	AusAid + Australian citizens	Not operating due to turbine failure, flood damage, theft of electrical equipment, etc. Community is still considering whether to refurbish this system.

Bulelavata (New Georgia, Western Province)	1999	29kw	14kw	AusAid	Operational. Supplies power to 20 households plus the Biula Secondary School(large boarding school).
Manawai Hobour (Malaita Province)	1997	50 kw	15-25kw (average = 20kw)	Republic of China	Operational. Various economic and rural development spin-offs.
Raeao (Malaita Province)	2002	25kw	14kw	Republic of China	Operational.
Nariaoa (Malaita Province)	Feb. 2004	25 kw	(average =14kw)	Republic of China	Project completed but operational status not known.
Masupa (Malaita Province)	Feb. 2010	40 kw	(average = 20 kw)	Solomon Islands Governm ent	This scheme powers a freezer room/ice-making facility that is used by fishermen in the area to earn money by selling fish to traders who eventually supply the Honiara market with fresh fish. Current price of fish in Masupa is

					$13.00 per kg. This scheme has opened up a new income-generating opportunity for the rural people in that area.
Total		**200.6 kW**	**100.5 kW**		

As seen in Table 36 the average generation of power through hydroelectricity only stands at around 100.5 kW or **880.380 MWh** per annum and off-setting **703.26 t CO_2e[7] per annum.**

The replacement of business as usual case from Solomon Islands' present power generation (i.e. dominated by diesel) scenario with the hydro power project can directly reduce the GHG emissions (i.e. direct and indirect), but here considered only direct GHG emissions reduction, due to unavailability of relevant data associated with the indirect GHG emissions from the present conventional power generation.

Planned hydro schemes in Solomon Islands

There are several hydro schemes planned for various parts of the country for at least the next decade. One of the major schemes is the Tina Hydro Development Project located at the eastern side of Honiara. This projected if completed should supply ample hydro power that could almost replace the fossil fuel based electricity that is literally powering the whole of Honiara at the moment.

Table 37 Planned Hydro Schemes for various parts of Solomon Islands

Planned hydro schemes	Specification/capacity
Tina Hydro Development Project. Completion 2012	14 MW(Initially), Expansion planned 28MW
Huro Hydro power Development Project	340kW
Rualae Hydro Development project Malaita	120 kW
Rori Hydro Development	300 kW
Luembalele Hydro site, Temotu	50 kW
Mataopuku1, Hydro site, Guadalcanal	1.6MW
Maotapuku 2 Hydro site, Guadalcanal	1.4 MW
Sasa Hydro site, Guadalcanal	280 kW
Silolo Hydro site, Malaita	2.1 MW
Kware‟a Hydro site, Malaita	600 kW
Kubolota hydro site, Isabel	80 kW
Waimapuru hydro site, Makira	20 kW
Sorave Hydro site, Choiseul	70 kW
Total	48.96MW

[7] At an assumed specific fuel consumption of 3.38 kWh per lit of diesel each liter of diesel replaced by hydro equals 2.7 kg CO_2 – Mini Hydro Prefeasibility Studies, RETA 7329: PromotingAccess to Renewable Energy in Pacific Solomon Islands Component Technical Assistance, ADB

If the planned hydro schemes in Table 37 are installed in the next ten years a total of 48.96MW of hydropower could be generated. This is approximately 15 % of the total potential for hydropower for Solomon Islands and equivalent to 428,889.6MWh per annum and off-setting approximately **343.112 tCO_2 e per annum.**

Solar PV Technology

According to a report by the Tokyo Electric Power Services Cooperation Ltd (1999), Solomon Islands average sunshine hours is found to be approximately 5.8 hours. According to the study based on data from 1981 to 1998, and based on the average sunshine hours data, Solomon Islands has a potential of about 10Ah of solar generation a day that can be expected with a PV panel of 50 watts. The study also revealed that rural Solomon Islands households making up about 80% of the national population only requires about 50-100watts PV panel to drive these basic appliances.

Table 38 Existing Solar PV Schemes in Solomon Islands

Programmes	Capacity
Community Hugh Schools	6 kW
Baegu/Asifola Battery charging Stations	5 kW
Pockets of rural Solar PV set-up in rural Communities (Iumi Solar Development Programs	34.895 kW
California Solar Pumping and Aola Area Health Center	2 kW
Portable Solar Home systems, 40 X 20 watts units per constituency in	40 kW
Solomon Islands	
Italian funded rural Electrification for 5 Schools	18.69 kW
Turkish funded rural Electrification for Clinics and Schools	7.58kW
Santa Ana Solar Power Project	3.0 kw
Nahu Community solar project	1.60kw
Privately owned standalone solar Home Systems	30 kw
Total	**148.765**

From the above total generation an estimated 1,303.18 MWh per annum is generated from existing solar power schemes equivalent to a baseline emission level of approximately **1.043 tCO_2 eq. per annum.**

Until recently the use of solar PV has been minimal, especially for rural electrification, even though there has been a long-standing government policy to increase rural electrification through renewable energy. By the end of the ethnic troubles, fewer than 100 homes in rural areas were known to have solar electricity. In 2011, almost 8 000 homes are said to have received solar installations (Table 38).

Historically, solar PV has been used at church missions since the 1970s for lighting. A few PV refrigerators were installed in 1992 for vaccine cooling in health centres.

Table 39 Solar installations in Solomon Islands households

Location	Population	Households	Kerosene	Solar
Malaita	137596	24421	19211	2969
Makira	40419	7173	5735	424
Central	26051	4905	4476	188
Western	76649	13762	10425	1149
Isabel	26158	5143	3825	870
Choiseul	26372	4712	3869	478
Renbel	3041	688	145	515
Temotu	21362	4303	3431	532
Guadalcanal	93613	17163	14198	597
Honiara	64609	8981	2835	202
Solomon Islands	515870	91251	68150	7924

Source: Mr. David Iro, Willies Electric and Solar Power, Honiara, Presentation at IRENA Sydney Workshop 2011.

Planned Solar Power Schemes

While there is a steady increase in distribution of small scale household solar power systems across the country there are also a number of planned projects that can potentially scale up the level of power generation from solar power.

Table 40 Planned Solar PV Schemes for Solomon Islands

Planned Solar PV schemes	Specification/ capacity	Funding Source
MMERE & Rural Electrification program forecast for the next five years	500 kW	Solomon Islands Govt.
Proposed Honiara Solar PV Grid Connected Power Plant	3 MW	Donor to be confirmed
Gizo Solar Power generation site	150 kW	Donor to be confirmed
On-Going Turkey funded Electrifcation for Schools and Clinics	100 kW	Govt. of Turkey
Italy Funded Rural Electrification Project for Boarding Schools	200 kW	Italian Govt.
PEC fund Proposed home systems for 50 Constituencies	600 kW	Various donors
Taiwanese Funded Solar System for Parliament BLDG	13.5 kW	Govt of Taiwan
On-going Taiwanese fund for Portable Home Systems to Constituency in Solomon Islands	40 kW	Govt of Taiwan
Iumi Solar program Forecast for the future	400 kW	Various donors
Total	**4.6035 MW**	

From the above total generation of 4.6035MW, 40,326.66MWh per annum is generated from existing solar power schemes with a baseline emission for planned solar PV schemes in Solomon Islands at approximately **32.261 t CO_2e per annum.**

Biomass Energy

Although almost all 85% of Solomon Islander living in the rural areas and even many in the urban areas uses biomass in the form of firewood for household cooking, there is not much done to improve the efficiency of this traditional technology. The continuous reliance on raw wood for household cooking, copra drying, fish smoking, bech-der-mer drying, etc, has started to result in shortage of fuel wood causing negative impacts on the environment in many areas in Solomon Islands. For example, cutting of mangroves for firewood throughout the years has resulted in massive clearing of mangroves in many coastal villages of Malaita which in turn also has a negative impact on the marine biodiversity of these areas.

However, there are areas where wood waste or biomass is abundant. For example, saw milling factories and plantation sites have a lot of biomass as wastes that can be converted to useful energy using appropriate technologies. Studies need to be done to improve the traditional biomass household usage as well in a higher scale, businesses that have biomass waste as their by-product should seriously apply technologies.

Table 41 Existing Biomass Schemes in Solomon Islands

Biomass project	Specification/Capacity	Funding Source
Guadalcanal Plantations Palm Oil Ltd (GPPOL)	500kW	Guadalcanal Plains Palm Oil Ltd

This is equivalent to 4,380MWh per annum with a baseline emission of approximately **3.504 t$CO_{2\ eq.}$ per annum.**

Table 42 Planned Biomass Schemes for Solomon Islands

Biomass Projects	Specification/Capacity
GPPOL increased Production plan for the next 10 years	300kW
Proposed Biomass plant at Noro, Western Province	4 MW
Total	**4.3MW**

This is equivalent to 37,668.0MWh per annum generated from planned biomass schemes in Solomon Islands with a baseline of approximately **30.134t CO_2eq per annum.**

Bio-Fuel Energy

Table 43 Existing Bio-Fuel Energy Schemes

Biofuel Projects	Specification/Capacity
Solomon Tropical Products Ltd (STPL)	350kva=255 kW
Rokera Provincial Secondary School Genset	10 kVA = 7.27 kW
Lata Hospital Bio-fuel Genset	10 kVA = 7.27 kW
Total	**269.54 kW**

This is equivalent 2,361.1704 MWh per annum with a baseline emission at approximately **1.889 t CO_2 eq. per annum.**

Table 44 Planned Bio-fuel Energy Schemes

Bio-Fuel Projects	Specification/Capacity
Proposed bio-fuel generator for Lata	200 kW
Auki Biofuel Generator	135 kW
Total	**335kW**

Total generation of 335 kW translates to 2,934.6MWh per annum with a baseline emission per annum of approximately **2.348 t CO_2eq. per annum.**

Wind Energy

There are is still no existing wind energy schemes in Solomon Islands apart from two wind monitoring stations installed at Gizo (Western Province) and Rennell and Bellona**.**

The potential for wind energy in parts of the country could only be known if similar monitoring studies are carried out. Two major wind energy projects are being proposed to be implemented in the coming years as seen in the table below.

Table 45 Planned Wind Energy Schemes for Solomon Islands (next 20 years)

Wind Energy projects	Specification/Capacity
Proposed Wind Farm for Honiara	5 MW
Wind Farms for Provincial Centers 200kW each	1.8 MW
Total	**6.8MW**

Total generation is equivalent to 59,568.0MWh per annum with a baseline emission of approximately **47.654 t CO_2e per annum.**

Table 46 Total offsets in terms of tCO_2 eq per annum saved by existing renewable energy schemes and expected savings from planned renewable energy schemes for the next ten years.

Renewable Energy Schemes	Existing scheme offsets (tCO_2 eq/annum)	Planned scheme expected offsets (tCO_2 eq/annum)
Mini- Hydro power	7.043	343.112
Solar PV	1.043	32.261
Biomass	3.504	30.134
Bio-fuel	1.889	2.348
Wind	0	47.654
Total	**13.466**	**453.161**

As shown in above section that, the renewable energy (Hydro, Solar PV, Biomass, Biofuel and Wind) generation is replacing and will replace business as usual case from Solomon Islands' present power generation (i.e. dominated by fossil fuel) scenario and can directly reduce the GHG emissions (i.e. direct and indirect) associated with the power generation, but here considered only direct GHG emissions reduction, due to unavailability of relevant data associated with the indirect GHG emissions from the present conventional power generation and its supply chain.

4.2.3 Energy Efficiency Schemes

As reported in the initial national communication, inefficient use of energy is observed mainly in areas such as lighting, air conditioning and refrigeration. Although the concept of conserving energy use to minimise cost already existed, the idea to use more efficient white appliances or the need to conserve energy because it will minimise emission of GHGs into the atmosphere is still be realised amongst the majority. The cost of electricity in Solomon Islands is SBD $4.76/kwh. This is one of the highest rates in the region.

Buildings, and other infrastructure and industrial sectors have strong linkages to energy efficiency and conservation. Commercial, government offices and residential buildings‟ energy consumption trends need to be investigated. Building designs to cater for minimal cooling systems and lightings are some of the tasks that need looking into.

Transport infrastructure such as road-network; public and private road transport systems; sea and air transport network would be investigated to identify measures to minimize the amount of energy used, whilst delivering the required services. The consumption of electrical power in various manufacturing, commercial service and retailing industries have links to energy wastage and GHG emission. Use of energy efficient technologies in these sectors is crucial to GHG emission. The lack of stringent regulatory system for imported white appliances and measures on building codes is the major issue regarding energy efficiency in Solomon Islands.

4.2.4 Non-Energy Sectors

Waste

Although waste generation is quite significant in Solomon Islands through the following sectors: (i) Solid Waste Disposal Sites, (ii) Wastewater Treatment and Discharge, (iii) Biological treatment of Solid Waste and (iv) Incineration and Open Burning of Waste, there is no enough data or studies done to estimate the amount of GHGs emitted from waste. With the minimal data that is available, according to the GHG inventory report on waste, it is estimated that emissions from solid waste and waste water from 2000 to 2010 were as follows.

Table 47 GHGs Emission from Wastes

Year	2000	2005	2010
Solid Waste	120.22	138.75	144.21
Domestic waste water	39.49	45.58	47.37
Total	159.71	184.33	191.58

There is no estimate for greenhouse gases being emitted from other waste sectors due to lack of data and also there is a lot of uncertainties surrounding the above estimates. As for waste water, there is no waste water treatment plant in existence at present even in the urban areas. A few factories are treating their waste waters and pipe them into the sewage pipeline, hence it is assumed that GHGs especially methane is emitted directly into the atmosphere. As can be seen, there is a good opportunity to introduce mitigation technologies whereby GHGs emitted, especially methane from waste water can be captured and put into good use.

LULUCF

As for other non-energy sectors like LULUCF, there was insufficient data and information on the mitigation technologies applied whereby by reliable measurements of GHGs could be calculated. However, there is potential for reforestation, low emission agriculture (organic agriculture) programmes and initiatives throughout the country.

4.2.5 Emission scenarios

A major area with potentially high levels of emissions is subsistence agriculture however due lack of data and difficulties in determining extent of land use change the levels of emissions was not estimated (excluding livestock waste).

Below the all possible sectors have been covered to show the emissions scenario of Solomon Islands (as per the available authentic data).

Baseline emissions scenario

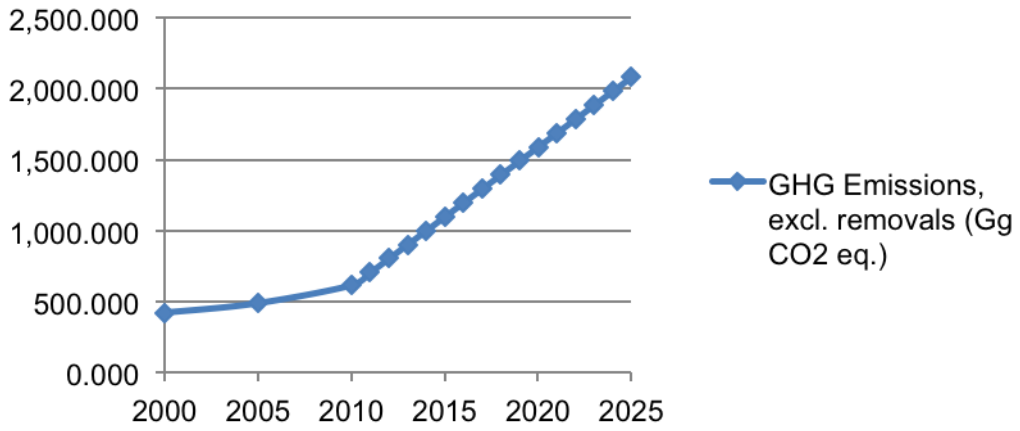
This scenario presents a "business as usual" trend of Solomon Islands GHG emissions between 2000 and 2010. In addition, a "business as usual" projection of Solomon Islands GHG emissions beyond 2010 up to 2025 will also be illustrated.

