Republic of Nauru

Second National Communication

Submitted

By

Republic of Nauru

To

United Nations Framework Convention on Climate Change

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ABBREVIATION

ADB	Asian Development Bank
AFOLU	Agriculture, Forestry and Other Land Use
AOSIS	Alliance of Small Island States
ARM	Atmospheric Radiation Measurement
AWS	Automatic Weather Station
BPC	British Phosphate Commission
CASA	Civil Aviation Safety Authority
CBD	Convention On Biological Diversity
CBO	Community Based Organization
CCA	Climate Change Adaptation
CCE	Community And Continuing Education
CH_4	Methane
CIE	Ministry of Commerce, Industry and Environment
CMIP	Coupled Model Inter-comparison Project
CO	Carbon Monoxide
CO2e	Carbon Dioxide equivalent
DoA	Department of Agriculture
DPK	Dual Purpose Kerosene
DRR	Disaster Risk Reduction
DSM	Demand Side Management
EDF	European Development Fund
EE	Energy Efficiency
EEAP	Energy Efficiency Action Plan
EEZ	Exclusive Economic Zone
ENSO	El Niño–Southern Oscillation
ER	Emission Reduction
ESTs	Environmentally Sound Technologies
FAO	Food And Agriculture Organization
FATF	Financial Action Task Force
FMS	Fiji Meteorological Services
FSM	Federated States Of Micronesia
FY	Financial Year
Gg	Giga Grams
GHG	Greenhouse Gas
GoN	Government Of Nauru
GPCP	Global Precipitation Climatology Project
HFC's	Hydro Floro Carbons
ICDE	International Council For Open And Distance Education
IPPU	Industrial Processes and Product use
IRENA	International Renewable Energy Agency
ITCZ	Inter-Tropical Convergence Zone

IUCN	*International Union For Conservation Of Nature*
kV	Kilo Volt
LCT	Local Coastal Tanker
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
LPG	Liquefied Petroleum Gas
LULUCF	Land Use, Land Use Change and Forestry
MCIE	Ministry of Commerce, Industry and Environment
MHHW	Mean Higher High Water
ML	Million Liters
MoH	Ministry of Health
MPs	Member Of Parliaments
MW	Megawatt
N_2O	Nitrous Oxide
NCD	Non Communicable Diseases
NDRM	National Disaster Risk Management
NDRMO	National Disaster Risk Management Office
NEAP	National Environmental Action Plan
NEISIP	Nauru Economic Infrastructure Strategy and Investment Plan
NEMS	National Environmental Management Strategy
NEPF	National Energy Program Framework
NERM	National Energy Road Map
NFMRA	Nauru Fisheries and Marine Resources Authority
NIANGO	Nauru island Association for Non-Government Organisation
NMVOC	Non-methane volatile organic compounds
NPC	Nauru Phosphate Corporation
NPRT	Nauruan Phosphate Royalties Trust
NRC	Nauru Rehabilitation Corporation
NSDS	Nauru Sustainable Development Strategy
NUA	Nauru Utility Authority
NUC	Nauru Utility Corporation
NWSHP	Nauru Water, Sanitation and Hygiene Policy
OTEC	Ocean Thermal Energy Conversion
PAD	Planning and Aid Division
PCCSP	Pacific Climate Change Science Joint Program
PEQD	Pacific Equatorial Divergence
PFC's	Per Floro Carbons
PIC	Pacific Island Countries
PICCAP	Pacific Islands Climate Change Action Program
PIGGAREP	Pacific Islands Greenhouse Gas Abatement Through Renewable Energy Projects
PIPSO	Pacific Island Private Sector Organisation
PIREP	Pacific Islands Renewable Energy Project
PNA	Parties To The Nauru Agreement

PNG	Papua New Guinea
PPA	Pacific Power Association
PSC	Project Steering Committee
RCP	Representative Concentration Pathways
RE	Renewable Energy
RONAdapt	The Republic of Nauru Framework for Climate Change Adaptation and Disaster Risk Reduction
RONPHOS	Republic of Nauru Phoaphate Corporation
RPC	Regional Processing Centre
SF_6	Sulfur Hexaflouride
SIDS	Small Island Developing State
SPCZ	South Pacific Convergence Zone
SPREP	Secretariat of the Pacific Regional Environment. Programme
tCO_{2e}	Tonnes of Carbon Di-oxide Equivalent
TEPCO	Tokyo Electric Power Company
TFR	Total Fertility Rate
TNA	Technology Needs Assessment
TTM	Taiwan Technical Mission
TVET	Technical Vocational Education And Training
TWG	Technical Working Group
TWP	Tropical Western Pacific
UNCCD	United Nations Convention On Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USP	University Of The South Pacific
V&A	Vulnerability and Adaptation
VDS	Vessel Day Scheme

EXECUTIVE SUMMARY

National Circumstances

The Republic of Nauru is one of the smallest independent, democratic states in the world. It is a republic with a Westminster parliamentary system of government but with a slight variance as the President is both head of government and head of state. The island is small, isolated, coral capped with 21 km^2 in area, 20 km in circumference, located in the central Pacific Ocean 42 km south of the equator and 1287 km west of the International Date Line. Ocean Island (Banaba) is its nearest neighbour.

Nauru is a small single oval-shaped and raised coral equatorial island, located about 40 kilometres (km) south of the Equator at 0° 32' 0" S, 166° 55' 0" E. Its total land area is 21 square kilometres (km^2) with an Exclusive Economic Zone (EEZ) of 320 000 km^2. The island is divided into two plateau areas – "bottomside" a few metres above sea level, and "topside" typically 30 metres higher. The topside area is dominated by pinnacles and outcrops of limestone, the result of nearly a century of mining of the high-grade tricalcic phosphate rock. The bottom side consists of a narrow coastal plain that is 150 – 300 m wide as well as surrounded by coral reef, which is exposed at low tide and dotted with pinnacles. The bottom side is the residential area for the Nauru populace. The highest point of the island is 65m above sea level. The island lies to the west of Kiribati; to the east of Papua New Guinea (PNG); to the south of the Marshal Islands and to the north of the Solomon Islands.

The climate is equatorial and maritime in nature. There have been no cyclones on record. Although rainfall averages 2 080 mm per year, periodic droughts are a serious problem with only 280 mm of rainfall in the driest year recorded. Land biodiversity is limited, with only 60 species of indigenous vascular plants. A century of mining activity in the interior has resulted in the drainage of large quantities of silt and soil onto the reef, which has greatly reduced the productivity and diversity of reef life. Sewage is dumped into the ocean just beyond the reef, causing further environmental problems, while the island's many poorly maintained septic tanks have contaminated the ground water. Access to fresh water is thus a serious problem on Nauru with potable water coming only from rainwater collection and reverse osmosis desalination plants. These desalination plants used around 30% of the energy generated by Nauru Utility Corporation (NUC) in 2008.

The main driver of climate variability in Nauru is the El Niño-Southern Oscillation (ENSO). La Niña events are associated with delayed onset of the wet season and drier than normal wet seasons, often resulting in an extended drought. During El Niño, temperatures on Nauru are warmer than normal due to warmer sea temperatures; and rainfall and cloud amount are increased. Another key climate driver for Nauru is the Inter-tropical Convergence Zone (ITCZ). The ITCZ affects Nauru all year round. Its seasonal north/south movement drives the seasonal rainfall cycle, which peaks in Dec-Feb. The South Pacific Convergence Zone (SPCZ) affects Nauru during its maximum northward displacement in July and August.

The 2012 census shows a population of 9 945 persons of whom 90.8% are ethnic Nauruan. The population has fallen since 2002 mainly due to a fall in the number of expatriate workers, mostly from Kiribati and Tuvalu, who began leaving Nauru as the island's phosphate production dwindled. The main economic sector used to be the mining and export of phosphate, which is now virtually exhausted. The island has been mined extensively in the past for phosphate. Few other resources exist and most necessities are imported from Australia. Small scale subsistence agriculture exists within the island communities.

Nauru is faced with serious economic challenges. Its once thriving phosphate industry has ceased operation thus depriving Nauru of its major lifeline revenue source. The local infrastructure, including power generation, drinking water and health services, has been adversely affected in recent years by the decline in income from phosphate mining. However, further explorations of the residual phosphate deposits have raised hopes that there may be potential to keep the phosphate mining for yet sometime. With fewer prospects in the phosphate industry, Nauru has to look at other alternative revenue sources to support its economic development. Unfortunately, for a country of the size of Nauru (21 km^2) with its limited natural resources, the options are not many.

Fresh water is also a serious problem on Nauru with potable water coming only from rainwater collection and reverse osmosis desalination plants. Nauru is a permeable island with very little surface runoff and no rivers or reservoirs. Potable water is collected in rainwater tanks from the roofs of domestic and commercial buildings. Water for non-potable uses is obtained from domestic bores at houses around the island. Shallow groundwater is the major storage for water between rainy seasons. There is increasing salinity in the groundwater bores around the perimeter of the island, and increasing demand for groundwater water due to development. Groundwater is contaminated by wastewater disposal from houses, shops, commercial buildings and RPC.

Nauru now is highly dependent on donor support especially from Australia, Japan, New Zealand and Taiwan (ROC). It is important that Nauru develops and strengthens its partnership arrangements with the above countries to be able to meet the goals of its national development strategies which have identified key areas to be targeted in order to achieve some degree of economic stability.

The Government has prioritized reforms in the electricity and water sectors and in the management of fuel. With the recent adoption of its National Energy Policy additional legislation will be developed as required to provide a clear and practical path towards sustainable development.

National Greenhouse Gas Inventory

The Nauru's Inventory for Greenhouse Gases has been calculated for the base year 2000 using the revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, the IPCC "Good Practice Guidance and Uncertainty Management in National GHG Inventories (GPG2000)" and software for "Non Annex1 National Greenhouse Gas Inventory Software, Version 1.3.1" has been used for the estimation of Nauru's second GHG inventory. Sectoral data for GHG emissions estimation was compiled from various sources primarily using available national data, data collected and presented for National Energy Roadmap, Nauru Census Report, Agriculture Division, other statistical reports, studies, brochures and other country specific information sources. Wherein no formal data is available, are not considered in the study.

The sectors and gases assessed for the estimation of second national GHG inventory includes the emissions by sources and removals by sinks of all anthropogenic GHGs. As per the 1996 IPCC guidelines, the inventory estimates the GHG emissions from following sectors which are relevant for Nauru:

- Energy Sector
- Agriculture Sector (Livestock)
- Waste Sector

The direct GHG emissions are estimated in this national GHG inventory are:

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

Emissions from the following indirect GHGs are also estimated and reported in this second national GHG inventory:

- Oxides of Nitrogen (NOx)
- Carbon Monoxide (CO)
- Non-Methane Volatile Organic Compounds (NMVOC) and
- Sulphur dioxide (SO_2)

In year 2000, the total GHG emissions by sources and removals by sink for Nauru was 19.4906Gg CO_2eq (excluding removals); which comprises of 13.3371Gg CO_2e from Energy; 1.6074Gg CO_2e from Agriculture and 4.5460Gg CO_2e from Waste Sector. Emissions from per fluorocarbons (PFCs), hydro fluorocarbons (HFCs) and sulphur hexafluoride (SF6) in Nauru are negligible, as the products containing these gases are not produced in the country. The data on land-use change and forestry (LUCF) activities was not available for Nauru, therefore CO_2 sequestration by the LUCF sector has not been considered for year 2000. Total GHG emissions, including FOLU, are also not estimated.

Nearly 100% of GHG emissions in Nauru come from five activities: energy industries (electricity production); manufacturing industries & construction (phosphate mining and processing); transport (road); other (residential-cooking); waste - solid waste disposal on land and wastewater handling; livestock (swine and poultry (chicken and ducks)) - enteric fermentation, manure management and agriculture soils (only N_2O emissions from livestock waste). The largest contributor to GHG emissions in year 2000 was energy industries (electricity production) amounting to 36.99 % of total emissions. The next biggest contributor was waste management (solid waste disposal on land and waste water handling) with 23.32 % of total GHG emissions followed by road transport, manufacturing industries & construction (phosphate mining and processing) and enteric fermentation & manure management i.e. from livestock (swine and poultry (chicken and ducks)) which contributed to 17.09%, 13.90% and 7.03 % of total emissions respectively.

Nauru, with very limited industrial sector presence and relatively poor energy infrastructure results in high share of GHG emissions from energy sector. Nauru needs both technical and financial support to come up with mitigation plans e.g. energy efficiency to reduce GHG emissions from the energy sector.

The total GHG emissions of energy sector increased by 25% over 1994-2010, due to increase in petroleum fuel consumption, followed by waste sector increased by 31%, due to population increment, whereas agriculture sector i.e. only livestock drastically decreased, due to agriculture activity (reduction in livestock) and water, as agricultural activity on Nauru is very limited due to the small amount of land available and also, more importantly, the scarcity of water. Emissions from the land-use change and forestry (LUCF) sector, per-fluorocarbons (PFCs), hydro-fluorocarbons (HFCs) and Sulphur hexafluoride (SF_6) were not considered in this 2000 GHG inventory.

The GHG emission for Nauru for the year 2003, 2007 and 2010 has also been calculated based on the similar data source and methodology used for estimation of GHG emissions for

year 2000. The quantity of CO_{2e} emissions increased from 19.49 Gg CO_2e in 2000 to 42.35 Gg CO_2e in 2010.

The sectoral GHG emissions trend 1994-2010 (Gg $CO_{2\ eq.}$) in Nauru, shows that, the trend of major GHG emissions' fluctuations was in energy sector since 1994 to 2010 (estimated as per available data), this is mainly due to change in fossil fuel consumption and total petroleum fuel import change (the fuel consumption pattern in electricity generation, phosphate mining and transportation sub sectors have been varied due to economy fluctuation).

Vulnerability and Adaptation (V&A)

In Nauru, life and culture are interdependent and are strongly related to land, ocean and environment. The changes in climate parameters and adverse impacts related to climate variability and change are a significant threat to the biodiversity and ecosystems, the lives of its people and the economic viability of the islands.

Nauru faces a full range of geologic and climatic hazards and is also subjected to climatic variability and extremes. The main climate change vulnerabilities in Nauru include sea level rise and the effect that an increase in temperature will have on marine resources and already stressed water and vegetative resources. Due to environmental degradation, the island is already experiencing coastal erosion and declines in the productivity of its coral reef systems. Rising ocean temperatures, sea level rise, and an increase in the number of intense storms could cause further damage to these ecosystems. Climate-related disasters have had huge impacts on the economic growth and national development.

The wind-wave climate displays strong inter-annual variability at Nauru, varying strongly with the El Niño–Southern Oscillation (ENSO). Nauru has consistent monthly mean air temperatures throughout the year. The air temperatures are closely related to the sea-surface temperatures, which also are fairly constant throughout the year. The wet season usually starts in November and continues to April of the next calendar year. Drier conditions occur during the months of May to October. Rainfall in Nauru is affected by the Inter-tropical Convergence Zone (ITCZ) and the South Pacific Convergence Zone (SPCZ). The higher rainfall in the wet seasons is caused by the ITCZ moving south and the SPCZ strengthening and expanding north at that time of year.

The annual rainfall for Nauru has extremely high variability (standard deviation of 1151 mm) and the main influence on this climate variability is the El Nino Southern Oscillation (ENSO). During El Nino years, Nauru is warmer and usually much wetter than average, receiving up to 4500 mm of rainfall. La Nina years are associated with a delayed onset of the wet season and drier than normal conditions, often resulting in an extended drought. In some La Nina years, Nauru only receives around 500 mm of rainfall.

The main climate extremity experienced by Nauru is drought. Tropical cyclone formation within the Nauru Exclusive Economic Zone (EEZ) is highly unlikely due to the islands proximity to the equator. The sea-level rise near Nauru measured by satellite altimeters since 1993 is about 5 mm per year slightly higher than the global average of 3.2 ± 0.4 mm per year. The Nauru's future climate projections show growing climate and disaster risks. Climate change is likely to impact on all economic sectors that are pertinent to the sustainable development of Nauru.

There is very high confidence in the direction of long-term change in a number of key climate variables, namely an increase in mean and extremely high temperatures, sea level and ocean acidification and the frequency and intensity of extreme rainfall will increase. There is

medium confidence that mean rainfall will increase, and medium confidence in a decrease in drought frequency. The Government of Nauru recognises that effective institutions and the inter-relationships between them are at the heart of its ability to respond to growing climate and disaster risks. For this reason, the Department of Environment under the Ministry of Commerce, Industry and Environment (CIE), Government of Republic of Nauru (GoN) has primary responsibility for coordination of Nauru's climate change activities. CIE includes a Climate Change Unit as well as a National Disaster Risk Management (NDRM) Unit.

The "National Sustainable Development Strategy (NSDS)" outlines the major climate change impacts and geo-hazards for Nauru. The Republic of Nauru Framework for Climate Change Adaptation and Disaster Risk Reduction (RONAdapt) – represents the Government of Nauru's response to the risks to sustainable development posed by climate change and disasters. RONAdapt is intended to support progress towards the country's national development priorities and the goal of environmental sustainability, by ensuring that a focus on reducing vulnerabilities and risks is incorporated into planning and activities across all sectors of the economy and society. The priority actions identified here are not intended to be an exhaustive list of CCA and DRR needs.

The priorities outlined in the RONAdapt are intended to contribute to the achievement of the National Sustainable Development Strategy (NSDS) and to increasing Nauru's resilience to climate change and disasters, by targeting the following goals:

1. Water security
2. Energy security
3. Food security
4. A healthy environment
5. A healthy people
6. Productive, secure land resources

The below provides an overview of the prioritised high-level strategies for addressing Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) in each sector, namly, Water, Health, Agriculture, Fisheries and marine resources, Disaster management and emergency response, Energy, Land management and rehabilitation, Infrastructure and Coastal protection, Biodiversity and environment, Education and human development, these all sectors have been explained in this report.

From a disaster perspective, the key water concern in Nauru is drought, and loss of secure water for key services such as the hospital. During periods where there is little or no rain for more than 3 months, Nauru's water supply situation deteriorates dramatically, and production capacity becomes stressed. If the RO units break down during drought periods, Nauru faces a social and health disaster.

Enhancing water security is therefore both a key national development priority and also fundamental to reducing vulnerability to climate change and to potential disaster events. Under the water sector, there are also some important policy and planning gaps that need to be filled.

Major health issues in Nauru include non-communicable diseases (NCDs) and water-borne illnesses. Nauru has very high rates of NCDs including cardiovascular disease, diabetes, cancer and respiratory diseases.

Nauru's small population and distance from other countries also presents challenges in providing quality, cost effective health care. Supply lines are not always reliable, key services such as water and energy are at times disrupted, and health infrastructure

(including both hospitals) are subject to coastal flooding risks. Lack of local capacity is an additional constraint to improved health outcomes.

Climate change and extreme events are anticipated to introduce additional stresses, both to community health as well as to the functioning of the health care system. There is a need to build local capacity of the health sector to prepare and cope with adverse effects of climate change and vulnerability of disasters.

Food insecurity is a major risk for Nauru, given the island's dependence on imported foods and its geographic isolation. This situation is also closely linked with health problems such as the prevalence of NCDs, and is exacerbated by government debt and household income levels which make imported foods expensive and supply unsteady. For these reasons, agricultural development is targeted by the NSDS as a priority.

Agricultural production is relatively small at present, and is constrained by limited availability of suitable land and water, and by limited expertise and interest in growing food and raising livestock. The island's soil is relatively infertile and has poor water holding capacity while in some areas is also contaminated. In addition, the land tenure system means land ownership is fragmented and little is publicly owned, which increases the complexity of land management. What little fertile land remains untouched by mining is in the coastal strip, and thus in small parcels around houses.

Climate change adds to the already significant challenge of attaining the NSDS goal of increasing domestic agricultural production. Despite these constraints, there is potential to increase agriculture production and productivity, and in doing so strengthen food security and improve livelihoods and health, thus contributing to Nauru's efforts to reduce vulnerability to future climate change.

The Division of Agriculture under department of CIE has primary responsibility for supporting agricultural development from subsistence to small scale farming, and is the lead agency responsible for overseeing implementation of the agriculture sector's priority CCA and DRR actions.The institutional and human capacity available in Nauru to support and expand agricultural development is limited and needs to be expanded.

Fisheries are a critically important resource in Nauru, contributing to food security and cultural practices (particularly in low income households) as well as providing an important source of foreign revenue for government.

Climate change is also expected to affect fisheries. Nauru lies within the Pacific Equatorial Divergence (PEQD) and the Western Pacific Warm Pool (Warm Pool) provinces, depending on the prevailing El Niño-Southern Oscillation (ENSO) conditions. Climate change is projected to increase sea surface temperatures, sea levels, ocean acidification and to change ocean currents. These effects will, in turn, impact on Nauru's fisheries resources.

The Nauru Fisheries and Marine Resource Management Authority (NFMRA), a statutory corporation under the *Nauru Fisheries and Marine Resources Authority Act 1997*, is responsible for fisheries management including overseeing, managing and developing the country's natural marine resources and environment.

The practice of Disaster Management (DM) and Emergency Response (ER) implies strengthening preparedness, response and recovery systems for potential extreme events or disaster scenarios. Oversight of DRM activities lies with the NDRMO (which resides with CIE), supported by high-level guidance from the National Disaster Risk Management Council. Coordination of emergency response is at present the responsibility of the Police

department. There are some important policy and planning gaps that need to be filled to strengthen disaster management and emergency response.

The energy sector can play a critical role in helping to improve Nauru's coping and adaptive capacities with respect to climate change, and to development goals generally. Energy services provide a tool for reducing vulnerability through, for instance, economic empowerment and the delivery of health and education services.

Electricity production is currently reliant on imported diesel, and thus places a significant burden on the government's limited financial resources. Import-dependency also creates supply risks. Further, energy production is closely linked to water production, since the reverse osmosis desalination units are energy intensive. At the same time, energy infrastructure is located in the coastal strip, and thus susceptible to particular climate and disaster risks which need to be considered in future planning.

From a disaster perspective, a key concern is the potential for outbreak of fire at the tank farm area. The fire protection system at the tank farm is presently not functioning, and is also not of sufficient capacity to extinguish a major fire. Such an event would have major implications for provision of energy to the island, both during the disruption and for quite some time after given limited alternative infrastructure available should the facility be destroyed. The possibility of energy shortages, arising from for instance fuel supply disruptions and/or problems with the power station, is also a critical concern.

The Energy Roadmap endorsed by the government in 2014 sets out strategies and activities in six thematic areas, namely: power, petroleum, renewable energy, demand side energy efficiency, transport, and institutional strengthening and capacity building. Progress implementing the Roadmap will contribute directly towards helping Nauru adapt to climate change and reduce disaster risks. The Energy Roadmap identifies a swathe of institutional strengthening activities for the sector.

Land is a scare resource in Nauru and much of the island has already been degraded by mining activities, which are ongoing. A related issue is that of waste collection, disposal and management. The dump site has very little available capacity, and is being further stressed by the large quantities of waste (mainly plastics) generated by the RPC. Moreover, the existing dump site is not lined, leading to concerns about possible migration of contaminated leachate into Buada lagoon.

At present Nauru has no endorsed land use plan to guide development decisions. Land use planning is critical to, for instance, ensure that future infrastructure investments are coherent with the visions and needs of all of Nauru's communities. Preparation and endorsement of a *Nauru Land Use Plan* (broadening the Master Land Use Plan proposed for Topside to focus also on Nauru's coastal areas) which integrates climate and disaster risks.

As highlighted by the NSDS, strategic infrastructure can play an important role in improving economic productivity and/or reducing community vulnerability, and thus in making Nauru more resilient. The 2011 *Nauru Economic Infrastructure Strategy and Investment Plan* (NEISIP) identifies the government's needs and immediate priorities in the infrastructure sector, focusing on short and medium term needs relating to transport, water, sanitation, waste management, telecommunications and government buildings (including schools and hospitals).

Infrastructure needs to be designed and managed with future conditions in mind, sometimes referred to as being "climate proofed" and able to withstand disaster events. Sea level rise and associated coastal erosion, flooding during extreme rainfall events, storm surge and fires are hazards that may threaten vital infrastructure.

The absence of an over-arching coastal zone management plan hinders coordination between government agencies and communities regarding management of the coastal zone. There is also presently no environmental legislation or building codes that govern development activities.
Develop and implement an *Integrated Coastal Zone Management Plan (ICZMP)*, which integrates climate and disaster risks. Over time, this should be integrated as a component of a wider *Nauru Land Use Plan.*

Protection of scarce land and soil resources is an important issue for reducing environmental degradation and improving the overall health of Nauru's environmental resources, as is addressing water contamination.

A *National Biodiversity Strategic Action Plan* (NBSAP) was first prepared in 2010, and updated in 2014. A goal of the 2010 plan was "an annual increase of 2% to enhance, develop and manage current conservation and rehabilitation of biological diversity and ecosystems to increase the percentage of Nauru's protected and conserved areas from the existing 2% of total land, including coastal areas, to 30% by 2025".

Strong social linkages, a sense of culture, empowerment of disadvantaged individuals or groups, and greater engagement of people in managing their local environment and supporting their local community can all play an important role in strengthening the resilience of Nauru to future scenarios in which climate change, disasters or other stresses may present new challenges. Community development activities encompass a wide range of issues, from empowerment of women, youth development and engagement in community building activities, the strengthening of social networks and improving livelihood opportunities for households and small businesses.

Limited human capacity is a major challenge for delivering on sustainable development aspirations in Nauru, and also constrains the country's capacity to adapt to climate change. Few students are pursuing education in technical fields such as science, technology, ICT and healthcare, meaning Nauru is heavily dependent on expatriate expertise.

In addition to building the basic capacities needed to implement Nauru's development strategy, various sectors have emphasized the need to build into the school curriculum and other community education channels a greater focus on social and environmental vulnerability, including the way this may be influenced by climate change and potential disaster events.

The constrained resource base, dependency on imports for food and energy security and high level of aid received have resulted in extreme vulnerability to external forces, such as global food and energy price changes and financial and economic crises.

Virtually all Nauruan residential buildings and most economic infrastructure are located along the narrow coastal flat. Marine and coastal fisheries continue to be a source of food security for most people, particularly low-income households. Due to the proximity to the coast and the dependence on coastal and marine resources for livelihood and food security, Nauru is highly vulnerable to climate change, sea level rise, ocean acidification and natural disasters.

Nauru has limited resources. Its main exports are fish and phosphate soil, which is a finite resource. The mining of phosphate has degraded the land to a useless state, which is about 80% of the islands surface area.

Adaptation action in Nauru is relatively low as compared to other Pacific Island countries. However, Nauru is participating in multi-country regional projects that address several of its

priority areas for adaptation, as well as gender, forestry and tourism. The limited current programming in the country means that some gaps remain within the priority adaptation areas identified by the country, including health and marine resources.

Mitigation

Nauru is committed to formulating strategies, national policies and best practices for addressing GHG emissions and making a practical contribution to the global mitigation efforts. While at the same time the country is also pursuing its national and regional development priorities and sustainable development objectives. This is planned to be achieved by integrating GHG abatement efforts with other social, environmental and economic priorities.

Energy is one of the crucial development indicators in any country and like the other Pacific Island Countries; Nauru's primary energy needs are mainly met by imported petroleum fuel. The majority of electricity is produced from Diesel. Nauru is exploring opportunities to further utilize the renewable energy sources and energy efficneyc in supply and demand side.

GoN is also focusing on mitigation options for emissions from phosphate mining and transportation sector.

The GHG emissions from the waste sector makes a significant contribution to GHG emissions from Nauru. However the limited resources (financial and technical) poses a larger challenge in planning and implementation of GHG mitigation measures.

Nauru is an active participant in Pacific island regional affairs and has signed on to a number of regional policies and initiatives that have implications for climate change mitigation.

This chapter outlines Nauru's contribution towards global climate change mitigation efforts, including effectiveness of potential greenhouse gas abatement actions for long-term sustainable development. The chapter also outlines priority climate change mitigation areas that require international support.

Other Information

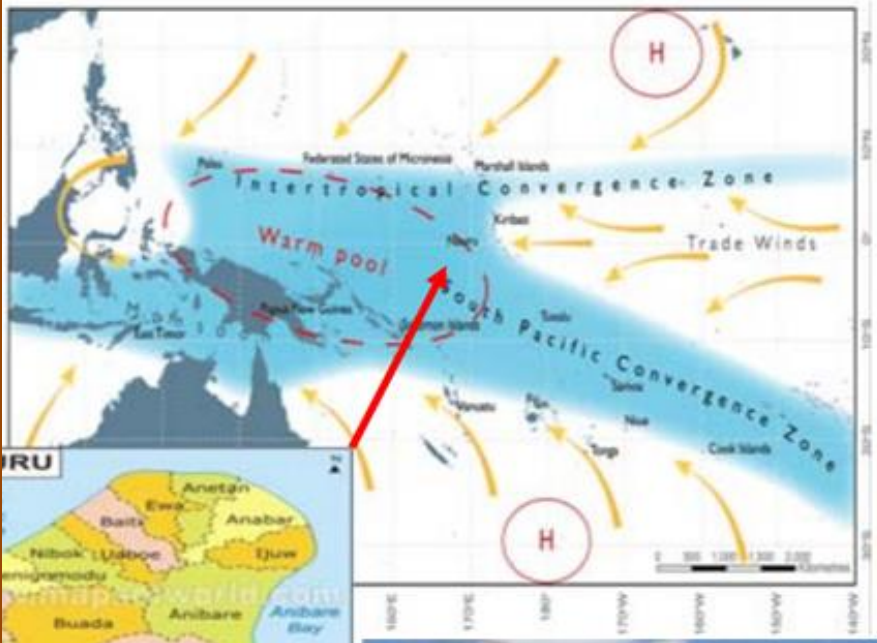
In order to address climate change, the need for development of new technologies and transfer of existing appropriate technologies (for both mitigation and adaptation) cannot be overstated. New and clean energy technologies need to be developed to reduce greenhouse gas emissions while technologies also need to be developed to address climate change. Development and technology transfer is one of the four pillars of the Bali Action Plan which are critical to the achievement of both adaptation and mitigation initiatives.