The assumption is that population growth and economic developments will continue and that there are no GHG abatement schemes implemented. The business as usual baseline trend and projection for Solomon Islands is based mainly on the following sectors: Energy, Industrial Processes, Agriculture and Waste. Other sectors are not considered due to lack of data. A summary of the emissions and removals in tCO_2eq and Gg CO_2eq for 1994 (base year for the initial national communication) and 2000 (selected base year for the second national communication) to 2010 (final year considered for the second national communication GHG inventory).

Table 48 Total Emissions from 2000-2010

Sectors	1994	2000	2005	2010
Energy	294	192	235	351
Industrial Processes	NE	-	-	-
Solvents and Other Products Use	NE	NE	NE	NE
Agriculture	NE	70	74	76
Waste	NE	160	184	192
Total GHG Emissions, excl. Removals	**294**	**422**	**493**	**619**

Figure 35: Future GHG emissions excluding removals, 2000 to 2025 (Gg $CO_{2\ eq.}$)



Mitigation Emissions Scenario 1

Under this scenario the same assumption made for the baseline "business as usual" scenario is used but also taking into consideration offsets from existing mitigation schemes. It is assumed that all mitigation activities were operational from 2000 as well as emissions/sinks from LULUCF are not considered in this analysis.

Table 49 Gg CO_2 eq. Offsets

Emissions	Year		
	2000	**2005**	**2010**
Total emission excl. removals (Gg CO2 eq.)	422	493	619
Emissions after offsets from existing mitigation schemes (Gg CO2 eq.)	422.27	493	618.59

Mitigation Emissions Scenario 2

Under this scenario the same assumption made for the baseline "business as usual" scenario is used but also taking into consideration both the existing and planned mitigation schemes offsets from 2011 to 2025. LULUCF emissions and removal is not considered in this analysis.

A summary of the $GgCO_2eq$ off sets that would occur by 2025 if all the existing and planned mitigation schemes are still operational are shown in below table.

Table 50 Projection of emissions in the Business as Usual Case versus Emissions after Offsets: 2011 - 2025

Year	GHG Emissions, excl. removals (Gg CO2 eq.)	GHG emissions excl. removals after offsets (Gg CO2 eq.)
2011	422	422
2012	493	493
2013	619	618
2014	708	707
2015	806	805
2016	904	903
2017	1,002	1,002
2018	1,100	1,100
2019	1,198	1,198
2020	1,297	1,296
2021	1,395	1,394
2022	1,493	1,492
2023	1,591	1,591
2024	1,689	1,689
2025	1,787	1,787

A major area with potentially high levels of emissions is subsistence LULUCF and agriculture however due lack of data and difficulties in determining extent of land use change the levels of emissions was not estimated (excluding livestock waste).

Table 51 Sectors, Categories and Sub-Categories with a high GHG-relevance

Sectors/Categories	GHG emissions in 2000 (Gg $CO_{2\ eq.}$)	% share of subsectors in country's annual GHG emissions
Energy Industries (Electricity production)	44.76	10.60%
Transport (Road)	88.68	21.00%
Other Sectors (Commercial, Industrial & Residential)	58.78	13.92%
Industrial Processes (Food & Drink)	0	0.00%
Enteric Fermentation (Animal Waste)	19.61	4.64%
Manure Management (Animal Waste)	32.09	7.60%
Agricultural Soils (N20 from animal waste)	18.65	4.42%
Solid Waste Disposal on Land (Domestic)	120.22	28.47%
Wastewater Handling (Domestic)	39.49	9.35%
Total GHG Emissions, excl. Removals	**422.28**	**100%**

Here all of the LULUCF, solvent & other product use sectors and agriculture sub-categories are not included, only emissions from livestock were estimated. The other sub-sector or sub-category of importance but not assessed due to limited data is the smallholder agriculture where emissions are expected to be high. Estimates from PNG in 2010 have subsistence agriculture contributing about 30% of total emissions (UN Collaborative Programme on reducing emissions from deforestation and forest degradation in developing countries – National Programme Document, 2011). Subsistence gardeners in PNG and Solomon Islands, like many South East Asian nations, apply similar land clearing and land preparation methods and have similar tropical forest settings. It could therefore be assumed that emissions per unit area of land subjected to shifting cultivation would be similar to PNG situation.

Potential GHG Emissions Mitigation Project Opportunities:

Like other Pacific island countries, the Solomon Islands does not have big industrial facilities and the per capita energy consumption is low. Therefore the country's greenhouse gas mitigation potential is mainly in the form of numerous small scale emission reduction opportunities that scatter among numerous locations and facilities and households. Compared with stand-alone regular CDM projects, the Programme of Activities, which allows for registration of a programme and a typical programme activity, and the adding of unlimited number of more programme activities over a maximum period of 28 years, can more effectively unlock the potential of greenhouse gas emission reduction in the Solomon Islands.

Under the CDM Component of the ACP MEA projects, 3 PoA PINs have been developed below is a brief summary of these three PoA PINs[8].

1.) PoA for Promotion of Small Hydro Power in Solomon Islands:

The proposed PoA will develop small scale run-of-river hydropower plants. Electricity generated will replace power generation based on imported diesel. The Programme of Activities (PoA) will develop small scale run-of-river hydropower plants to harness the abundant hydropower resources. The first CPA will be a 2.74 MW plant to be built on the Mataniko River.

Facts

Project Type: Electricity generation from hydro
Project size: Small scale
CERs/Year: First CPA: 10,160 tCO2e/year
The PoA is currently at feasibility study stage. It is expected to be operational by 2013.
The first CER delivery is expected in 2015.

2.) PoA for Solid Waste Management in Solomon Islands:

Over the several decades, waste management has become a major concern for small island countries in the Pacific region as poorly managed waste has the potential to cause negative impacts on national development activities, including tourism and trade, food supplies, public health and the environment. The objective of the Programme of Activity (PoA) is to implement effective, manageable and

[8] www.acp-cd4cdm.org

deliverable waste management systems to enable to reduce the amount of waste that is currently generated in the country.

Facts

PoA Type: Sanitary landfill to avoid methane emissions from unmanaged waste dumping
Project size: Each CPA will be of small scale
CERs/Year: The proposed first CPA involves the building and operation of a Solid Waste Management at Ranadi Dump, Honiara. The estimated daily waste disposed in Honiara is 61tonnes/day. It is expected that the CPA can generate 6381 tCO2e of emission reduction each year during its first 7-year crediting period (2015-2021).

3.) PoA for Supply Side Energy Efficiency Improvement on Solomon Islands Electricity Authority (SIEA) power stations:

In Solomon Islands, electricity is generated and supplied by the Solomon Islands Electricity Authority (SIEA), which is a state-owned electricity utility that has the sole mandate to provide power across the country. The objective of the Programme of Activity (PoA) is to implement energy efficiency measures in all SIEA power stations which will reduce fuel consumption in the diesel generators used for power generation.

Facts

Project Type: Energy efficiency for electricity generation
Project size: Each CPA will be of small scale
CERs/Year: The proposed first CPA involves installation of EDC system at Noro Munda power station. It is estimated that the project activity on an average will lead to diesel savings of the tune of 5,369,877 litres per year over a period of 21 years at Noro Munda Power Station. This CPA is expected to generate 9137 tCO2e of emission reduction per year during its first 7-year crediting period (2014-2020).
Status of acceptance of the Host Country: The project has been chosen by the Solomon Islands government for PIN development.
Status of project: Pre-Feasibility Study Finished. The project is expected to be operational by 2013. The first CER delivery is expected in 2014.

4.3 Policies and Regulations relevant to Mitigation

Climate Change Policy

Solomon is in the process of drafting its Climate Change Policy which will cater for the need for mitigating climate changes. However there are some related existing policies in other related sectors that give a guiding framework for any mitigating activities to be carried out. The following related national policies can be used as mitigation guidelines:

National Energy Policy Framework and National Development Strategy (NDS: 2011-2020)

A National Energy Policy Framework was gazetted in 2007. The Policy framework sets out the Government‟s policies for the planning and management of the energy sector up to 2017.

From the outset, the policy framework was not explicit and firm about the importance of the energy sector‟s linkage to climate change and mitigation, although it mentioned that fossil based fuels contributed to the emission of GHGs. Nevertheless, the energy policy framework has two polices with direct relevance to climate change mitigation and environmental conservation:

- Promote the use of renewable energy resources
- Ensure minimal negative impacts of energy production, distribution and consumption on the environment.

In variance to previous medium development plans, the government recently gazetted a 10 year national development strategy in 2011. The NDS also has a policy to ensure availability and efficient use of energy to achieve development goals of improving the livelihood and quality of life for all the people in the Solomon Islands. The strategy to achieve the above policy is to “increase the supply and coverage of electricity by respond to community requests in rural areas to assess and develop renewable energy resources…focusing on hydro-power in larger islands and solar power on water short atolls and outer islands whilst evaluating other renewable resources and adopting both appropriate technologies and institutional arrangements, including community management”” (Solomon Islands Government 2011).

Environment Act 1998

The Environment Act was enacted by Parliament in 1998 and came into force in August 29th 2003. The overarching function of the Environment Act 1998 is to protect, restore and enhance the quality of the environment of Solomon Islands, having regard to the need to promote sustainability. The Act has two specific parts to help facilitate this:

- firstly, there is the requirement for development control and environmental impact assessment to be applied in the approval of development projects;
- Secondly, there is a specific requirement for pollution control to be exercised in the management of wastes.

Environmental Impact Assessment Guidelines 2010

Revised by the Environment and Conservation Division, the guidelines aim is to promote sustainable development by ensuring that development proposals do not undermine critical resources and ecological functions or the wellbeing, lifestyle and livelihood of the communities and peoples who depend on them.

The Environment Act requires that all “prescribed developments‟ undertake an Environmental Impact Statement (EIS) or a public environmental report before any development any proceed. The EIS should identify all potential environmental impacts and define appropriate mitigation measures to ameliorate the impacts throughout the life of the development

Solomon Island National Solid Waste Management Strategy 2009-2014

The Solomon Islands National Solid Waste Management Strategy 2009-2014 was developed in collaboration with SPREP and JICA. The strategy is developed to address the increasing problems concerned with solid waste management to improve on the management of solid waste in the country in the long term. The implementation of the strategy through the promotion of the 4R, Refuse, Re-use, Reduce, Recycle can reduce amount of waste going to the dumpsite, thus reduces the GHG emission.

National Biodiversity Strategic Action Plan

The National Biodiversity Strategic Action Plan was developed in 2008 through the collaboration of National and Provincial Government, NGO‟s, rural communities and resource owners. It is developed to enhance the effective management of the country‟s biodiversity. The Action Plan identifies Climate Change as one of its 13 themes. Under this theme it aims to ensure that the pressures, impacts and mitigation measures of climate change are adequately supported and addressed to conserve the country‟s biodiversity.

4.4 Barriers

Barriers to Mitigation Technologies

The barriers to effective identification and adoption of mitigation technologies has been determined through the SNC consultations and also includes a range of barriers to renewable energy technologies (RETs) identified in the Solomon Islands national report of the Pacific Regional Energy Assessment (2004) and which are considered to be applicable today.

Fiscal

- SIEA has an exemption from duty on distillate which could bias fuel choice against local biofuels. There is no fiscal incentive to import RETs, which attract the same duty as electrical equipment in general.
- There are no „green" interest rates for RE or access to foreign capital for RE through government support.
- The lack of any analysis of the likely development impact of large-scale use of coconut and/or other vegetable oils as bio-fuel is real barrier to its serious consideration for development.
- Poor management of re-forestation levy by government and customary land owners

Financial

- Minimal staffing and financial resources of the Energy and Forestry Division;
- Serious government budgetary constraints in general;
- Very low cash incomes in rural communities;
- Higher initial costs of RETs compared to conventional energy systems;
- SIEA tariff policies, with heavy cross-subsidies and penalties for self-generation;
- Lack of donor funding for coconut oil biofuel
- Inability of banks to use customary land as security or equity for loans;

Legislative, Regulatory and Policy

- No formal energy plans, and few standards or regulations regarding energy use and development;
- Inadequate legislation for consumer protection, price control, fuel storage and handling, and power sector regulation
- Lack of legislation for Renewable Energy Service Companies
- Forestry Act no longer effective and still needs to be revised to provide stronger protection and enforcement
- Weak enforcement of the Environment Act
- Weak or no monitoring and enforcement of the Code of Logging Practice
- Lack of Forestry and Climate Change policy and strategy to guide the work of the Forestry Division and the forest sector in general to address forestry and climate change

Institutional

There are serious institutional weaknesses at all government levels (except local communities in some provinces). Government institutions generally lack the expertise to foster or effectively develop Renewable Energy (RE) and forestry projects. There is no energy sector coordination mechanism.

- Government lacks capacity to effectively absorb donor assistance for energy projects;
- Weak coordination amongst national stakeholders in the forestry sector
- Ineffective cooperation among regional organisations can be a barrier for RE efforts.

Technical

- There are no standards for imported Renewable Energy Technologies (RETs)
- Shortage of technical skills and virtually no industry away from Honiara and Noro

Market

- Lack of affordable, reliable shipping for copra to be shipped to urban centres for processing into biofuel;
- Protection of SIEA"s operations, so SIEA has no incentive to improve, and RETs cannot compete
- No mechanism in place yet for carbon trade
- Limited support for rural milling operators to ensure good quality timber is sold to the best markets in Honiara and overseas

Knowledge and Public Awareness

- Limited knowledge regarding various renewable energy options other than Solar energy
- Limited public understanding on the links between climate change and the role of forests in adaptation and mitigation
- Poor access to information on prior experience in the Pacific on renewable energy and sustainable forest management
- Knowledge of the pros and cons of solar PV is very limited.
- No laboratory facilities to test biofuels or petroleum fuels.
- Little or no appropriate RE and sustainable forest management training

Other barriers

- Difficulties accessing customary land for most RET and Forestry development projects due to land disputes.
- Logging activities affecting water sheds and potential for hydroelectricity schemes.
- Lure of quick money from logging operations with not many alternative income generation opportunities in rural areas

Intended Nationally Determined Contributions (iNDCs)

Solomon Islands as a party to the convention is keen to develop its iNDC and display commitment towards an ambitious agreement during the CoP 21 in Paris. At the 17th Conference of the Parties (COP) in Durban in December 2011, Parties to the UNFCCC decided to launch a process to develop a protocol, another legal instrument, or an agreed outcome with legal force under the Convention applicable to all Parties, to be completed no later than 2015.

At COP 19 in Warsaw in November 2013, Parties were invited to initiate or intensify domestic preparations for their intended nationally determined contributions (INDCs) and to communicate them well in advance of COP 21 (by the first quarter of 2015 by those Parties ready to do so), in a manner that facilitates the clarity, transparency, and understanding of the intended contributions. While the most recent COP in Lima provided further guidance on INDCs, including upfront information to be included when submitting INDCs to the UNFCCC Secretariat; countries are preparing their INDCs under some degree of uncertainty.

The two important outcomes from COP 20 in Lima include the Lima "Call to Action," which includes language on INDCs, and draft elements of the negotiating text, which were included in the annex of the Lima Call to Action. The concept of "no backsliding" (decreasing contributions over time) was also adopted in Lima, as was an invitation to Parties to include adaptation undertakings or components in their INDCs if they wish. The decision clarified upfront information to be included when submitting INDCs to the UNFCCC Secretariat to facilitate clarity, transparency, and understanding.

INDCs include the word "intended" because their legal status and final form – as well as what the final agreement will look like – are not yet known. Because INDCs are "nationally determined," it is important to not wait for guidance from the process. The Lima decision also helped clarify the INDC process in 2015: the UNFCCC Secretariat will publicize communicated INDCs through an INDC online portal and will prepare a synthesis report by 1 November on the "aggregate effect" of all contributions received by 1 October.

Solomon Islands scope and type of contribution is envisaged to be based on national priorities which also includes a diversity of national circumstances, capacities, and capabilities. The country is working towards securing a political mandate with clear goals and timelines, as well as defined roles and responsibilities under the INDC. The existing institutional structures are being reviewed to identify and develop the most appropriate structure (the lead institution, policy/sectoral experts, and technical teams) to coordinate the INDC activities. Consultations with relevant stakeholders are planned to be carried out to build trust, feed the technical process, and create mutual accountability.

Efforts will be made to build on existing information, activities, and regulations (such as national communications, greenhouse gas inventories, Clean Development Mechanism (CDM) projects, national adaptation programs of action (NAPAs), development plans and national climate change policies and regulations).

Currently there is lack of clarity in terms of the technical, financial and capacity building support that would be provided to LDC's such as Solomon Islands to fulfil the determined contributions. More analysis is needed on the feasibility of proposed contributions, including co-benefits. The key challenge is to strike a balance between sound technical information and realistic goals, given the political processes that exist.

4.5 Conclusion and Recommendations

The National Energy Policy Framework, proposed NAMA and the findings of the SNC provides a foundation for developing an appropriate climate change mitigation strategy for Solomon Islands while the barriers identified (as explained in above section 5.2.7) can be considered as opportunities for improvement and capacity development. Solomon Islands has a very strong potential to increase use of renewable energy technologies and its political and community leaders and resource owners must now exercise wise decision making to ensure that the abundant natural resources in the country that can contribute to climate change adaptation and mitigation are not mismanaged and wasted. Many if not all of the mitigation actions can also contribute to enhancing the adaptive capacity of the country and its people. A number of recommendations are presented to guide further work at the national level to address climate change mitigation:

i. Finalize the NAMA for use as a guiding strategy to increase mitigation efforts in the country

ii. Use the National Energy Policy Framework to develop more specific provincial and Honiara city renewable energy strategies including renewable energy and sequestration targets and capacity building actions

iii. Review SIEA legislation and identify opportunities to provide incentives for development of renewable energy and sale of electricity into the national grid.

iv. Revise and strengthen the Forestry Act to protect forest resources and provide stronger enforcement of rules that can ensure sustainable forest management

v. Immediately seek donor support to implement the newly gazetted Protected Areas legislation

vi. Scale up planting of forest plantations and woodlots to provide alternative source of timber and fuel wood to enable the natural forest cover to regenerate and recover from logging

vii. Secure funding and carry out a national agriculture census to provide data for future inventories in the agriculture and land use sector as well for national agriculture development planning purposes.

viii. Implement the UN REDD+ Readiness Project and build the required governance framework and capacity to engage in carbon trade

ix. Seek increased funding from GEF and other development partners for mitigation projects targeting renewable energy and sustainable forest management

x. Develop and implement a communication strategy to raise awareness on climate change mitigation

xi. Immediately build capacity of the Forestry Division, School of Natural Resources, Water Resources Division, Climate Change Division and Ministry of Agriculture and Livestock to mainstream climate change mitigation into their strategies and operations.

CHAPTER 5

OTHER INFORMATION

5.1 Technology Transfer

5.1.1 Background

”the latest scientific knowledge on climate change indicates that the world is on a GHG emissions trajectory which is worse than the IPCC worst case scenario and that there is a risk of severe disruption of the climate system” (UNDP 2009). Global energy demand will double from present levels by around 2030 (IEA 2008).

“Technology transfer includes not merely transfer of hardware but also of best practices, information and improvement of human skills, especially those possessed by specialized professionals and engineers. The acquisition and absorption of foreign technologies, and their further development, are complex processes that demand considerable knowledge and efforts on the part of those that acquire them. It is the capacity of the countries and the enabling environment in those countries that will enable them to change to a low carbon economy.” (EGTT 2009)

As this SNC report has shown in Part 2 of the report, Solomon Islands has low GHG emission levels from the energy sector but a relatively high emission level from managed forests, a resource which the country is very dependent on for national income and family livelihoods. The country is also extremely vulnerable with its high level of exposure, high sensitivity and low coping capacity including having one of the lowest HDI in the Pacific for a fast growing population. Technology development and transfer is an essential strategy for Solomon Islands to develop and use environmentally sound technologies for climate change adaptation and mitigation. This begins with a Technology Needs Assessment (TNA). The purpose of the TNA is to “to identify, evaluate, and prioritize technological means for achieving sustainable development in developing countries, increasing resilience to climate change, and avoiding dangerous anthropogenic climate change” (Handbook for conducting Technology Needs Assessments for Climate Change, 2009)

Decision 4CP/7 defines the technology needs assessment process as a set of country driven activities that identify and determine the mitigation and adaptation technology priorities for developing country Parties. Technology transfer is concerned with the flow of experiences, know how, and equipment between and within countries and is a priority action under the UNFCCC.

Presented in this component of the SNC are the findings of a TNA carried out during 2010-2011 by the TNA Thematic Working Group.

5.1.2 TNA Process Overview

The TNA process and consultations was overseen by the TNA TWG of the SNC project, coordinated by the SNC Project Coordinator and included representatives from government, NGOs, private sector, public utilities, training and research institutions. A Terms of Reference compiled by the MECDM with inputs from various resource persons was finalized and provided to the TNA TWG team leader and members. The assessment was a learning experience for the TWG and the stakeholders they engaged with, as there had not been a similar exercise carried out in the recent past. Also, the assessment was undertaken when the Ministry of Planning and Aid Coordination (MDPAC) was undertaking a nationwide consultation on the Solomon Islands National Development Strategy (2011-2020) (NDS). In addition to soliciting views and negotiating priorities from stakeholder the team also reviewed national policies and strategies as well as a range of technical reports to identify instances where these pointed to technology development and transfer. One of the main difficulties encountered was the non-availability of some of the key stakeholder representatives due to work commitments and travel and this made it difficult for the TWG to keep to its work plan.

Adding to the difficulty of assessing priorities was the fact that the national government does not have strong research and development programs and resources across the main sector ministries such as agriculture, forestry, fisheries and water resources. The Ministry of Agriculture and Livestock national research station was destroyed in 2000 during the ethnic unrest and continues to do research but at a much lower level of implementation. The

Ministry of Forestry and Research and the Water Resources Division‟s capacity to undertake research is severely undermined by limited funding. Research capacity has been enhanced with the World Fish Centre undertaking research in aquaculture and marine resources and NGOs such as the KGA which is carrying out applied research with farmers. As this was a first experience with the TNA process a „home grown‟ approach was used based on the TNA

Handbook guidelines but which did not involve use of the tools recommended.

The TNA approach or process taken was a variation of the process recommended in the Handbook for conducting Technology Needs Assessments for Climate Change but reached the similar objective of prioritizing technology needs. Technology needs were determined early in a range of climate change related and development issues before aligning with the NDS which was still in a draft form when the TNA findings were established towards the end of the project. Information obtained from the consultations, reviews and prioritization were organized under a range of themes linked to the NDS. The approach included:

- Review of the NAPA and V&A issues and projects from the findings of the SNC V&A Assessments
- Review of the Energy policy and the Green House Gas Inventory and Mitigation actions determined in the SNC
- Review of sector policies and strategies e.g. Agriculture and Rural Development Strategy, National Transport Plan, Forestry Corporate Plan, Water Resource Division Corporate Plan, NBSAP, UNCCD NAP (draft), NDRMP
- PIFACC
- Identify technologies linked to strategies and actions identified in the NAPA, V&A Component of the SNC and Mitigation Report in the SNC
- Align the various strategies and actions with the recently developed Solomon Islands National Development Strategy (2011-2020)

5.1.3 Key Sectors & Technology Needs

The TNA primarily focused on;

i) Priority climate change vulnerability and adaptation and risk reduction issues identified in the NAPA, SNC V&A report and NDMO reports and the range of technology needed to reduce vulnerability and enhance adaptive capacity
ii) Technology needs to reduce emissions from key categories as determined by GHG Inventory, and contribute to national sustainable development

Prioritization of adaptation and risk reduction technologies was based on consultations with the TNA TWG and key informants and was guided by the following criteria:

a) Technologies that has already been used in other countries or recommended in climate change adaptation reports
b) Technologies that are appropriate for use in Solomon Islands and can be adopted and adapted for wide use in the country
c) Minimal disturbance to the natural environment and culturally acceptable
d) Reduces GHG emissions in the key categories
e) Contributes to wider socio-economic wellbeing of the country and improves livelihoods

The steps for sector analysis and prioritization under TNA, as well as the outputs, are summarized in Table 52.

Table 52 Steps for prioritizing the sectors

Steps	Description	Output
Step 1	Identifying development priorities • Priorities in light of changing climate	• List of development priorities, which are consistent and which take account of environmental (including climate change), technical, economic/market risks and uncertainties.
Step 2	Identification of sectors that have a high GHG relevance	• List of high GHG emitting sectors (sub)sectors
Step 3	Prioritizing (sub)sectors in terms of development and sustainable mitigation priorities	• A final short list of prioritized sectors with large contribution to GHG emission reduction and to sustainable development

Source: TNA Handbook pp 39

5.1.4 Adaptation and Risk Reduction Technologies

Table 53 Adaptation, Risk Reduction and Sustainable Development

Adaptation and Disaster Risk Reduction Priority Sectors [9]
Agriculture and food security (NAPA priority)
Development and Vulnerability Context[10]
From the distant low lying islands to the high mountainous islands the informal subsistence food production sector is foundation of food security in Solomon Islands and it relies heavily on quality of ecosystem services such as soil conditions, water resources and forests for its sustainability. It is estimated that the production of root crops in Solomon Islands, using the national population and the equivalent calorific values, quantities and price for imported rice, is a conservative 1.189 billion Solomon Dollars (USD 148,625 million) per annum (Solomon Islands State of Environment Report, 2008). Disturbances to the smallholder system by unsustainable land use practices and climate change will reduce the capacity of this system to feed the country, increase poverty and will place significant cost burdens on the government. Already this system is under threat from rising populations, changing weather patterns and extreme events
NDS Policy[11]
Develop and implement programs to alleviate poverty based on improved market access and a vibrant smallholder sector through sustainable natural resource use and commercial activities in rural and remote areas
NDS - Strategy[12]
Develop agriculture and livestock through agricultural, marketing and land use planning to improve food security, livelihoods, and community sufficiency in rural areas through targeted multi-disciplinary intervention to diversify agriculture and promote agribusiness and alternative livelihoods.
Technology needs[13]
• Climate models and cropping calendars to plan for future production and minimize food shortages • Food crop varieties that tolerate high rainfall and high salinity areas • Species of trees and nuts that increases soil nitrogen and soil potassium levels • Equipment for production of biochar to raise soil fertility • Integrated agro-pastoral and agro-forestry farming systems to increase productivity of land and diversify food sources • High yielding varieties of fruit trees and root crops • Low-cost and efficient irrigation systems for enhancing soil moisture and increased productivity
Adaptation and Disaster Risk Reduction Priority Sectors[14]

[9] Derived from NAPA, NDMO assessments and updated adaptation needs identified during the SNC consultations

[10] Summary of development issue and vulnerability context

[11] Policies derived from the Solomon Islands National Development Strategy 2011-2020

[12] Strategies from Solomon Islands National Development Strategy 2011-2020

[13] Technology needs determined from stakeholder workshops and consultations with key informants

[14] Derived from NAPA, NDMO assessments and updated adaptation needs identified during the SNC consultations

Agriculture and food security (NAPA priority)	
Technology needs[15] cont..…	
• Small scale root crop processing equipment to make flour and animal feed • Integrated livestock, aquaculture and crop production systems to maximize nutrient cycling and productivity • Tissue culture laboratory and equipment to conserve endemic and introduced agro-biodiversity • Geographic Information System and satellite imagery for land use planning • Methodologies and equipment for community-based land-use mapping and planning integrating climate change considerations • Solar technology for drying and preserving fruit, nuts, vegetables and root crops • Soil testing field kit for soil sampling and soil pH tests • Soil drying, grinding, testing and analysis equipment housed in a dedicated laboratory • Plant pathology equipment and laboratory for identification of plant and animal diseases housed in a dedicated laboratory • Plant entomology equipment and laboratory for identification of plant and animal pests housed in a dedicated laboratory • Small scale machinery using bio-fuel for chipping of plant materials to make compost • Small scale rapid composting technology • Wetland/terracing technology for taro in areas with high rainfall • Drought tolerant varieties of root crops • Heat treatment technology for exporting of root crops • Undertake marketing study to identify niche markets and incentive mechanisms to promote rural production • Water efficient small to medium scale piggery and poultry units • Technology to recycle waste water from small livestock units for use as liquid manure on cropping land • Expertise, methodology and equipment to undertake assessment to determine subsistence production areas experiencing very low soil productivity on degraded lands and for development of soil and landscape rehabilitation strategies • Drought, flood and cyclone early warning system and communication technology for rural areas	
Adaptation and Disaster Risk Reduction Priority Sectors	
Water supply and sanitation (NAPA priority) Development and Vulnerability context	
Development and Vulnerability context	
Statistics on the main sources of drinking water reflect the population.s vulnerable situation with 35% of households using community standpipes, 25% using rivers and streams and 12% using household water tanks. The remaining households use wells, communal tanks and user pay water supply systems. Level of access to toilet facilities is alarming and reveals the very high level of exposure of families and communities to diseases. Of the total number of households in the country 57% have no proper toilet facilities, 21% use pit latrines and the 22% use toilet systems that require water (Solomon Islands Census 2009). Water supply and sanitation systems on low coastal areas are threatened by rising sea levels and increasing storm surges with high potential for increasing pollution of the marine environment.	
NDS Policy	
Improve water supplies and sanitation in urban and rural areas in terms of quality, reliability and coverage	
NDS – Strategy	Technology needs