As Nauru's greenhouse gas emissions are limited to a small number of well-defined sectors, the opportunities to reduce these emissions are relatively clear. Although Nauru's emissions are relatively small, Nauru still remains very mindful of its vulnerability to climate change and the future potential effects predicted as a result of sea-level rise. In consideration of these, Nauru has taken a positive approach towards improving its own situation as well as actively participating at both the regional and international levels.

This chapter details Nauru's capacity to respond to climate change including implementation strategies and key initiatives. This section also discusses issues and challenges to integrate climate change with long term sustainable development goals such as the need for technology transfer, appropriate policies, research, data and information gaps.

CHAPTER 1

NATIONAL CIRCUMSTANCES



1. Introduction

Nauru is one of the smallest independent, democratic states in the world. It is a republic with a Westminster parliamentary system of government but with a slight variance as the President is both head of government and head of state. The island is small, isolated, coral capped with 21 km^2 in area, 20 km in circumference, located in the central Pacific Ocean 42 km south of the equator and 1287 km west of the International Date Line. Ocean Island (Banaba) is its nearest neighbour.

The 2012 census shows a population of 9 945 persons of whom 90.8% are ethnic Nauruan. The population has fallen since 2002 mainly due to a fall in the number of expatriate workers, mostly from Kiribati and Tuvalu, who began leaving Nauru as the island's phosphate production dwindled. The main economic sector used to be the mining and export of phosphate, which is now virtually exhausted. The island has been mined extensively in the past for phosphate. Few other resources exist and most necessities are imported from Australia. Small scale subsistence agriculture exists within the island communities.

Nauru is faced with serious economic challenges. Its once thriving phosphate industry has ceased operation thus depriving Nauru of its major lifeline revenue source. The local infrastructure, including power generation, drinking water and health services, has been adversely affected in recent years by the decline in income from phosphate mining. However, further explorations of the residual phosphate deposits have raised hopes that there may be potential to keep the phosphate mining for yet sometime. With fewer prospects in the phosphate industry, Nauru has to look at other alternative revenue sources to support its economic development. Unfortunately, for a country of the size of Nauru (21 km^2) with its limited natural resources, the options are not many.

Fresh water is also a serious problem on Nauru with potable water coming only from rainwater collection and reverse osmosis desalination plants. Nauru is a permeable island with very little surface runoff and no rivers or reservoirs. Potable water is collected in rainwater tanks from the roofs of domestic and commercial buildings. Water for non-potable uses is obtained from domestic bores at houses around the island. Shallow groundwater is the major storage for water between rainy seasons. There is increasing salinity in the groundwater bores around the perimeter of the island, and increasing demand for groundwater water due to development. Groundwater is contaminated by wastewater disposal from houses, shops, commercial buildings and RPC.

Nauru now is highly dependent on donor support especially from Australia, Japan, New Zealand and Taiwan (ROC). It is important that Nauru develops and strengthens its partnership arrangements with the above countries to be able to meet the goals of its national development strategies which have identified key areas to be targeted in order to achieve some degree of economic stability.

The Government has prioritized reforms in the electricity and water sectors and in the management of fuel. With the recent adoption of its National Energy Policy additional legislation will be developed as required to provide a clear and practical path towards sustainable development.

Figure 1: Nauru Country brief profile

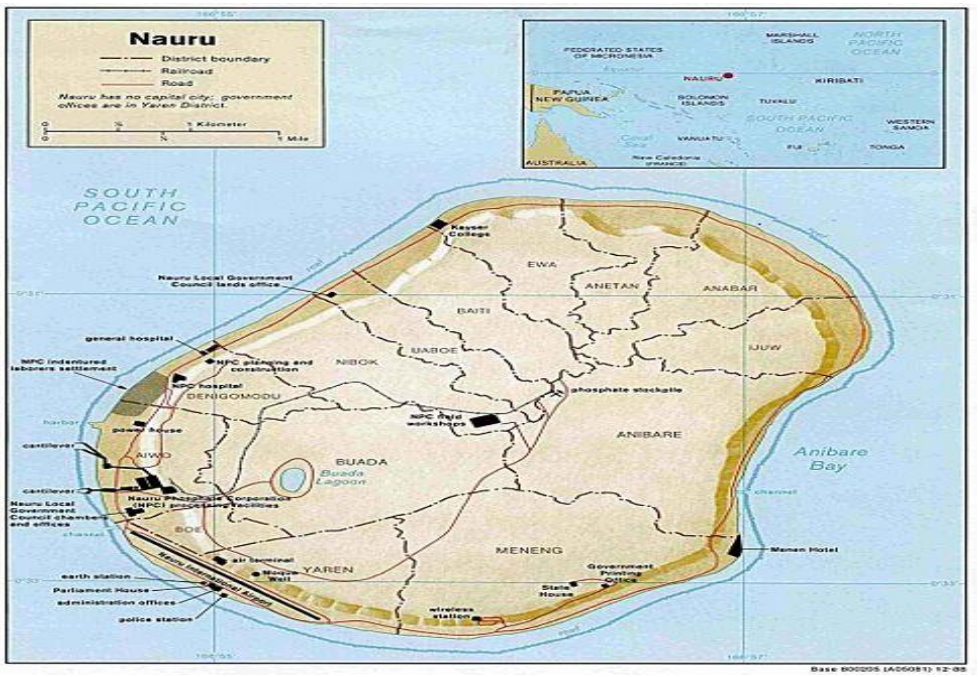
Country	Nauru
Capital	Yaren District
Capital island	Nauru
Population	9771 (PRISM 2009 projection, 51% males); 9,233 (2006 census)
Land Area	21 km^2
Max height above sea-level	70 m (location along plateau ring)
Geography	Nauru consists of a single raised coral island with a phosphate plateau in the centre. There are two separate plateau areas: 'bottom side' that is a few metres above sea-level and 'topside' that is typically 30 metres higher. Topside is dominated by pinnacles and outcrops of limestone. There are no natural harbours and the island is surrounded by a fringing reef 120–400 metres wide. The reef falls off very rapidly and deep-water ships can moor within a short distance of the reef edge.
Location	Latitude: 0° 32' S. Longitude: 166° 55' E
EEZ	320 000 km^2
Climate	Nauru has a tropical climate that is tempered by sea breezes. There are no cyclones, though rainfall is cyclic and periodic droughts are a serious problem.
Rainfall	Annual precipitation has ranged from severe drought at 280 mm to very wet at 4590 mm, making water supply a particularly difficult problem.
Mean temperature	29°C
Economic	Nauru's economy mainly revolves around phosphate mining. The sale of fishing rights in Nauru's territorial waters is another major form of income. Apart from these, Nauru relies heavily on Australia for financial support. New Zealand and Taiwan/ROC also provide aid support.
GDP per capita	USD 5,632.69
Currency	Australian dollar – AUD
Exchange rate	AUD/USD – $0.7919
Language	English and Nauruan
Government	Republic with parliamentary system
Country representative to SPC	Secretary for Foreign Affairs & Trade Department of Foreign Affairs & Trade Government Offices Yaren District

2. Geography

2.1 Geographical location

Nauru is a small single oval-shaped and raised coral equatorial island, located about 40 kilometres (km) south of the Equator at 0° 32' 0" S, 166° 55' 0" E. Its total land area is 21 square kilometres (km^2) with an Exclusive Economic Zone (EEZ) of 320 000 km^2. The island is divided into two plateau areas – "bottomside" a few metres above sea level, and "topside" typically 30 metres higher. The topside area is dominated by pinnacles and outcrops of limestone, the result of nearly a century of mining of the high-grade tricalcic phosphate rock. The island lies to the west of Kiribati; to the east of Papua New Guinea (PNG); to the south of the Marshal Islands and to the north of the Solomon Islands.

Figure 2: Map and geographical location of Nauru



2.2 Topography

Located just south of the equator in the western South Pacific Ocean, Nauru lies approximately between 0.5°S and 167°E coordinates. It is a raised atoll with an area of 21 km^2. Approximately 6 km long (NE-SW) and 4 km wide (NW-SE), Nauru has a maximum elevation of 71 m. The Exclusive Economic Zone has an area of 320 000 km^2. There is no official capital but the Yaren District is the largest settlement and where the Government offices are located..

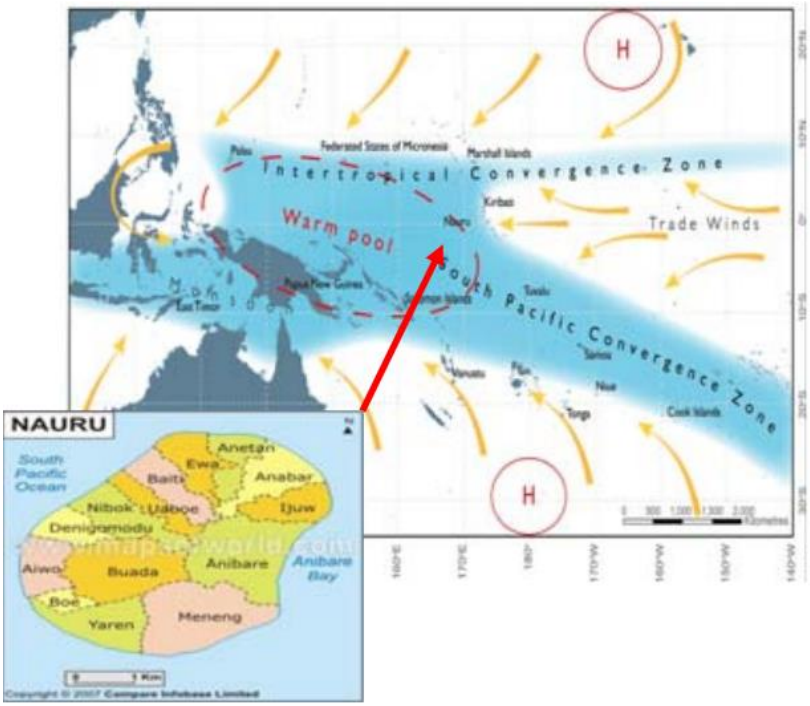
The land is distinguished according to a 'bottom side' and a 'top side'. The bottom side consists of a narrow coastal plain that is 150 – 300 m wide as well as surrounded by coral reef, which is exposed at low tide and dotted with pinnacles. The bottom side is the residential area for the Nauru populace. On the other hand, the topside consists of a matrix of coral – limestone pinnacles and limestone outcrops, between which lie extensive deposits of soil and high – grade tricalcic phosphate rock. The highest point of the island is 65m above sea level.

3. Climate

The climate is equatorial and maritime in nature. There have been no cyclones on record. Although rainfall averages 2 080 mm per year, periodic droughts are a serious problem with only 280 mm of rainfall in the driest year recorded. Land biodiversity is limited, with only 60 species of indigenous vascular plants. A century of mining activity in the interior has resulted in the drainage of large quantities of silt and soil onto the reef, which has greatly reduced the productivity and diversity of reef life. Sewage is dumped into the ocean just beyond the reef, causing further environmental problems, while the island's many poorly maintained septic tanks have contaminated the ground water. Access to fresh water is thus a serious problem on Nauru with potable water coming only from rainwater collection and reverse osmosis desalination plants. These desalination plants used around 30% of the energy generated by Nauru Utility Corporation (NUC) in 2008.

The main driver of climate variability in Nauru is the El Niño-Southern Oscillation (ENSO). La Niña events are associated with delayed onset of the wet season and drier than normal wet seasons, often resulting in an extended drought. During El Niño, temperatures on Nauru are warmer than normal due to warmer sea temperatures; and rainfall and cloud amount are increased. Another key climate driver for Nauru is the Inter-tropical Convergence Zone (ITCZ) (Figure 3). The ITCZ affects Nauru all year round. Its seasonal north/south movement drives the seasonal rainfall cycle, which peaks in Dec-Feb (Figure 4). The South Pacific Convergence Zone (SPCZ) affects Nauru during its maximum northward displacement in July and August.

Figure 3: Nauru Climate drivers and features



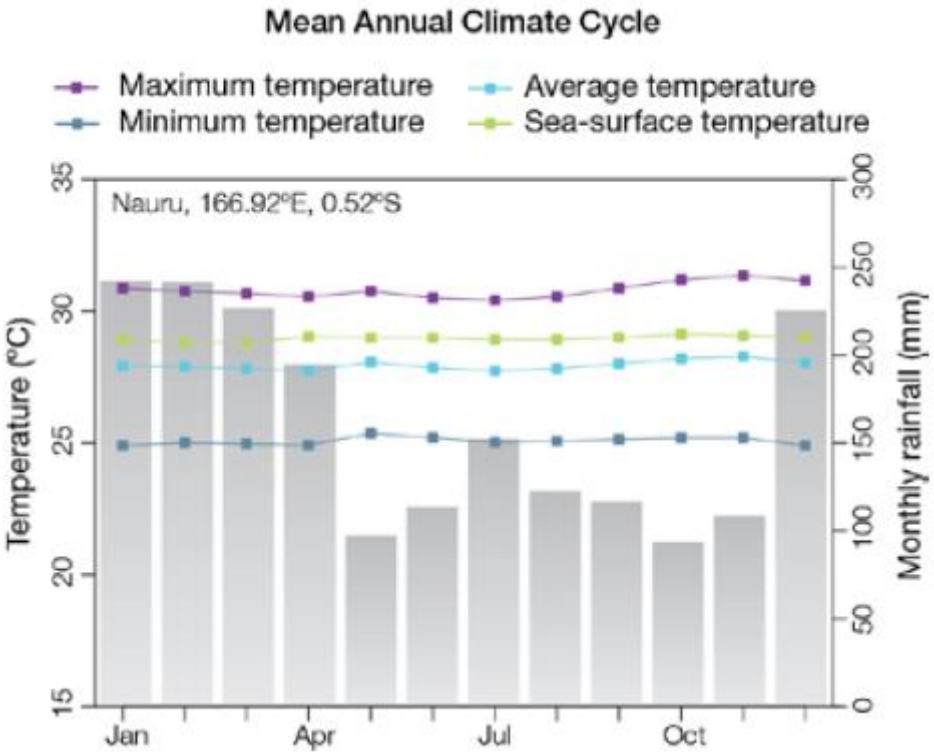
Being so close to the equator, Nauru does not experience tropical cyclones, although it is subject to strong winds and sea squalls. The main climate extreme experienced by Nauru is drought, which can last as long as 36 months. Droughts occur when La Niña events decrease the surrounding sea temperature, resulting in less cloud and rainfall. Prolonged droughts cause a lowering of the underground fresh-water lens, resulting in water supply problems and severe stress on natural systems. The people of Nauru have noticed changes

in their climate. Elders sense that these changes are not normal. Consequently, some of the cultural and traditional practices that predate industrial activities have been modified to adapt to the impacts of climate change.

3.1 Temperature and rainfall

Nauru lies in the dry belt of the equatorial oceanic zone, with diurnal temperatures ranging from 26 to 35°C, and nocturnal temperatures between 22 and 34°C. The annual daily temperature is 27.8 degrees Celsius with an average humidity estimated at 80%. Nauru has consistent monthly mean air temperatures throughout the year (Figure 4). Its air temperatures are closely related to the sea-surface temperatures, which also are fairly constant throughout the year.

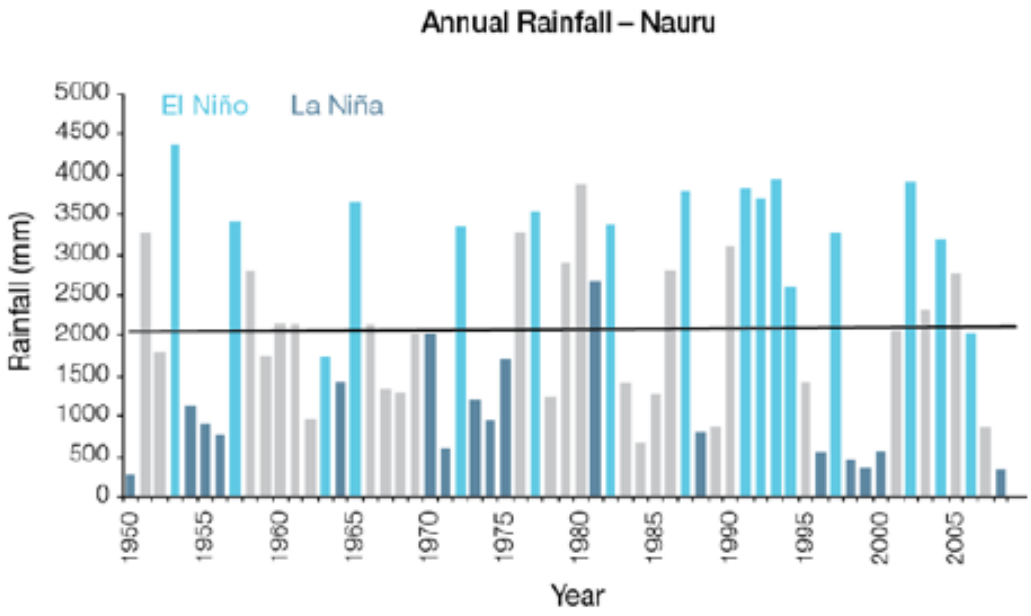
Figure 4: Mean seasonal cycles in temperature and rainfall at Nauru.



The wet season usually starts in November and continues to April of the next year. During the wetter months, winds are generally from the west at 10-18 knots. During the drier months of May to November, the prevailing wind direction is generally easterly at 5-10 knots. Both the Inter-tropical Convergence Zone (ITCZ), which sits to the north of Nauru for most of the year, and the South Pacific Convergence Zone (SPCZ), which sits to the south, bring rainfall to Nauru. The higher rainfall in the wet seasons is caused by the ITCZ moving south and the SPCZ strengthening and expanding north at that time of year.

The annual rainfall of Nauru has extremely high variability (standard deviation is 1151 mm) and the main influence on this climate variability is the El Nino.Southern Oscillation (ENSO) (Figure 5). During El Nino years, Nauru is warmer and usually much wetter than average, receiving up to 4500 mm of rainfall. La Nina years are associated with a delayed onset of the wet season and drier than normal conditions, often resulting in an extended drought. In some La Nina years, Nauru only receives around 500 mm of rainfall.

Figure 5: Annual rainfall at Nauru. Light blue, dark blue and grey bars denote ElNiño,La Niña and neutral years respectively.



3.2 Sea level monitoring

Monthly averages of the historical tide gauge, satellite (since 1993) and gridded sea-level (since 1950) data agree well after 1993 and indicate inter-annual variability in sea levels of about 23 cm (estimated 5–95% range) after removal of the seasonal cycle. The sea-level rise near Nauru measured by satellite altimeters since 1993 is about 5 mm per year, slightly larger than the global average of 3.2 ± 0.4 mm per year. This rise is partly linked to a pattern related to climate variability from year to year and decade to decade.

3.3 Sea-Surface Temperature

Water temperatures around Nauru have risen gradually since the 1950s. Since the 1970s the rate of warming has been approximately 0.12°C per decade. At these regional scales, natural variability may play a large role in the sea-surface temperature trends making it difficult to identify any long-term trends.

3.4 National Meteorological Office

In 1998, the Atmospheric Radiation Measurement, also known as ARM established its second Tropical Western Pacific (TWP) facility in Nauru. ARM selected Nauru because the island is located in the eastern edge of the Pacific warm pool under La Nina conditions. Throughout this period, ARM has been acting as Nauru's Meteorological office providing national data on the climate of the island (ARM 2014).

In September 2013, the ARM program closed its facilities and to date there is no meteorological office in the Republic. However, the Civil Aviation Authority is currently providing meteorology services. Moreover, Regional Specialized Meteorological Centres, such as the Fiji Meteorological Services (FMS) is also currently assisting the Republic by providing weather services.

4. Flora and Fauna

4.1 Flora and vegetation

Nauru is home to 56 native species of flora, in addition to 125 introduced flora species. None of the native species are endemic and many being extirpated or on the verge of being extirpated from the island[1]. According to the 5th Nauru National Report to the Convention on Biological Diversity, seven plant communities were recognized which include: Littoral strand; Limestone forest; Mangrove forest; Freshwater marsh; Managed land vegetation; Secondary scrub, and Secondary forest. The secondary scrub community covers majority of the land, this is especially for the topside of island.

Nauru's Biodiversity Rapid Assessment carried out in 2013 observed that many of the weeds found in previous reports were absent but new weed species, which are yet to be officially identified, were recorded. Moreover, long settlement, widespread destruction since World War II, monoculture expansion of coconut palms, and over 90 years of open – cast phosphate mining have led to serious vegetation degradation, disturbance, and displacement.

4.2 Terrestrial fauna

Nauru is home to 36 species of birds including the endemic reed warbler *(Acrocephalus rehsei)* and the natives of the Noddy bird *(Anous minutus)* and the Frigate bird *(Fregata).* Common in Nauru is the Polynesian rat (*Rattus exulans*) and others introduced are rats, cats, dogs, pigs and chickens.

Figure 6 : Nauru Reed Warbler

[1] Nauru's Fifth National Report to the Convention on Biological Diversity

4.3 Marine and Fisheries

The coral reefs of Nauru have a low diversity with species Poritesrus dominating the coral reefs. The five colonies of the *Acropora* coral, which were found in abundant in the past, are now nearing extinction; Of the 51 coral species found in Nauru, 7 were recorded as representing extensions of their bio – geographic range, 4 may be locally endangered and all others are considered locally vulnerable.

Nauru's low diversity of coral species is due to the small size of the island and isolation from neighbouring archipelagos of higher coral diversity, but not a sign of unhealthy reefs. According to the 2013 Nauru's Biodiversity Rapid Assessment Report the islands coral cover is among the highest on the planet and considered to be much healthier than the Great Barrier Reef in Australia. Due to Nauru's unique size and isolation, the island also has a low diversity of marine invertebrates. 79 invertebrates' species were recorded last year, representing 43 families, 18 orders, and 11 class grouping. There are two species of the giant clams, the *Tridacna maxima*, these two species were thought to be locally extinct in the 1980s. Five species of sea cucumber were also observed with very little *Turbo species* and no *Trochus* despite habitat availability.

Nauru is home to 407 species of reef fish species and the *Labridae* mainly dominates the marine ecosystem with 34 species. Other species includes; *Pomacentridae* with 30 species, *Acanthuridae* 21 species, *Chaetodontidae* 21 species, *Balistidae* 12 species, *Serranidae* 11 species and *Scaridae* with 10 species. Signs of overfishing were noted due to the low numbers of large fish (i.e. large Groupers and Snappers). The presence of the *Rhizophora* mangrove was noted surrounding the anchialine ponds along the coastline in the district of Anabar. However, there are no other species of mangroves nor sea grass in Nauru.

Figure 7: Rhiophora mangrove forest around an anchialine pond.

There are four major groups of algal species that have been observed in Nauru, which dominate the intertidal areas. The green algae dominates the mid – intertidal areas (area between high tide and low tide lines), while the red turf algae are common in the low – intertidal (average between high tide and low tide) to the reef crest area. Introduced marine species such as the fire – worm was also found mainly on abandoned structures on the reefs.

Once Nauru was known for its abundance in tuna fish stocks, especially: skipjack, yellow-fin and to a lesser degree: big-eye. However, climate variability and change, including ENSO events has influenced the number of fish stocks caught within Nauruan waters. The El Nino tended to produce more catches while the La Nina resulted in lesser catch.

5. Culture

Nauruan's are Micronesians inhabiting the island for almost 3,000 years, with evidence of Melanesian and possibly Polynesian influence. The Nauruan language is distinct from other Pacific languages yet it shares many words with other Micronesian islands such as Kiribati and the Marshall Islands. The society is matrilineal and the people are drawn from twelve tribes that are totemic in origin.

Nauruan's are Christians and adhere to the Nauruan Congregational Church and the Roman Catholic Church. Approximately 70% of the Christian population is Protestant. Nauruan's traditionally existed on a subsistence economy until the discovery of phosphate deposits shortly after 1888. At the turn of the century and with the commencement of mining in 1906 there was a significant change in lifestyle and economy, which has been apparent by the very high per capita GDP. The advent of phosphate mining has led to a dramatic change in lifestyle for the Nauruan people, and effectively transformed the culture into one that is compatible with a cash economy. Since 1990, Nauru's GDP per capita is declining at an average of 4.9% while inflation is increasing at 4.3% per annum. The literacy rate in Nauru has improved since the 1980s (90 percent) with around 95 percent of the population able to read and write. Life expectancy has also improved at 58 years.

5.1 Land tenure

According to the constitution of Nauru, each and every Nauruan has rights to land that are held individually. This is the foundation of identity of a Nauruan. The land is passed down through generations from the parents to their children. The lands are distinguished between the coconut land and the phosphate land. The coconut land is synonymous with residential and house are built under the coconut trees. On the other hand, the phosphate land, located at the topside is not for residential or building purposes. Land in Nauru is typically owned by individuals or by groups of landowners. The land is leased for a specific time period either for general, commercial or development purposes. Lease arrangements are common with the landowners and the government or through corporate. Foreigners or non-Nauruan's are not entitled to own lands.

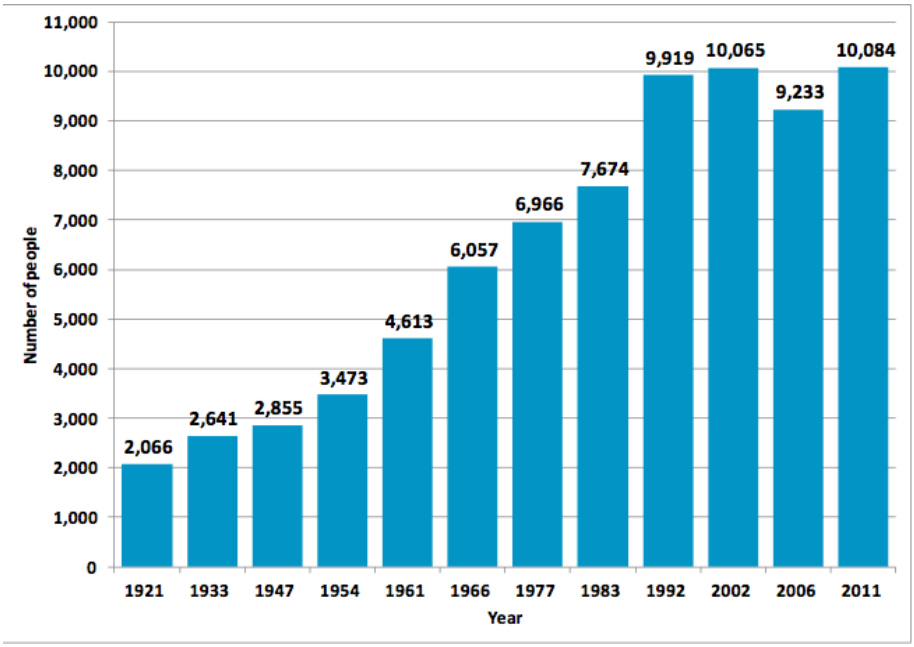
5.2 Constitutional arrangements

The Constitution of Nauru established provisions for a unicameral Parliament; currently seating 19 members that are elected every three years through the right to vote from 14 district communities. Nauru's constitution has been effective from 29 January 1968. The 14 communities are divided into district levels and are administered by their elected Member of Parliaments (MPs). There is no local level of administration. On the other hand, community leaders are appointed but their roles are not clearly defined. The traditional governing structures, which the indigenous population evolved from and derived their functions during the past, are virtually non-existent in the present day.

6. Population

The population has continuously increased from 1921 to 1992 and it is now about five times the size it was in 1921. According to a 2011 census count in Nauru, the total enumerated population of Nauru was 10,084. This is an increase of 851 persons compared to the 2006 population that was carried out in an interim mini census.