[15] Technology needs determined from stakeholder workshops and consultations with key informants

Address the urgent need upgrade and extend coverage of water supply and sanitation systems by undertaking baseline and monitoring surveys of water and sanitation problems in provinces and identify least cost solutions in water supply and sanitation programmes to be implemented in an integrated manner.	• Equipment and training to strengthen hydrological monitoring network in the country • Software for analysing hydrological data • Mainstreaming of climate change into Integrated Water Resources Management • Ramp up pump equipment and training for isolated mountainous areas • Communication strategy and tools to promote health and sanitation
Ensure clean water and proper sanitation is available in all communities , ensuring the water resources are sufficient and safe for all communities	• Water testing kits appropriate for use by communities • Methodologies for community based assessment of demand and supply of water • Portable water filtration/purification systems for use during flood events • Solar powered water pumping systems for remote rural locations • Composting toilets • Water efficient toilet systems • Feasibility study on an improved sewerage system for Honiara including opportunities for methane capture
Improve catchment management through reforestation, land-use controls and appropriate legislation	• Methodologies and training for integrated catchment management using climate change models • Modelling software and 3-D modelling tools for community based planning of catchments • Expert advice on application of Protected Areas legislation and regulations for protection of water catchments • Satellite imagery and ground survey methodology to assess health of catchments and identify priority vulnerable and degraded catchments
Adaptation and Disaster Risk Reduction Priority Sectors	
Human health (NAPA priority) Development and vulnerability context	
Development and vulnerability context	
The total population of 515,870 (2009) is growing at 2.3% over the past years compared to 2.8% in the past decade with the dependency at 80 to every 100 economically active adult (NDS 2011-2020). About 23% of total population face difficulty in securing basic food needs and non-food essentials. (SINSO, 2009). MDG Goal 5 has been met with a Maternal Mortality Rate dropping by 75% in 2010 from 550 in 1990. 32.8% of all children under 5 years old were stunted of which another 8% were severely stunted. HIV AIDs cases totalled 13 with 8 still living. There is a big drop in TB cases and the number of malaria cases is expected to drop in the coming years. Since 2005 government and donor funding for the	

<table>
<tr><td colspan="2">health sector in real terms per capita has increased by 16% but is expected to decline over the coming years. It is predicted that climate change will also impact on vulnerable communities particularly those experiencing low human development in least developed countries.</td></tr>
<tr><td colspan="2">NDS Policy</td></tr>
<tr><td colspan="2">Provide quality health services for people in urban and rural areas for a healthy, happy and productive society.</td></tr>
<tr><td>NDS - Strategy</td><td>Technology needs</td></tr>
<tr><td>In consultation with provinces and NGOs and CSOs, develop a National Health Services Development Plan to determine health service standard and facilities, in the provinces and identify the resources required, including the numbers and types of medical staff and improvement of outreach services. (NDS pp 18)</td><td>• Methodology and expertise to undertake an assessment on the potential impact of climate change on disease incidence in Solomon Islands and identify strategies to prepare for such scenarios.
• Expert advice to mainstream climate change considerations into national health policies and strategies.
• Improved data collection and analysis technology and capacity.
• Health equipment and facilities for rural clinics</td></tr>
<tr><td>National health awareness raised through media on specific health issues distributed throughout the country (NDS pp 19)</td><td>• Communication strategy on links between climate change and health and the predicted impacts of climate change on health of people and preventative measures that can be taken at both rural and urban areas.
• High impact communication tools to raise awareness on HIV AIDS</td></tr>
<tr><td colspan="2">Adaptation and Disaster Risk Reduction Priority Sectors</td></tr>
<tr><td colspan="2">Fisheries and marine resources (NAPA priority) Development and vulnerability context</td></tr>
<tr><td colspan="2">Development and vulnerability context</td></tr>
<tr><td colspan="2">For commercial fisheries, the major income earning activity is the licensing of Foreign Fishing Vessels, who pay license fees to target the country‟s tuna resources. Development potential is substantial and Tuna is a major export with numerous distant fishing nations operating in the EEZ. Government wants to see foreign investors set up processing and value adding establishments in the country.

For inshore and coastal fisheries, most Solomon Islands villages are sited on the coast and rely heavily on marine resources for food and cash incomes. However, over-fishing, illegal, unregulated and unreported fishing are threatening this resource. A control mechanism and legislation are needed to manage this resource and provide funds to regulate, monitor and manage small scale fishery.</td></tr>
<tr><td colspan="2">NDS Policy</td></tr>
<tr><td colspan="2">Promote sustainable use of natural resources to increase production, productivity, value added and rural incomes.</td></tr>
<tr><td>NDS - Strategy</td><td>Technology needs</td></tr>
<tr><td>Ensure fisheries laws and regulations are in line with international laws and conventions and that monitoring systems for fisheries and marine resources, including tuna, provide accurate and timely information on commercial and sustainable fisheries for all</td><td>• Monitoring systems to accurate and timely information on commercial and sustainable fisheries for all stakeholders
• Simplified tools for assessing threats and status of local fishery at the</td></tr>
</table>

stakeholders, including the private sector and regional organizations (NDS pp 29).	community level.
Ensure effective coordination between national, provincial and community levels to facilitate sustainable development of inshore fisheries and shift from "open access" to "managed" fisheries in partnership with resource owners and fishing communities, to improve food security, sustainable marine resource management and economic productivity (NDS pp 29).	• Simplified community-based marine resource management tools for local communities and fisher folks. • Provision of timely data and information and professional advice to local communities and fisher folks.
Promote community based small scale producer activities by providing access to markets and fisheries infrastructure and supporting community based initiatives for sustainable economic development of inshore fisheries, including reduced dependence on marine capture through diversification and introduction of appropriate aquaculture systems (NDS pp 30).	• Revitalise and sustain local fisheries centres with capacity for chilling and value addition. • Targeted provision of powered boats for fishing projects. • Transfer of skills for small scale aquaculture technology to local communities.
Adaptation and Disaster Risk Reduction Priority Sectors	
Coastal Protection (NAPA priority) Development and vulnerability context	
Development and vulnerability context	
Coastal environments and systems are at risk from sea level rise and warmer sea temperatures. Coastal zones are most vulnerable to flooding and inundation as a result of sea level rise, with the combined effects of seasonal storms, high tides and storm surges associated with tropical cyclones. Coastal erosion is already evident in many parts of the country. Majority of the Solomon Islands live on coastal zones and therefore, key infrastructures such as health centres, schools, administrative and commercial centres are also located in coastal zones. Moreover, essential ecosystems such as mangroves forests and coral reefs are also located in the coastal zone. The net effects of human settlement and location of essential ecosystems in the coastal zone are the increased vulnerability to climate risks described above and potential high accumulative costs of adaptation in the absence of sustained adaptation action.	
NDS Policy	
To integrate national environmental issues in a holistic way so as to adapt to climate change and variability, halt deterioration of the eco-systems, restore damaged ecosystems and ensure their survival in the long term to benefit Solomon Islanders.	
NDS – Strategy	Technology needs
Increase disaster awareness by programmes, including “risk maps” showing types of risk in each location, reaching all the people of the Solomon Islands and village disaster risk programmes leading to an expanding network of safe, sustainable, resilient villages across the provinces.	• Development of risk maps at various scales (national-provincial-ward-village (town). • Climate change proof the local building code.

5.1.5 Mitigation Technologies

The recommended mitigation technologies are limited by the scope of the GHG Inventory for Solomon Islands during the SNC. A major area with potentially high levels of emissions is subsistence agriculture however due lack of data and difficulties in determining extent of land use change the levels of emissions was not estimated. Technologies to improve and sustain subsistence agriculture have therefore featured under adaptation given that food security is the main NAPA priority.

LULUCF and Agriculture (except livestock waste) sectors have not been assessed in this inventory due to certain data unavailability. It is recommended that the next National Communications include an inventory on emissions from subsistence LULUCF and agriculture.

Table 54 Sectors with a high GHG-relevance

Sector/Sub-sector	GHG emissions in 2010 (Gg $CO_{2\ eq}$)	Percentage share of subsector in country's annual GHG emissions
Energy	350.6	56.68%
Agriculture (only livestock waste)	76.4	12.35%
Waste	191.6	30.97%
Total	**618.6**	**100%**

The GHG inventory did not include all of the agriculture sub-categories. Only emissions from small livestock were estimated. Emissions from cattle was not estimated but is expected to be very low given the very small population of cattle in the country (estimated at 2,500 heads in 2010). The other sub-sector or sub-category of importance but not assessed due to limited data is the smallholder agriculture where emissions are expected to be high. Estimates from PNG in 2010 have subsistence agriculture contributing about 30% of total emissions. (UN Collaborative Programme on reducing emissions from deforestation and forest degradation in developing countries – National Programme Document, 2011). Subsistence gardeners in PNG and Solomon Islands, like many South East Asian nations, apply similar land clearing and land preparation methods and have similar tropical forest settings. It could therefore be assumed that emissions per unit area of land subjected to shifting cultivation would be similar to PNG situation.

Of the categories and sub-categories assessed in the SNC, managed forests and the energy sector are the main emitters making up more than 95% of the total emissions estimated. Emissions from managed forests included; Emissions from logging (removal of round logs); Emissions from forest disturbance during logging, and; Emissions from fuel wood.

Emissions from logging due to removal of round logs from forests are calculated from log export data, includes logs that leave the country for export and does not include logs that are rejected at the log ponds, logs left behind in the forest after operations or used for building of bridges and log ponds, and logs used for milling of timber. If included the levels of carbon lost and CO2 emissions would increase.

Table 55 Mitigation and Sustainable Development

Mitigation - Priority Categories and Sub-Categories
Managed forests (logging and disturbed areas)
Development context and emissions
Current harvesting (logging) rates are more than three times the estimated sustainable cut of 300,000 with increasing instances of re-entry logging. Increasingly logging activities are moving into sensitive areas above the 400m contour and above 30¢ª slope. The forest sector is also very important for the economy of Solomon Islands contributing up to 60% of total national income and creating employment. Sustainable harvesting of forest resources can benefit the economy of Solomon Islands, protect biodiversity and ecosystem services in the long term and also contribute to global efforts to reducing GHG emissions.
NDS Policy
i) Promote sustainable use of natural resources to increase production, productivity, value added and rural incomes (NDS pp 29) ii) To integrate national environmental issues in a holistic way so as to adapt to climate change and variability, halt deterioration of the eco-systems, restore damaged ecosystems and ensure their survival in the long term to benefit Solomon Islanders (NDS pp 39)
NDS - Strategy
i) Ensure wood supply for future generations through promotion of a family based reforestation approach and maintaining links with rural communities through village based forestry extension network and undertake tree breeding and improvement programs, provide technical advice and information and distribute seeds to out-growers and maintain professional services to resource owners (NDS pp 30) ii) Introduce policies and measures to establish a Designated National Authority to meet the requirements of the Kyoto Protocol for Clean Development Mechanism projects to reduce GHG emissions and secure related revenues (NDS pp 39) iii) Conduct readiness activities for REDD+ and inform line Ministries about the program and carbon financing alternatives to logging, working with NGOs and CSOs on REDD+ compatible projects (NDS pp39) iv) Project remaining forest resources and re-establish forests, sustainably manage logging extractions in the remaining forests including through increased taxation and emphasise reforestation to replace depleted forests, review forestry Act. v) Prepare and enforce laws and regulations for conservation areas, national parks and sanctuaries to manage and restore threatened flora and fauna and maintain biodiversity.
Technology needs
i) Protected forest areas • Satellite imagery, GIS and on-the-ground survey technologies and

methodologies to identify vulnerable forested areas as candidates for protected areas • Expertise and resources to pilot a number of community based forest protected areas using the new Protected Area legislation and regulations • Equipment and expertise to assist Forestry Officers document flora and ecosystems • Equipment, GIS and expertise to establish and maintain permanent sampling plots for on-going monitoring of forests including forest carbon • Equipment and expertise to conduct surveys and document forest fauna including fresh water fish species, birds, mammals, insects etc. • Equipment and expertise to document forest environment and use in awareness raising and promotional programmes tailored for children, youth and adults. • Expertise and methodology for establishing governance framework and identifying capacity building needs for implementing REDD+
Managed forests (logging and disturbed areas)
Technology needs
ii) Replanting and rehabilitation of post-logged and degraded areas • Expertise and equipment to assess post-logged areas to locate disturbed areas, assess extent of disturbance to soil and river systems • Expertise and equipment to plan and implement community-based reforestation and rehabilitation of post-logged areas • Re-habilitate National Forestry Research Station building and equipment • Soil sampling and testing equipment • Expertise and methodology to assess for carbon levels in post-logged areas and to monitor changes in carbon levels in the forest soil and above ground growth. • Expertise, methodology and equipment to assess stream flows in degraded areas and monitor over time.
iii) Reforestation through privately owned and community forest plantations and family woodlots • Equipment , expertise and operational procedures to establish and maintain plantations and woodlots using indigenous and exotic tree species • Expertise and operational procedures for establishing and maintaining Agro-forestry areas of timber species, fruit and nut species and food crops • Expertise and methodology for conducting economic assessments of forestry

industry, plantations and woodlots • Expertise and equipment to measure and monitor carbon levels in planted forests • Equipment and expertise for low impact harvesting of planted forests and efficient milling technology. • Expertise and resources to develop a national reforestation program including annual targets, incentive schemes for communities and families, laws and regulations to protect replanted areas, benefit sharing mechanisms and value-adding and marketing strategies and funding initiatives
iii) Low impact logging • Equipment for low compaction and forest disturbance during logging activities • Expertise, equipment and method for monitoring logging operations to ensure compliance with Code of Logging Practice. • Expertise, equipment and method for selecting and preserving sensitive areas • Legislation and Regulations to protect sensitive areas (instead of using the Code of Logging Practice which cannot be legally enforced.
Mitigation - Priority Categories and Sub-Categories
Managed Forests (fuelwood)
Development context and emissions
In 2000 average daily use of fuel wood per household was reportedly estimated (with limited data). This excludes wood and other biomass used for copra and cocoa drying and household uses during festive seasons, when use can be high (Johnston, Peter et al, Pacific Regional Energy Assessment, 2004). During the 2005/2006 Household Income and Expenditure survey it was estimated that more than 50% of households in Honiara use open fire for cooking. A detailed survey of fuel wood use in Solomon Islands will enable the development of strategies to minimize emissions through appropriate technologies and also ensure adequate planning for future sustainable supply of fuelwood.
NDS Policy
i) Promote sustainable use of natural resources to increase production, productivity, value added and rural incomes (NDS pp 29) ii) To integrate national environmental issues in a holistic way so as to adapt to climate change and variability, halt deterioration of the eco-systems, restore damaged ecosystems and ensure their survival in the long term to benefit Solomon Islanders (NDS pp 39)
NDS – Strategy
i) Ensure wood supply for future generations through promotion of a family based reforestation approach and maintaining links with rural communities through village based forestry extension network and undertake tree breeding and improvement programs, provide technical advice and information and distribute seeds to out-growers and maintain professional services to resource owners (NDS pp 30)
Technology needs
• Expertise and methodology for undertaking a national survey on use of fuel wood

- Expertise and methodology for developing and implementing community based sustainable fuel wood supply strategies targeting areas of low forest cover and limited fuel wood.
- Wood efficient cooking stoves and ovens
- Wood gasifier stoves for households, institutions and small industries
- Biogas generation

Mitigation - Priority Categories and Sub-Categories

Energy

Development context and emissions

During 2010 total emissions from the energy sector was estimated at 350.6 Gg CO2 eq (SNC GHG report). This is within the estimated growth range predicted for Solomon Islands by the Pacific Energy Survey in 2004 assuming that population increases 2.8% per year (3.8% in Honiara), GDP grows 3-4% per year, and – assuming no major investments in renewable energy or energy efficiency –petroleum imports grow 4% annually, except distillate for electricity use at 5.2 percent.