Figure 8: Total Population size, Nauru: 1921 – 2011

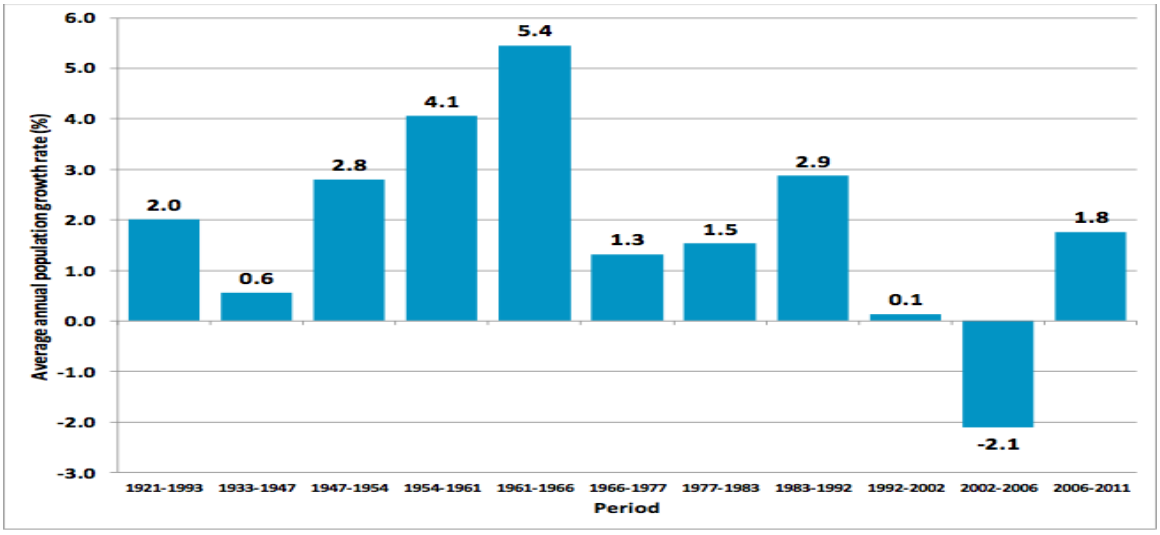


6.1 Growth rates

During the period 2002 – 2006 the population growth rate was negative (- 2.1 %) with a decrease in size. The decrease was mainly due to departure of many I-Kiribati and Tuvaluan nationals who used to work for the phosphate industry. During the period 2006-2011 the average annual growth rate increased by 1.8%, due to Nauru's natural growth.

However, currently the population growth is much higher than 1.8% as Nauru's fertility is increasing, and is around 2.9% which translates into an annual increase of about 300 people per year. With this current high level of growth the population is expected to double its current size, and estimated to reach 20,000 people in the year 2038. Nauru' population density of 478 people per sq. km is the highest in the region, and should the population indeed double in size, it will be close to 1,000 people per sq. km in future.

Figure 9: Average annual population growth rate (%), Nauru: 1921 – 2011



6.2 Distribution

Location has the largest population size of 1,497 people around 15% of the total Nauru population followed by Meneng (1,380), and Aiwo (1,220). The districts of Ijuw and Anibare were the smallest with only 178 and 226 people, representing only 2% of the total population each. While the ranking of districts changed little during the last 19 years, the district of Location lost a lot of people because of the repatriation back home of the I-Kiribati and Tuvaluan workers who used to live there. The districts with the strongest growth were Aiwo and Anabar; both grew in population size by 40% since 1992.

Figure 10: Population distribution by district (%), Nauru: 2011

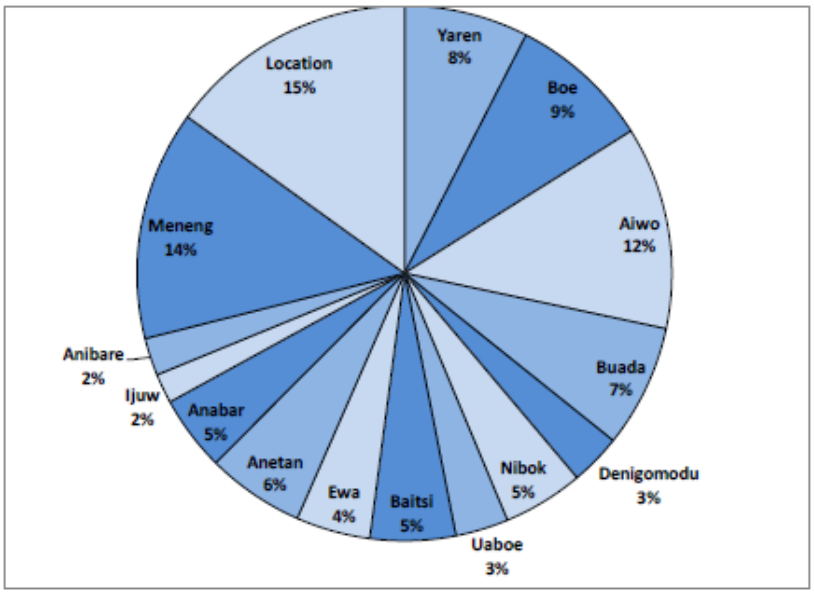
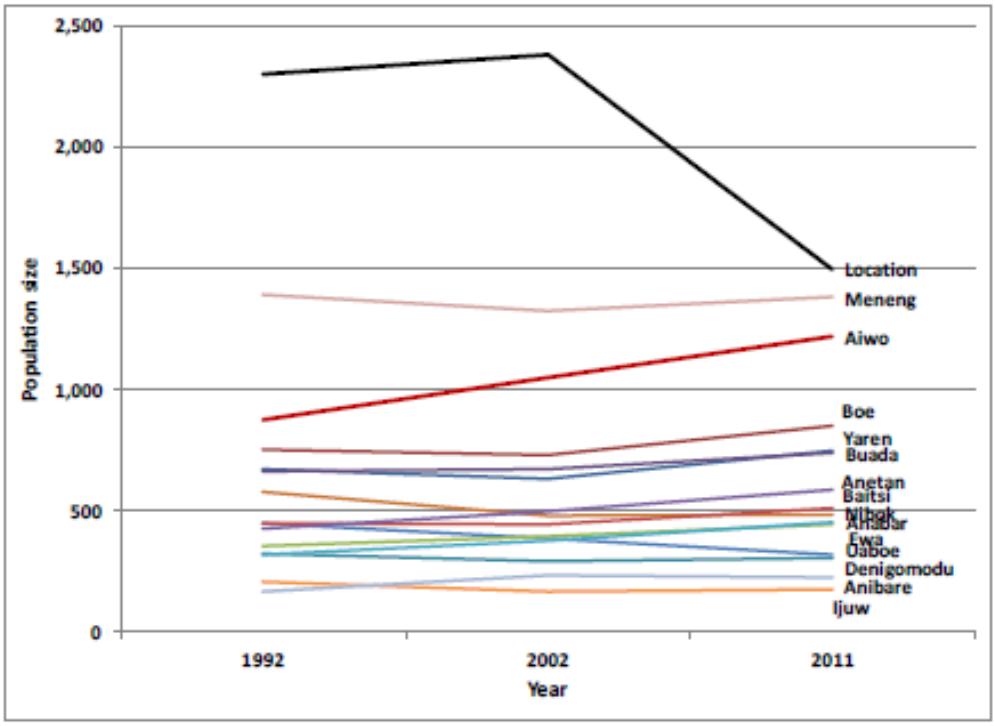


Figure 11: Population trend of districts, Nauru: 1992–2011



6.3 Density

According to a 2014 report, Nauru has a young and fast growing population with the highest population density in the Pacific of 478 people per square kilometre.

6.4 Statistics

According to the 2011 Census, the total fertility rate (TFR) was 3.7 percent (2009-11) and the infant mortality rate for the same period was 8.21 percent per 1,000 live births and the child mortality rate was 3.7%. Birth rate for Nauru was 25.61 percent and the death rate was 5.9 percent per 1,000 populations. The life expectancy at birth for Nauru was 66.4 years (male – 62.3 years and female – 69.83 years).

Figure 12: Summary of Main Indicators

Indicator	Total	Males	Females
Total population	10,084	5,105	4,979
Average annual population increase, 2006-2011 (in numbers)	170	79	91
Average annual population growth rate, 2006-2011 (%)	1.8	1.6	1.9
Population density (number of people per sqkm)	478		
Population structure			
Number of children (<15 years)	3,813	1,984	1,829
Youth population (15-24 years)	1,948	993	955
Population aged 25-59 years	4,035	2,005	2,030
Older population (60 years and older)	287	122	165
Median age (in years)	21.5	20.9	22.1
Dependency ratio (15-59)	69		
Sex ratio	103		
Households			
Number of private households - headed by males/females	1,647	1,083	564
Number of people in private households	9,945	5,031	4,914
Average household size (number of people per household)	6.0	3.1	3.0
Number of institutions - males/females in institutions	5	74	65
with wages/salaries as a main source of household income (%)	85		
receiving remittances (%)	1		
with improved drinking water sources (%)	97		
with improved sanitation facilities (%)	98		
connected to electricity grid (%)	99		
with radio (%)	39		
with (mobile) phone (%)	89		
with Internet connection (%)	28		

Indicator	Total	Males	Females
Marriage			
Mean age at first marriage (SMAM)		24.4	22.6
Proportion married at age 15-19 years (%)		3.6	13.4
Labour force (population 15 years and older)	3,954	2,425	1,529
Employed population	2,883	1,790	1,093
Subsistence workers	99	82	17
Unpaid workers	64	35	29
Unemployed	908	518	390
Labour force participation rate (%)	64.0	78.9	49.3
Employment–population ratio (%)	46.7	58.2	35.2
Unemployment rate (%)	23.0	21.4	25.5
Number of people with a severe disability	78	44	34
Education			
School enrolment rates of 7–12 year-olds (%)	97.3	96.9	97.7
School enrolment rates of 13–18 year-olds (%)	68.1	64.9	71.8
Proportion of population aged 15 years and older with (%):			
primary education	4.0	4.8	3.1
secondary education	91.2	89.7	92.6
tertiary education	4.9	5.5	4.3
Adult literacy rate, population 15 years and older (%)	96.5	95.7	97.2
Youth literacy rate, population aged 15-24 years (%)	95.6	94.4	96.8
Language ability, population 5 years and older (%)			
Nauruan	95.3	94.6	96.1
English	66.0	65.1	66.8
Other language	11.9	12.1	11.7

Indicator	Total	Males	Females
Fertility			
Total Fertility Rate (TFR), 2009-2011	**4.3**	2.2	2.1
Teenage Fertility Rate (per 1000), 2009-2011			81
Children Ever Born, CEB (45-49)	**4.0**	2.0	2.0
General Fertility Rate (GFR)			105
Child-Woman Ratio (CWR)			611
Mean age at childbearing (in years)		29.6	27.8
Average annual number of births, 2007-2011	**351**	181	170
Crude Birth Rate (CBR), 2007-2011	**36.3**	36.8	35.9
Sex ratio at birth	**106**		
Mortality			
Proportion of live-born children still alive (%)	**95.5**	94.5	96.5
Proportion of population 60 years and older widowed (%)	**37.1**	21.7	48.7
Proportion of population orphaned (%)			
Father dead	**65.2**		
Mother dead	**75.3**		
Infant mortality rate (IMR), (per 1000)			
Average for period 2002-2006	**43**	51	34
Average for period 2007-2011	**33**	39	27
Child mortality (per 1000)			
Average for period 2002-2006	**5**	2	8
Average for period 2007-2011	**4**	4	3
Under-five mortality (per 1000)			
Average for period 2002-2006	**48**	53	42
Average for period 2007-2011	**37**	44	30
Life expectancy at birth (e0), in years, 2007-2011	**60.4**	57.5	63.2
Average annual number of deaths, 2007-2011	**72**	42	30
Crude death rate (CDR), 2007-2011	**7.5**	8.6	6.3
Natural growth			
Average annual number	**279**	138	141
Natural growth rate (%)	**2.9**	2.8	3.0
International migration			
Period 2002-2006			
Total number of migrants	**-1,389**	-707	-682
Average annual number of migrants	**-339**	-172	-166
Migration rate (%)	**-3.5**	-3.5	-3.5
Period 2006-2011			
Total number of migrants	**-543**	-296	-246
Average annual number of migrants	**-109**	-59	-49
Migration rate (%)	**-1.1**	-1.2	-1.0

7. Economy

Phosphate mining shaped the economic development of Nauru since it became independent in 1968. The phosphate era brought wealth to the nation. However, in time the exploitation of this natural resource caused an economic shift within the young independent nation. The economic downturn was characterized by escalating domestic and external constraint to development, which are similar to those of other Pacific Island Countries (PICs) – i.e., remoteness from major market, small domestic market, lack of skilled and trained workforce, limited resource base, a narrow export base, heavy reliance on imported goods, poorly developed infrastructure and vulnerability to natural disasters. The poor management of the investment portfolio of the Nauruan Phosphate Royalties Trust (NPRT) further crippled Nauru's small economy. The economy of Nauru suffered from what some refer to as the so – called 'Dutch Disease'.

With a diminished phosphate industry, Nauru today has turned to the commercial fishing industry to generate revenue. The revenue is predominately generated through bilateral agreements between Australia and the host of the Regional Process Centre (RPC) for refuges, public administration and services, transport and communication, ownership of dwellings and other overseas businesses and investment funds. Nauru has increased its efforts in agriculture and fish production including the maximization of revenue from fisheries access fees and development of the informal sector. Limited power and water supply continue to be critical concerns for businesses. The resurgence of large-scale phosphate mining in 2008 has seen GDP grow substantially in recent years, which has also contributed in the recovery for Nauru's economy. Now that the Government has undertaken major reforms, Nauru is removed from the Financial Action Task Force (FATF) blacklist. From 2004 to 2009, economic recovery efforts were engaged and were supported through the Pacific Regional Assistance to Nauru, through a regional response program.

7.1 Energy

Through history, Nauru was one of the richest countries of the world and used to have the second highest per capita in incomes primarily due to its revenue from the phosphate mining. Also associated with its enriched history was Nauru's energy household demand, which used to be the highest in the Pacific region averaging at 900 kWh. However, the current consumption level for household in Nauru per month stands at 370 kWh.

Electricity in Nauru today is provided and distributed by the Nauru Utilities Corporation (NUC), which is an independent corporation outside of the government system. The legal basis for the daily operation of the NUC is the NUC Act. All Nauruans are connected to the grid, except for the Australian Regional Processing Camp (RPC) and the main processing plant of RONPHOS.

7.1.1 Resources

Electricity generation is highly dependent on imported petroleum and the Government of Nauru (GoN) is responsible for the purchase and distribution of petroleum to all customers, except for RONPHOS, which does its own purchasing. According to the (Nauru Budget 2013 – 2014), the current domestic expenditure is AUD$96,406,870 and AUD$25,281,629 (26%) is allocated for the purchasing of imported petroleum for this financial period (Nauru Budget 2013 – 2014). Seventy percent (70%) of the imported petroleum is be used for power generation and the remaining will be for transportation (land, sea & air), cooking and commercial users. LPG and kerosene are privately imported and distributed.

7.1.2 Transformation

In recognition of the problems associated with Nauru's energy sector, the GoN identified in its National Sustainable Development Strategy 2005 – 2025 (NSDS) that by 2015, 50% of Nauru's electricity will be provided from renewable sources. However, the government today is proposing for a longer period on this target, and to achieve the commitment by 2020. Energy efficiency measures were also considered for the betterment of Nauru's energy sector.

The GoN developed related policies and strategies that will ensure means of implementation of achieving the renewable energy goal. As a result, the National Energy Policy Framework (NEPF) was developed in 2009 and the framework will deliver a guideline for the development of the energy sector in Nauru for the immediate future and mid and long term. The policy framework highlighted broad aims and strategies for the energy sector, including power, renewable and energy efficiency. The NUC also released its Corporate Strategy in September 2013, which will reflect on NUC's long – term sustainability.

Currently, Nauru along with various development partners, including ADB, AusAID, EU, GIZ, IRENA, IUCN and UNDP, is developing the energy road map, which will assist the implementation of the NEPF. The roadmap and its implementation will have a strong focus on renewable energy and energy efficiency as a key enabler for reducing heavy dependence on imported fossil fuels. Currently, less than 1% of Nauru's electricity is produced from renewable energy sources.

7.1.3 Demand

The current energy demand for Nauru is 3.3 MW; hence, the generation capacity of 5 MW is sufficient to meet demand. However, shedding is implemented on a daily basis due to shortage of fuel supply. Through various activities relating to energy efficiency campaigns and renewable energy projects, majority of households, commercial businesses and government buildings were installed with prepayment meters. Following the introduction of the prepayment meters, demand in electricity consumption dropped significantly. This greatly assisted the restoration of the twenty-four-hour power supply later in the year.

7.2 Transport

Nauru has 24 km paved road that circles the island and a dirt track that leads to Nauru Rehabilitation Corporation (NRC) stockpile and offices. In 2011, 29% of households owned at least one car and 46% of households had at least one motorbike . Public sector transport has improved. Schools, public sector employees and other people benefit from the public bus system.

The island's airport consists of a stretch of road that serves as a runway, and an airline terminal. Our Airline, formerly Air Nauru, provides air service. The airline was re-launched in October 2006 after its only plane was impounded in December 2005. The aviation sector is now using Civil Aviation Safety Authority (CASA) standard certification, i.e. infrastructure, safety & service.

The marine transport has improved in reliability and operations. The marine transport sector improvements include: barges for loading/unloading cargo; pilot boat for port entry and at sea emergency; and NFMRA boats for in-shore SAR.

7.3 Trade and Tourism

Nauru is a remote destination with no actual tourist attractions and minimal hospitality infrastructure. Developing tourism in Nauru remains a challenge for the government, and the global financial crisis has made this task even more difficult. Nauru currently receives approximately 150 tourists per year; however, the number of business travellers to Nauru is quite high and this was related to the Australian Regional Processing Centre. Business travellers are the primary source of tourism receipts in Nauru.

7.4 Industry/Mining

The prospector Albert Fuller Ellis discovered phosphate in 1900. After the discovery, the Pacific Phosphate Company began to exploit the reserves in 1906 by agreement with Germany, and by 1907, the first shipment of phosphate was exported. In 1914, following the outbreak of World War I, Nauru was captured by Australian troops. Australia, New Zealand and the United Kingdom signed the Nauru Island Agreement in 1919, creating a board known as the British Phosphate Commission (BPC) that took over the rights to phosphate mining.

During World War II, phosphate mining was not operated due to the mining company being severely damaged by the German auxiliary cruisers. After the war, trusteeship was established by the United Nations, with Australia, New Zealand and the United Kingdom as trustees for Nauru. Hence, the mining was re – operated under the guidance of these trustees. In 1967, the people of Nauru purchased the assets of the British Phosphate Commissioners, and in June 1970, control passed to the locally owned Nauru Phosphate Corporation (NPC). Income from the mines gave Nauruans one of the highest standards of living in the Pacific and led the establishment of the Nauru Phosphate Royalties trust (NPRT), which was developed to provide reliable national income following the depletion of minable phosphates.

However, the NPC is no longer operating and the Republic of Nauru Phosphate Corporation (RONPHOS) today is managing the phosphate mining industry, since 2008. The change to RONPHOS was influenced by the collapse of phosphate mining in 2002 due to the virtual exhaustion of minable resources and most importantly to signal change. Today RONPHOS currently employs 20.4% of the working population of the Republic. The RONPHOS is extracting secondary mining, which the layer further below the initial layer of primary mining, and secondary mining is believed to hold an estimate of 20 million tones of minable resources.

Rehabilitation of Nauru's mined out land was a priority for the Government of Nauru. This led to the development of Nauru Rehabilitation Corporation (NRC), which was a statutory body established by an act of Parliament in July 1997 and which came into being in May 1999. The NRC's objective was to provide environmentally sustainable rehabilitation of the mined out land for future generations of Nauru people.

7.5 Agriculture

Agriculture in Nauru was identified as a priority sector for sustainable development in view of its direct link to and role in improving nutrition and food security. However, agriculture in Nauru is very limited and after decades of mining, soils availability and fertility are limited and only available in the narrow coastal belt and the land surrounding Bauda lagoon.

The agricultural commodities that are nationally cultivated are fruit trees including coconut and breadfruit, horticultural commodities including fruits and vegetables and livestock including poultry and swine. However, commercial agriculture is not effective and insufficient to meet the national demand. Therefore, majority of agricultural commodities are imported from both Australia and Fiji.

Other barriers such as fresh water availability and soil infertility also affect the effectiveness of agriculture in the Republic. Nauru soils are generally poor and suffer major deficiencies of key elements (particularly nitrogen and potassium). Use of fertilizer and composting is not common due to costs and lack of farmer skills. Fresh water in Nauru is very limited; hence, it is prioritized for human consumption than for agricultural purposes. The only source of natural water in Nauru is brackish water, and this is contaminated water, which is not recommended for agricultural use. But given resources, these problems can be rectified

Currently, the agricultural division is promoting agriculture with major developing partners, such as Taiwan, FAO and SPC. As the people of Nauru become aware of the need to improve their food security and nutrition status, agriculture is beginning to grow in importance as more people are now starting to plant crops and entertain livestock husbandry.

7.6 Fisheries

The fishery sector was also considered as a priority sector for sustainable development in view of its direct link to and role in improving nutrition and food security of the Republic. Most importantly, fisheries play an important role in the economy of the country from license fees for foreign fishing boats fishing in the substantial EEZ. Nauru collects between AUD$5 million and AUD$7 million per year in fishing license. The licenses represent about 8% of the value of the catch taken from Nauruan waters, which is on the order of AUD$50 million to AUD$80 million dollars per year.

Fisheries revenue is projected to increase to AUD$14.8 million, a 54% increase compared to last financial year AUD$9.6 million budgeted revenue. The improved performance in fisheries revenue is the culmination of several year' work, particularly the implementation of the Vessel Day Scheme (VDS), the improvement in fisheries monitoring, control and surveillance management, and effective negotiations with stakeholder groups such as the PNA, FFA, SPC and WCPFC for the improvements in the application of a common set of regional fisheries management standards.

In recognition of the importance of the fishery sector in Nauru, the Parties to the Nauru Agreement (PNA) or more commonly known, as the Nauru Agreement was established in 2010. The PNA controls the world's largest sustainable tuna purse seine fishery and the members include: the Federated States of Micronesia (FSM), Kiribati, Marshal Islands, Nauru, Palau, Papua New Guinea (PNG), Solomon Islands and Tuvalu. The focus of PNA efforts to sustainably manage tuna is the VDS. PNA members agree on a limited number of fishing days for the year, based on scientific advice about the status of the tuna stock. Fishing days are then allocated by country and sold to the highest bidder. In this way, Pacific Islanders reap economic benefits from their sustainable management of tuna (PNA 2013).

7.7 Waste

The NRC manages the waste management program in Nauru which includes garbage collection, disposal, composting and recycling. The Littering Act and the draft Solid Waste policy provides a policy framework for waste management in Nauru. There have also been numerous strategies to improve waste management in the Republic, through improving

Reduce, Re – use and Recycle projects. A few initiatives include: Clean and Green Project, which is a success today, composting, the scrap metal scheme, privatization of recycling, pick up of wheelie bins, and compost toilets. There is an existing and growing community awareness of the importance of waste management. The Aiwo Road Map provides a successful example of a community led initiative.

7.8 Service sector

The Chief Secretary Department is the Axe and axle of the Public Service. The department is divided into six sections for its smooth operation and the section includes: Secretariat, Administration, human Resources and Labour, Registry of births, deaths and marriages, and warehouse and post office. The Chief's Secretary's Department plays a key role in monitoring, maintaining and supervising the Public Service Departments and its day to day activities and also provides assistance to the Ministerial and President Office. The Department is also responsible for introducing and implementing government policies, arranging Cabinet Meeting and preparing documents for Cabinet and handling General election.

7.9 Water

The major challenge for Nauru is the sustainable provision of adequate supplies of non-polluted fresh water. It follows that the conservation, management and protection of surface water and groundwater and the collection and storage of rainwater are critical to sustaining human settlements in Nauru. There are no streams on Nauru. There is however, a small brackish lagoon, Lake Buada (approximately 14 hectares) and a smaller brackish lagoon in the Anabar District. Ground water is utilized from hundreds of shallow wells on the coastal margin and is primarily used as non-potable water as it is brackish as a result of pumping impacts and the contraction of the freshwater lenses in dry periods. These wells are also proximate to habitation, building, and sanitation structures. Contamination has been detected, thus restricting further the use of water from these wells.

Recent investigations indicate uncertainty about the estimates of water from the freshwater lens due to mixing in the open test bore holes. On current knowledge, it is not possible to assess the long term sustainability of the freshwater lens as a viable water source for Nauru. This has led to focus on more certain, yet expensive alternatives as desalination, osmosis and importation. The development of this resource will have to depend upon studies, testing and simulation using more recently available techniques for extraction.

Nauru has a modern desalination plant - an important source of water delivered to domestic tanks via road transport. This plant is using the waste heat generated from the power station. But recently, the plant has not been operational due to the high cost of energy as well as its dependency on the power output of the Power Station. As the facility is experiencing problems, the heat energy required to operate the desalination plant is not available, causing it to shutdown.

As the desalination plant experiences usual shutdowns, the people of Nauru collect storm water for subsequent re-use. Collection of storm water (rainwater) contributes efficiently and effectively to water conservation. Storage tanks for surplus water produced during wet periods when there is sufficient rainfall to fill household and institutional tanks play an important role for water supply needed for livestock, irrigation of crops and gardens. However, potable water is still imported and continues to cause a major challenge.

8. Education

The education system in Nauru experienced near-collapse during 2000 – 2005. During these years, schools on the island barely functioned. Exams were not held, maintenance of school buildings ceased, teaching materials were unaffordable, teachers went unpaid and teaching effectively broke down. The aftermath of the crisis was a sharp decline in the number of schools at all levels and the departure of most skilled teachers. However, reforms and reconstruction of the education system were introduced following the crisis. In 2006, a new student – oriented curriculum known as the 'Footpath' was introduced. This was a unique task based – curriculum based on New Basics and Rich Tasks. The focus was to encourage students to remain in school and to broaden the opportunities available to school leavers.

Another significant reform was decided in 2010 to extend the school day in primary and secondary schools to 3.00 p.m. Further reform also focused on job – oriented education and on development of technical and vocational training. Currently, the Nauru education system follows the British Model with students commencing school at age 5. The system is based upon a 3-6-4 model and attendance is compulsory between the ages of five and sixteen.

The GoN offers secondary level school, and a new school complex for this level was completed in 2010. The school now includes adult learning TVET training facilities. The curriculum at the school is also being reoriented toward vocational education.

Tertiary studies are also offered in Nauru through an extension centre of the University of the South Pacific (USP). The USP Nauru Campus is the only higher education institution in Nauru and the campus provides face – to – face teaching in accounting, management, education, early childhood education, library studies and English. In addition, the Campus provides a range of community and continuing education (CCE) courses and distance education programs. Students wishing to undertake tertiary studies also have the opportunity to apply for competitive government scholarships to study abroad.

CHAPTER 2

NATIONAL GREENHOUSE GAS INVENTORY

1. Introduction

1.1 Background

As per the 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. In accordance, Nauru has prepared and submitted its Initial National Communication to UNFCCC in October 1999. Further, 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[2]".

As a non-Annex I country and a developing country, Nauru has chosen year 2000 as the base year for estimating GHG inventory as part of its Second National Communication. Further to the base year 2000; GHG emissions has also been estimated for the years 2003, 2007 and 2010 to portray the clear picture of the Nauru's total GHG emissions. The presented GHG inventory also contains emission results, trends and comparison with Nauru's first inventory (INC) to reflect changes in country's national GHG emissions since 1994. Recalculation of previous inventory has not been done because, major source of activity data and emission factors are ideally same.

1.2 Methodology

The second national GHG inventory for Nauru has been prepared using the methodology provided in *"Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories"(hereafter 1996 IPCC guidelines);* The IPCC Guidelines for National Greenhouse Gas Inventories are approved internationally and developed through an international process. Further, the IPCC "Good Practice Guidance and Uncertainty Management in National GHG Inventories (GPG2000)" and software for "Non Annex1 National Greenhouse Gas Inventory Software, Version 1.3.1" has been used for the estimation of Nauru's second GHG inventory.

The preparation of GHG inventory in Nauru was coordinated by Department of Commerce, Industry and Environment, Government of Nauru and was prepared in support with relevant departments namely Planning and Aid Division (PAD), Nauru Utilities Corporation (NUC) and Ministry of Foreign Affairs.

The key steps carried out in inventory preparation include:

- ⇨ Team formation for GHG Inventory (Working Group)
- ⇨ Capacity building and training
- ⇨ Data collection for sectors covered under the GHG Inventory
- ⇨ Identification of data gaps and uncertainty assessment
- ⇨ Documents/data review for quality assurance
- ⇨ Preparation of GHG Inventory Report

Sectoral data for GHG emissions estimation was compiled from various sources primarily using available national data, data collected and presented for National Energy Roadmap, Nauru Census Report, Agriculture Division, other statistical reports, studies, brochures and

[2] http://unfccc.int/resource/docs/cop8/07a02.pdf#page=2

other country specific information sources. Wherein no formal data is available, are not considered in the study.

The emission factors used were based on the IPCC 1996 Guidelines. Generally, greenhouse gas emissions are calculated by multiplying the emission factor of specific fuels by the activity data. Similar to the Initial National Communication, this National Greenhouse Inventory was carried out in accordance with the methodology developed by the IPCC.

The preparation of the national inventory included the following tasks:

- Collecting and validating sources of data
- Identification of data gaps and uncertainties
- Application of tables and worksheets established in the IPCC methodology
- Processing and analysis of information
- Preparation of GHG Emission Sectoral reports
- Preparation of GHG Emission National Report.

Data collection and analyzing methodology used according to 1996 IPCC Guidelines:

- Apparent consumption in original units
- Convert to common energy units
- Multiply by emission factors to compute the carbon content
- Compute carbon stored
- Correct for carbon unoxidised
- Convert carbon unoxidised to CO2 emissions

There were no national conversion and emission factors therefore; all sectoral calculations used the IPCC default values.

In this SNC Nauru has used Tier 1 approach (the 'Reference Approach' and the 'Sectoral Approach')

The Reference Approach estimates CO2 emissions from fuel combustion in several steps:

- Estimation of fossil fuel flow into the country (apparent consumption);
- Conversion to carbon units;
- Subtraction of the amount of carbon contained in long-lived materials manufactured from fuel carbon;
- Multiplication by an oxidation factor to discount the small amount of carbon that is not oxidised;
- Conversion to CO2 and summation across all fuels.

The reference approach calculation identifies the apparent consumption of fuels in Nauru from import data. This information is included as a check for combustion related emissions (IPCC, 2000).

For the Tier 1 Sectoral Approach, total CO2 is summed across all fuels (excluding biomass) and all sectors.

The Reference Approach provides only aggregate estimates of emissions by fuel type distinguishing between primary and secondary fuels, whereas the Sectoral Approach allocates these emissions by source category

1.3 Sectors and Gases Assessed

The sectors and gases assessed for the estimation of second national GHG inventory includes the emissions by sources and removals by sinks of all anthropogenic GHGs. As per the 1996 IPCC guidelines, the inventory estimates the GHG emissions from following sectors which are relevant for Nauru:

- Energy Sector
- Agriculture Sector (Livestock)
- Waste Sector

In addition to the sectoral approach, the reference approach has also been used to estimate equivalent CO_2 emissions from the energy sector. Emissions from International bunker are also estimated and reported as memo items in the inventory; however the GHG emissions from the international bunker are not included in the Nauru's total GHG emissions. The direct GHG emissions are estimated in this national GHG inventory are:

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

Emissions from the following indirect GHGs are also estimated and reported in this second national GHG inventory:

- Oxides of Nitrogen (NOx)
- Carbon Monoxide (CO)
- Non-Methane Volatile Organic Compounds (NMVOC) and
- Sulphur dioxide (SO_2)

However the indirect GHG emissions are not accounted for Nauru's aggregated national GHG emissions. In this report Nauru has reported emissions mainly in Giga-grams (Gg). The aggregated GHG emissions and removals are expressed in CO_2 equivalents (Gg CO_2e) using the Global Warming Potential (GWP) defined by Intergovernmental Panel on Climate Change (IPCC). The concept of a Global Warming Potential (GWP) has been developed by IPCC 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 1 provides the GWP of GHG assessed in the inventory report.

Table 1: Global Warming Potential (GWP)

	Chemical formula	GWP	Species	Chemical formula	GWP
Carbon Dioxide	CO_2	1	**HFC-23**	CHF_3	11,700
Methane	CH_4	21	**HFC-236fa**	$C_3H_2F_6$	6,300
Nitrous Oxide	N_2O	310	**HFC-143a**	$C_2H_3F_3$	3,800
Perfluoroethane	C_2F_6	9,200	**HFC-134a**	CH_2FCF_3	1,300
Perfluoropentane	C_5H_{12}	7,500	**HFC-134**	$C_2H_2F_4$	1,000
Perfluorohexane	C_6H_{14}	7,400	**HFC-32**	CH_2F_2	650
Sulphur hexafluoride	SF_6	23,900	**HFC-41**	CH_3F	150
Source: IPCC 1996					

The sector and sub-sectors considered for the sectoral greenhouse gas inventory of anthropogenic emissions of Nauru has been listed in the Table-2.

Table 2: Sectorial GHG Inventory of anthropogenic emissions-Nauru

Sector	Comment
Energy Sector	
Fuel Combustion Activities – CO_2 and Non-CO_2 Emissions	Estimated
Fugitive Emissions from Fuels	Not Estimated
Industrial Processes	
	Not Estimated
Solvent And Other Product Use	
	Not Estimated
Agriculture Sector	
Enteric Fermentation	Estimated
Manure Management	Estimated
Rice Cultivation	Not Estimated
Agricultural Soils	Estimated
Prescribed Burning of Savannas – Non – CO_2 Gases	Not Estimated
Field Burning of Agricultural Residues – Non – CO_2 Gases	Not Estimated
Land-Use, Land-Use Change & Forestry Sector (LULUCF)	
Changes In Forest And Other Woody Biomass Stocks	Not Estimated
Forest And Grassland Conversion	Not Estimated
Abandonment Of Managed Lands	Not Estimated
Co2 Emissions And Removals From Soil	Not Estimated
Waste Sector	
Solid Waste Disposal On Land	Estimated
Wastewater Handling	Estimated
Waste Incineration	Not Estimated
Other (Memo Items)	
International bunkers	
Aviation	Estimated
Marine	Not Estimated
CO_2 emissions from biomass	
	Not Estimated

1.4 Uncertainty Assessment

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

In Nauru, 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 good data available on fuel imports into the country but there is lack of information on end usage. Similarly, for Land Use Change and national forest resources currently there is no national data available. The waste sector also lack information on waste generation, characterization, composition, disposal and treatment. It can be concluded that with adequate training and capacity building on GHG inventory requirements, Nauru can provide more detailed and accurate information in subsequent GHG inventories.

2. Nauru's Greenhouse Gas Emissions

2.1 GHG Emissions in Nauru

As per the methodology for GHG inventory discussed in the previous section, the GHG emissions for Nauru has been estimated for the base year 2000. Table 3 presents total GHG emissions by sources and removals by sinks for Nauru for the base year 2000. Total national GHG emissions excluding removals in year 2000 was 19.4906 Gg CO_2e; which comprises GHG emission 13.3371 Gg CO_2e from Energy Sector; 1.6074 Gg CO_2e from Agriculture Sector (for swine (anaerobic lagoons, solid storage and drylot and other); and for poultry (pasture range and drylot and other)) and 4.5460 Gg CO_2e from Waste Sector. Emissions of other GHGs like per fluorocarbons (PFCs), hydro fluorocarbons (HFCs) and sulphurs hexafluoride (SF6) are negligible in Nauru as the products containing these gases are not produced in the country. The data on land-use change and forestry (LUCF) activities was not available for Nauru, therefore CO_2 sequestration by the LUCF sector has not been considered for year 2000. Total GHG emissions, including FOLU, are also not estimated.

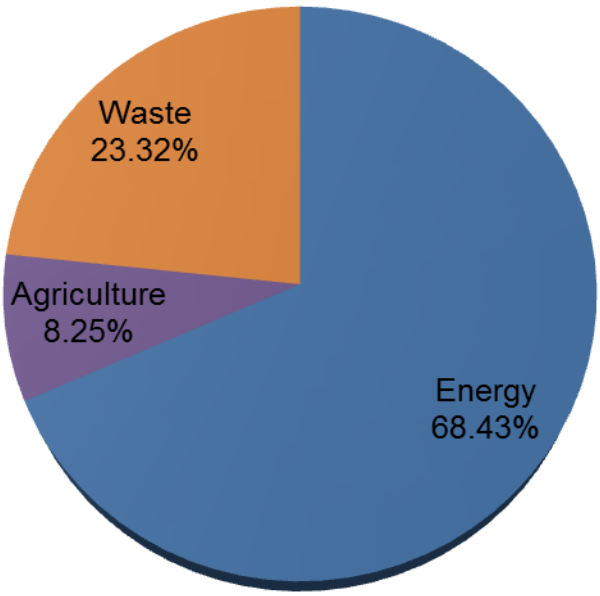
Table 3: GHG Emissions in Nauru – 2000

GHG Sources & Sinks	Sectoral Total GHG emissions in Gg in 2000							
	CO_2e	CO_2	CH_4	N_2O	NOx	CO	NMVOC	SO_2
Energy	13.3371	13.2885	0.001	0.0001	0.0507	0.2814	0.0532	0.0477
Industrial Processes	NE	NE	NE	NE	NE	NE	NE	NE
Solvent and Other Product Use	NE	NE	NE	NE	NE	NE	NE	NE
Agriculture	1.6074	0	0.059	0.0012	0	0	0	0
Land-Use Change & Forestry	NE	NE	NE	NE	NE	NE	NE	NE
Waste	4.546	-	0.20653	0.00067	0	0	0	0
Total GHG Emissions (excl. removals)	**19.4906**	**13.2885**	**0.2666**	**0.0019**	**0.0507**	**0.2814**	**0.0532**	**0.0477**
NE: Not Estimated								

The sectoral contribution of Nauru's total GHG emissions for year 2000 follows:

- Energy (13.3371 Gg CO_2 e.) 68.43%
- Agriculture[3] (1.6074 Gg CO_2 e.) 8.25 %
- Waste (4.5460 Gg CO_2 e.) 23.32 %

Figure 13: Nauru GHG Emission (2000) by Sectors (Gg CO_2 e)

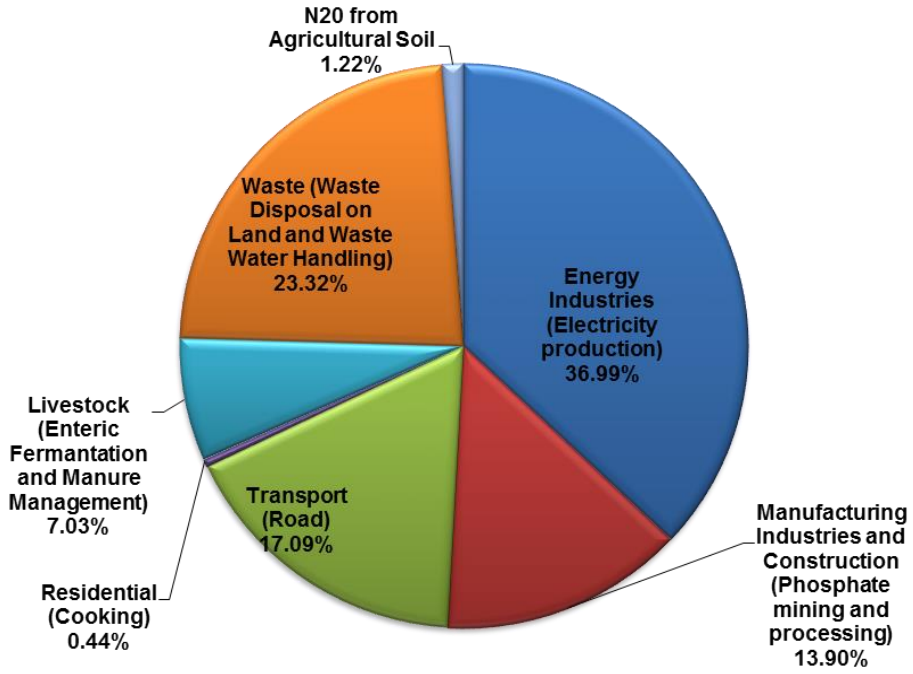


The GHG emission for year 2000 shows that the, energy sector is the biggest source of GHG emission in Nauru followed by the waste and agriculture sector; there is negligible contribution from industrial process and solvent &other product use. Further; CO_2 is the main GHG emitted as result of energy sector activities in Nauru. Figure-13 presents the sectoral distribution of GHG emissions in Nauru during year 2000.

The figure 14 highlights the sectoral activity breakdown in Nauru's GHG emissions for year 2000. Each of these sub-sectors are further discussed in following section. The largest contributor to GHG emissions in year 2000 was energy industries (electricity production) amounting to 36.99 % of total emissions. The next biggest contributor was waste management (solid waste disposal on land and waste water handling) with 23.32 % of total GHG emissions followed by road transport, manufacturing industries & construction (phosphate mining and processing) and enteric fermentation & manure management i.e. from livestock (swine and poultry (chicken and ducks)) which contributed to 17.09%, 13.90% and 7.03 % of total emissions respectively.

[3] Agriculture sector emissions includes emission from livestock only (for swine (anaerobic lagoons, solid storage and drylot and other); and for poultry (pasture range and drylot and other))

Figure 14: Nauru GHG Emission (2000) by Sectoral Activities (Gg CO_2 e)

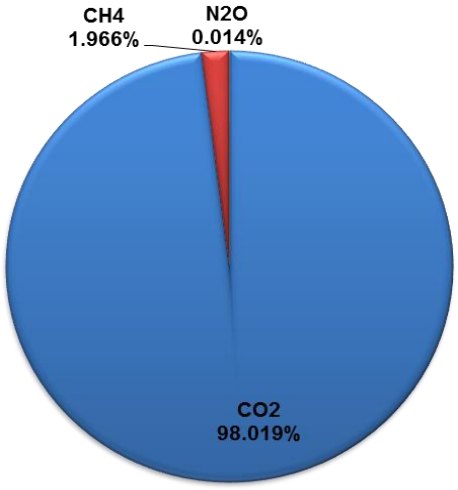


The share of major GHG emitting activities in Nauru, presented below (Table-4). It is observed that nearly 100% of GHG emissions in Nauru come from six activities: energy industries, manufacturing industries & construction, transport, residential (cooking), livestock (swine and poultry (chicken and ducks)) and agriculture soil (only N_2O emissions from livestock waste). The highest contributors among these subsectors includes energy industries, manufacturing industries & construction, transport and waste. Nauru, with very limited industrial sector presence and relatively poor energy infrastructure results in high share of GHG emissions from energy sector. Nauru needs both technical and financial support to come up with mitigation plans e.g. energy efficiency to reduce GHG emissions from the energy sector.

2.2 Gas by Gas Emission Inventory

The gas by gas GHG emission inventory for Nauru for year 2000 has been provided in this section. The GHG emissions mainly contributed from Energy, Waste and Agriculture sector. Greenhouse gases covered in this analysis include CO_2, CH_4 and N_2O and are estimated to be 98.0819 % CO_2, 1.966 % CH_4 and 0.014 % N_2O of the total GHG emissions. Figure 15 presents contribution of individual gases for year 2000 in Nauru.

Figure 15: Nauru GHG Emission (2000) by Gas (Gg CO_2e)



2.2.1 Carbon dioxide (CO_2)

Net CO_2 emissions in Nauru are estimated to be 13.2885 Gg i.e. 98.019 % of total GHG emissions in the year 2000. The energy sector is the main source of CO_2 emissions, accounting for approximately 100% of emissions. Combustion of fossil fuels is the main contributor of CO_2 emissions in Nauru. However the net CO_2 emissions in Nauru has decreased by 44.97% since 1994 (since, in 2000 Land-Use Change & Forestry is not considered, due to lack of information). This is mainly due to decreased economic activity mainly phosphate mining and respectively use of petroleum fuels (as shown in Table 5). Table 4 represents the contribution of CO_2 emissions from sectors covered under this inventory report.

Table 4: Carbon dioxide (CO_2) Emissions (Gg), Nauru, 1994 – 2000

Sectors	1994[4]	2000	% Change since 1994
Energy	28.32	13.29	-113.10%
Industrial Processes	-	-	-
Solvent and Other Product Use	NE	NE	NE
Agriculture	-	-	-
Land-Use Change & Forestry	-9.05	NE	-
Waste	-	-	-
Total	**19.27**	**13.289**	-44.97%

[4] Nauru Initial National Communication in 1999

Table 5: Fuel Deliveries 1999-2003 (litres)

	1999	2000	2001	2002	2003	Average
Petrol	31,18,707	9,99,542	35,22,926	29,40,131	68,58,850	34,88,031
ADO	104,46,041	30,50,666	80,57,090	188,22,123	71,67,802	95,08,744
Jet Fuel	28,76,808	3,70,023	18,30,368	24,75,188	5,47,757	16,20,029
Heavy Oil	8,52,432	0	0	0	0	1,70,486
Kerosene	6,35,142	0	0	0	0	1,27,028
Waste Oil		8,77,004	59,132	0	0	2,34,034
Source: NPC						

2.2.2 Methane (CH_4)

The net Methane (CH_4) emissions in Nauru has been estimated to be 0.2666 Gg and constitute 1.966 % of total GHG emissions in year 2000. Waste sector is the biggest source of methane emissions in Nauru and accounts for 77.47 % of total methane emissions in the country; followed by 21.14 % from agriculture sector (Livestock- Swine, Chicken and Duck) and 0.39 % from energy sector.

The overall methane emission in Nauru has been decreased by 29.94 % since 1994. The reduction is mainly due to reduced agriculture activity (agriculture methane emissions decreased by 296.41% since 1994, due to reduction in livestock) and water availability. Agricultural activity in Nauru is very limited due to the small amount of land available and also, more importantly, the scarcity of water. Whereas, methane emissions from waste sector has been increased by 45.58% since 1994; mainly due to increase in population and change in lifestyle. Table 6 represents methane emission in Nauru from different sectors.

Table 6: Methane (CH_4) Emissions (Gg), Nauru, 1994 – 2000

Sectors	1994	2000	% Change since 1994
Energy	0	0.001	-
Industrial Processes	-	-	-
Solvent and Other Product Use	NE	NE	NE
Agriculture	0.23	0.06	-296.41%
Land-Use Change & Forestry	-	NE	-
Waste	0.11	0.21	45.58%
Total	**0.35**	**0.267**	**-29.94%**

Methane Conversion Factor is used as per IPCC Guidelines, which states that *"default values are 1.0 for anaerobic, and zero for aerobic systems. Here it is assumed that after the discharge of the wastewater to a river, lake, sea, etc., half of the degradable organic carbon will decay anaerobically".*

2.2.3 Nitrous Oxide (N_2O)

The net Nitrous oxide (N_2O) emissions in Nauru are estimated to be 0.00195 Gg; which translates to 0.014 % of total GHG emissions in year 2000. N_2O emissions from livestock and waste sector are the biggest source of nitrous oxide emissions and accounts for 60.92

% and 34.61 % of N_2O emissions respectively in the country followed by 4.47 % of energy sector. The overall nitrous oxide emissions show increment mainly because these emissions from the AFOLU sector were not considered in the 1994 and 2000 GHG inventory and waste sector emissions increased. Table 7 represents N_2O emission in Nauru from different sectors.

Table 7: Nitrous Oxide (N_2O) Emissions (Gg), Nauru, 1994 – 2000

Sectors	1994	2000
Energy	-	0
Industrial Processes	-	-
Solvent and Other Product Use	NE	NE
Agriculture	-	0.001
Land-Use Change & Forestry	-	NE
Waste	0.001	0.000674
Total	**0.001**	**0.001948**

2.2.4 Other GHGs (PFCs, HFCs and SF_6)

Emissions from per-fluorocarbons (PFCs), hydro-fluorocarbons (HFCs) and sulphurs hexafluoride (SF_6) in Nauru are negligible; as the products containing these gases are not produced in the country. Emissions from the consumption of Halocarbons and SF_6 were not estimated due to lack of activity data.

Table 8: Other Greenhouse Gases Emissions in Nauru, 2000

Type of Gas	Emissions (Gg)
PFCs	Not Estimated
HFCs	Not Estimated
SF_6	Not Estimated

2.2.5 Indirect Greenhouse Gases (NOx, CO, NMVOC)

Apart from the direct GHG emissions in Nauru; Table 9 represents emissions from indirect gases in Nauru. NOx, CO, NMVOC are the main indirect gases emitted. The main sources of these gases are from energy sector wherein these gases are emitted due to burning of fossil fuel.

Table 9: Indirect Greenhouse Gases Emissions in Nauru, 2000

Type of Gas	Emissions (Gg)
NOx	0.0507
CO	0.2814
NMVOC	0.0532

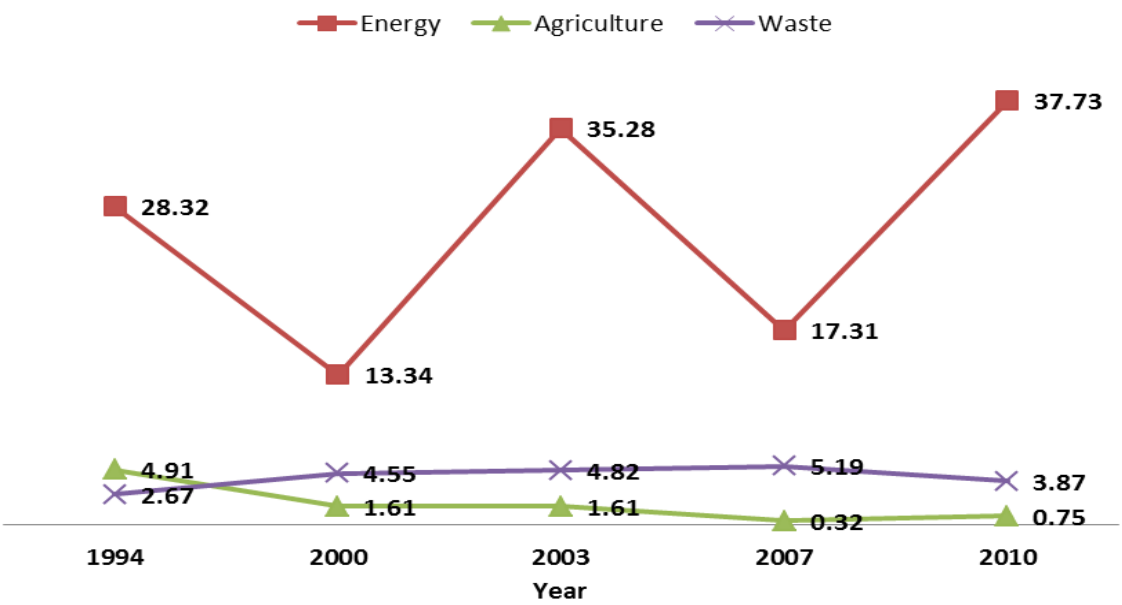
2.3 GHG Emissions Trend Analysis (1994 – 2000 – 2010)

The total GHG emissions of energy sector increased by 25% over 1994-2010, due to increase in petroleum fuel consumption, followed by waste sector increased by 31%, due to population increment, whereas agriculture sector i.e. only livestock drastically decreased, due to agriculture activity (reduction in livestock) and water, as agricultural activity on Nauru is very limited due to the small amount of land available and also, more importantly, the scarcity of water. Table 10 and figure 16 presents the Nauru's sectoral total GHG emissions trend since 1994 to 2010.

Table 10: Nauru Sectoral GHG emissions trend, 1994-2010

Sector wise comparison of GHG emissions in Gg CO_2e							
Sectors	**1994**	**2000**	**2003**	**2007**	**2010**	**% Change since 1994 to 2010**	**% change since 2000 to 2010**
Energy	28.32	13.34	35.28	17.31	37.73	25%	64.65%
Industrial Processes	-	NE	NE	NE	NE	NE	NE
Solvents and Other Products Use	-	NE	NE	NE	NE	NE	NE
Agriculture	4.91	1.61	1.61	0.32	0.75	-555%	-114.14 %
Land Use Change and Forestry (removals)	-	NE	NE	NE	NE	NE	NE
Waste	2.67	4.55	4.82	5.19	3.87	31%	-17.46%
Total GHG Emissions (excl. removals)	**35.9**	**19.49**	**41.71**	**22.82**	**42.35**	**15%**	**54.30%**

Figure 16: Nauru Sectoral GHG emissions trend 1994-2010 (Gg CO_2e)



The sectoral GHG emissions trend 1994-2010 (Gg $CO_{2\ eq.}$) in Nauru, shows the trend of major GHG emissions' fluctuations was in energy sector since 1994 to 2010 (estimated as per available data); this is mainly due to change in fossil fuel consumption and total petroleum fuel import change (the fuel consumption pattern in electricity generation, phosphate mining and transportation sub sectors have been varied due to economy fluctuation).

The total GHG emissions for the representative year has been estimated as follows:

For year 1994 the GHG emissions data was obtained from Nauru Initial National Communication (INC); the GHG emissions considered mainly from energy sector;– (all energy including transport); agriculture sector emissions(only livestock) and waste sector emissions.

For year 2000; GHG emissions considered from energy sector (energy industries, electricity generation), manufacturing industries and construction (phosphate mining), transport (road transport) and other sector (residential cooking)), agriculture sector (livestock) and waste sector;
For year 2003; GHG emissions considered from energy sector (energy industries- electricity generation), transport (road transport) and other sector (residential cooking)), agriculture sector (livestock) and waste sector;

For year 2007; GHG emissions considered from energy sector (energy industries (electricity generation), transport (road transport) and other sector (residential cooking)), agriculture sector (livestock) and waste sector;

For year 2010; GHG emissions considered from energy sector (energy industries (electricity generation), manufacturing industries and construction (phosphate mining), transport (road transport) and other sector (residential cooking)), agriculture sector (livestock) and waste sector;

3. GHG Emissions by Sector in Nauru

3.1 Energy Sector

The energy sector in Nauru is depended on the imported, refined petroleum fuel. The imported petroleum fuel are delivered at Nauru by either medium range (MR) tanker ships directly from Asian refineries, from high seas bunkering vessels that service the Pacific fishing fleet or occasionally via local coastal tanker (LCT) from a Pacific large regional bulk fuel supplier such as Fiji.

The petroleum fuels are mainly imported by the Government of Nauru and Nauru Phosphate Corporation (RONPHOS); Joint procurement was carried out until 2000 when RONPHOS was part of Government. At present, fuel procurement and supply by the Government and RONPHOS are carried out separately. All fuel imports into Nauru are retained in the country itself, there is no re-export, although facilities were installed recently which would be capable of re-fuelling passing fishing vessels (limited compare to actual fuel consumption in the other sectors in the Nauru).

Government of Nauru's fuel supply is further disintegrated into diesel fuel, mainly for electricity generation; Dual purpose kerosene (DPK) for jet fuel and cooking and petrol. The fuel oil was also imported by Government in the 1990s for the phosphate industry; Import of fuel oil continue today but are handled by RONPHOS directly. These are estimated at 4 million litres per year but may vary from year to year depending on phosphate production. LPG is also imported into Nauru by two private sector companies with imports estimated at 9.5 tonnes per year (IRENA, 2013).

Total average fuel demand in Nauru is estimated at 14 million litres per year, which is around half of what it was in the 1990s. The decrease in fuel imports can be attributed to the significant decline of the phosphate mining industry in the intervening years. There is a very limited data on the segregation of fuel use between different sectors and sub-sectors. Table 11 presents the approximate segregation of imported fuel oil.

Nauru is 99% dependent on diesel fuel for electricity generation (SPC, 2012). Electricity is supplied by a single power station operated by Nauru Utilities Corporation (NUC). Most of the power is currently generated by four ageing medium-speed Ruston stationary engines with a high-speed Cummins generator providing essential supplementary capacity.

Table 11: Estimated Average Petroleum Fuel Demand in Nauru

Energy Sub-sector	Type of Fuel	Quantity
Electricity	Diesel	6-7 million liters per year
Phosphate (RONPHOS)	Fuel Oil (for drying process)	Self-imported: 4 million liters per year
	Diesel (for own generators)	Self-imported: no data
Our Airline	Kerosene (DPK)	0.5-1 million liters per year
Transport	Diesel	1 million liters
	Petrol	2 million liters
Cooking	Kerosene (DPK)	0.1 million liters per year
	LPG	9.5 tons per year

Based on the petroleum fuel demand in Nauru (Table 13); the fuel usage in different sub-sectors of energy has been estimated and respectively GHG emission from various sub-sector has been calculated for the year 2000, 2003 and 2007. Percentage distribution of fuel consumption in energy sector has been presented in Table 12.

Table 12: Percentage distribution of fuel consumption in energy sector

Energy Sub-sector	Fuel			
	Diesel	Petrol	Jet Fuel (DPK)	Fuel Oil
Electricity	87.50%	Not Applicable	Not Applicable	Not Applicable
RONPHOS	Not Available	Not Applicable	Not Applicable	100%
Our Airlines	Not Applicable	Not Applicable	90.91%	Not Applicable
Transport (Road)	12.50%	100%	Not Applicable	Not Applicable
Cooking	Not Applicable	Not Applicable	9.09%	Not Applicable
Total	**100%**	**100%**	**100%**	**100%**

GHG emissions in the energy sector are primarily associated with fuel combustion and fugitive emissions from fuels. Since Nauru is 100% dependent on imported fossil fuels to meet its energy demand and has no energy resource mining and exploration activities, fugitive emissions from fuels are not considered for the GHG Inventory. GHG Emissions from the energy sector from fuel combustion includes following categories:

- ⇨ Energy Industries
- ⇨ Manufacturing Industries and Construction
- ⇨ Road Transport
- ⇨ Residential

In the year 2000, energy sector was the major dominant source of GHG emissions in Nauru accounting for 54.1% of total GHG emissions in country. GHG estimation from energy sector is based on data from Department of Commerce, Industry and Environment, Planning and Aid Division (PAD), Nauru Utilities Corporation (NUC), Ministry of Foreign Affairs, RONPHOSE (Republic of Nauru Phosphate Mining Company) and private party. GHG emissions from fuel combustion in Nauru are associated with the use of petroleum products mainly for electricity generation, phosphate mining and road transport. Kerosene and LPG are mainly used for cooking. The total GHG emissions from the energy sector are estimated to be 13.337126 Gg CO_2e. Table 13 below presents Gg CO_2e emissions from different sub sectors under the energy sector.

As fuel consumption in Commercial, Institutional, Agriculture, Forestry and Fishing was not estimated and considered in this inventory due to unavailability of data (except residential cooking).