The same survey predicted that; "Solomon Islands could reduce emissions by 122 Gg per year within a decade, nearly 60% of current emissions and 40% of those a decade from now. This is based on proven technologies and known resources but does not consider economic, financial, political, social, technical, environmental or other practical constraints. About 90% of potential reductions would be from renewable energy (mostly biofuels and from hydro) and 10% from improved energy efficiency. Large-scale solar PV and wind combined would account for less than four percent" (Johnston, P., 2004 - Pacific Regional Energy Assessment – Solomon Islands National Report). To date the few mini hydro schemes and biofuel driven generators together with a fast growing number of solar energy systems are contributing, albeit insignificantly, to reducing reliance on fossil fuels and lowering GHG emissions.

While access to affordable energy is a national goal, only about 20% of the national population has access to electricity. With abundant biomass and sources of biofuel, sunshine and hydro power potential of 200-300 MW (National Energy Policy Framework) the national strategy is to improve wellbeing of people through easy access to affordable energy while at the same time contributing to global efforts to reduce GHG emissions.

NDS Policy

Ensure availability and efficient use of energy to achieve development goals of improving the livelihood and quality of life for all people in Solomon Islands

i) Strengthen energy sector planning and policy implementation through an integrated approach supported by appropriate capacity and dissemination of energy related information through school curricula, community training and wider consultations on policy issues, legislation and regulations (NDS pp 34)

ii) Increase supply and coverage of electricity by responding to community requests in rural areas to assess and develop renewable energy resources…focussing on hydro-power and solar power whilst evaluation other renewable energy resources and adopting both appropriate technologies and institutional arrangements including community management (NDS pp 34)	
Technology needs	Emissions Off-sets per annum (tCO_2)
i) Hydro power • Expertise and technology to establish and maintain the Designated National Authority (DNA) for the Clean Development Mechanism • Planning, equipment and establishment of a 14 MW large hydro project at Tina River to supply Honiara city and surrounding areas • Planning, equipment and establishment of mini hydro schemes on various high islands (35MW) • Planning, equipment and establishment of pico hydro schemes on various low and high islands (35MW)	343
Mitigation - Priority Categories and Sub-Categories	
Energy	
Technology needs	Emissions Off-sets per annum (tCO2)
ii) Solar Power • Expertise, equipment and finance to establish large scale solar power systems • Expertise and methodology to develop a national strategy to manage waste from the solar power industry including recycling and disposal of batteries	32.26
iii) Biomass • Expertise and methodology for conducting a national survey and	30.13

consultation to develop biomass gasification technology in Solomon Islands • Expertise, equipment and finance to pilot bio-mass gasification schemes using forest biomass and agriculture by-products	
iv) Bio-fuels • Expertise, equipment and finance to produce coconut oil on a large scale • Study on economic incentives and national strategy for the development and use of coconut oil as bio-fuel for power generation and transport • Review and revise legislation to provide an enabling environment for the use of bio-fuel driven generators to generate electricity for sale to the national grid system • A review of existing legislation and regulations with revisions to aid in rational energy choices for electric power, liquid fuels, fuel pricing, and RET development • Develop a library of RET information materials specifically selected and developed for the Solomon Islands	2.35
v) Wind energy • Expertise and equipment to install and test wind monitoring systems in strategic locations in the country • Expertise, equipment and finance to pilot wind turbines for generation of electricity	47.65
vi) Energy efficiency • Expertise and methodology for development of an Energy Efficiency strategy for Solomon Islands • Energy efficient industrial equipment and electrical appliances • Study to review energy use in the transport sector and development of an energy efficiency strategy including development of legislation and provision of economic incentives.	Not estimated

5.1.6 Barriers

5.1.6.1 Barriers to Mitigation Technologies

The barriers to effective identification and adoption of mitigation technologies has been determined through the SNC consultations and also includes a range of barriers to renewable energy technologies (RETs) identified in the Solomon Islands national report of the Pacific Regional Energy Assessment (2004) and which are considered to be applicable today.

Fiscal

- SIEA has an exemption from duty on distillate which could bias fuel choice against local biofuels. There is no fiscal incentive to import RETs, which attract the same duty as electrical equipment in general.
- There are no „green" interest rates for RE or access to foreign capital for RE through government support.
- The lack of any analysis of the likely development impact of large-scale use of coconut and/or other vegetable oils as bio-fuel is real barrier to its serious consideration for development.
- Poor management of re-forestation levy by government and customary land owners

Financial

- Minimal staffing and financial resources of the Energy and Forestry Division;
- Serious government budgetary constraints in general;
- Very low cash incomes in rural communities;
- Higher initial costs of RETs compared to conventional energy systems;
- SIEA tariff policies, with heavy cross-subsidies and penalties for self-generation;
- Lack of donor funding for coconut oil biofuel
- Inability of banks to use customary land as security or equity for loans;
- Legislative, Regulatory and Policy
- No formal energy plans, and few standards or regulations regarding energy use and development;
- Inadequate legislation for consumer protection, price control, fuel storage and handling, and power sector regulation
- Lack of legislation for Renewable Energy Service Companies
- Forestry Act no longer effective and still needs to be revised to provide stronger protection and enforcement
- Weak enforcement of the Environment Act
- Weak or no monitoring and enforcement of the Code of Logging Practice
- Lack of Forestry and Climate Change policy and strategy to guide the work of the Forestry Division and the forest sector in general to address forestry and climate change

Legislative, Regulatory and Policy

- No formal energy plans, and few standards or regulations regarding energy use and development;
- Inadequate legislation for consumer protection, price control, fuel storage and handling, and power sector regulation
- Lack of legislation for Renewable Energy Service Companies

- Forestry Act no longer effective and still needs to be revised to provide stronger protection and enforcement
- Weak enforcement of the Environment Act
- Weak or no monitoring and enforcement of the Code of Logging Practice
- Lack of Forestry and Climate Change policy and strategy to guide the work of the Forestry Division and the forest sector in general to address forestry and climate change

Institutional

There are serious institutional weaknesses at all government levels (except local communities in some provinces). Government institutions generally lack the expertise to foster or effectively develop Renewable Energy (RE) and forestry projects. There is no energy sector coordination mechanism.

- Government lacks capacity to effectively absorb donor assistance for energy projects;
- Weak coordination amongst national stakeholders in the forestry sector
- Ineffective cooperation among regional organisations can be a barrier for RE efforts.

Technical

There are no standards for imported Renewable Energy Technologies (RETs)
Shortage of technical skills and virtually no industry away from Honiara and Noro

Market

- Lack of affordable, reliable shipping for copra to be shipped to urban centres for processing into biofuel;
- Protection of SIEA.s operations, so SIEA has no incentive to improve, and RETs cannot compete
- No mechanism in place yet for carbon trade
- Limited support for rural milling operators to ensure good quality timber is sold to the best markets in Honiara and overseas

Knowledge and Public Awareness

- Limited knowledge regarding various renewable energy options other than Solar energy
- Limited public understanding on the links between climate change and the role of forests in adaptation and mitigation
- Poor access to information on prior experience in the Pacific on renewable energy and sustainable forest management
- Knowledge of the pros and cons of solar PV is very limited.
- No laboratory facilities to test biofuels or petroleum fuels.
- Little or no appropriate RE and sustainable forest management training

Other barriers

- Difficulties accessing customary land for most RET and Forestry development projects due to land disputes.
- Logging activities affecting water sheds and potential for hydroelectricity schemes.
- Lure of quick money from logging operations with not many alternative income generation opportunities in rural areas

5.1.7 Conclusions and recommendations

i. The SNC has identified a range of climate change adaptation and mitigation technologies appropriate to Solomon Islands setting. The technology needs are aligned with the NDS as well as findings of NAPA, national energy policy guidelines and linked to findings in the V&A and Mitigation components of the SNC. The scope of the assessment is limited to information available to national stakeholders involved in the assessment. Priority adaptation technology needs are guided by the top main priority sectors of the NAPA and vulnerability issues identified in the SNC while the priority mitigation technology needs are those required to reduce emissions among the key categories of emissions as determined by the SNC and which also contributes to sustainable development. This is the first of such an assessment and lays the foundation for future technology needs assessments. The recommendations presented below are intended to guide future technology needs assessments and implementation of the findings of the SNC:

   i) Future TNA must have a stronger participation from the private sector and from community representatives, the eventual users of technology.

   ii) MECDM to develop and coordinate a national methodology for on-going TNA in close collaboration with sector ministries, institutions, communities and regional organizations

   iii) MECDM to develop a database of climate change mitigation and adaptation technologies

   iv) Organize and convene a national conference on climate change mitigation and adaptation and risk reduction traditional technologies

   v) Build capacity of national research organizations and institutions to conduct research into technology needs and development

   vi) MECDM to collect information on technologies for climate change mitigation and adaption from other developing countries.

   vii) Integrate technology development interventions into climate change and other development projects to build experience and confidence in technology transfer

5.2 Research and Systematic Observation

5.2.1 Background

Articles 4.1 (g) and (h), 5 and 12.1 (b) requires Parties to report on national actions that are related to the Global Climate Observation System in order to further the understanding of the climate system, climate change and its impacts which also includes the socio-economic costs associated with climate change.

One of the roles and functions of the Meteorological Service as outlined in the Meteorology Act 1985 is to establish and maintain a national network of meteorology and observation stations ensuring a high standard of quality.

5.2.2 History

Records of meteorological observations date back to the 1800.s when explorers came to the islands. In 1858, the Australian Frigate .Novara. encountered a storm north of San Cristobal and recorded 3 inches of rainfall in 5 hours. Records also show 15 months meteorological observations from Santa Ana and Ugi by the British explorer, H.B. Guppy who established stations on these two islands in 1882. There were other rainfall records for Tulagi in 1897 and locations such as Rendova, Lunga and the Russell Islands in 1906.

During the Second World War, there was an increase in meteorological activities in the region and the country mainly to support military operations. The end of war also brought about the desire for civil air routes across the Pacific and the outside world and this increases the demand for meteorological information. As a result, the South Pacific Air Transport Council (SPARTC) was established. SPARTC was responsible for establishing and maintaining observational networks across the commonwealth territories and the Australian Bureau of Meteorology was asked to do likewise for Solomon Islands. The observation stations were mainly doing weather and forecasting roles specifically for aviation air services. By 1953, the Australian Bureau of Meteorology established six surface observations station and an Upper Air Station by 1958 Under the arrangement, an Upper Air Station (surface and the upper air observations) at Vavaya Ridge and six Surface Observing Stations at Henderson Airport, Auki in Malaita, Kirakira in Makira, Lata in Santa Cruz, Munda in New Georgia and Sasamuga in Choiseul.

The unsatisfactory role assumed by SPATC in the Solomon Islands especially for other service providers whose daily operations are also influenced by the state of the weather eventually led to the establishment a local marine meteorological service. This network consisted of twenty five local stations and includeds Voluntary Weather Reporting Stations which were operated by the Police, local councils and missions and the Search Air Meteorological Stations.

5.2.3 Present Status of SIMS Observation Network

The SIMS still maintains five of the observation stations which were established by the Australian Bureau of Meteorology except for Kira Kira in Makira Province which has stopped operation since 2000 because of land issues rather than technical problems. The issue of non-maintenance of instruments has made it worse and so conditions of instruments have deteriorated to a stage that makes it impossible to operate the instruments.

Although, some changes were made to some of these stations over the past years, especially with the relocation of the instrument enclosure, most of the infrastructure has remained almost the same. As most of the structures are now more than 50 years, office buildings have deteriorated and some instruments have never been maintained until this year, 2010.

The SIMS forecasting office is also responsible for issuing weather forecasts such as public weather forecast, marine forecasts for coastal and Solomon sea and warnings such as tropical cyclone warnings and flood advisories. It is also worth noting that this section also performs a huge responsibility when it comes to tsunami warnings.

Figure 32 Map showing SIMS Observation Network

5.2.4 National Climate Observation Network

SIMS still maintains the five (5) Surface and the Upper stations that were established by the Australian Bureau of Meteorology except for Kira Kira which was closed in 2000 because of the Governments non-payment of the land lease. At present, SIMS climate observations only involves the following climate variables: pressure, rainfall, maximum and minimum temperature, humidity, wind speed and direction, evaporation and others for aviation purposes. Variables such as solar radiation have been halted due to lack of funding to finance sunshine cards. Other.s such as evaporation has been resumed only this year (2010) with the installation of new evaporation pans supplied by the Australian Bureau of Meteorology as part of the Pacific Islands Climate and Sea Level Monitoring Project. With the vast area of coverage and the remoteness of some of the islands, expanding and upgrading of SIMS observation network continues to be a challenge

Henderson Meteorological Station (91520)

- Location - 9.42 degrees south and 160.05 degrees east at the Henderson International Airport, on the Island of Guadalcanal.
- Climate and aeronautical meteorological station
- Administers and coordinates all meteorological observations and hourly reports for civil aviation and synoptic reports for climate monitoring

Plate 16. Henderson station

One of the roles this station also assumes is the collection of Meteorological data from all the other station and transmission of these data.s by e-mail and AFTN to the regional data centers and eventually WMO.s Global Telecommunication System (GTS). The recent switch to e-mail to complement the AFTN is a step forward as now SIMS is transmitting above 90 % of its observations to the world data centers such Melbourne and eventually the GTS. Work is now progressing on the installation of a VSAT System as a backup for internet services provided by Our Telekom

Honiara Meteorological Station (91517)

Station is located at 9.42 degrees south and 159.97 degrees east and is a climate station. Digitized rainfall and temperature data from this station started from 1953 and is one of WMO.s GSN stations which perform both surface and upper air observations. The station has been revitalized with funds provided under the GCOS program and is now equipped with new instruments. A new Automatic weather station for recording wind speed and direction and pressure has also been installed and it is the only AWS that is currently in operation within SIMS network.

For upper air observations, the station has a new hydrogen generator and a Digigora machine installed in 2007. With these new equipment, SIMS is now doing upper air observations with one flight per day at 11UTC. Power outage is a common problem is affecting the upper air flights as they depend very much on electricity to generate hydrogen for the balloons.

Auki Meteorological Station (91507)

This is the only meteorological station on the island of Malaita and is located at latitude 08.47 degrees south and 160.44 degrees east. The station is a climate station and is doing three hourly synoptic observations and hourly metars when needed. Digitized data, both rainfall and temperature goes back to 1962. The instrument enclosure has been relocated twice as land previously used were bought and developed for other purposes. Negotiations are continuing with land owners of the nearest airfield for the station to be relocated permanently to this site.