Table 13: CO_2e Emissions from Energy Sub sectors in Nauru (Gg CO_2e), 2000

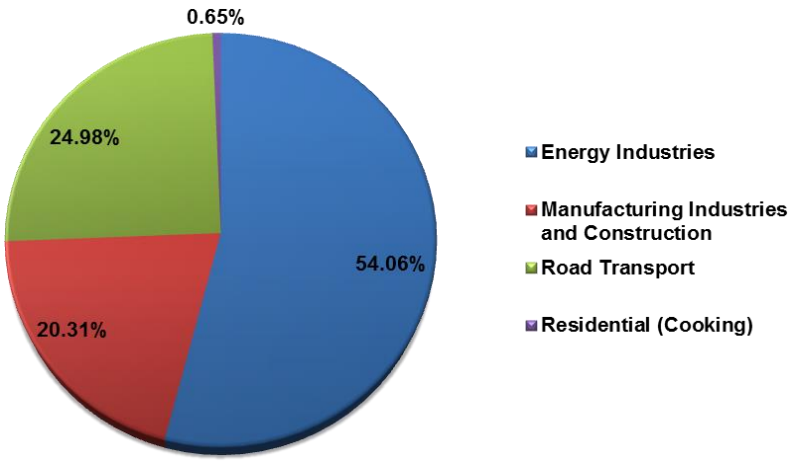
Source	2000
Energy Industries	7.210477
Manufacturing Industries and Construction	2.708496
Road Transport	3.331562
Residential (Cooking)	0.086591
Total CO_2e Emissions	13.33713
International Bunkers (not included in national total)	13.33713

Table 14 presents emission of different gases from energy sector in Nauru. From the calculated data, it can be inferred that the most prominent GHG emitted from the energy sector is CO_2 amounting to 13.29 Gg followed by CH_4 emissions of 0.0010 Gg. Some minor NOx and CO emissions associated with the energy sector exist and are estimated to be 0.05 and 0.28 Gg respectively.

Table 14: GHG Emissions from Energy Sector in Nauru (2000)

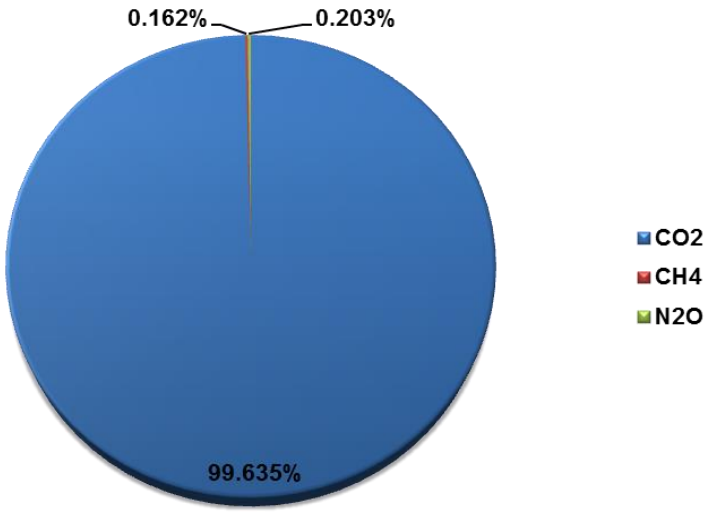
Source	CO_2 (Gg)	CH_4 (Gg)	N_2O (Gg)	NO_x (Gg)	CO (Gg)	NMVOC (Gg)	SO_2 (Gg)	Total CO_2e (Gg)
Energy Industries	7.19	0.0003	0.00006	0.0196	0.0015	0.0005	0.0075	7.21
Manufacturing Industries and Construction	2.71	0	0	0	0	0	0.0383	2.71
Road Transport	3.31	0.0007	0.000028	0.031	0.28	0.05	0.0019	3.33
Residential (Cooking)	0.09	0	0	0	0	0	0	0.09
Total GHG Emissions	**13.29**	**0.001**	**0.00009**	**0.05**	**0.28**	**0.05**	**0.0477**	**13.34**
International Bunkers (not included in National total)	0.87							0.87

Figure 17: Energy Sub-Sector GHG Emissions (Gg CO_2e), 2000



During the year 2000, under the energy sector CO_2 emissions contributed 99.635% of emissions, followed by N_2O and CH_4 emissions, as 0.203% and 0.162%, respectively. Figure 18 presents the contribution of various gases under the energy sector.

Figure 18: GHG Emissions by Gases under Energy Sector, 2000



3.1.1 Electricity Generation

Energy industries is the first bigger emitter under energy sector accounting for 54.1% of emissions. Electricity generation is the major source of GHG emissions from the energy industries in Nauru. The significant growth in emissions from energy industries reflects increased demand for electricity in the country.

Nauru is 99% dependent on diesel fuel for electricity generation (SPC, 2012). Electricity is supplied by a single power station operated by Nauru Utilities Corporation (NUC). Most of the power is currently generated by four ageing medium-speed Ruston stationary engines with a high-speed Cummins generator providing essential supplementary capacity.

3.1.2 Road Transport

It is observed that the share of GHG emission from transport sub-sector (under energy sector) is second largest accounting for 24.98 % of GHG emissions. The majority of emissions from this sector is CO_2 emissions resulting from the combustion of gasoline and automotive diesel oil (ADO) used in internal combustion engines.

Road transportation constitutes 100 % of GHG emissions under transportation which is dominated by cars and other light multi utility vehicles (About half of all households own a motorbike (45%) and 37% own a car, with Land Rovers (21%) and minivans/trucks (18%) providing other forms of popular household transport.[5]).
As per latest Nauru Census report (2011), in total 573 motor cars were counted during the census, 1,066 motor bikes, 98 trucks, vans or mini buses, and 763 bicycles. 29% of households owned at least one motor car; but motor bikes were much more common than cars, and 46% of households had at least one motor bike available. As can be expected, the

[5] 2002 Nauru Census Main Report

percentage of households owning a truck, van or mini bus is with 5% very low. Just over one-quarter of all households in Nauru owned at least one bicycle.

As per Nauru Energy Road Map 2014 – 2020, the majority of transport energy is for land transport, although some fuel is also used for small domestic fishing boats (due to lack of data not estimated) and cooking (31.3% of households use LPG as their main cooking fuel and 1.3% use kerosene) and jet fuel is used for air transport (0.5 – 1 million litres). Air transport to Nauru is provided by the national airline, Our Airline.

Domestic aviation is not occurring in the country, only one airline is there that is international, however this does not include emissions due to international flights, such emissions are estimated separately and are reported as memo items as international bunker (aviation) in this report.

3.1.3 Manufacturing Industries and Construction

Total emissions from Manufacturing Industries and Construction sub sector accounts for 20.3 % of GHG emissions under the energy sector.

Phosphate mining is one of the bigger petroleum fuel private importer (by their-own) and consumer (diesel for self-electricity generation and waste oil fuel oil for drying process). Heavy oil and waste oil were used only in the phosphate drying kiln.

The basis for Nauru's economy since the early 1900s has been phosphate exports. At the peak of Nauru's phosphate industry in 1975, after the mid-1990s, production gradually fell reaching almost zero by 2004.

Since 2004, successive governments have been dealing with the near-exhaustion of primary phosphate reserves and the legacy of years of economic mismanagement. In 2005, the Nauru Phosphate Corporation became the Republic of Nauru Phosphate Corporation (RONPHOS). RONPHOS then began work on accessing the leftovers from earlier mining and phosphate shipments again began, though at a lower level. Some income flow resumed in 2007 and production in 2009 was 41,549 tonnes. In 2012 phosphate exports from Nauru reached 519,000 tons, the highest annual figure since production recommenced in 2007, and contributed strongly to economic growth of 4.9% in fiscal year (FY) 2012. Phosphate exports are expected to hold steady in FY2014 as mining exhausts primary phosphate reserves and taps into deeper secondary phosphate resources.

3.1.4 Residential

Residential sub-sector in Nauru is the fourth source of GHG emissions and constitutes 0.6 % of energy sector emissions. As per Nauru Census Report 2011, the main and almost exclusive source of energy for lighting in Nauru was electricity, apart from very few households in Uaboe, Baitsi, and Location that used kerosene or gas as the main source of lighting. The main source of energy for cooking was electricity for 60% of all households in Nauru, followed by gas (31%) and wood or open fire (6%). More than three-quarter of households in Location and Uaboe relied on electricity as energy for cooking, while half of all households in Ijuw used wood or open fire for cooking, but the limited availability of biomass on Nauru would make it difficult to support a biofuels industry. Hence CO_2 emission from biomass is not estimated.

3.2 CO_2 Emissions from the Energy Sector Using Reference Approach and Sectoral Approach

The GHG Emissions from the energy sector were estimated using reference and sectoral approaches using IPCC Tier 1 analytical framework. Under the reference approach, GHG emissions were estimated using only the fuel consumption data for each type of fuel. The results of estimated CO_2 emissions for the year 2000 using reference approach was 13.2885 Gg which is equal to the 13.2885 Gg of CO_2 emissions estimated using sectoral approach. The difference between the outputs from the two approaches is 0. Table 15 represents the calculation results using reference and sectoral approach.

Table 15: Energy Sector CO_2 Emissions using Reference and Sectoral Approach, 2000

Sector	Approach	CO_2	CH_4	N_2O	NO_x	CO	NMVOC	SO_2	Total GHG Gg CO_2e
		Gg	Gg	Gg	Gg	Gg	Gg	Gg	
Energy	Reference Approach	13.2885							
	Sectoral Approach	13.2885	0.00103	0.000087	0.051	0.2814	0.05332	0.0477	13.33713
Fuel Combustion		13.2885	0.00103	0.000087	0.051	0.2814	0.05332	0.0477	13.33713
Fugitive Emissions		-	-		-	-	-	-	-

3.3 Memo Items

In accordance with 1996 IPCC guidelines, CO_2 emissions from International Bunkers and burning of biomass are not included under the national items, only International Bunkers i.e. aviation has been estimated and reported separately as memo items in the inventory.

3.3.1 International Bunkers

International bunkers include aviation and navigation. Emissions from marine transportation are not estimated due to lack of data. CO_2 emissions from international aviation for the year 2000 were estimated to be 0.866 Gg CO_2e, while emissions from other gases were insignificant. These emissions are not counted under national total GHG emissions.

3.3.2 Biomass

The limited availability of biomass on Nauru would make it difficult to support a biofuels industry, unless that changed dramatically into the future. One possibility for this would be if the centre of the island were planted with a potential fuel crop such as Coconut, Oil Palms, Pongamia, Jathropha or other fast growing vegetation that could be converted into biofuel using advanced biofuel technologies that are currently being developed. However, the

issues of food versus cash crops as well as water availability would have to be carefully examined, among others.

CO_2 emissions from biomass fuels are not estimated and not included in this inventory as memo item. Emissions from use of biomass fuels are not included and reported in the national GHG emissions.

By 2004, virtually all but a small coastal area had been stripped of trees. Although it is conceivable that rehabilitation efforts could recover a major part of the biomass resource lost to mining, for the near term the resource is inadequate to form the basis of any significant energy producing effort. Less than 15% of the land area has not been mined or cleared for human habitation. This represents only about 3 km^2 of land available for biomass production, insufficient to provide much energy benefit.

Biofuels also are conceptually possible for future development with coconut plantations being possible as part of the topside development. However, the concept lies many years into the future and at present the coconut resource is only sufficient for household use.

3.4 Industrial Processes

This sector covers GHG emissions from industrial processes as an output of non-energy related activities. In Nauru this sector is negligible except phosphate mining. Hence GHG emissions from this sector are not estimated, only phosphate mining (in terms of energy consumption, as phosphate mining uses only diesel based self-generated electricity and fuel oil based drying process and no other chemical process) estimated and reported in this report as manufacturing industries & construction.

3.5 Solvents and Other Products Use

This sector comprises emissions (primarily Non Methane Volatile Organic Compounds) from solvents and other products use containing volatile compounds. There are no calculations and emissions factors in the revised 1996 IPCC guidelines to estimate GHG emissions from this sector. However in Nauru there are no solvents and other products use industries and process; hence GHG emissions from this sector are not estimated.

3.6 Agriculture

The agriculture sector is one of the contributors of methane emissions in Nauru and is last contributor of GHG emissions in the Nauru. Emissions in this sector are estimated for following categories:

- ⇨ Livestock Farming i.e. Enteric Fermentation and Manure Management
- ⇨ N_2O Emissions from Agricultural Soil

Emissions due to rice cultivation and burning of Savannas do not occur in Nauru while emissions from field burning of agricultural residues have not been estimated.

Data used for estimating GHG emissions from agriculture sector were used from Nauru Census 2011 (for 2010), Agriculture Division (for 2007) and Open Source, which uses UN data as source i.e. *www.factfish.com* (for 2003 and 2000). Since use of fertilizers in Nauru is very limited and records are not available for 2000, emissions from use of fertilizer are not estimated under the agriculture sector.

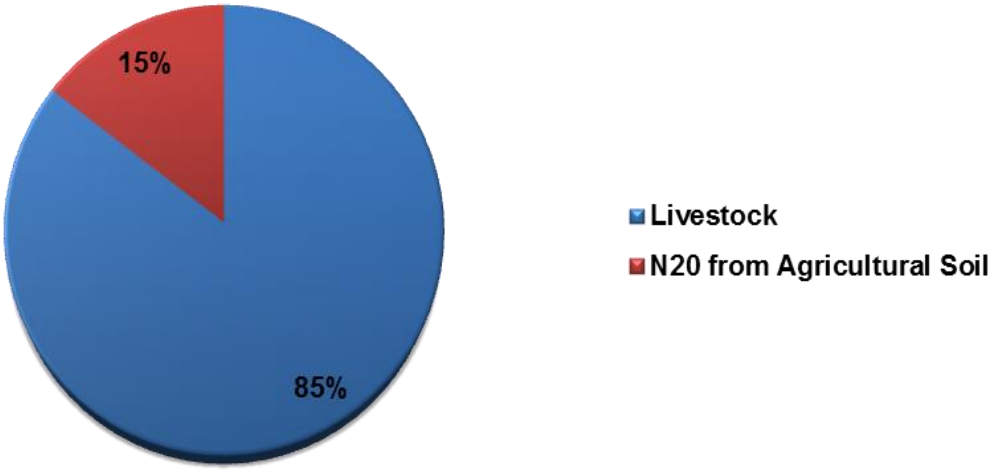
The emissions from agriculture sector (Only from Ivestock – Swine, Chicken and Duck) in Nauru are last and account for 8.33% (1.6074 Gg CO_2e) of Nauru's total GHG emissions for the year 2000. It can be observed from Table 16 that GHG emissions from agriculture sector have decreased since 1994. This decrease is primarily due to decrease in livestock farming and as mentioned earlier in the report N_2O emissions from agricultural soil was not estimated under the Initial National Communication.

Table 16: GHG Emissions from Agriculture Sector in Nauru (Gg CO2e), 1994-2000

Source	1994	2000	% Change since 1994
Livestock Farming	4.91	1.371	
N_2O from agricultural soil	NE*	0.237	
Total GHG Emissions	**4.91**	**1.607**	**-205.71%**
**NE – Not estimated*			

Emissions from agriculture sector are primarily composed of methane and nitrous oxide. However, emissions of indirect GHGs such as CO and NOx are considered negligible and are not estimated. Emissions from this sector are largely from livestock farming and account for 1.371 Gg CO_2e which is 85% of emissions from the sector. The remaining 15% of GHG emissions are due to N_2O emissions from agricultural soil (Figure 19).

Figure 19: Sectoral Emissions from Agriculture Sector, 2000



3.6.1 Livestock Farming

There are two sources of GHG emission from Livestock farming in Nauru:

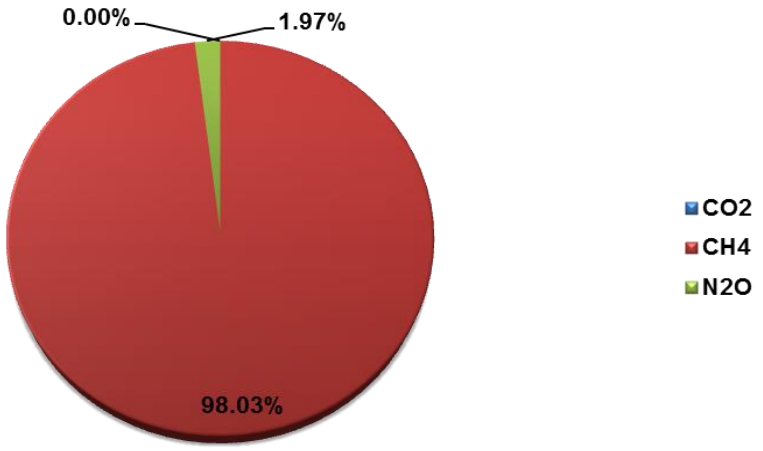
Enteric Fermentation: Enteric Fermentation is the fermentation that takes place in the digestive system of animals. In particular in ruminant animals (cattle, buffalo, sheep, goats) methane is produced in the rumen by the bacteria as a by- product of fermentation process. This methane when released adds to GHG emission in the atmosphere. Enteric fermentation accounts to 4.3 % of GHG emissions from Livestock farming in Nauru. Agricultural activity on Nauru is very limited due to the small amount of land available and also, more importantly, the scarcity of water. Livestock on Nauru is limited to pigs, chickens and ducks due to this unavailability of pastures and free range / grazing land areas, which has decreased significantly since 1994 and hence is last source of GHG emissions in the country.

Manure Management: Systematic management of manure from livestock is not practised in Nauru. There is limited data available on management of manure from swine and poultry excretion. Hence GHG emission for manure management is estimated based on default values provided in Revised 1996 IPPC guidelines. In Nauru, GHG emissions from manure management account to 95.7 % of GHG emissions from livestock farming sector. This can be reduced by introducing animal waste management systems.

N_2O Emissions from agricultural soil: Emissions of N_2O from managed soils are primarily due to the microbial processes of nitrification and de-nitrification. Emissions from this category constitute 14.7 % of total $CO_{2\ eq.}$ emission from livestock farming sector. Due to limited data available on usage of fertilizers in Nauru for the year 2000, only emissions due to nitrogen animal waste are taken into account.

Biogas generation in small quantities is also possible utilising the waste from the pigs and chickens on the island. However the numbers are small and the animals not concentrated sufficiently to make biogas an economically interesting energy resource.
Gas by gas emission from agriculture sector in Nauru in year 2000 was as shown in figure 9

Figure 20: Nauru Agriculture Sector Gas by GHG Emissions, 2000



3.7 Land Use Change and Forestry Sector

Nauru is a single, raised coral equatorial island and is about half way between Sydney and Honolulu. Total land area is 21 km^2 with an EEZ of 320,000 km^2. There are two separate plateau areas: "bottom side" that is a few metres above sea level and "topside" that is typically 30 metres higher. Topside is dominated by pinnacles and outcrops of limestone.

Phosphate mining has occurred on Nauru for over a century, with consequent landscape degradation over a wide area and decline in soil quality, rendering over 70% of the land area uninhabitable and almost all of the land non-productive. This loss of soil fertility and reduced crop cover exposes soils to high levels of UV radiation which further reduces the organic components. Ultimately this may lead to desertification[6]

Land availability is also constrained by Nauru's size and land tenure system. The current system is seen as preventing planned land use, encouraging 'random building' by landowners, and generally in need of reform.

Lack of data also brings a challenge to accurately assessing the importance of some environmental issues. This is particularly true for forest area, carbon dioxide emissions, and consumption of ozone-depleting substances, which all lack data.

Phosphate mining has damaged about 80% of terrestrial ecosystem habitat on Nauru. The mined phosphate land is currently not suitable for either habitation or agriculture. The lack of arable land for agriculture has created additional challenges. The lack of forest and natural vegetation threatens biodiversity and erodes the national culture. The lack of either natural or regenerated forests has translated into a lower resilience of the natural environment (for example, poor water quality due to poor filtration, higher possibilities of erosion, poor precipitation, higher droughts, higher CO2 emissions, etc.).

Only 250 hectares of land is presently available for cultivation with coconuts being the main crop. Soils are poor and highly porous, rainfall is generally variable[7].

Due to unavailability of appropriate data the Land Use Change and Forestry sector has not been estimated and not reported in this inventory.

3.8 Waste

GHG emissions from the waste sector in Nauru are estimated for following subsectors:

- Solid Waste Management and Disposal
- Domestic and Commercial wastewater handling

Waste management sector emissions has been estimated using data from open source, Nauru census and pacific specific waste generation and composition, due to lack of reliable data on waste generation. Data for waste sector has been largely sourced from published literature on municipal solid waste management, solid waste education and awareness in pacific island countries, pacific regional waste awareness and education programme, SPREP and from the population census report 2011 for 2010, and for 2000, 2003 and 2007 population has been considered from open source i.e. *www.indexmundi.com*
Table 17 presents GHG emissions from waste management in Nauru for the year 2000. The emissions from waste sector were estimated in 1994 under the first national communication.

[6] Nauru energy road map v6.0
[7] Global Forest Resources Assessment, Country Reports, Nauru, Rome 2010

Emissions from this sector totalled 4.5460 Gg CO_2e i.e. 23.32% of Nauru's total GHG emissions.

Table 17: CO_2 Emissions from Waste Sector in Nauru (Gg CO_2e), 1994-2000

Sectors	1994	2000	% Change since 1994
Waste	2.6704	4.546	41.26%

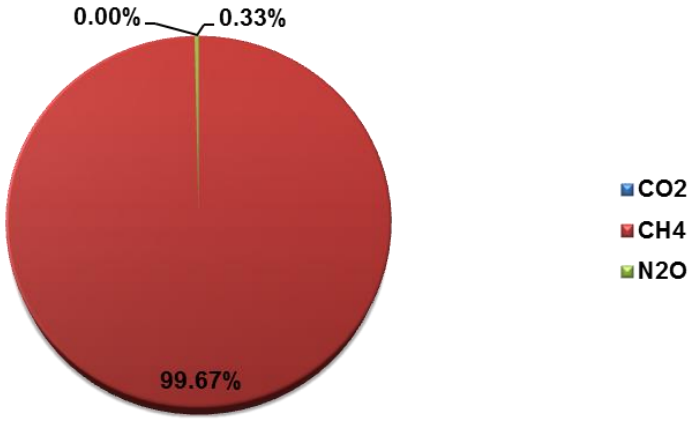
Since 1994 waste sector GHG emissions increased by 41.26% due to population change and change of life style.

Table 18 and figure 21 present emissions of different gases in waste sector in Nauru. Methane is the most prominent gas emitted from the waste sector. Unmanaged solid waste (SW) and waste water sites, lead to methane emissions. The methane emissions so emitted are estimated using the quantity of waste generated the management of the waste, the proportion of carbon that may be transformed into methane etc.

Table 18: GHG Emissions from Waste Sector in Nauru (Gg), 2000

GHG Sources & Sinks	Waste Sector Total GHG emissions in Gg			
	(CO_2,CH_4 and N_2O), CO_2-equiv	CO_2	CH_4	N_2O
Waste	4.546022	0	0.206528	0.000674

Figure 21: Gas by Gas Emissions from Waste Sector in Nauru, 2000



3.8.1 Solid Waste Management and Disposal

The key source of methane emissions under the solid waste management and disposal include emissions from anaerobic decomposition of waste.

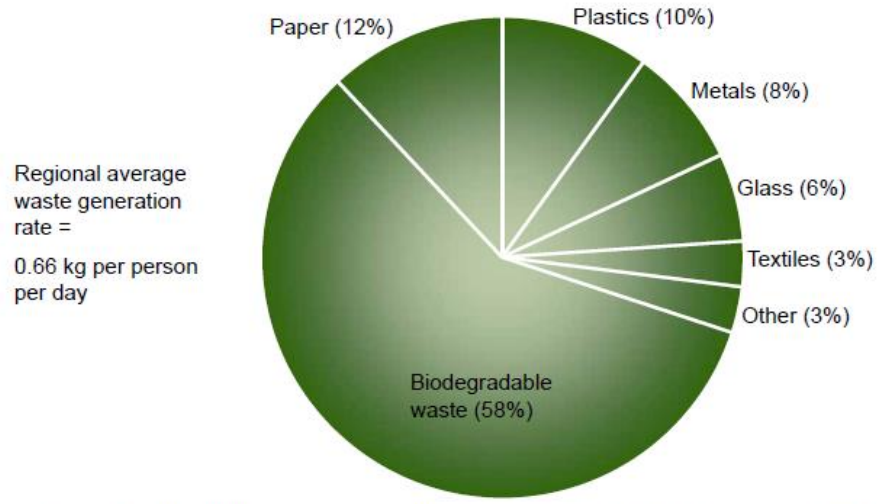
In Nauru, common methods of disposal include open backyard dumpsites, disposal at sea or on unused land, and burning. The management and control of the landfill has been, and continue to be a challenge. Nauru lacks national environmental and health laws to regulate the dumping of hazardous waste and general rubbish.

Municipal waste is taken to the landfill, which is also operated by NRC. It is located on top of an aquifer, which does not have appropriate lining of waste disposal cells or leachate collection. The waste is usually burned first and then pushed into old mined-out areas. Occasionally, the landfill area is bulldozed and covered with a thin layer of soil. Only one bulldozer is working at the dumpsite, and sometimes the waste accumulates since the bulldozer is also used for other jobs on the island. The landfill is reaching the end of its life; and if the landfill is not rehabilitated, seepage from the site will cause major contamination of underground sources of water.

Biowaste from medical facilities has, at times, been burned at the landfill because of operational problems with the hospital incinerator. With little segregation of wastes and proper disposal of hazardous waste, chemical substances pose a risk to public health and the environment.

One particular area of concern is the disposal of asbestos. An estimated 90% of Nauru's houses are built with asbestos roofing, which is now being replaced because of the health risks it presents. Special training is needed in the handling and disposing of asbestos. Phosphate processing, which releases cadmium-rich waste, also poses an environmental threat. The waste composition considered for the current inventory calculation is provided in Figure 22.

Figure 22: Typical Composition of Solid Waste in Pacific



Source: S.C. Raj (2000), *Solid waste education and awareness in Pacific Island Countries*, Pacific Regional Waste Awareness and Education Programme, SPREP, Apia.

3.8.2 Domestic and Commercial Wastewater Handling

There is not appropriate information available for sanitation system in Nauru, however common practice would be decentralized system, consisting of privately managed household and commercial septic tanks for the collection of human waste. These allow the decomposition of the waste but the process leaves sludge as a by-product. Emissions from incineration and open burning of waste have not been estimated in the current inventory.

4. Key Findings

GHG inventory serves as a baseline for country to measure its progress towards reduction of greenhouse gases. It also serves as an integral tool in designing countries climate change policies and to measure the success of such policies. The current GHG inventory provides comprehensive information about all emissions and removals in Nauru for the base year 2000 and also reflects the GHG emission trend since 1994. The key findings of this inventory development exercise include:

- In Nauru, there is insufficient documentation of methods and data sources used for data collection, this in turn adversely impacts the reliability of the data.
- There is lack of country-specific emission factor in Nauru and hence IPCC default values are generally used in estimating the GHG emissions.
- It is also observed that there is lack of detail in the activity data as is case with other SIDCs as well. For example in the energy sector there is substantial information available on fuel imports but limited information is available on end use consumption.
- There are no industrial activities in Nauru except for Phosphate mining and emissions from this sector are not estimated due to non-availability of fuel consumption data.
- There is need of data readiness from private parties for fuel import and consumption pattern in the country e.g. RONPHOS.
- There is very limited quality land for farming activity in Nauru and hence limited use of fertilizers in the country, the data of fertilizer usage is not currently available. It can be included in the subsequent GHG inventory report under Third National Communication.
- There is a lack of support for GHG estimation activity initiatives resulting in small teams under different departments working with multiple responsibilities and limited resources. More resources (financial and human) are required to integrate GHG estimation with other sustainable and business as usual activities.
- Difficulties retaining capacity and expertise developed during the preparation of previous National Communications are leading to drain of resources.

CHAPTER 3

VULNERABILITY AND ADAPTATION ASSESSMENT

1. Background

The aim of the vulnerability and adaptation assessment is to generate and update information about how projected climate change, climate variability and extreme events may affect Nauru's economic and social sectors. This chapter outlines Nauru's current climatic, socio-economic and natural systems; current vulnerability and adaptation efforts; future risks and national/sectoral adaptation policies, strategies and measures including a summary of potential adaptation actions for priority sectors.

Nauru is one of the leading countries in the pacific region to take active actions towards climate change and sustainable development. Nauru through it's ambassador is currently represented as chairperson of the Alliance of Small Island States (AOSIS). AOSIS is a coalition of Small Island and low-lying coastal countries that share similar development challenges and concerns about the environment, especially their vulnerability to the adverse effects of global climate change. It functions primarily as an ad hoc lobby and negotiating voice for Small Island Developing States (SIDS) within the United Nations system.

Nauru's implementation of the UNFCCC has progressed exponentially in recent years as government sector agencies become more organized and civil society, academic, the private sector, development partners and regional agencies have stepped up their activities in Nauru. The island faces a full range of geologic and climatic hazards and is also subjected to climatic variability and extremes.

Nauru's climate is equatorial marine in nature with cyclic rainfall and periodic droughts which pose serious concerns for the island. In terms of potable water resources, desalinated water is used for regular use, coupled with rainwater and limited groundwater.

The main climate change vulnerabilities in Nauru include sea level rise and the effect that an increase in temperature will have on marine resources and already stressed water and vegetative resources [8] . Due to environmental degradation, the island is already experiencing coastal erosion and declines in the productivity of its coral reef systems. Rising ocean temperatures, sea level rise, and an increase in the number of intense storms could cause further damage to these ecosystems[9]

Nauru lacks significant surface water resources; desalination plants and groundwater are its only potable water sources. Water scarcity is already affecting human health. Greater incidence of drought could therefore reduce the sustainability of the country's groundwater resources, the health of its population, and the persistence of a vegetation ecosystem already stressed from major phosphate mining[10].