Munda Meteorological Station (91503)

- Located at latitude 08.20 degrees South and longitude 157.16 degrees East on the island of New Georgia, the biggest island in the western province and located along the Munda airstrip.
- Digitized data for both temperature and rainfall ranges from 1962 to 2010.
- Second WMO.s GSN station within SIMS network and it performs both hourly reports (METAR.S & SPECI.S) and also three hourly synoptic reports (SYNOPS) for climate monitoring
- Regarded as an aeronautical and a climate station because of the role it plays in climate observations.

Plate 17. Munda station

Taro Island meteorological station (91502)

- Located at 6.70 degrees south and 156.38 degrees east in Choiseul Province
- First established in Sasamunga by the Australian Bureau of Meteorology but was later relocated to Taro.
- Three hour observation reports (SYNOP) for climate purposes and when required, hourly observations for domestic flights can be requested.
- Relocation is an issue as the station is located on a small low lying island and provincial capital station of Taro. The headquarters will be re-located to the nearby big island of Choiseul.

Plate 18. Taro Island station

Kira Kira (91527)

The old station is located at 10.42 degrees south and 161.92 degrees east in Makira Province. This is one of the stations that was established by the Australian Bureau of Meteorology under the SPATC program but was decommissioned in early 2000 because of non-payment of the lease agreement by the Solomon Islands Government. Despite the closure and the deterioration of all the infrastructure and instruments, SIMS still manages to get rainfall data from a voluntary station around Kira Kira.

SIMS is still putting all efforts to revitalize Kira Kira and with funding from the Solomon Islands Government.s 2010 Development Budget. SBD$800,000 has been allocated for this project and the current allocation is only enough to rebuild the office. Funds will need to be sought elsewhere for the building of staff quarters and the instrument enclosure. Despite this shortfall, work on the office and instrument enclosure should commence this year (2010)

Lata Meteorological Station (91541)

- Located on the island of Santa Cruz at latitude 10.70 degrees south and longitude 165.80 degrees east.
- The only climate station in the southern region of the country and its location and data is very important as this is a hot spot for cyclogenesis.

Plate 19. Lata station

A recent visit by a technician from the Bureau of Meteorology, Australia has identified that the current instrument enclosure is not suitable for climate observations and has recommended the need for relocating this site. Already a site has been identified and the enclosure will be relocated when funds are available.

5.2.5 Automatic weather stations network

It is both impractical and costly to maintain conventional (manned) weather stations in the more remote or smaller islands despite the fact that they are the most vulnerable to hydro-meteorological disasters. Hence, it is important that meteorological data is obtained from these areas to improve weather and climate forecasts and warnings and also for climate monitoring purposes. Such issues can be partially addressed with the introduction of automatic weather stations (AWS).

With only seven synoptic stations, the present observation network is also inadequate and the existing climate data does not really represent the Solomon Islands climate. Establishing a network of automatic weather stations around Solomon Islands will assist in the climate data distribution across the entire country. SIMS AWS network has only one AWS installed at Honiara as part of the refurbishment work at the upper air station with funds provided by the US Government towards the Global Climate Observation System (GCOS)/Global Upper Air Network (GUAN) project. The other two AWS.s were installed at Henderson Airport (Theodore Friedrichs) and at the remote island of Anuta (Vaisala) but are now unserviceable because of lack of spare parts, technical expertise and accessibility.

Funds are been sought at the moment for two more AWS to be installed at Henderson and Munda Meteorological Station as part of the effort to have more quality data and also to satisfy requirements by the International Civil Aviation Organizations for international flights.

Plate 20. AWS with its display

Future Network

SIMS is embarking on the task of establishing other manned stations around the country especially at the big islands or Provinces that are yet to have weather stations. In 2010 the Government approved a total of SBD$1.6 million for the construction of two new manned stations at Tiggoa on Rennell Island and the revitalization of Kira Kira weather station which was closed since 2000. Already suitable sites for the office and the instrument enclosure have been surveyed and approved by the respective customary landowners and Provincial Government. SIMS anticipates construction to commence towards the end of this year 2010.

Other projects that are also in the plan are the establishment of Fera weather station in Isabel Province. Isabel Province is yet to have a weather station and so still lacks basic weather services and as such establishing a manned station there should be prioritized in SIMS future budgetary planning. Other locations that have been identified for future weather stations are Mbabanikira on Guadalcanal and Afio on Small Malaita.

There are also relocation issues to be considered in the next couple of years and among those stations that need to be relocated are Auki, Lata and probably Taro. Depending on the availability of land and funds, there is also the possibility of relocating the upper air station to the Henderson International Airport.

5.2.6 Voluntary Rainfall Stations

The earliest voluntary rainfall stations were established in 1950.s and by 1980; the numbers have increased to sixty (60) stations, all providing rainfall data to SIMS. As of October 1979, there were 29 rainfall stations in the Solomon Islands solely aimed for agricultural purposes, primarily for research. The network also consists of rainfall stations established at various plantations (coconut/cocoa) and also cattle farms especially on Guadalcanal. A numbers of these stations were also established at Provincial Police Stations, Forestry Camps and Churches

Most of these stations were closed in the 90.s for some unknown reasons however for agricultural stations, the closure of Dodo Creek and Fote Agricultural Research Centers is also instrumental in the closure of the other stations.

Attempts are now been made to revive these rainfall stations or establish new stations around the country. Already SIMS is working with stakeholders to re-establish similar rainfall stations with the rain gauges that were supplied by the University of Oklahoma.

5.2.7 Data Management and Processing

Quality control and data management are critical components of the GCOS requirements. The Data Management and Processing Section within the Meteorology Division is responsible for quality control and archiving of all climate data. Hard copies of old data from different locations are currently been digitized. Some of these data were observations done by explorers and plantation owners and so extra effort is being put into this program to ensure that the data are safe and ready to be used. Digitized data are archived in three formats, Excel, CliCom and Climsoft. Also as part of this data rescue program, hard copies are been stored in acid free card boxes.

Data Analysis and Seasonal Forecasts ¡V This section also prepares other climate products for specific users such as the three months rainfall outlook which is issue once a month. During cyclone season, tropical cyclone outlook for the season can also be published to stakeholders.

5.2.8 Hydrological Observation Stations

The Hydrological Monitoring sites are coordinated by the Hydrology Section which is housed within Water Resources Division of MMERE. The activities been undertaken by the Hydrological sites are basically water level monitoring and rainfall.
The focus of the hydrological monitoring is more oriented towards:

- Monitoring sites for Hydro power
- Monitoring sites for Water Supply

As such, the demand or the establishment of any new monitoring sites will depend very much on the development needs for a particular river or a catchment area. More work is needed for on water information for flood and drought forecasting

Table 56 Hydrological Monitoring Sites

Type	Site	Province
Water level	Lungga at Betikama School	Guadalcanal
Water level	Rove at Botanical Garden	Guadalcanal
Water level	Kovi	Guadalcanal
Rainfall site	Tetere Police Station	Guadalcanal
Rainfall site	Rate School	Guadalcanal
Rainfall site	Mt Austin	Guadalcanal
Rainfall site	Henderson Airport	Guadalcanal
Rainfall site	Headquarter	Guadalcanal
Water level	Rori at Afu afu Village	Malaita
Water level	Kubulota Stream	Isabel
Rainfall site	Kubulota Stream	Isabel
Water Level	Sorave	Choiseul

Plate 21. Lunga Monitoring Site ¡V Guadalcanal Province

5.2.9 Ocean observation stations

Sea level Stations

There are three sea level stations that are operational in the Solomon Islands and SIMS is the focal point. These stations are installed for different times and serve different purposes. The first station was installed in 1994 as part of the Pacific Islands Climate and Sea level monitoring project funded by AusAID through the Australian Bureau of Meteorology. The main purpose of this installation is to get sea level data to monitor sea level changes due to anthropogenic climate change. It was later upgraded to function as part of the tsunami network.

The Mbokona Sea level station consists of the following components:

- Tide Gauge to measure the sea level,
- AWS to measure the atmospheric factors that influence the sea level such as atmospheric pressure.
- Continuous Global Positioning System to measure the land movement of the islands.

Through this arrangement, sea level data from these stations are transmitted and archived at National Tidal Facility, Flinders University, Australia and monthly copies are sent to SIMS in CD-ROMS.

The other two sea level stations were installed in July of 2010 as part of theAustralian Tsunami Warning System and data from these stations can be accessed upon request.

Plate 22. Mbokona Sea Level Monitoring Station

5.2.10 Research

Pacific Climate Change Science Program (PCCSP)

This is a three (3) year regional science program aimed to help PIC.s and Timor Leste further their understanding of how climate change is likely to affect the region and Individual countries. The organizations that are involved in the PCCSP are the Australian Department of Climate Change, AusAID, Bureau of Meteorology, Commonwealth Scientific Research Organization and Pacific Island Countries. The five (5) components of the project are:

1. Recent and current climate and trends, to underpin improved projections of future climate change;
2. Major regional climate phenomena, including the South Pacific Convergence Zone, El Nino ¡V Southern Oscillation and the Western Pacific Monsoon, which drive seasonal and year-to-year variations in rainfall, winds and tropical cyclones;
3. Detailed climate projections and fine-resolution modelling;
4. Ocean processes including sea-level rise and ocean acidification.
5. Synthesis of the science research outputs and production of technical and user-friendly products for key stakeholders in Partner Countries.

Glider observations of the western boundary current in the Solomon Sea

Glider operations in the South West Pacific are part of the South Pacific Climate Experiment (SPICE) endorsed by CLIVAR. The glider missions have been initiated from collaboration between the IRD/LEGOS-Noumea, PMEL and SCRIPPS who provides and operates the SPRAY glider. The experiments began in 2005 and 2006 in the Coral Sea to observe the SEC inflow between Guadalcanal Island (10¢XS, 160¢XE) and New Caledonia (21¢X4'S, 165¢X2'E). Since 2007 Gliders are continuously deployed in the Solomon Sea to observe the western boundary currents at the Papua New Guinea coast, and the entering flow between Solomon Island and the southeast extremity of New Guinea.

Funding is now available for two gliders to work each time: one will continue the time series of transport between Gizo and PNG (the tip of the Louisiade Archipelago), and the other will explore other parts of the Solomon Sea (we are planning to make crossings of Solomon St between Bougainville and New Britain, to be able to distinguish transport that goes through Vitiaz St vs Solomon St). The aim of these observations is primarily to measure and understand the flow variations in the Solomon Sea and their relationship to El Nino. The results to date suggest that the usual northward flow is about 20 million cubic meters/second, but decreases to near zero during La Nina events.

5.2.11 Conclusion and Recommendations

Whilst the international community is aware of the need for better and quality scientific data, there is always minimal support provided to fund observation programs because the benefits of these programs are not always realized or prioritized. Instrument/sensors calibration and maintenance is always a challenge because of budgetary constraints and in cases where instruments have been neglected and not functioning, observations of related climate parameters are also suspended, hence reducing the number of parameters that are observed. Not only that but the switch from conventional instruments to automated instruments is highly desirable but with the limited funding, the number of sensors will also be restricted.

Solomon Islands is trying to commit to its international obligations by ensuring that limited funds are made available to maintain these observations network and also expand on the existing setup. The support through USA financial support for the GCOS/Pacific Islands Global Climate Observation System (PI-GCOS) for the revitalization of the Honiara GUAN station is a step forward as the Solomon Islands Government at that time just doesn.t have the funds. The closure of all the voluntary rainfall stations has also reduced the observation network and efforts should now be emphasized to ensure the continuity of these stations and also establish new sites for climate monitoring in suitable sites.

5.3 Education, Training, Public Awareness and Capacity Building Needs

5.3.1 Introduction

With support from development partners Solomon Islands is making some progress in addressing Article 6 of the UNFCCC particularly with the implementation of the UNFCCC Capacity Building Framework and the Amended New Delhi Program of Action targeting education, training, public awareness and capacity building needs. A range of actions have targeted and assisted decision-makers, practitioners and the general public to understand better climate change and its effects. The GEF-funded National Capacity Self Assessment (NCSA) project has developed a National Environmental Capacity Development Action Plan (2008-2012) and a number of past projects have also enabled the government and national stakeholders to undertake capacity needs assessments and capacity development activities.

The range of capacity needs identified in this SNC is the outcome of consultations undertaken by the Capacity Building Thematic Working led by the School of Natural Resources of the Solomon Islands College of Higher Education. The needs were determined from feedback obtained by other TWGs and from recommendations of past assessments including the NCSA.

5.3.2 Progress in implementing Article 6, the UNFCCC Capacity Building Framework Progress and the Amended New Delhi Work Programme

As part of their national programmes to implement the Convention, and taking into account national circumstances and capacities, Parties are encouraged to undertake activities under the categories listed below, which reflect the six elements of Article 6 and also contained in the Amended New Delhi Work Programme.

(a) Institutional capacity-building, including the enhancement and/or creation of an enabling environment;

While there is a growing awareness of the predicted impacts of climate change on the different sectors of the country most government Ministries and civil society organizations are yet to formally mainstream climate change into their corporate plans and strategies and will need assistance to do this. Limited mainstreaming has meant that most of these organizations are yet to seriously strengthen institutional capacity needed to address climate change. Some progress with integrating climate change into national policies and strategies has begun in the Ministry of Agriculture and Livestock and the Ministry of Infrastructure Development.

Coordination amongst government ministries and civil society organizations as well as between the national and provincial governments is also weak. This situation is now soon to change with the finalization of the national climate change policy which provides guidance for mainstreaming and coordination. Furthermore the MECDM has recently established a Climate Change Working Group to coordinate work amongst government, donor partners and civil society. During 2011 a meeting of Premiers on Environment and Climate Change recognized and called for the need to build capacity at the provincial level to address climate change and strengthen coordination between the national government and provincial governments.

National and provincial laws and regulations also need to be reviewed to ensure they include provisions to support climate change adaptation and mitigation. This has begun with the review of legislations and regulations that can contribute to disaster risk reduction. A similar approach will need to be taken for climate change.

b) National communications and national action plans;

This Second National Communication builds on the INC. During these national communications Solomon Islands has developed a NAPA, established a Designated National Authority for the Clean Development Mechanism and begun drafting a National Climate Change Policy. Other national action plans developed and can contribute to adaptation and mitigation outcomes include the National Action Program to address Land Degradation, National Action Plan for the Coral Triangle Initiative, Renewable Energy Policy Framework, Agriculture and Livestock Policy, Organic Agriculture Policy, Food Safety Policy and Protected Areas legislation. With the support of the UNDP and other partners the government is now embarking on a REDD-Readiness project to support the country build capacity and establish the governance framework and enabling environment for engaging in carbon trade.

c) Greenhouse gas (GHG) inventories, and emission database management, and systems for collecting, managing and utilizing activity data and emission factors;

The GHG inventory work in the SNC was very challenging given the lack of any archived information from the INC, the limited availability of activity data and lack of nationally generated emission factors. With experience from the SNC the following actions is recommended to build capacity for GHG inventories:

- Convene a stakeholder workshop immediately following the completion of the SNC to establish clearer roles and responsibilities for undertaking GHG work, review activity data and emission factors needed and develop a strategy for addressing the capacity gaps.
- Identify a designated officer within MECDM to coordinate future GHG work
- Develop an emissions database
- Identify and implement measures to begin planning and implementing data collection
- Prepare submission to the GEF for the 3rd National Communication following acceptance of the SNC by the UNFCCC Secretariat.
- Identify opportunities in existing or planned projects to gather data that can contribute to future GHG inventories.
- Review and revise legislation and regulations to ensure timely provision of information on fossil fuel distribution and use in the country.