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

8 http://www.pacificclimatechange.net/index.php/country-profiles/nauru
9 http://www.pacificclimatechange.net/index.php/country-profiles/nauru
10 http://www.pacificclimatechange.net/index.php/country-profiles/nauru

2. Nauru's Current Climatic Scenario

This section provides a brief description of climatic scenario for Nauru including its past (since 1950) and present climate as well as projections for the future, and is derived from the collective work of Nauru and Australian climatologists under the Pacific Climate Change Science Joint Program[11] (PCCSP- a collaborative research partnership between Australian Government agencies, East Timor and 14 Pacific Island countries). Observed trends and analysis of air temperature, rainfall, extreme events, sea-surface temperature, ocean acidification, mean and extreme sea levels are presented and projections for air and sea-surface temperature, rainfall, sea level, ocean acidification and extreme events for the 21st century are provided.

The climatic scenarios for Nauru studied under the PCCSP have identified a set of models, which provide a reasonable representation of observed climate over the region and future climate for Nauru. Currently, meteorological observations are taken by two automatic weather stations (AWS; data from the Bureau of Meteorology 'ARC-2' AWS are available from July 2003) and a manual rain gauge near Yaren. There is also a sub-daily rain gauge near the centre of the island which has been operational since October 2009.

Surface wind-wave driven processes can impact on many aspects of Pacific Island coastal environments, including: coastal flooding during storm wave events; coastal erosion, both during episodic storm events and due to long-term changes in integrated wave climate; characterisation of reef morphology and marine habitat/ species distribution; flushing and circulation of lagoons; and potential shipping and renewable wave energy solutions. The surface offshore wind wave climate can be described by characteristic wave heights, lengths or periods, and directions.

The wind-wave climate of Nauru is strongly characterised by the seasonal trade winds. On the west coast of Nauru, waves are directed from the south-east during June–September, and are directed from the north-east, and are slightly larger and longer than in the dry months, during December– March (Table 19, Figure 23).

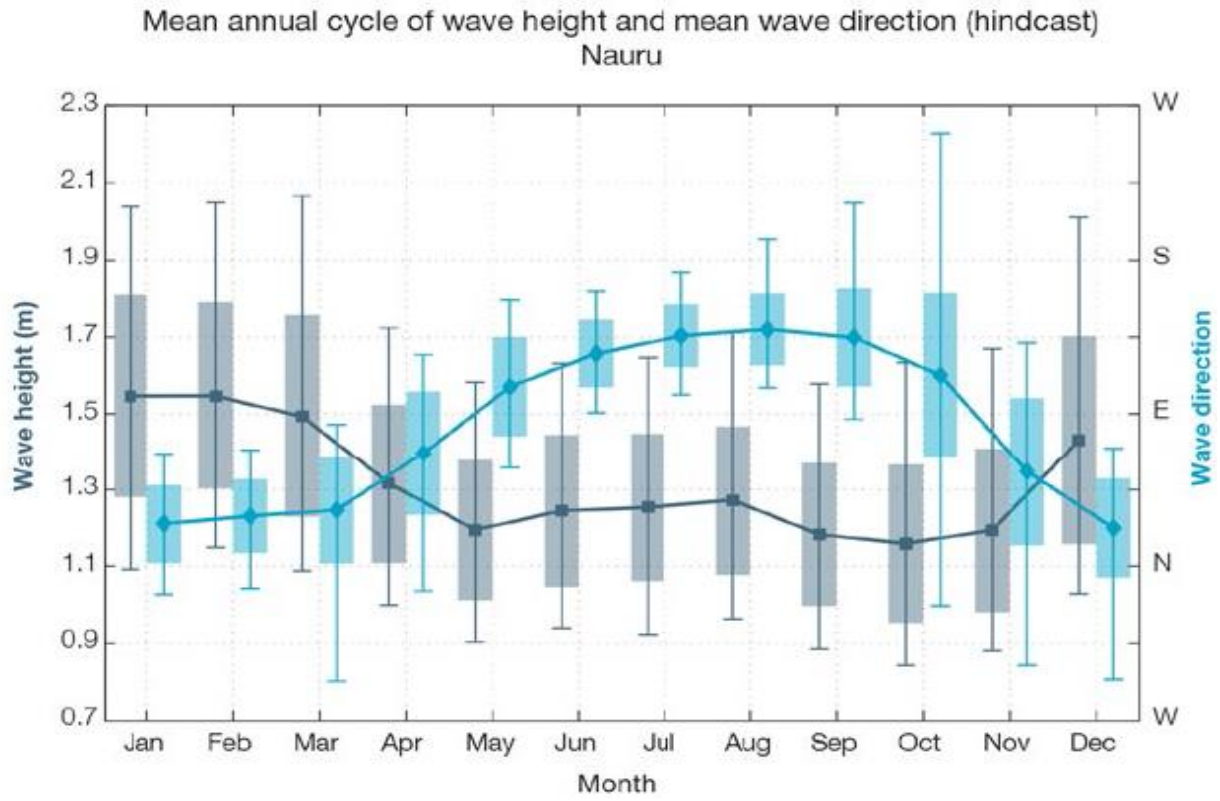
Table 19: Mean wave height, period and direction from which the waves are travelling near Nauru.

		Hindcast Reference Data (1979–2009)	Climate Model Simulations (1986–2005)
Wave Height (metres)	December–March	1.5 (1.1–2.0)	1.7 (1.4–2.0)
	June–September	1.2 (0.9–1.7)	1.2 (1.1–1.4)
Wave Period (seconds)	December–March	9.3 (7.5–11.6)	8.4 (7.5–9.7)
	June–September	8.6 (7.0–10.3)	7.9 (7.1–8.6)
Wave Direction (degrees clockwise from North)	December–March	30 (320–70)	40 (20–60)
	June–September	130 (100–180)	120 (100–140)

Observation (hindcast) and climate model simulation mean values are given with the 5–95th percentile range (in brackets). A compass relating number of degrees to cardinal points (direction) is shown in Table 19.

[11] www.pacific**climate**changescience.org

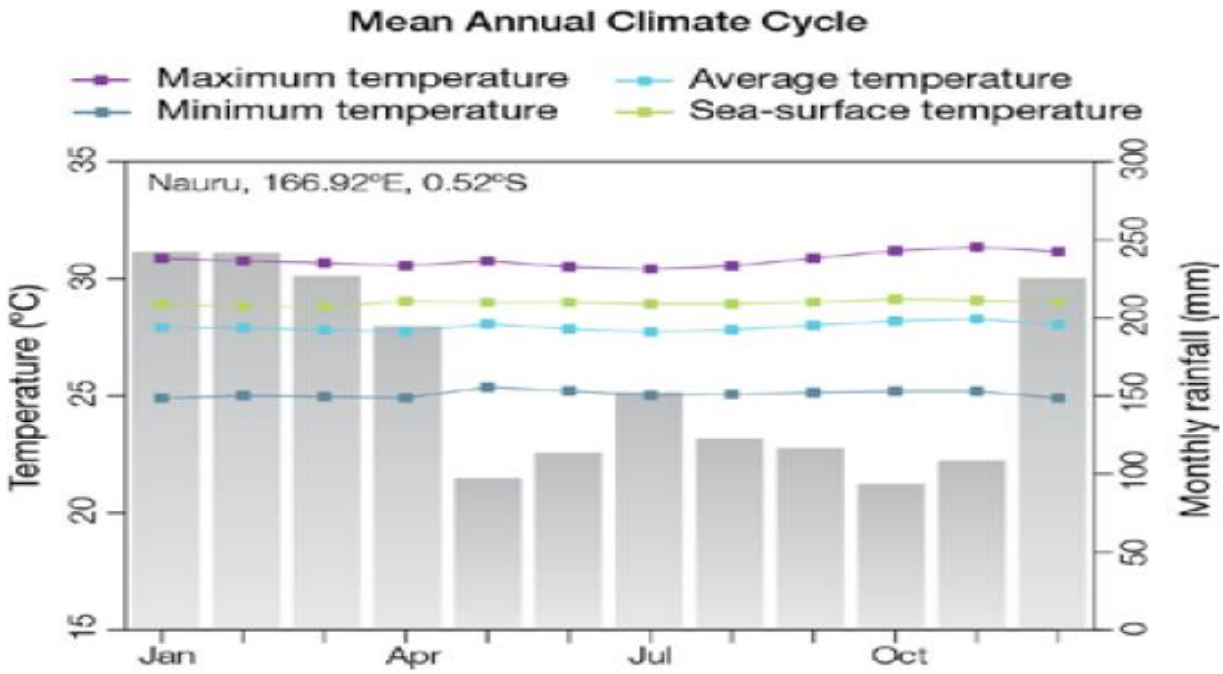
Figure 23: Mean annual cycle of wave height (grey) and mean wave direction (blue) at Nauru in hindcast data (1979–2009)



The wind-wave climate displays strong inter-annual variability at Nauru, varying strongly with the El Niño–Southern Oscillation (ENSO). During La Niña years, wave power is approximately 30% greater than during El Niño years in June–September and waves are more strongly directed from the east year round, associated with increased trade wind speeds.

Nauru has consistent monthly mean air temperatures throughout the year (as shown in figure 24). The air temperatures are closely related to the sea-surface temperatures, which also are fairly constant throughout the year. The wet season usually starts in November and continues to April of the next calendar year. Drier conditions occur during the months of May to October. Rainfall in Nauru is affected by the Inter-tropical Convergence Zone (ITCZ) and the South Pacific Convergence Zone (SPCZ), both the ITCZ, which sits to the north of Nauru for most of the year, and the SPCZ, which sits to the south, bring rainfall to Nauru. The higher rainfall in the wet seasons is caused by the ITCZ moving south and the SPCZ strengthening and expanding north at that time of year.

Figure 24: Mean annual cycle of rainfall (grey bars) and daily maximum, minimum and mean air temperatures at Nauru and local sea-surface temperatures derived from the HadISST dataset[12]



The annual rainfall for Nauru has extremely high variability (standard deviation of 1151 mm) and the main influence on this climate variability is the El Nino Southern Oscillation (ENSO) (as shown in Table 20). During El Nino years, Nauru is warmer and usually much wetter than average, receiving up to 4500 mm of rainfall. La Nina years are associated with a delayed onset of the wet season and drier than normal conditions, often resulting in an extended drought. In some La Nina years, Nauru only receives around 500 mm of rainfall.

Table 20: Correlation coefficients between indices of key large-scale patterns of climate variability and minimum and maximum temperatures (Tmin and Tmax) and rainfall at Nauru. Only correlation coefficients that are statistically significant at the 95% level are shown[13].

Climate feature/index		Dry season (May-October)			Wet season (November-April)		
		Tmin	Tmax	Rain	Tmin	Tmax	Rain
ENSO	Niño3.4			0.76			0.66
	Southern Oscillation Index			-0.77		0.46	-0.62
Interdecadal Pacific Oscillation Index							
ENSO Modoki Index			0.41	0.25			0.66
Number of years of data		29	29	60	28	27	63

Notable inter-annual variability associated with the ENSO is evident from the observed rainfall record since 1927 (Figure 25). Trends in annual and half-year rainfall presented in

[12]Pacific Climate Change Science, Government of Australia, (http://www.pacificclimatechangescience.org/publications/reports/)
[13] Climate Change in the Pacific: Scientific Assessment and New Research Volume 2: Country Reports, www.pacific**climate**changescience.org

Figure 25 and Table 21 are not statistically significant at the 5% level. In other words, annual and half-yearly rainfall trends show little change for Nauru.

Figure 25: Observed time series of annual total rainfall for Nauru. Light blue, dark blue and grey bars denote El Niño, La Niña and neutral years respectively. Solid black trend lines indicate least squares fit.

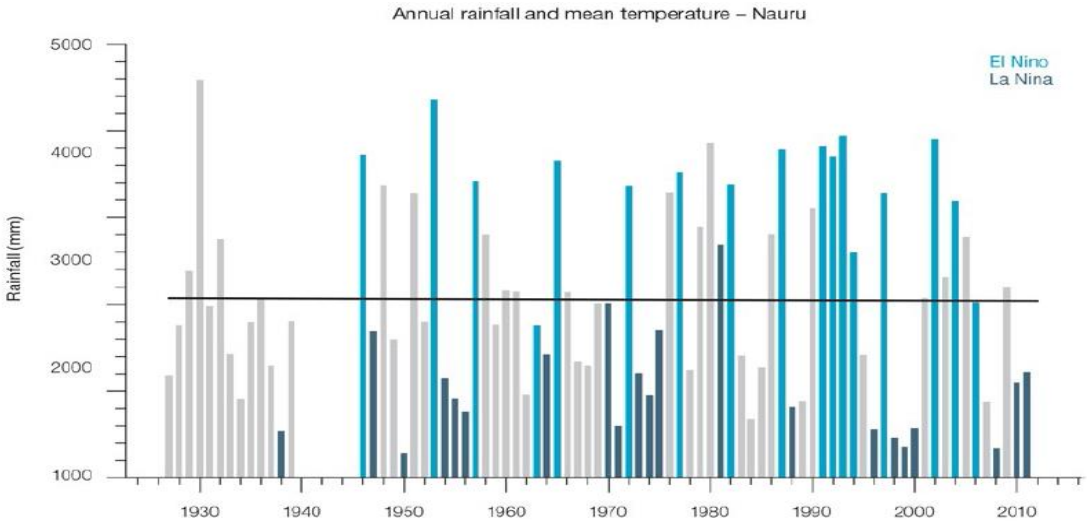


Table 21: Annual and half-year trends in rainfall at Nauru for the period 1927–2011. The 95% confidence intervals are shown in parentheses. None of the trends are significant at the 5% level[14].

	Nauru Total Rain (mm/10yrs)
Annual	-15.1 (-136.9, +115.1)
Nov–Apr	-40.8 (-130.2, +45.6)
May–Oct	+6.6 (-34.1, +59.9)

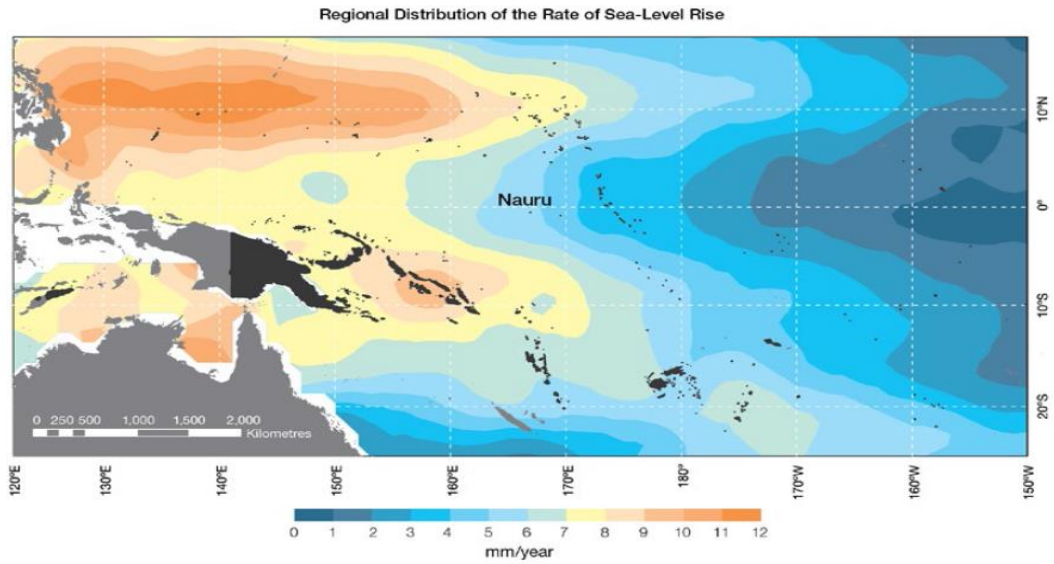
The main climate extremity experienced by Nauru is drought, which can last as long as three years. Tropical cyclone formation within the Nauru Exclusive Economic Zone (EEZ) is highly unlikely due to the islands proximity to the equator. There are no events on record, based on tropical cyclone data available from 1969/70 for the Southern Hemisphere and from 1977 for the Northern Hemisphere.

The sea-level rise near Nauru measured by satellite altimeters since 1993 is about 5 mm per year[15] (Figure 26) slightly higher than the global average of 3.2 ± 0.4 mm per year.

[14]Climate Change in the Pacific: Scientific Assessment and New Research Volume 2 Country Reports, www.pacificclimatechangescience.org

[15] www.pacificclimatechangescience.org

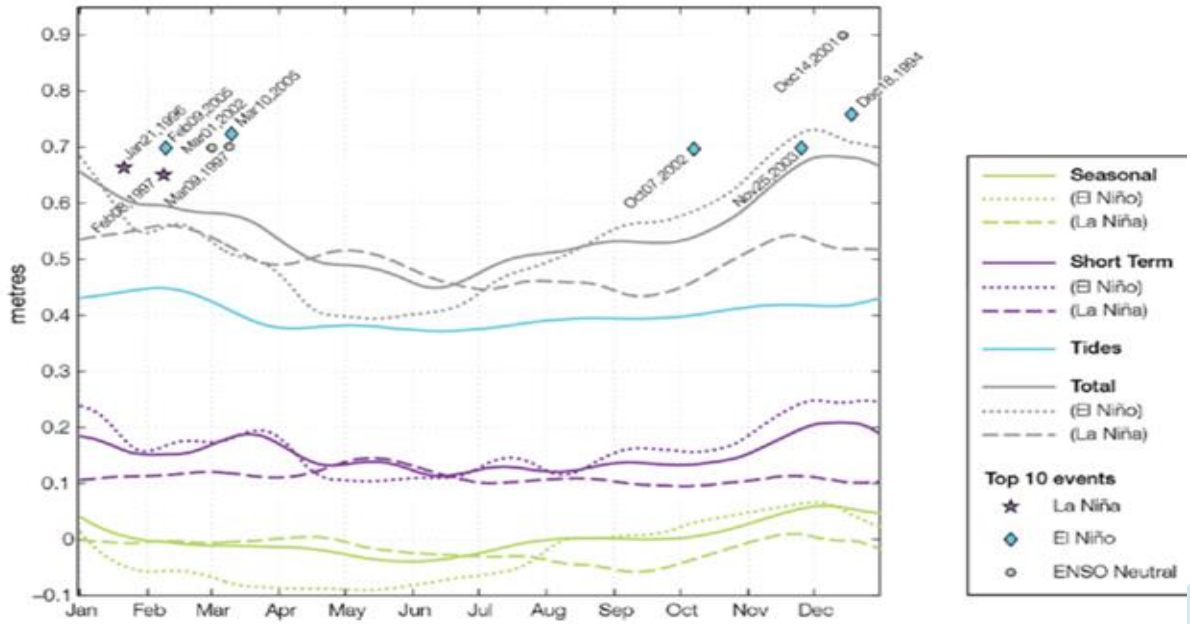
Figure 26: Rate of sea-level rise measured by satellite altimeters from January 1993 to December 2010



The annual climatology of the highest daily sea levels has been evaluated from hourly tide gauge measurements at Nauru (Figure 27). High tides show relatively small variation throughout the year maximising in December and January. There is no variation in the seasonal component of sea level, possibly due to Nauru's near equatorial position (0.5˚S).

The annual cycle of high waters is relative to Mean Higher High Water (MHHW) due to tides, short-term fluctuations (most likely associated with storms) and seasonal variations. The tides and short-term fluctuations are associated with the 95% exceedance levels of the astronomical high tides relative to MHHW and short-term sea level fluctuations. Components computed only for El Nino and La Nina years are shown by dotted and dashed lines, and grey lines are the sum of the tide, short-term and seasonal components. The 10 highest sea-level events in the record relative to MHHW are shown and coded to indicate the phase of ENSO at the time of the extreme event.

Figure 27: High Water Climatology – Nauru (1974 – 2011)

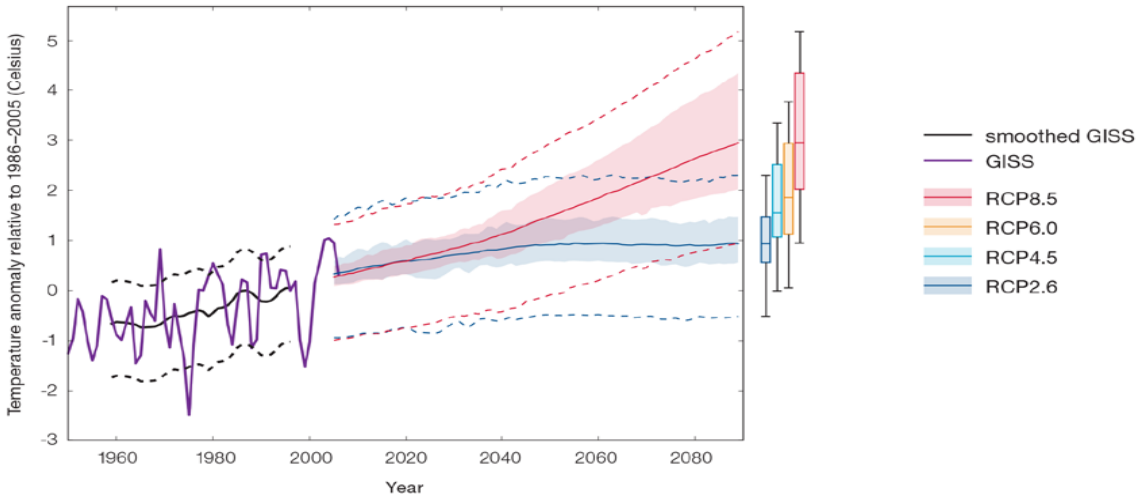


3. Nauru's Climate Projections

The Nauru's future climate projections have been derived from up to 18 global climate models from the CMIP3 database, for up to three emissions scenarios (B1 (low), A1B (medium) and A2 (high)) and three 20-year periods (centred on 2030, 2055 and 2090, relative to 1990). These projections represent an average change over the broad geographic region encompassing the Nauru and the surrounding ocean.

According to the future climate projections, further warming is expected over Nauru (Figure 28, Table 21). Under all RCPs, the warming is up to 1.2°C by 2030, relative to 1995, but after 2030 there is a growing difference in warming between each RCP. For example, in Nauru by 2090, a warming of 2.0 to 4.5°C is projected for RCP8.5 (very high emissions) while a warming of 0.6 to 1.5°C is projected for RCP2.6 (very low emissions). This range is broader than that presented in Australian Bureau of Meteorology and CSIRO (2011) because a wider range of emissions scenarios is considered. While relatively warm and cool years and decades will still occur due to natural variability, there is projected to be more warm years and decades on average in a warmer climate.

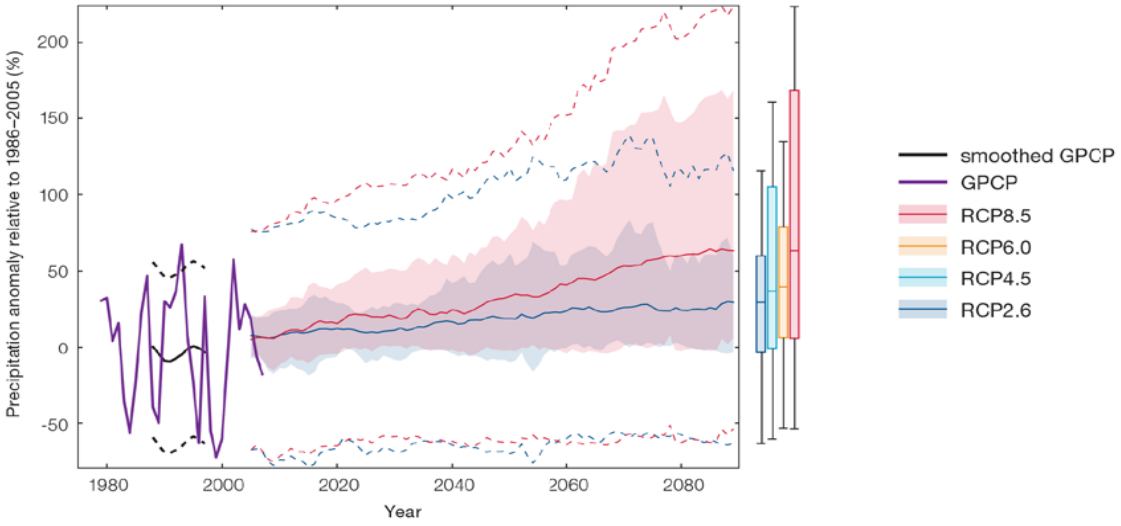
Figure 28: Historical and simulated surface air temperature time series for the region surrounding Nauru



The graph shows the anomaly (from the base period 1986–2005) in surface air temperature from observations (the GISS dataset, in purple), and for the CMIP5 models under the very high (RCP8.5, in red) and very low (RCP2.6, in blue) emissions scenarios. The solid red and blue lines show the smoothed (20-year running average) multi-model mean anomaly in surface air temperature, while shading represents the spread of model values (5–95th percentile). The dashed lines show the 5–95th percentile of the observed inter-annual variability for the observed period (in black) and added to the projections as a visual guide (in red and blue). This indicates that future surface air temperature could be above or below the projected long-term averages due to inter-annual variability. The ranges of projections for a 20-year period centred on 2090 are shown by the bars on the right for RCP8.5, 6.0, 4.5 and 2.6.

An increase in long-term average rainfall is projected by almost all models for Nauru. The increase is greater for the higher emissions scenarios, especially towards the end of the century (Figure 29, Table 21). Models also indicate that the rainfall is expected to increase. The 5–95th percentile range of projected values from CMIP5 climate models is large, e.g. for RCP8.5 (very high emissions) the range is 1 to 52% by 2030 and 6 to 168% by 2090.

Figure 29: Historical and simulated annual average rainfall time series for the region surrounding Nauru



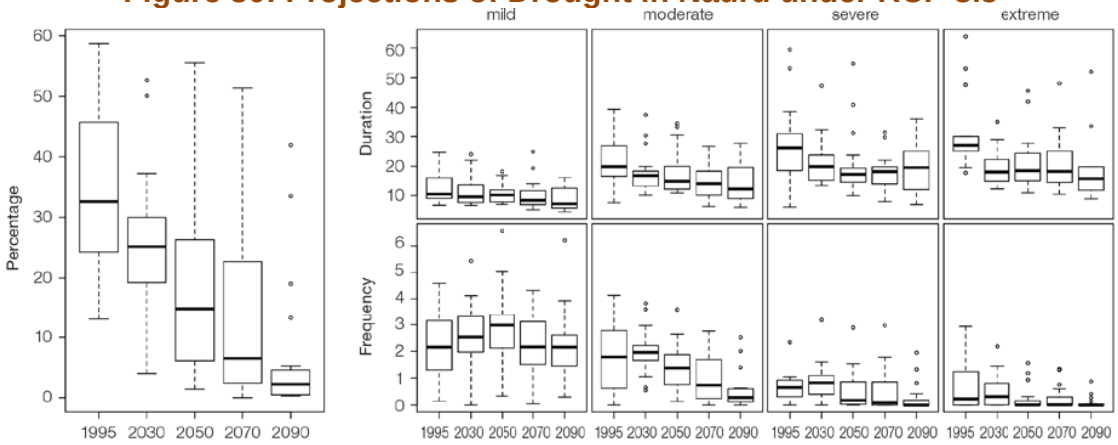
The graph shows the anomaly (from the base period 1986–2005) in rainfall from observations (the GPCP dataset, in purple), and for the CMIP5 models under the very high (RCP8.5, in red) and very low (RCP2.6, in blue) emissions scenarios. The solid red and blue lines show the smoothed (20-year running average) multi-model mean anomaly in rainfall, while shading represents the spread of model values (5–95th percentile). The dashed lines show the 5–95th percentile of the observed interannual variability for the observed period (in black) and added to the projections as a visual guide (in red and blue). This indicates that future rainfall could be above or below the projected long-term averages due to interannual variability. The ranges of projections for a 20-year period centred on 2090 are shown by the bars on the right for RCP8.5, 6.0, 4.5 and 2.6.

The temperature on extremely hot days is projected to increase by about the same amount as average temperature. The temperature of the 1-in-20-year hot day is projected to increase by approximately 0.6°C by 2030 under the RCP2.6 (very low) scenario and by 0.9°C under the RCP8.5 (very high) scenario. By 2090 the projected increase is 0.8°C for RCP2.6 (very low) and 3°C for RCP8.5 (very high).

There is high confidence that the frequency and intensity of extreme rainfall events will increase because: A warmer atmosphere can hold more moisture, so there is greater potential for extreme rainfall (IPCC, 2012); and Increases in extreme rainfall in the Pacific are projected in all available climate models.