(d) Vulnerability and adaptation assessment, and, (e) Implementation of adaptation measures;

As described in this SNC there is good progress in developing capacity to undertake V&A work as reflected in the range of V&A and DRR activities in the country. A V&A Learning Network meeting was held in early 2011 where partners were able to share their experiences and learn from each other. This is a fitting mechanism to coordinate V&A implementation and capacity development in the country and needs to be continued and strengthened. Recent efforts by the MECDM to align DRR and V&A work is also a step in the right direction and a proposed GEF and GEF DR funded climate change project is expected to contribute to strengthening future integration and alignment of DRR and V&A work in the country. In the recent years NGOs and the Solomon Islands Christian Association (SICA) have also begun integrating climate change V&A into their programmes

and contributing to the growing experience with V&A assessments in the country.

On-going capacity development needs in V&A and DRR include, but not limited to;

- Strengthening the role of the V&A and DRR Learning Network in the country to take on a more formal strategic planning, coordination and capacity development role.
- Reviewing and improving physical, economic and social data collection to support V&A and DRR assessments and adaptation planning
- Up-scaling training on V&A and DRR for field staff and community representatives
- Develop capacity of MECDM and government Ministries for strategic V&A assessment and planning at the sector level
- Finalization of integration and alignment of DRR and V&A roles and functions within MECDM
- Development of a database of V&A and DRR assessments and adaptation actions within MECDM and distribute information regularly
- Increasing the number of projects and activities that involves socio-economic and scientific research and build capacity of nationals to undertake research that can contribute to V&A and DRR assessments.
- Establish a special program to promote, strengthen and coordinate the use of traditional knowledge and technology for adaptation and disaster risk reduction.
- Support MECDM compile and make available a range of V&A and DRR assessment tools
- Conduct training and pilot activities to carry out economic valuation of vulnerability and adaptation options.
- Conduct training to integrate V&A and DRR into EIA and SEA processes.
- Investigate and implement mitigation actions that also contribute to adaptation.
- Strengthen collaboration with International and Regional Inter-governmental organizations

(f) Assessment and implementation of abatement options;

The Ministry of Mines and Energy, NGO and private sector continues to play a strong role in promoting and implementing small scale solar and hydro technology with initial work being done to assess potential for use of wind turbines. These are currently ad hoc but are part and partial of the efforts to implement the National Renewable Energy Policy Framework. The full range of GHG abatement options are not well understood in Solomon Islands despite the large supply of resources such as coconut oil, biomass and the large number of rivers with hydroelectricity potential. Planning is underway to implement Solomon Islands first large scale hydroelectricity and CDM project initially producing 14 MW electricity to supply the city of Honiara and surrounding areas.

Main capacity needs to assess and implement abatement options include:

- Expertise and guidance to build on the Renewable Energy Policy Framework, undertake assessments and consultations to develop a NAMA
- Expertise, technology and funding to plan and pilot biomass gasification, wind turbine and bio-gas projects in the country for purposes of future up-scaling in rural areas.
- Funding to enable national institutions and experts to carry out research into use of bio-fuel and bio-gas at the community and industry levels.
- Financial incentives to up-scale use of bio-fuel to generate electricity
- Training of technical officers at the provincial level to undertake energy audits and plan for future energy demand
- Training in the development, implementation and monitoring of NAMAs as abatement strategies at the provincial level.

- Training and expertise to review and identify potential technologies to enhance energy efficiency at the household and industry level including transport.
- Expertise and technology for up-scaling use of affordable wood-efficient cooking stoves in rural areas.
- Expertise, technology and training to develop a Forest Sector Adaptation and Mitigation Strategy to increase CO2 removals and limit emissions through unsustainable logging activities.
- Expertise and technology for the establishment and implementation of a REDD Readiness program for Solomon Islands
- Training of communicators and media personnel on key messages on Carbon Trade and the challenges and opportunities for Solomon Islands.

(g) Research and systematic observation;

For a large archipelagic nation such as Solomon Islands with its diverse geography and vast EEZ, national meteorological and hydrological observation, research and monitoring capacity is relatively very weak and very much under-funded. The looming threat of climate change requires that this aspect of preparedness be strengthened as a national priority. More recently the SIMS has benefited from funding support and technical assistance from the Australian Government Bureau of Meteorology and the Australian Government Department of Climate Change and Energy Efficiency under the International Climate Change Adaptation Initiative to improve data collection and management build technical skills of personnel and develop climate models and scenarios for Solomon Islands. This is being augmented by a recent support from the global Adaptation Fund to strengthen agro-meteorological services including installation of AWS in strategic locations in the country, provide early warning for the agriculture sector and improve information dissemination. Hydrological monitoring is capacity is also very weak with only a few monitoring stations in the country and limited personnel and expertise within government.

The following capacity development needs are linked to the main findings presented in the section of this SNC on Systematic Observation:

- Establishment of at least two new manned weather observation stations in the country
- Upgrading of weather recording instruments and equipment across all weather stations in the country
- Establishment of voluntary rainfall and temperature recording stations in the country including training and provision of equipment and incentives.
- Specialized training for officers of SIMS in forecasting, modelling, early warning systems, ocean monitoring, agro-meteorology and sea level monitoring
- Training of graduate and post-graduate level hydrologists
- Establishment of at least nine new hydrological monitoring stations in the country at targeted strategic locations
- Training on climate change and integrated water resources management for government and NGO officers
- Incorporate a research and development policy outcome into the national climate change policy
- Utilise NCCCT as the research and development body to develop research and development plans and provide oversight on the implementation of plans
- Secure funds (recurrent and overseas development aid) for competitive research projects
- Incorporate basic and applied research components to all climate change and mitigation projects to be implemented

(h) Development and transfer of technology;

The SNC has provided Solomon Islands its first opportunity to identify technology and technology transfer needs. There is yet no institutional arrangement and mechanism within government to formally monitor technology needs for adaptation and mitigation. The recommendations at the end of the TNA component of the SNC (Section 6.1.7) also applies to this section.

(i) Improved decision-making, including assistance for participation in international negotiations;

Training in international climate change negotiations has been implemented in the past by MECDM with the support of SPREP, FIELD and the ACP MEA Capacity Building project managed out of SPREP. MECDM and other government officials have over the past years developed very good experience in international negotiations and have contributed effectively to the UNFCCC COP and Subsidiary Bodies processes. Much of the knowledge and information gained from international negotiations will need to be disseminated to national stakeholders and potential project implementation partners. The following capacity needs and capacity development actions are recommended:

- Development of standard briefing and de-briefing process, templates and guide for use by national officers to report on important outcomes from global and regional conferences and meetings
- Development and distribution of communication materials informing and updating national stakeholders about the outcomes of international and regional negotiations and implications for the country and the government.
- Training on development of briefing notes for policy makes and national and provincial government leaders
- Development of MECDM web-site and Climate Change newsletter

(j) Clean development mechanism projects;

In 2011 Solomon Islands government endorsed the establishment of a Designated National Authority (DNA) for the Clean Development Mechanism. With this enabling mechanism in place the country.s opportunity to develop capacity to implement CDM projects can only happen if and when potential CDM projects are identified. The following capacity needs and actions need to be addressed to achieve this:

- Secure funding, technical assistance and train local experts to prepare to support the developers of the Tina Hydro Electricity Project as Solomon Islands first CDM project
- Secure funding and technical assistance to explore other CDM project opportunities in the country and to promote and market these potential projects.
- Undertake training visits to observe and learn from other CDM projects in the Asia-Pacific region.

(k) Education, training and public awareness in the implementation of the Convention and the Kyoto Protocol

- Building a critical mass of local climate change experts
- Utilise existing tertiary scholarship opportunities through the National Training Unit to allocate 2-3 postgraduate scholarships in climate change
- Maintain support for the Certificate in Environmental Studies offered at Solomon Islands College of Higher Education
- MECDM to plan and organise training workshops on climate change over the next 5 years
- Develop a guideline on Knowledge Management and distribute for countries to use

during development of policies, strategies and programmes.

- Conduct training for staff in lead agencies on leadership, coordination, communication and project management
- Development of a guide to incorporate communication strategies in the national climate change policies and strategies and in the role of lead agencies and relevant organizations
- Conduct a detailed capacity needs assessment for development, implementation and monitoring of a climate change communication strategy by lead agencies and relevant organizations
- Develop climate change communication tools in English and Pijin English languages
- Plan and conduct national level training on developing communication strategies including practical session on development of strategies to communicate impacts of climate change on coastal and marine environments.

(l) Information and networking, including the establishment of databases and the acquisition of information and communication technologies.

Information and data management is one of the most challenging institutional capacity issues within national organizations in the country. Past donor funded projects have developed various databases across government ministries and NGOs and there is a lot of information stored in the computers of officers and professionals that can contribute to raising awareness and increasing knowledge about climate change adaptation and mitigation. Much information on experiences from other countries are kept in regional inter-governmental organizations however accessing them is not very easy for most policy makers and technical officers. Regional networks for information sharing can be very useful if well utilized. There is currently no formal networking of climate change information at the national level and sharing of information is quite limited despite the wonders of modern information technology. An attempt at developing an integrated information management system for the government including an information management and sharing policy has been discussed in government circles but yet to be implemented. Given this situation the following is recommended to increase information and data sharing in the country;

Further to the above capacity needs and recommended actions the MECDM needs to undertake a review of progress of implementing the recommendations and actions presented in the following documents:

i) National Environmental Capacity Development Action Plan 2008-2012 (SI Government, 2008)
ii) Institutional capacity within Melanesian countries to effectively respond to climate change impacts, with a focus on Vanuatu and the Solomon Islands (Wickham et al, 2009)
iii) Coastal Governance in Solomon Islands: An evaluation of the strategic governance issues relating to coastal management (Lane 005)

Many of the gaps and needs are still very relevant and needs to be addressed. Finally, to monitor a moving target of capacity the MECDM needs to ensure that there is a dedicated officer position within the Ministry or the Climate Change Division that can monitor and evaluate capacity needs and actions to address climate change from time to time and report to the NCCCT through the Director of Climate Change Division and the PS of MECDM so that capacity development continues to be endogenous, iterative and strategic.

CHAPTER 6

CONCLUSION, RECOMMENDATIONS AND KEY MESSAGES

This Second National Communication follows the Initial National Communication which was submitted to the UNFCCC in 2003. National circumstances have changed since the INC with the national economy recovering after the years of ethnic unrest and supported predominantly by aid flows and a huge increase in timber extraction from logging. The 2009 national census has recorded a population of 515,000 and growing at 2.4%. The slow but steady growth in the national economy has also seen a rise in GHG emissions from 192 Gg $CO_{2\ eq}$ in 2000 to 351 Gg $CO_{2\ eq}$ in 2010, much of this from energy and waste sectors. The growing population, wholesale removal of logs, increasing land clearance for subsistence agriculture and increasing pressures on inshore and off-shore fisheries and the predicted impacts of climate change places the country in a very vulnerable situation.

The SNC project experienced a number of challenges which are presented below and accompanied by recommendations for improvement:

a. Initial training on the GHG Inventory was inadequate and officers did not understand well their roles and the use of the IPCC methodologies

b. Data availability is a key deficiency in the GHG Inventory process. The government must identify ways and means to build capacity to collect, store and analyse data from the following sectors and categories:
   - Fuel use by the transport sector
   - Fuel use by forestry and agriculture industry operators
   - Fuel use by industrial and others
   - Fuel wood use by households and schools
   - Industry emissions
   - Waste water volumes etc.

c. Data on range of modern and traditional technology for adaptation and mitigation needs to be collected

d. Data availability on land use, land use change and forestry particularly from the agriculture sector is crucial. A national agriculture census is long overdue and needs to be implemented.

e. Information (reports, technical papers etc.) across the different sectors is not readily available however the SNC has compiled a significant amount of information on a range of national, regional and international subjects and issues. Climate Change Division to maintain and update an electronic library to support on-going work.

f. Need to assign clear roles and responsibilities for officers to collect data for the purpose of the National Communications

g. Need for on-going training in GHG inventory methods in the different sectors and have these functions embedded in the roles of various government agencies

h. Establish and maintain a V&A network of policy makers and practitioners to monitor on-going work in V&A.

i. Develop the NAMA and establish a mechanism for on-going monitoring of mitigation efforts

j. Include funding resources for research into adaptation and mitigation technology options

k. The Thematic Working Group is a workable mechanism and should be maintained

perhaps as sub-committees of the NCCCT

l. A lot of information generated from the SNC process is important for adaptation, mitigation, technology development planning and capacity building strategies. MECDM Climate Change Division to coordinate a follow up meeting internally and with other stakeholders on the implications and opportunities that the findings of the SNC presents.

m. There needs to be strong national capacity for quality assurance and quality control. This was not easily available during the SNC. A recent training attachment by the Deputy Director Climate Change Division on GHG Inventories places the Division in a much better position to provide quality assurance and quality control.

n. Momentum is important. It is recommended that MECDM initiate application for a GEF Enabling Activity to do the 3rd National Communication and immediately build on the SNC

o. Gathering information and report writing for a significant technical report requires time. It was not easy to have government officers commit enough time given their core responsibilities. It is recommended that out-sourcing the report writing of each component be considered in the future.

Key Messages

This Second National Communication concludes with the following key messages for policy makers, national leaders at all levels, development partners and regional and international inter-governmental organizations:

1) The climate of Solomon Islands is already changing and will continue to change and affect Solomon Islanders and their environment (as explained in below points 2, 3 and 4[16]). Reliable science is now showing us that temperatures will continue to increase, there will be more very hot days, rainfall patterns will change, there will be more extreme rainfall days and less frequent but more intense tropical cyclones, sea level will continue to rise and ocean acidification will continue.

2) The adverse impacts on agriculture and food security are a major concern for many communities and/or villages. Evidence from changes in temperature and rainfall and the occurrence of tropical cyclones in Solomon Islands will have long-term effects on food production systems. These are likely to be exacerbated by the climate change and sea-level rise. Some of the impacts of concern are: increased intensity and frequency of tropical cyclones (e.g. Cyclone Namu destroyed rice industry in 1986); occurrence of pests and diseases; storm surges and flooding; sea-level rise and coastal erosion and inundation; increased temperatures; drought and ENSO-related changes to temperature and rainfall.

3) Water resources will also be affected immensely by climate change and sea-level rise. Adequate water supply is considered one of the key elements of food security and therefore directly linked to people's livelihood. Thus any change in rainfall will trigger changes in water supply. Water supply in Solomon Islands is sourced mainly from rivers and streams originating in high mountain and dense forest catchments on high islands, rainwater harvesting (especially on artificial islands) and from thin freshwater lens of underground aquifers on small low-lying atolls and islands. These sources will be affected by climate change and sea-level rise on both high and low-lying islands. Information provided by communities and/or villages indicate that they are already experiencing contamination of their freshwater sources by rising sea levels (low-lying atolls), water shortages, saltwater intrusion and flooding of rivers and streams.

4) Droughts in Solomon Islands have caused serious shortages of water supplies. For example the 1997/1998 ENSO had caused reduction of water supplies by 30-40% in Honiara. Flooding also causes serious health risks. For example an increase in urban flooding undermines the water quality of town water supply and services as well as water infrastructure. Saltwater intrusion and sea-level rise has caused damage to water infrastructure and contaminated freshwater supplies.

5) Solomon Islands population is growing at about 2.4% but its very low human development, income per capita and poor access to basic services by many people in rural areas makes it one of the least developed and most vulnerable countries in the Pacific and the world to the predicted impacts of climate change.

6) Solomon Islands is blessed with abundant natural resources from the land and the sea but this is under threat from economic activities and rising populations. The

[16] Napa Priority Project No. 1 - Managing The Impacts Of, And Enhancing Resilience To, Climate Change And Sea-Level Rise, On Agriculture And Food Security, Water Supply And Sanitation, Human Settlements And Human Health, Solomon Islands: Napa Project Profile

majority of the population living in rural areas are very resilient and self-sufficient but this is now changing and many people are experiencing hardship and poverty of opportunity.

7) Climate change will affect all Solomon Islanders. The ability of individuals and communities to adapt will depend on their levels of exposure, sensitivity to the change and ability to cope. There are already cases of increased hardship by people in various parts of the country due to rising sea levels, more intense rainfalls, hotter days and stronger winds. Extreme events such as cyclones, flooding and storm surges are expected to increase the level of disaster risks faced by communities. Climate change adaptation and risk reduction must be a moral and political commitment and must continue to be an important sustainable development priority for the government of Solomon Islands. This can also be achieved through carefully planned mitigation actions.

8) Climate change adaptation and mitigation is everybody.s business. The government and all stakeholders must integrate climate change into their policies and strategies, planning and operations and ensure effective coordination.

9) Social resilience is important to ensure ecological resilience. Strong communities can manage their environment better and adapt better to the increasing hazards and risks caused by climate change.

10) Vulnerability assessments and risk reduction measures must be aligned to address both short term climate variability and long term climate change.

11) Findings from this SNC show that energy and waste sectors are the biggest contributors to the country's total greenhouse gas emissions followed by agriculture, and LULUCF sector is also a big soruce of emissions and removas. With global warming predicted to exceed IPCCC projections and energy demand expected to double in 2020. Solomon Islands government and people must seriously work towards reducing emissions from the energy, waste and agriculture sector and management of forestry, land use and land use change, and urgently expedite planning and programming to increase use of renewable energy within the current decade to reduce reliance on fossils fuels and reduce greenhouse gas emissions. This must be guided by clear measurable targets for emission and mitigation levels

12) Technology development, including traditional knowledge, is important for adaptation and mitigation programmes and actions. Solomon Islands has embarked on a number of adaptation and mitigation technologies and need to research and develop new technologies to address the growing problems that climate change brings.

13) Observing and recording weather data in a systematic and timely way is important for Solomon Islands to understand and plan for changes. The capacity of the Solomon Islands Meteorological Services must be strengthened to ensure this on-going service for the country.

14) Solomon Islands must develop and strengthen its capacity at all levels, fully utilize its own talents and resources and seek partnerships to address climate change.

15) The adaptation and mitigation program and project proposals in this SNC must be supported if the country is to enhance its efforts to cope with climate change.

ANNEXURE

GHG Emissions UNFCCC Reporting Tables

2000 Emissions UNFCCC Reporting Tables

UNFCCC Reporting Table 1: National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors (2000)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2 Emissions	CO_2 Removals	CH_4	N_2O	NO_x	CO	NMVOC	SO_2
Total National Emissions and Removals	191.24352	NE	9.59999	0.09497	1.07517	4.70212	0.93807	0.26710
1 Energy	191.24352		0.02311	0.00156	1.07517	4.70212	0.89300	0.26710
A Fuel Combustion (Sectoral Approach)	191.24352		0.02311	0.00156	1.07517	4.70212	0.89300	0.26710
1 Energy Industries	44.60585		0.00183	0.00037	0.12194	0.00915	0.00305	0.04623
2 Manufacturing Industries and Construction	0.00000		0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
3 Transport	88.16787		0.01350	0.00073	0.87542	4.67741	0.88606	0.06724
4 Other Sectors	58.46981		0.00778	0.00047	0.07782	0.01556	0.00389	0.15363
5 Other (please specify)								
B Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO	NO
1 Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO
2 Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO
2 Industrial Processes	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.04507	0.00000
A Mineral Products	NA	NA	NA	NA	NA	NA	NE	NA
B Chemical Industry	NA	NA	NA	NA	NA	NA	NA	NA
C Metal Production	NA	NA	NA	NA	NA	NA	NA	NA
D Other Production	0.00000				0.00000	0.00000	0.04507	0.00000
E Production of Halocarbons and Sulphur	NA	NA	NA	NA	NA	NA	NA	NA
Hexafluoride	NA	NA	NA	NA	NA	NA	NA	NA
F Consumption of Halocarbons and Sulphur	NA	NA	NA	NA	NA	NA	NE	NA
Hexafluoride	NA	NA	NA	NA	NA	NA	NA	NA
G Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA
3 Solvent and Other Product Use	NA	NA	NA	NE	NA	NA	NE	NA
4 Agriculture			2.36300	0.06688	0.000000	0.000000		

A Enteric Fermentation	0.000000		0.93400					
B Manure Management	0.000000		1.42900	0.00673				
C Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO
D Agricultural Soils				0.06015				
E Prescribed Burning of Savannas	NE	NE	NE	NE	NE	NE	NE	NE
F Field Burning of Agricultural Residues	NE	NE	NE	NE	NE	NE	NE	NE
G Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA
5 Land-Use Change & Forestry [(2)]	NE	NE	NE	NE	NE	NE	NE	NE
A Changes in Forest and Other Woody Biomass Stocks	NE	NE	NE	NE	NE	NE	NE	NE
B Forest and Grassland Conversion	NE	NE	NE	NE	NE	NE	NE	NE
C Abandonment of Managed Lands	NE	NE	NE	NE	NE	NE	NE	NE
D CO_2 Emissions and Removals from	NE	NE	NE	NE	NE	NE	NE	NE
Soil	NE	NE	NE	NE	NE	NE	NE	NE
E Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA
6 Waste			7.21387	0.02653	0.000000	0.000000	0.000000	0.000000
A Solid Waste Disposal on Land			5.72497					
B Wastewater Handling			1.48891	0.02653				
C Waste Incineration	NE	NE	NE	NE	NE	NE	NE	NE
D Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA
7 Other (please specify)	NA	NA	NA	NA	NA	NA	NA	NA
Memo Items								
International Bunkers	0.6771		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Aviation	0.6771		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Marine	NE	NE	NE	NE	NE	NE	NE	NE
CO2 Emissions from Biomass	NE							

REFERENCES

Agriculture Research & Development Division. (2006) *Role of Research In Solomon Islands*, Ministry of Agriculture & Livestock. Honiara, Solomon Islands.

ADB. 2005, *Solomon Islands Country Environmental Analysis: Mainstreaming Environmental Considerations in Economic and Development Planning Processes*, Honiara Solomon Islands.

Baragamu, G. 2008, *Solomon Islands Red Cross – Preparedness for Climate Change*, Honiara, Solomon Islands.

CLIPP. 2007. *Sustainable Resource use or Imminent Collapse?: Climate, Livelihood and Production in the South West Pacific*. University of Copenhagen, Denmark

Cole, S. 2007. Potential climate change impacts on corals and coral reefs in Melanesia from bleaching events and ocean acidification, Climate Change and Biodiversity in Melanesia, Report produced by the Bishop Museum with funding support from the McArthur Foundation.

Food and Agriculture Organization (FAO)

Fox J C. and Yosi, CK, Kinnan, R, J. 2009. *Estimating CO2 emissions associated with selected timber harvesting and oil palm conversion in Papua New Guinea* (Unpublished draft), University of Melbourne, Australia Jackson, G., Tutua, J., Barry, I., Pitaki, T., Taro, L., Pae, S., Warita, P., Tamasia, F (2006) *Extreme Living, Extreme Need: assessment of the food security and livelihood potential of the Weather Coast of Makira*, KGA, Honiara Solomon Islands

Lane M. 2005, *Coastal Governance in Solomon Islands: An evaluation of the strategic governance issues relating to coastal management*, University of Adelaide, Australia.

Lane, M. 2006. *Coastal governance in Solomon Islands: An evaluation of the strategic governance issues relating to coastal management*. International Waters Project Technical Report, No.: 29, Apia, SPREP.

Leisz, S J and Burnett, J B. 2009. *Climate change and biodiversity in Melanesia*, Bishop Museum Technical Report 42, Hawaii

Leary, T.1993, *Solomon Islands State of the Environment Report,* SPREP, Apia, Western Samoa 131

LDC Expert Group. (2002). *Annotated Guidelines for the Preparation of National Adaptation Program of Action*, UNFCCC, Bonn, Germany.

Lipsett-Moore, G., Hamilton,R., Peterson, N., Game, E,. Atu, W., Kereseka, J., Pita, J., Ramohia, P., Siota, C. (2010) *Ridges to Reefs Conservation Plan for Choiseul Province, Solomon Islands*. TNC Pacific Islands Countries Report No. 2/10

Mataki M. 2011, *A critical assessment of solid waste paradigms for solid waste management in Pacific Island Countries*, unpublished PhD thesis, Murdoch University, Perth, Australia

McIntyre M. 2006, *NCSA UNCCD Stock take report*, Honiara, Solomon Islands

MECM/MFMR. (2010). *Solomon Islands Coral Triangle Initiative National Plan of Action*, SIG, Honiara, Solomon Islands.

MECDM. (2008). *National Environmental Capacity Development Action Plan: 2008-2012*. SIG, Honiara, Solomon Islands.

Ministry of Agriculture & Livestock. 2007, *Corporate Plan 2008- 2010*, Honiara Solomon Islands.

Ministry of Environment, Conservation and Meteorology. 2010, Strategic *and Corporate Plan 2010-2012*, Honiara Solomon Islands

Potter, S. 2008. The sting of climate change: Malaria and Dengue Fever in maritime South East Asia and the Pacific Islands, Policy Brief, Lowly Institute for International Policy.

Richards, K. and Timmermann, A. 2008, Regional *Climate Change Projections for Southwestern Pacific with a focus on Melanesia*. In Leisz, S.J and Burnett, J.B. (eds). Climate Change and biodiversity in Melanesia. Bishop Museum Technical Report 42(1).

Saelea, J. 2007, Research *Work Programmes*, Ministry of Agriculture & Livestock. Honiara, Solomon Islands.

Siho F.P. 2006, *NCSA UNFCC Thematic Assessment report*, Honiara, Solomon Islands.

Solomon Islands College of Higher Education. 2007*, Annual Report 2007*, Honiara Solomon Islands.

Solomon Islands College of Higher Education, *2006, Annual Report 2006*, Honiara Solomon Islands.

Solomon Islands Government. 2002, National Economic Recovery, Reform & Development Plan 2003-2006, Honiara Solomon Islands

Solomon Islands Government. 2004, Pacific Islands Renewable Energy Project, Honiara Solomon Islands

Solomon Islands Government. 2011. *Solomon Islands National Development Strategy*. edited by Ministry of Development Planning and Aid Coordination. Honiara.

Solomon Islands Government 2002, *Solomon Islands Human Development Report* Honiara Solomon Island

Solomon Islands Government, Ministry of Forests, Environment and Conservation. 2002, *The Revised Solomon Islands Code of Logging Practice*, Honiara Solomon Islands.

Solomon Islands Government National Parliament. 1998, *The Environment Act 1998* (No. 8 of 1998).

SPREP. 1993, Solomon Islands *National Environment Management Strategy (NEMS).* Apia, Western Samoa.

Solomon Islands Coastal Marine Resources Consultancy Services (SICFCS) 2002, *Solomon Islands National Assessment World summit on Sustainable development (Synopsis of issues, activities, needs and constrains- 1992-2002) World Summit on Sustainable Development (Rio + 10)*, Honiara Solomon Islands.

Solomon Islands Government. 2002, Solomon Islands Initial National Communication for UNFCC, Honiara Solomon Islands.

Solomon Islands Government. 2005, *Enabling Activity for the preparation of Solomon Islands second National Communication to the UNFCCC*, Honiara Solomon Islands.

Solomon Islands Government; Department of National Reform and Planning. 2003, *National Economic Recovery, Reform and Development Plan (NERRDP) 2003-2006: Strategic and Action Framework*, Honiara Solomon Islands

Solomon Islands Government, Office of the Prime Minister. 2008, *Solomon Islands CNURA Government National Policy Document*, Honiara Solomon Islands

Solomon Islands Government. (2011): *Nationally Appropriate Mitigation Actions*. Draft version for consultations.

Solomon Islands Government. (2002): *National Report to the United Nations Convention to Combat Desertification*, Honiara.

Solomon Islands Government. (2002) *National Economic Recovery, Reform & Development Plan 2003-2006*, Honiara Solomon Islands

Solomon Islands Government. (2002), *Solomon Islands Human Development Report* Honiara, Solomon Islands

Solomon Islands Government, 2008. *Medium Term Development Strategy 2008-2010*. Ministry of Development Planning and Aid Coordination

Solomon Islands Government, 2006. Thematic Report for Solomon Islands. Solomon Islands National Capacity Self Assessment Project

SPREP. 2004. *Action Strategy for Nature Conservation 2003-2007*, Apia Samoa.

SPREP. 2005, *Pacific Islands Framework for Action on climate change (2006-2015),* Apia Samoa.

Terry J.P., ed. (1998). *Climate and Environmental Change in the Pacific. School of Social and Economic Development*, The University of the South Pacific.

Thomas J. 2006, *UNCBD NCSA Thematic Assessment Report*, Honiara Solomon Islands

Thomas J. Siho F.P and Makini A. 2006, *NCSA Cross Cutting Assessment report*, Honiara, Solomon Islands

Thomas J. Siho F.P. and Makini A. 2007, *NCSA Action and Resource Mobilization Plan*, Honiara, Solomon Islands.

UNCCD. 2002, *United Nations Convention to Combat Desertification In Those Countries Experiencing Serious Drought and / or Desertification, particularly in Africa*, Secretariat of the United Nations Convention to Combat Desertification (UNCCD), Germany.

UNDP and SIG (u.d) *Capacity Building for Sustainable Land Management in the Solomon Islands*, Honiara.

UNDP. 2011, *Human Development Report 2011*. New York.

UNDP, UNFCCC Secretariat, Expert Group on Technology Transfer and Climate Technology Initiative. 2009, *Handbook for conducting technology needs assessment for climate change*, UNDP

Vickers, B., Ogle, L., Speight, N. 2011, *Regional REDD+ Readiness Support Strategy for the Pacific*

Walton, J <> (unpublished) *Land Use Planning in relation to Climate Change*.