For Nauru the overall proportion of time spent in drought is expected to decrease under all scenarios. Under RCP8.5 the frequency of drought in all categories is projected to decrease and the duration of events in all drought categories is projected to stay approximately the same (Figure 30). Under RCP2.6 (very low emissions) the frequency of mild drought is projected

Figure 30: Projections of Drought in Nauru under RCP 8.5



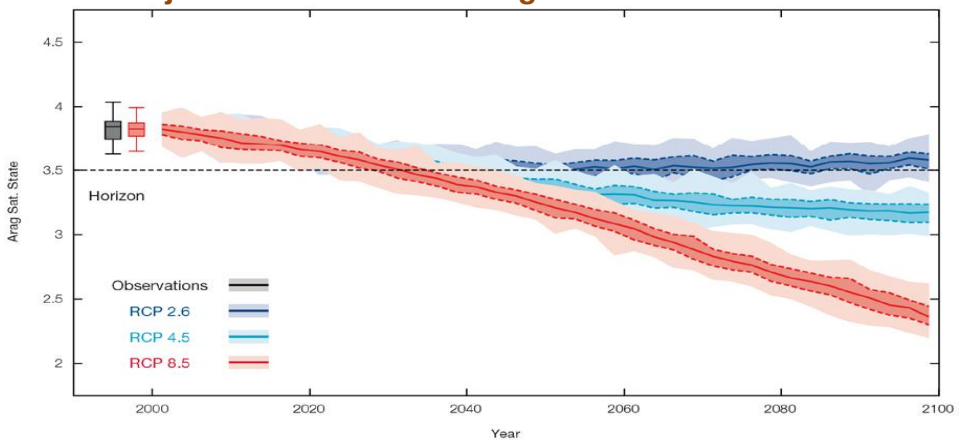
Box-plots showing percent of time in moderate, severe or extreme drought (left hand side), and average drought duration and frequency for the different categories of drought (mild, moderate, severe and extreme) for Nauru. These are shown for 20-year periods centred on 1995, 2030, 2050, 2070 and 2090 for the RCP8.5 (very high emissions) scenario. The thick dark lines show the median of all models, the box shows the interquartile (25–75%) range, the dashed lines show 1.5 times the interquartile range and circles show outlier results.

As atmospheric CO_2 concentrations continue to rise, oceans will warm and continue to acidify. These changes will impact the health and viability of marine ecosystems, including coral reefs that provide many key ecosystem services (high confidence). These impacts are also likely to be compounded by other stressors such as storm damage, fishing pressure and other human impacts

In Nauru the aragonite saturation state has declined from about 4.5 in the late 18th century to an observed value of about 3.9±0.1 by 2000. All models show that the aragonite saturation state, a proxy for coral reef growth rate, will continue to decrease as atmospheric CO_2 concentrations increase. The impacts of ocean acidification are also likely to affect the entire marine ecosystem impacting the key ecosystem services provided by reefs.

Projected decreases in aragonite saturation state in Nauru (Figure 31) from CMIP5 models under RCP2.6, 4.5 and 8.5. Shown are the median values (solid lines), the interquartile range (dashed lines), and 5% and 95% percentiles (light shading). The horizontal line represents the transition to marginal conditions for coral reef health (from Guinotte et al., 2003).

Figure 31: Projected decreases in aragonite saturation state for Nauru



As the ocean warms, the risk of coral bleaching increases (very high confidence). Corals can bleach when they are exposed to elevated temperatures over extended periods. The changes in the frequency (or recurrence) and duration of severe bleaching risk are quantified for different projected SST changes (Table 22).

Table 22: Projected changes in severe coral bleaching risk for the Nauru Exclusive Economic Zone (EEZ) for increases in SST relative to 1982–1999.

Temperature change [1]	Recurrence interval [2]	Duration of the risk event [3]
Change in observed mean	30 years	3.0 weeks
+0.25°C	6.2 years (3.7 months – 13.8 years)	6.7 weeks (2.8 weeks – 3 months)
+0.5°C	2.4 years (2.9 months – 8.1 years)	10.2 weeks (1.4 weeks – 6.6 months)
+0.75°C	1.1 years (0.8 months – 4.5 years)	12.8 weeks (1.3 weeks – 12.5 months)
+1°C	9.9 months (0.8 months – 3.9 years)	4.1 months (1.5 weeks – 2.8 years)
+1.5°C	6.4 months (0.8 months – 2.5 years)	6.9 months (5.2 weeks – 4.7 years)
+2°C	4.7 months (1.1 months – 9.9 months)	13.6 months (5.8 weeks – 6.8 years)

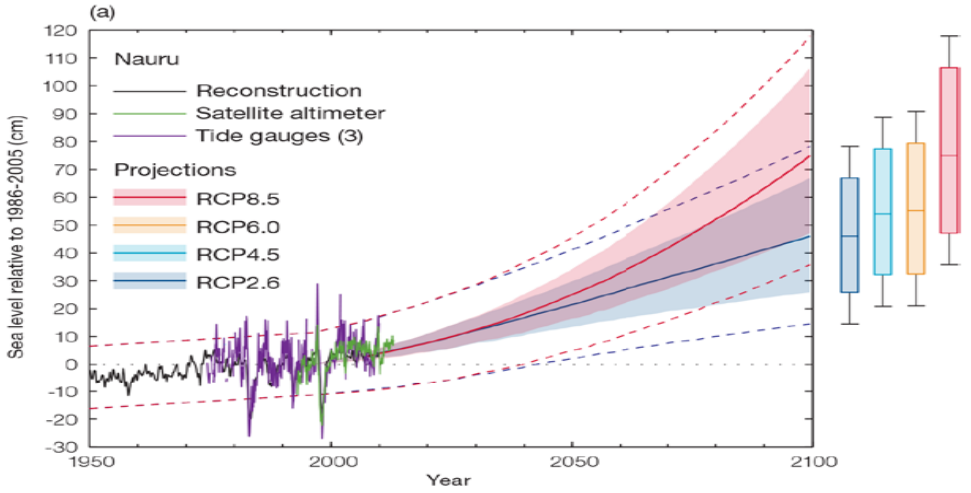
[1] This refers to projected SST anomalies above the mean for 1982–1999.

[2] Recurrence is the mean time between severe coral bleaching risk events. Range (min – max) shown in brackets.

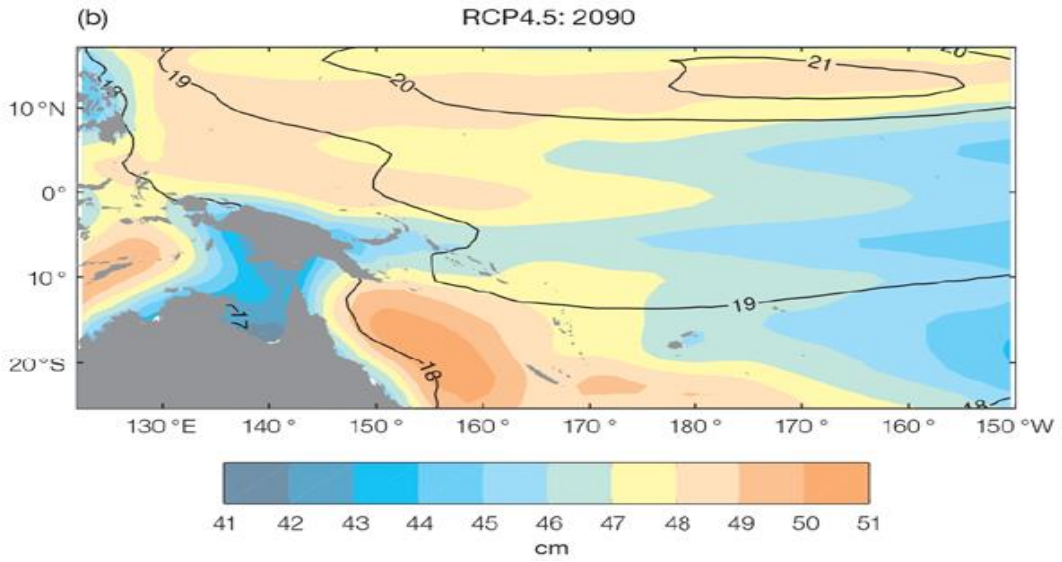
[3] Duration refers to the period of time where coral are exposed to the risk of severe bleaching. Range (min – max) shown in brackets.

Mean sea level is projected to continue to rise over the course of the 21st century. There is very high confidence in the direction of change. The CMIP5 models simulate a rise of between approximately 7–18 cm by 2030 (very similar values for different RCPs), with increases of 41–89 cm by 2090 under the RCP8.5 (Figure 32 and Table 23).

Figure 32: (a) Observed and projected relative sea-level change near Nauru



(a) The observed tide-gauge records of relative sea-level (since the late 1970s) are indicated in purple, and the satellite record (since 1993) in green. The gridded (reconstructed) sea level data at Nauru (since 1950) is shown in black. Multi-model mean projections from 1995–2100 are given for the RCP8.5 (red solid line) and RCP2.6 emissions scenarios (blue solid line), with the 5–95% uncertainty range shown by the red and blue shaded regions. The ranges of projections for four emission scenarios (RCPs 2.6, 4.5, 6.0 and 8.5) by 2100 are also shown by the bars on the right. The dashed lines are an estimate of inter-annual variability in sea level (5–95% uncertainty range about the projections) and indicate that individual monthly averages of sea level can be above or below longer-term averages.



(b) The regional distribution of projected sea level rise under the RCP4.5 emissions scenario for 2081–2100 relative to 1986–2005. Mean projected changes are indicated by the shading, and the estimated uncertainty in the projections is indicated by the contours (in cm).

There is very high confidence in the direction of long-term change in a number of key climate variables, namely an increase in mean and extremely high temperatures, sea level and ocean acidification and the frequency and intensity of extreme rainfall will increase. There is medium confidence that mean rainfall will increase, and medium confidence in a decrease in drought frequency.

Tables 23 and 24 quantify the mean changes and ranges of uncertainty for a number of variables, years and emissions scenarios. A number of factors are considered in assessing confidence, i.e. the type, amount, quality and consistency of evidence (e.g. mechanistic understanding, theory, data, models, expert judgment) and the degree of agreement, following the IPCC guidelines. Confidence ratings in the projected magnitude of mean change are generally lower than those for the direction of change (see paragraph above) because magnitude of change is more difficult to assess. For example, there is very high confidence that temperature will increase, but medium confidence in the magnitude of mean change.

Under four emissions scenarios, RCP2.6 (very low emissions, in dark blue), RCP4.5 (low emissions, in light blue), RCP6 (medium emissions, in orange) and RCP8.5 (very high emissions, in red), projected changes are given for four 20-year periods centred on 2030, 2050, 2070 and 2090, relative to a 20-year period centred on 1995. Values represent the multi-model mean change, with the 5–95% range of uncertainty in brackets. Confidence in the magnitude of change is expressed as high, medium or low. Surface air temperatures in the Pacific are closely related to sea-surface temperatures (SST), so the projected changes to air temperature given in this table 8.4 can be used as a guide to the expected changes to SST.

Table 23: Projected changes in the annual and seasonal mean climate for Nauru

Variable	Season	2030	2050	2070	2090	Confidence (magnitude of change)
Surface air temperature (°C)	Annual	0.7 (0.4 to 1)	0.9 (0.6 to 1.4)	0.9 (0.5 to 1.4)	0.9 (0.6 to 1.5)	*Medium*
		0.7 (0.4 to 1.2)	1.1 (0.6 to 1.5)	1.4 (0.8 to 2.1)	1.5 (1.1 to 2.5)	
		0.7 (0.4 to 1)	1 (0.7 to 1.6)	1.5 (0.9 to 2.3)	1.9 (1.1 to 3)	
		0.9 (0.5 to 1.2)	1.5 (1 to 2.2)	2.3 (1.5 to 3.5)	3 (2 to 4.5)	
Maximum temperature (°C)	1-in-20 year event	0.6 (0.1 to 1.1)	0.7 (0.2 to 1.2)	0.8 (0.4 to 1.4)	0.8 (0.4 to 1.3)	*Medium*
		0.6 (0.2 to 0.9)	0.9 (0.5 to 1.3)	1.2 (0.6 to 1.8)	1.4 (0.8 to 2.2)	
		NA (NA to NA)	NA (NA to NA)	NA (NA to NA)	NA (NA to NA)	
		0.9 (0.4 to 1.2)	1.5 (0.8 to 2.4)	2.3 (1.4 to 3.5)	3 (1.9 to 4.4)	
Minimum temperature (°C)	1-in-20 year event	0.7 (0.3 to 1)	0.8 (0 to 1.6)	0.8 (0.2 to 1.6)	0.8 (0.4 to 1.2)	*Medium*
		0.6 (0.2 to 0.9)	1 (0.6 to 1.3)	1.2 (0.6 to 1.6)	1.4 (0.8 to 2.1)	
		NA (NA to NA)	NA (NA to NA)	NA (NA to NA)	NA (NA to NA)	
		0.8 (0.4 to 1.3)	1.5 (0.8 to 2.8)	2.4 (1.5 to 3.6)	3 (2 to 4.3)	
Total rainfall (%)	Annual	11 (-7 to 27)	19 (-9 to 56)	25 (5 to 72)	30 (-4 to 60)	*Low*
		18 (2 to 40)	24 (1 to 61)	33 (0 to 84)	37 (-1 to 105)	
		18 (-1 to 38)	26 (2 to 49)	29 (4 to 65)	40 (6 to 79)	
		21 (1 to 52)	32 (-3 to 69)	52 (-2 to 142)	63 (6 to 168)	
Total rainfall (%)	Nov-Apr	7 (-16 to 27)	16 (-17 to 47)	21 (-8 to 59)	28 (-9 to 60)	*Low*
		15 (-4 to 41)	19 (-7 to 50)	26 (-3 to 65)	27 (-7 to 90)	
		18 (-3 to 46)	24 (-11 to 50)	25 (-11 to 57)	34 (-12 to 83)	
		13 (-4 to 32)	26 (-12 to 74)	35 (-12 to 105)	45 (-7 to 139)	
Total rainfall (%)	May-Oct	16 (-1 to 51)	24 (-4 to 63)	31 (-3 to 93)	31 (-2 to 76)	*Low*
		22 (-1 to 50)	32 (3 to 108)	43 (0 to 128)	48 (10 to 143)	
		17 (-8 to 43)	28 (-7 to 73)	33 (-4 to 80)	48 (8 to 100)	
		32 (5 to 90)	41 (7 to 107)	73 (2 to 212)	86 (3 to 202)	
Aragonite saturation state (Ωar)	Annual	-0.3 (-0.6 to -0.1)	-0.4 (-0.7 to -0.1)	-0.4 (-0.6 to -0.1)	-0.3 (-0.6 to -0.1)	*Medium*
		-0.3 (-0.6 to 0.0)	-0.5 (-0.8 to -0.2)	-0.6 (-0.9 to -0.4)	-0.7 (-1.0 to -0.4)	
		NA (NA to NA)	NA (NA to NA)	NA (NA to NA)	NA (NA to NA)	
		-0.3 (-0.6 to -0.1)	-0.6 (-0.9 to -0.4)	-1.0 (-1.3 to -0.7)	-1.4 (-1.6 to -1.1)	
Mean sea level (cm)	Annual	12 (8–17)	22 (14–30)	32 (19–45)	42 (24–60)	*Medium*
		12 (7–17)	22 (14–31)	35 (22–48)	48 (29–68)	
		12 (7–16)	22 (14–30)	34 (21–48)	49 (30–69)	
		13 (8–18)	25 (17–34)	42 (28–58)	63 (41–89)	

Projected average changes in wave height, period and direction at Nauru (Table 24) for December–March and June–September for RCP4.5 (low emissions, in blue) and RCP8.5 (very high emissions, in red), for two 20-year periods (2026–2045 and 2081–2100), relative to a 1986–2005 historical period. The values in brackets represent the 5th to 95th percentile range of uncertainty. Wind-wave variables parameters are calculated for a 20-year period centred on 2035.

Table 24: Waves Projections near Nauru

Variable	Season	2035	2090	Confidence (range)
Wave height change (m)	December–March	-0.0 (-0.2 to 0.2) -0.1 (-0.3 to 0.1)	-0.1 (-0.2 to 0.1) -0.2 (-0.3 to -0.1)	*Low*
	June–September	+0.0 (-0.1 to 0.1) +0.0 (-0.1 to 0.1)	0.0 (-0.1 to 0.1) +0.0 (-0.1 to 0.1)	*Low*
Wave period change (s)	December–March	-0.0(-1.1 to 1.0) -0.1 (-1.1 to 1.0)	-0.1 (-1.2 to 1.1) -0.2 (-1.3 to 1.0)	*Low*
	June–September	+0.0 (-0.6 to 0.7) 0.0 (-0.6 to 0.6)	0.0 (-0.7 to 0.7) -0.1 (-0.8 to 0.6)	*Low*
Wave direction change (° clockwise)	December–March	0 (-10 to 10) 0 (-10 to 10)	0 (-10 to 10) 0 (-10 to 10)	*Low*
	June–September	+0 (-10 to 20) +0 (-10 to 20)	+0 (-10 to 20) +10 (-10 to 30)	*Low*

4. Sector Assessment and Strategic Activities

The Government of Nauru recognises that effective institutions and the inter-relationships between them are at the heart of its ability to respond to growing climate and disaster risks. For this reason, the Department of Environment under the Ministry of Commerce, Industry and Environment (CIE), Government of Republic of Nauru (GoN) has primary responsibility for coordination of Nauru's climate change activities. CIE includes a Climate Change Unit as well as a National Disaster Risk Management (NDRM) Unit.

As the National Sustainable Development Strategy (NSDS) highlights, Nauru already struggles with the challenges of ensuring sustainable social and economic development. A scarcity of arable land and fresh water resources, geographic isolation, dependence on imports for meeting basic food and energy needs, environmental degradation and the emergence of chronic health problems all make achieving sustainable development a difficult task, and at the same time also create vulnerability to other stresses, such as those brought on by climate change and disasters.

Against this background, climate variability and climate change have the potential to make Nauru's efforts to secure sustainable development even more challenging. Sea level rise threatens to increase saltwater intrusion into precious groundwater reserves as well as to exacerbate coastal erosion and flooding during storm events, changes in rainfall patterns will likely affect water scarcity, while important fish resources may be affected by changes in ocean temperature and acidification.

The Republic of Nauru Framework for Climate Change Adaptation and Disaster Risk Reduction (RONAdapt) – represents the Government of Nauru's response to the risks to sustainable development posed by climate change and disasters. RONAdapt is intended to support progress towards the country's national development priorities and the goal of environmental sustainability, by ensuring that a focus on reducing vulnerabilities and risks is incorporated into planning and activities across all sectors of the economy and society. The priority actions identified here are not intended to be an exhaustive list of CCA and DRR needs.

The priorities outlined in the RONAdapt are intended to contribute to the achievement of the National Sustainable Development Strategy (NSDS) and to increasing Nauru's resilience to climate change and disasters, by targeting the following goals:

1. Water security
2. Energy security
3. Food security
4. A healthy environment
5. A healthy people
6. Productive, secure land resources

The table 25 below provides an overview of the prioritised high-level strategies for addressing Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR) in each sector.

Table 25: Overview of the RONAdapt's priority CCA and DRR actions

Sector	Strategy
Water	➢ Fill information gaps and increase access to baseline information about the water sector ➢ Increase water supply and storage capacity ➢ Reduce water demand through appropriate conservation measures ➢ Rehabilitate and protect groundwater resources ➢ Disaster and contingency management for water sector
Health	➢ Fill key knowledge and awareness gaps to reduce community health risks, including those relating to the impacts of climate change ➢ Reduce chronic health problems of the community ➢ Expand environmental monitoring capacity ➢ Build human capacity of health services ➢ Secure key health infrastructure and services against extreme events
Agriculture	➢ Improve water security for agricultural needs ➢ Increase household engagement with agriculture and livestock and improve grower skills and practices
Fisheries and marine resources	➢ Fill knowledge gaps – Identify and document vulnerable fisheries and marine resources ➢ Support a community based ecosystem approach to fisheries management (CEAFM) ➢ Promote aquaculture as an important contributor to food security that can reduce pressure on coastal fisheries ➢ Strengthen the human capacity of government and community stakeholders
Disaster management and emergency response	➢ Improve community preparedness and response systems ➢ Fill knowledge gaps and ensure equitable access to information
Energy	➢ Reduce electricity demand for water ➢ Expand renewable energy capacity ➢ Reduce transport fuel use while ensuring mobility ➢ Improve local capacity for managing and maintaining a sustainable energy sector ➢ Reduce risk of major fire outbreak at tank farm
Land management and rehabilitation	➢ Increase availability and productivity of land resources ➢ Improve waste management to reduce land degradation and contamination risks
Infrastructure and coastal protection	➢ Reduce coastal risks to key infrastructure ➢ Reduce flooding occurrence and intensity
Biodiversity and environment	➢ Designate areas for conservation of biodiversity ➢ Protection of flora and fauna, through control of invasive species

Community development	➢ Take greater account of gender in planning ➢ Implement community development strategies of the Ministry of Home Affairs, relating to women and youth, family services, preservation of cultural resources, and livelihood development
Education and human development	➢ Skills transfer to local Nauruans during development projects

4.1. Water

Water resources in Nauru are a precious commodity, and water scarcity a major challenge. Communities rely on a combination of expensive treated seawater from reverse osmosis desalination plants (which is delivered to households by trucks since there is no water reticulation system), rainwater and in some areas groundwater. Rainwater collection and use is limited by frequent droughts and insufficient rainwater capture and storage facilities, while much of the available groundwater has been contaminated either as a side effect of phosphate mining or by leakage of sewage from septic systems, making it unsuitable for human consumption and even in some cases for agricultural use. Water quality from both sources has proved difficult to maintain, and water-borne illnesses including diarrhoea and skin and eye diseases are commonly observed. Treated seawater is expensive to produce and supply is also constrained by the limited national storage capacity. Further, the desalination plants are energy-intensive which means that high demand for treated water presents a financial burden on the government and increases Nauru's vulnerability to international oil prices.

Climate change and disasters will exacerbate these existing challenges of meeting demand for potable water, posing threats to basic livelihoods and constraining opportunities for economic development. Projections indicate Nauru may receive more rainfall in future, but within shorter periods of intense rain. With present infrastructure, this could result in less overall rainwater harvesting due to storage capacity constraints at the household and community level. Sea level rise and storm surges are likely to further inundate coastal groundwater, making it less suitable for human use. Disaster events such as storm surges could, for example, threaten key water infrastructure which tends to be located in the low-lying coastal zone (e.g. desalination plant, storage tanks, roads for household water deliveries), while the need to extinguish fires during dry periods means precious water resources are diverted away from households and businesses.

From a disaster perspective, the key water concern in Nauru is drought, and loss of secure water for key services such as the hospital. During periods where there is little or no rain for more than 3 months, Nauru's water supply situation deteriorates dramatically, and production capacity becomes stressed. If the RO units break down during drought periods, Nauru faces a social and health disaster.

Enhancing water security is therefore both a key national development priority and also fundamental to reducing vulnerability to climate change and to potential disaster events.

The *Nauru Water, Sanitation and Hygiene Policy* (NWSHP) 2012 aims to establish "reliable, safe, affordable, secure, efficient and sustainable water supply", accounting for current and future risks to water resources. Successful implementation of the priority goals and strategies described in the associated *Nauru Water, Sanitation and Hygiene Implementation Plan* (NWSHIP) 2012 will significantly boost Nauru's resilience to climate change.

Table 26 details the goal and targeted outcomes of priority activities for the water sector with respect to climate change adaptation and disaster risk reduction. These activities are guided by the NWSHIP, which indicates that highest priority actions should include increasing RO production capacity as well as improving the state of household water and sanitation infrastructure.

Table 26: CCA and DRR priorities the water sector[16]

Strategy	Activities	Lead
Fill information gaps and increase access to baseline information about the water sector	Conduct a **National Water Audit**, including assessment and mapping of current resources (including groundwater) and their sustainable yield, quality and fit-for-purpose uses. Set up a coordinated **water resources and sanitation monitoring and reporting system**, linked to a centralised, publicly accessible national water resources, sanitation and hygiene data base. Establish a system for regular and ongoing data collection, to update and report on water demand by different sectors from all sources. This includes collecting, storing and analysing data on rainfall and rainwater harvesting.	CIE
Increase water supply and storage capacity	Prepare a 20-year **infrastructure investment, maintenance and replacement program** (Water and Sanitation Master Plan), including consideration of water treatment needs. This will identify key needs, however some known priorities (i.e. “no regrets” actions) are as follows. Increase **production capacity of the reverse osmosis units**, which is critical during droughts. Increase capacity for public rainwater collection and storage, through **targeted investments in new public rainwater infrastructure**, at community and national level (for example, use of airstrip as water catchment, rainwater collection infrastructure on Topside). Increased rainwater harvesting will reduce the financial and environmental (energy-related emissions) costs associated with desalination plants. Develop and implement a **program to reduce unaccounted-for water and water losses** from desalination system **Augment national water storage capacity**, in order to be used for storage of treated water from desalination plants.	CIE, NUC
Reduce water demand	Introduce **incentive programs and technologies for water use efficiency** at the household and business level (e.g. retrofit households with water efficient devices) Amend **water pricing regime** to increase cost recovery for water supply Develop a **public education, communication and**	CIE, NUC

[16] Republic of Nauru Framework for Climate Change Adaptation and Disaster Risk Reduction (RONAdapt), September, 2104

	behaviour change strategy around water use issues, to increase capacity, raise awareness and encourage participation in conserving and protecting water sources. This includes, for example, **establishment of local district water, hygiene and sanitation sub-committees**.	
Rehabilitate and protect groundwater resources	Introduce **incentive programs for moving to improved sanitation systems** that minimise groundwater pollution and reduce the use of potable water for flushing	CIE, MoH
Disaster and contingency management for water sector	Develop **early warning system for extreme seasonal weather** and climate events relevant to water supply, such as changes in the ENSO system. These will enable communities to take action to, for instance, store water ahead of projected dry periods, or clean rainwater systems ahead of project wet periods.	NUC, NDRMO

The Department of CIE is responsible for coordinating implementation of these priority actions as resources become available, though individual components require leadership from other parts of government and from other stakeholders, including NUC who are responsible for water production and delivery.

Institutional strengthening and mainstreaming

Under the water sector, there are also some important policy and planning gaps that need to be filled, specifically:

- Development of a 20-year Water and Sanitation Master Plan to guide planning, including investment in and maintenance of infrastructure, and which specifically integrates climate variability, climate change and disaster risk considerations.
- Finalisation and endorsement of the Drought Management Strategy. The strategy should link to the NWSHP and the DRM Plan.

4.2. Health

Major health issues in Nauru include non-communicable diseases (NCDs) and water-borne illnesses. Nauru has very high rates of NCDs including cardiovascular disease, diabetes, cancer and respiratory diseases. According to the Nauru NCD Risk Factors Report,[17] Nauru has the poorest health indicators for NCDs in the Pacific region, and these are the most important drivers of morbidity and mortality in Nauru.[18] The majority of hospital admissions in Nauru are due to diabetes and associated complications, while life expectancy is among the lowest in the Pacific region and has declined over the last two decades. The prevalence of NCDs is linked to obesity, smoking, low levels of physical activity and poor nutrition. NCDs are a significant burden on communities and the government, and by making people more vulnerable to heat and water stress, for instance, they also make people more vulnerable to future climate change. Therefore, tackling the underlying drivers of NCDs is a priority. A NCD Action Plan was drafted in 2004.

Water-borne illnesses are also a major issue, especially following flooding during heavy rains. In the health sector, priority actions to tackle this include improved community education and behaviour change campaigns to reduce exposure pathways. Priority actions

[17] *Nauru NCD Risk Factors STEPS report*, Republic of Nauru and the World Health Organisation, 2007. http://www.who.int/chp/steps/Printed_STEPS_Report_Nauru.pdf s

[18] The *National Health Strategic Plan* (2010-2015) cites NCD's as the cause of 79% of deaths on the island (MoH, 2010).

in other sectors can also contribute to reducing water borne-illness, for instance the provision of better drainage infrastructure to reduce the occurrence of flooding around settlements, and improved sanitation systems to reduce contamination of water.

There is currently no functioning Health Information System. Previous patient records have been damaged in a series of accidents, while the health indicator monitoring conducted by District Primary Health Care workers (i.e. health profiles for communities) should be updated centrally but there is currently have no system for this. This means Nauru has limited capacity for developing and maintaining a disease surveillance system to provide early warning and timely interpreted data to support response planning to epidemics and pandemics such as influenza.

Nauru's small population and distance from other countries also presents challenges in providing quality, cost effective health care. Supply lines are not always reliable, key services such as water and energy are at times disrupted, and health infrastructure (including both hospitals) are subject to coastal flooding risks. Lack of local capacity is an additional constraint to improved health outcomes. In the absence of formal health worker training on Nauru, the provision of health and medical services is highly dependent on expatriate staff.

Climate change and extreme events are anticipated to introduce additional stresses, both to community health as well as to the functioning of the health care system.

- According to the World Health Organisation (WHO, 2009), globally climate change and natural disasters increase the threats of: communicable and non-communicable diseases, including vector-borne, water-borne and food-borne diseases; injuries and deaths from extreme weather events; compromised food security and malnutrition; and mental health impacts of, among other things, loss of livelihoods and climate change-induced population displacement.
- As part of developing the draft *Nauru Climate Change and Health Action Plan* (NCCHAP, 2012), an assessment was conducted of climate-sensitive health risks in Nauru, including consideration of the baseline burden of climate-sensitive diseases. The main climate change impacts on health were assessed as being mainly through drought and associated diarrheal diseases and worsening food security conditions leading to poorer nutrition and exacerbating existing challenges in combating NCDs. In addition, climate change and disasters also present risks to health infrastructure.
- From a disaster perspective, the greatest risk to the health sector are (i) possible relocation needs during extreme events such as fire, tsunami or major flooding (in particular, the ability of hospitals continue to deliver daily treatments, such as to dialysis patients, if physical relocation of patients is required) and (ii) supply chain disruptions are a threat to medical treatment (medicines, energy, water).

Table 27 details priority activities for the health sector related to climate change adaptation and disaster risk reduction.

Table 27: Priority CCA and DRR activities for the health sector

Strategy	Activity	Lead
Fill key knowledge and awareness gaps to reduce community health risks, including those relating to the impacts of climate change	Undertake an **epidemiological study of the expected changes in climate-sensitive diseases** in Nauru (e.g. dengue fever, diarrhoeal disease) Strengthen **health-related information systems** (data collection, collation, analysis) and improving staff capacity in the areas of biostatistics and epidemiology Progress **community education, health promotion and awareness-raising**, integrating climate and disasters-related health issues.	MoH
Reduce chronic health problems of the community	Implement **NCD Action Plan**	MoH
Expand environmental monitoring capacity	Establish a **vector-borne disease control unit** under the Environmental Health unit. Introduce monitoring and surveillance of climate- and disaster-related health risks, including of key illness/disease vectors: • Water quality – at households, and in Buada lagoon, which is a resource for aquaculture • Mosquitoes – indicates potential for major outbreaks of diseases such as dengue • Food – contamination as a result of polluted water, introduction of illegal foods to Nauru through quarantine • Ocean temperatures and incidence of marine toxins, to warn of possible outbreaks of ciguatera in reef fish • Mycotoxins and pathogens in aquaculture/fisheries, in areas at risk of contamination during extreme rainfall events or as a result of leachate from waste disposal • Animals – disease testing as needed (e.g. migratory birds are a vector for the introduction of new diseases)	MoH, CIE DoA, Fisheries
Build human capacity of health services	**Train health officials** in identifying symptoms and early treatment options for water-borne diseases	MoH, CIE
Secure key health infrastructure and services against extreme events	Develop/update (if needed) **emergency management plan that addresses critical health sector needs** (e.g. water for dialysis patients during extreme events, critical patient relocation) Conduct **training programmes and information campaigns on emergency management** for health sector staff	MoH, NRC, MoE, NDRMO

The Ministry of Health is responsible for overseeing implementation of these priority actions as resources become available, though individual components require direction from other stakeholders.

Institutional strengthening and mainstreaming

In addition to the above, there is a need to build local capacity of the health sector to prepare and cope with adverse effects of climate change and vulnerability of disasters. There are also some important policy and planning gaps that need to be filled, specifically:

- Endorsement of the 2009 *Public Health Bill*, which is currently still in draft form;
- Finalisation and endorsement of the NCCHAP;
- Incorporation of climate change and disaster related considerations into the upcoming revision of the *National Health Strategic Plan*;
- Finalisation and endorsement of the *Food Safety Regulations*, to give regulatory backing to the *Food Safety Act*; and
- Updating and endorsement of a revised *Environment Act*.

4.3. Agriculture

Food insecurity is a major risk for Nauru, given the island's dependence on imported foods and its geographic isolation. This situation is also closely linked with health problems such as the prevalence of NCDs, and is exacerbated by government debt and household income levels which make imported foods expensive and supply unsteady. For these reasons, agricultural development is targeted by the NSDS as a priority.

Agricultural production is relatively small at present, and is constrained by limited availability of suitable land and water, and by limited expertise and interest in growing food and raising livestock. The island's soil is relatively infertile and has poor water holding capacity while in some areas is also contaminated. In addition, the land tenure system means land ownership is fragmented and little is publicly owned, which increases the complexity of land management. What little fertile land remains untouched by mining is in the coastal strip, and thus in small parcels around houses.

Most agricultural activity in Nauru is carried out by individual households on family land. According to the most recent census, 13% of households (more than 250 in total) grow food of some kind, though diversity and volumes are low. The most common food grown is paw paw (10% of households), followed by bread fruit (6%) and pumpkin and cabbage. There is no commercial agriculture. In recent years the government has initiated a "grow and green" programme to encourage households to participate in agriculture, through planting of fruit trees and vegetables including breadfruit, lime, coconut, pawpaw, soursop and mango. Also, the ROC-Taiwan Technical Mission (TTM) has been supporting the development of kitchen gardens; water distribution during drought; livestock; egg production; and training in best practices (i.e. mulching, cover cropping, composting, waste management, transplanting) to facilitate growth of crops such as cucumber, cabbage, watermelon, pumpkin and cherry tomato. The TTM has developed two small farms – for horticulture and livestock, respectively – to demonstrate farming techniques and trailing of vegetable cultivars. The two farms are expected to be handed over to the government in the future.

Climate change adds to the already significant challenge of attaining the NSDS goal of increasing domestic agricultural production. Climate variability driven by the ENSO also makes stable agricultural production a challenge; the prolonged droughts that are a feature of La Niña conditions can limit the type of crops that can be grown, while extreme rainfall events during El Niño periods can lead to crop losses through water logging and soil erosion.

Despite these constraints, there is potential to increase agriculture production and productivity, and in doing so strengthen food security and improve livelihoods and health, thus contributing to Nauru's efforts to reduce vulnerability to future climate change. The

NSDS emphasises four strategic actions namely: developing local food and agricultural production initiatives such as kitchen gardens, fruit tree planting and root cropping; promoting production of value-added forestry and agro-forestry products for domestic consumption; promoting viable piggeries and duck and poultry production (including for eggs) and agricultural businesses; and setting up a resource centre on agricultural and livestock production.

The *Strategic Plan for the Sustainable Development of Agriculture in Nauru (2007-2017)* (SPSDAg) developed with assistance of FAO, is the first step in the government's efforts to strengthen agriculture development and promote greater self-sufficiency and food security. The policy goals and strategies of the SPSDAg include the ambition of significantly increasing the quantity of locally grown agricultural produce, as a means to improve food security and simultaneously improve community nutrition. To accomplish this, it highlights the need to expand dedicated water storage facilities and promote water-efficient irrigation techniques, to cultivate partnerships between growers, government and donors, to build local capacity, and to strengthen policy and regulatory frameworks for the agriculture sector, as well as governance frameworks.

Improving water security specifically for agricultural production is a key need, particularly since previous initiatives such as Grow and Green have stalled because of inadequate water. Water security for agriculture is also an important strategy from a disaster risk reduction perspective, since a healthy agricultural sector reduces the risk of food insecurity and shortages.

Table 28 details priority CCA and DRR activities for the agriculture sector; Overall, food security is a major concern in Nauru, while agricultural production is small and not well established. Our priorities, therefore, focus on encouraging greater smallholder participation in crop and livestock production (rather than commercial scale), and boosting skills in these areas.

Table 28: Priority CCA and DRR actions for the agriculture sector

Strategy	Activity	Lead
Improve water security for agricultural needs	Invest in **dedicated water storage** to ensure supplies available during drought periods (water for agriculture is otherwise a low priority during water shortages) Introduce **more efficient water use** practices, including simple irrigation systems such as "bucket irrigation" and the use of recycled and grey water for irrigation of kitchen gardens Introduce and **promote drought tolerant crop** varieties. Encourage use of **shade for crops** where appropriate, to reduce evaporation and hence water stress	CIE, NUC
Increase household engagement with agriculture and livestock	Support community and household **education and training in kitchen gardening** (including through the school curriculum) Encourage house-hold **production of livestock (pigs and chickens)** for meat and eggs, and improved livestock husbandry practices to cope with the effects of drought Encourage **greater consumption of local produce**, through community awareness and behaviour change campaigns.	CIE
Improve grower skills and	Engage growers in the **documenting of best practice** examples. Include guidance on the use of composting	CIE

practices, to increase productivity and make crops less vulnerable to extreme events such as drought	and mulching to improve soil fertility and moisture retention, incorporate knowledge from traditional practices, and management options for responding to extreme events such as droughts or heavy rainfall periods. Encourage further **development of nurseries** to propagate planting material and improve growing stock by nurturing and distributing appropriate crop varieties (e.g drought tolerant plant varieties). Improve **seasonal forecasting** and grower access to weather and climate information to enable growers to adapt the type or variety of crop planted.	

The Division of Agriculture under department of CIE has primary responsibility for supporting agricultural development from subsistence to small scale farming, and is the lead agency responsible for overseeing implementation of the agriculture sector's priority CCA and DRR actions.

Institutional strengthening and mainstreaming

The institutional and human capacity available in Nauru to support and expand agricultural development is limited and needs to be expanded:

- Human capacity within both government and the community requires dedicated skills training programs in agricultural production and management. Skills development is a near-term priority, since implementation of other activities depends on this.
- The *Strategic Plan for the Sustainable Development of Agriculture in Nauru (2007-2017)* should be reviewed and updated.
- Food Safety regulations need endorsement (as mentioned in the Health section), to protect agriculture in Nauru from pests. Fruit fly incursions have previously destroyed crops, and improved inspection and quarantine practices will help protect Nauru from further incursions.[19]
- Development of a Waste Management Policy for agriculture, particularly for livestock waste which needs addressing if greater production is to be encouraged.

4.4. Fisheries and Marine

Fisheries are a critically important resource in Nauru, contributing to food security and cultural practices (particularly in low income households) as well as providing an important source of foreign revenue for government. Foreign fleets licensed to fish in Nauru's exclusive economic zone (EEZ) made average annual catches of 63,000 tonnes between 1999 and 2008, worth USD 52 million. Revenue from the sale of fishing licenses are an important contributor to the annual government budget. By contrast, Nauru has only a very small local fishery for tuna within its EEZ. Greater capitalisation of the economic benefits from fishing beyond the territorial sea should be pursued, since at present Nauru receives only a fraction of the value of this resource.[20]

Coastal fisheries are made up mainly of three categories: demersal fish (bottom-dwelling fish associated with coral reef habitats), near-shore pelagic fish (including tuna, rainbow runner, wahoo and mahi-mahi), and invertebrates gleaned from intertidal and sub-tidal areas.

[19] *Situation Analysis and Agriculture Sector Overview*. Report by the Food and Agriculture Organisation (FAO). http://www.fao.org/fileadmin/user_upload/sap/docs/Nauru.pdf

[20] *Nauru National Assessment Report for the Third International Conference on Small Island Developing States (SIDS)*. May 2013.

Demersal and near-shore pelagic fish are estimated to make equally important contributions to total catch.
Climate change is also expected to affect fisheries. Nauru lies within the Pacific Equatorial Divergence (PEQD) and the Western Pacific Warm Pool (Warm Pool) provinces, depending on the prevailing El Niño-Southern Oscillation (ENSO) conditions. The PEQD province is generated by the effects of the earth's rotation on the South Equatorial Current, which results in significant upwelling of nutrients, conditions which create the richest surface waters in the region. Climate change is projected to increase sea surface temperatures, sea levels, ocean acidification and to change ocean currents. These effects will, in turn, impact on Nauru's fisheries resources: [21]

- The ability of corals and invertebrates to form will be affected by ocean acidification (the result of absorption of carbon dioxide from the atmosphere), which reduces the availability of calcium carbonate;

- Coral bleaching will increase as a result of higher sea-surface temperatures; and

- The abundance of key oceanic fish species will be affected by changes to ocean currents, such as the Southern Equatorial Current, and to the area and location of the PEQD and the Warm Pool and their convergence (which results from changes in the El Niño-Southern Oscillation).[22]

Given Nauru's small size, geographic isolation and limited air connections, the emergence of a viable, locally-based export fishing industry is unlikely.[23] However, fisheries and marine resources underpin livelihoods in Nauru, particularly during times when other food supplies are unreliable. Furthermore, improving the status of fisheries and marine resources will contribute to a number of the development goals in the NSDS including improving governance, enhancing food security and maximizing revenue. Given the vulnerability created by food insecurity and high government debt levels, fisheries management is an important focus for building longer term resilience in Nauru.

Fisheries management in Nauru is guided by the Fisheries NSDS and the Nauru Fisheries and Marine Resources Authority Corporate Plan. Table 29 details priority activities for the fisheries and marine resources sector with respect to CCA and DRR.

[21] Bell, J.D., Johnson, J.E. and Hobday, A. (editors), 2011.*Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change*. Secretariat of the Pacific Community, Noumea, New Caledonia.
[22] The convergence of PEQD and the Warm Pool, which creates prime feeding areas for tuna, is expected to move eastwards as a result of climate change. Preliminary modelling suggests that catches of skipjack tuna in Nauru's EEZ could increase by 20–25% in 2035 relative to the 20-year average (1980–2000) but are expected to approximate the 20-year average under a high greenhouse gas emissions scenario in 2100. Catches of bigeye tuna are projected to decrease, while trends for yellowfin tuna are expected to be similar to those for skipjack tuna.
[23] NEISIP, 2011

Table 29: Priority CCA and DRR actions for the fisheries and marine resources sector

Strategy	Activity	Lead
Fill knowledge gaps – Identify and document vulnerable fisheries and marine resources	Collect and analyse **fisheries and marine resources data** in conjunction with assessments of climate change and disaster impacts on coastal resources. Includes establishing programs for regular **monitoring of fish resources**, ensuring active community participation. Development of effective **monitoring, control and surveillance (MCS) capability**, through national programmes and regional cooperation.	NFMRA
Support a community based ecosystem approach to fisheries management (CEAFM)	Strengthen the **community fisheries program** of NFMRA, to support CEAFM. Develop **integrated fisheries management plans**, through community consultation, which integrate future changes and risks due to climate change.	NFMRA
Promote aquaculture as an important contributor to food security that can reduce pressure on coastal fisheries	Assess the impact of **drought on aquaculture** and develop management tools. Investigate **contamination of Buada lagoon** from the waste dump site, and determine strategies to prevent further contamination Finalise an **action plan for aquaculture** development	NFMRA
Strengthen the human capacity of government and community stakeholders	Promote and facilitate human resource development through **fisheries education and training programmes**. Specifically, increase local capacity in aspects of marine science, including fisheries techniques, monitoring and analysis of resources and any impacts of climate change, coastal and marine resource management practices, and seafaring Increase local **capacity to support aquaculture** expansion.	NFMRA

The Nauru Fisheries and Marine Resource Management Authority (NFMRA), a statutory corporation under the *Nauru Fisheries and Marine Resources Authority Act 1997*, is responsible for fisheries management including overseeing, managing and developing the country's natural marine resources and environment.

Institutional strengthening and mainstreaming

- The key legislative and policy frameworks governing Fisheries and Marine Resources are the *Nauru Fisheries and Marine Resources Authority Act 1997*, the *Fisheries Act 1997*and associated regulations. These need updating and strengthening, taking account of possible changes in fisheries resources as a result of climate change; and
- Greater capitalisation of economic benefits from fishing beyond the territorial sea, through strengthening of Nauru's skills in trade negotiations.

4.5. Disaster Management and emergency response

The practice of Disaster Management (DM) and Emergency Response (ER) implies strengthening preparedness, response and recovery systems for potential extreme events or disaster scenarios. Potential major disaster situations that require planning for include:

- Medical service disruptions, due to supply chain interruptions (medical supplies, energy, water) or flooding of infrastructure;
- Acute water and food shortages, for instance during droughts or supply chain interruptions;
- Extended energy shortages, which also reduces water production and thus threatens water security;
- Coastal erosion and inundation, which threatens houses and key assets located on the coastal strip; and
- Security risks and/or civil unrest, for example as a result of breakdown in services (energy, water, food) delivered to the Regional Processing Centre.

Climate change may alter and/or intensify traditional disaster risks, and thus it is important that DM and ER planning take account of future climate scenarios and risks. For instance, water security concerns may become even more acute since climate change is projected to alter the ENSO system which strongly influences Nauru's weather patterns. Also, storm surges and flooding may increase, due to sea level rise and heavy rainfall respectively, increasing coastal erosion and thereby threatening public infrastructure and private housing, particularly in low lying areas such as Anetan, Anibar, Anibare, Ijuw and Menen.

Table 30 details priority CCA and DRR activities for the disaster management and emergency response sector which have not already been articulated by other sectors. These focus on improving preparedness, strengthening institutional capacity and creating community awareness about disaster response.

Table 30: Priority disaster management and emergency response actions contributing to CCA and DRR

Strategy	Activity	Lead
Improve community preparedness and response systems	Implement community awareness, training and education, including a community outreach strategy to **develop and maintain high levels of community awareness and preparedness** for responding to extreme events. Establish a multi-hazard **early warning system** for disaster events. Build the **capacity of response agencies** (Fire, Police, Ambulance, Marine Search and Rescue)	NDRMO
Fill knowledge gaps and ensure access to information	Compile **vulnerability assessments** for Nauru relating to disaster risk, climate change and climate variability, as the basis for identifying future priority actions.	NDRMO

Oversight of DRM activities lies with the NDRMO (which resides with CIE), supported by high-level guidance from the National Disaster Risk Management Council. Coordination of emergency response is at present the responsibility of the Police department.

Institutional strengthening and mainstreaming

There are some important policy and planning gaps that need to be filled to strengthen disaster management and emergency response, specifically,

- Update and finalise the DRM Plan 2008. The Plan is still in final draft form and needs updating, while the DRM Act also needs reviewing (not least because institutional arrangements for DRM have changed since 2008, for instance with the establishment of the NDRMO in 2010).
- Strengthen the human capacity of the NDRMO and of the Climate Change Unit. At present expertise and institutional memory is concentrated in very few people.
- Develop clear national plans and guidelines for emergencies, including procedures to mobilise and coordinate emergency relief. This includes finalisation and implementation of the Drought Management Strategy.
- Re-establish the national coordination centre for emergency response. Under the DRM Act 2008 responsibility was designated as being with the Police, however since then responsibilities have changed. Furthermore, the police coordination centre is physically located by the coast, which is itself vulnerable during extreme coastal events.

4.6. Energy

The energy sector can play a critical role in helping to improve Nauru's coping and adaptive capacities with respect to climate change, and to development goals generally. Energy services provide a tool for reducing vulnerability through, for instance, economic empowerment and the delivery of health and education services.

Electricity production is currently reliant on imported diesel, and thus places a significant burden on the government's limited financial resources. Import-dependency also creates supply risks. Further, energy production is closely linked to water production, since the reverse osmosis desalination units are energy intensive. At the same time, energy infrastructure is located in the coastal strip, and thus susceptible to particular climate and disaster risks which need to be considered in future planning.

From a disaster perspective, a key concern is the potential for outbreak of fire at the tank farm area. The fire protection system at the tank farm is presently not functioning, and is also not of sufficient capacity to extinguish a major fire. Such an event would have major implications for provision of energy to the island, both during the disruption and for quite some time after given limited alternative infrastructure available should the facility be destroyed. The possibility of energy shortages, arising from for instance fuel supply disruptions and/or problems with the power station, is also a critical concern.

The Energy Roadmap endorsed by the government in 2014 sets out strategies and activities in six thematic areas, namely: power, petroleum, renewable energy, demand side energy efficiency, transport, and institutional strengthening and capacity building. Progress implementing the Roadmap will contribute directly towards helping Nauru adapt to climate change and reduce disaster risks.

Table 31 highlights several actions from the Roadmap as CCA and DRR priorities. These are emphasised by the RONAdapt because they are considered by the Roadmap as "high priority" actions to strengthen the sector and/or because they clearly address multiple resilience goals at once. It is noted that there is a particularly strong link between the energy and water sectors, and thus many of the Roadmap's priorities targeting energy security and closely intertwined with the achievement of greater water security. In addition, one DRR priority relates to addressing a specific high-consequence risk at the tank farm storage area.

Table 31: Priority CCA and DRR actions for the energy sector

Strategy	Activity	Lead
Reduce electricity demand for water	Identify opportunities for **electricity savings from water pumping** and RO units, and by **reducing leakages** in the reticulation, delivery and storage systems /tanks	NUC
Expand renewable energy capacity	First tranche of solar energy capacity expansion. Initially to be progressed through: • Preparation of a **Solar Feasibility Study** and **technical standards and specifications** for all phases of solar installations; • **Identification of potential sites for solar**, including survey of roofs of government owned buildings, power poles, parking lots for PV and locating land on Topside for potential large scale solar plants; and • Tendering for, and **installation of, the first 600 to 1000 kWp of grid-connected solar without storage**.	NUC, CIE
Reduce transport fuel use while ensuring mobility	Design and introduce incentives to **increase the use of bicycles and motorcycles for personal transport**, as well as car-pooling and other behavioural changes to encourage energy efficiency	CIE
Improve local capacity for managing and maintaining a sustainable energy sector	Facilitate development of appropriate local skill base to meet future demand in the energy sector through various forms of **training in energy efficiency and renewable energy**. Includes building capacity to install, operate and maintain solar PV systems	CIE
Reduce risk of major fire outbreak at tank farm, and subsequent disruption to energy services	Upgrade and expand **fire protection system for tank farm** area	NUC, NDRMO

Institutional strengthening and mainstreaming

The Energy Roadmap identifies a swathe of institutional strengthening activities for the sector. Several are highlighted here as important substantive steps towards building a stable, well managed energy sector and thus contributing to the overall resilience of Nauru:

- Develop a legislative and governance framework for the energy sector;
- Develop supporting regulations for the NUC Act; and
- Establishment and staffing of an energy unit within the department of CIE, to fill the current gap in management of the sector within government.

4.7. Land management and rehabilitation

Land is a scare resource in Nauru and much of the island has already been degraded by mining activities, which are ongoing. In addition, the Regional Processing Centre has been developed quickly and as a result one of the camps was erected directly over land proposed in a draft Land Use Plan as a conservation area (where there is fertile "black soil"), resulting in a loss of important soil resources that could support biodiversity as well as agriculture. Around the coast, cemeteries are full which means families are burying deceased relatives by their houses, posing a contamination risk to the groundwater lens.

A related issue is that of waste collection, disposal and management. The dump site has very little available capacity, and is being further stressed by the large quantities of waste (mainly plastics) generated by the RPC. Moreover, the existing dump site is not lined, leading to concerns about possible migration of contaminated leachate into Buada lagoon. A new disposal site needs to be identified and prepared. Waste management is also challenged by the fact that there are few assets available on-island for supporting community waste collection (trucks and skips), and these are heavily occupied by the RPC.

At present Nauru has no endorsed land use plan to guide development decisions. Land use planning is critical to, for instance, ensure that future infrastructure investments are coherent with the visions and needs of all of Nauru's communities. A Master Land Use Plan proposed to set out future development aspirations on Topside will be broadened to a whole-of-island land use plan, to provide strategic direction to land rehabilitation and to decisions on future land use (including siting of new infrastructure). Given that major infrastructure sectors such as energy and water have developed, or are developing, investment plans covering the next decade or more, preparation and endorsement of a Nauru Land Use Plan is becoming an urgent priority.
Table 32 identifies CCA and DRR priorities relating to the management of land resources, focusing on those not already raised in other sections of the RONAdapt (noting that there is a strong overlap with coastal management issues described in the section below).

Table 32: Priority land management actions contributing to CCA and DRR

Strategy	Activity	Lead
Increase availability and productivity of land resources	Continue to implement effective **land rehabilitation** of Topside, in order to increase long-term availability of land for agriculture, settlement, infrastructure, and social services (e.g. cemeteries) **Plant coastal vegetation** such as salt bush trees to protect other vegetation from wind and salt spray, and to reduce soil erosion. (co-benefit for agricultural production)	NRC, RONPhos, Community
Improve waste management to reduce land degradation and contamination risks	Identification of **new landfill site** (as part of developing a Nauru Land Use Plan, see below), and preparatory work to design, construct and commission a new landfill. Train local livestock farmers on **animal waste management** technologies to reduce public health risks and environmental pollution.	NRC CIE

Institutional strengthening

The following are priorities in relation to land management:

- Preparation and endorsement of a *Nauru Land Use Plan* (broadening the Master Land Use Plan proposed for Topside to focus also on Nauru's coastal areas) which integrates climate and disaster risks. The plan will incorporate the concept of

Integrated Coastal Zone Management, and should link to the priorities identified in sectoral plans including the Energy Roadmap, the forthcoming Water and Sanitation Master Plan, the NBSAP, Solid Waste Strategy, the Strategic Plan for the Sustainable Development of Agriculture, community development plans, and RONPhos and NRC operational plans regarding future mining. The plan should also be developed through close consultation with the community.

- Finalisation and endorsement of the draft *Solid Waste Strategy 2013* and the *Solid Waste Action Plan*.

4.8. Infrastructure and coastal protection

In relation to CCA and DRR specifically, consideration of infrastructure is critical for two main reasons.

Firstly, as highlighted by the NSDS, strategic infrastructure can play an important role in improving economic productivity and/or reducing community vulnerability, and thus in making Nauru more resilient. The 2011 *Nauru Economic Infrastructure Strategy and Investment Plan* (NEISIP) identifies the government's needs and immediate priorities in the infrastructure sector, focusing on short and medium term needs relating to transport, water, sanitation, waste management, telecommunications and government buildings (including schools and hospitals). For example:

- The sea and air ports are critical assets to ensure supply of essential goods and services (food, fuel, parts, medical supplies), as well as for export of phosphate and dolomite;
- Improving drainage systems will reduce flooding during heavy rains, which restricts mobility and is also linked with water-borne illnesses (and therefore linked to health outcomes);
- Expanding renewable energy capacity will improve energy security and should also over the medium term reduce energy-related expenditure by government, thereby freeing up limited resources for other pressing development needs (see Section A2.6);
- Expanding public water storage capacity can make water and agriculture outcomes more resilient to climate variability and change, and also have benefits for energy since greater water storage can reduce peak energy demands by spreading the load that is required for water production (see Section A2.1); and
- Rehabilitation of mined areas can expand scarce land resources for settlement, agriculture, energy infrastructure, waste disposal and cultural practices (see Section A2.7).

Secondly, infrastructure needs to be designed and managed with future conditions in mind, sometimes referred to as being "climate proofed" and able to withstand disaster events. Sea level rise and associated coastal erosion, flooding during extreme rainfall events, storm surge and fires are hazards that may threaten vital infrastructure.

The majority of Nauru's housing and its economic infrastructure are located in the low-lying coastal strip, including power generation, water treatment, roads, RONPHOS plant, air and sea ports, and medical services.[24] The RON Hospital is low-lying and floods during heavy rains, and Nauru Government Hospital – which contains the dialysis units, public health sectors, children's clinic, diabetes clinic – is susceptible to coastal erosion. Nauru secondary school and the catholic school in Ewa district are also potential erosion risk sites. Both the Police station (which is also the Emergency Coordination Office) and the prison are immediately by the coast, and although there is an existing coastal protection structure in

[24] The Pacific Catastrophe Risk Assessment and Financing Initiative report (2011) provides data on the location of key infrastructure and potential damage costs due to future disaster events.

this area there is also evidence of ongoing erosion and subsidence of buildings (some prison buildings are no longer useable because they are unstable). In addition to public infrastructure, most communities are in the coastal strip which means most people's homes are at a low elevation. Many of Nauru's key assets, therefore, are vulnerable to coastal-related hazards, including sea-level rise, storms and flooding – which are projected to intensify under long term climate change.

In addition to infrastructure priorities highlighted in other sectors (particularly energy and water), key CCA and DRR objectives for infrastructure planning and investment are to reduce loss and damage of infrastructure due to coastal erosion and to reduce the frequency and intensity of flooding of coastal areas during heavy rains and/or storm surge. To support development of a Nauru land use plan that incorporates an Integrated Coastal Zone Management Plan (ICZMP), an assessment of coastal activities and management practices, as well as biophysical coastal processes, is necessary for making informed decisions. The ICZMP component of the Nauru land use plan will provide management strategies relating to planning, siting and design of coastal structures (including guidance on climate-proofing), prioritization of the need to renovate or remove badly dilapidated infrastructure situated at or near the coast, and replanting of coastal vegetation in exposed areas. The plan would also guide the integration of climate and disaster risks into major infrastructure development planned under the NEISIP. Table 33 summarises priority CCA and DRR activities relating to infrastructure and coastal management.

Table 33: Priority infrastructure and coastal management actions contributing to CCA and DRR

Strategy	Activity	Lead
Reduce coastal risks to key infrastructure	Conduct **coastal vulnerability assessment and mapping**, with strong focus on community involvement, to identify key infrastructure at risk from coastal hazards and identify options to reducing risks (also in Coastal Management section). Assessment of coastal activities and management practices, as well as biophysical coastal processes, as a platform for making informed coastal management decisions. Develop an **Integrated Coastal Zone Management Plan** (as part of a Nauru Land Use Plan), identifying priority areas for reinforcement/protection, adjustments in land management, and possible relocation needs for specific high risk assets.	CIE
Reduce flooding occurrence and intensity	Develop and implement heavy rainfall and local **flooding contingency plans** Design and construction of **drainage infrastructure**, to reduce flood risks in critical locations	PAD, NDRMO

Institutional strengthening and mainstreaming

The absence of an over-arching coastal zone management plan hinders coordination between government agencies and communities regarding management of the coastal zone. There is also presently no environmental legislation or building codes that govern development activities. These gaps result in limited formal integration of environmental considerations into the policy making and development planning processes. Therefore, priority institutional actions include:

- Develop and implement an *Integrated Coastal Zone Management Plan (ICZMP)*, which integrates climate and disaster risks. Over time, this should be integrated as a component of a wider *Nauru Land Use Plan* (see and management section above);

- Develop a Code of Practice for coastal structure design and engineering, including clarity around the environmental assessment process for new development. The code should also support consideration of climate- and disaster-related risks in infrastructure planning. Clear land management guidelines will help ensure that future development is appropriately situated, designed and constructed to reduce coastal risks. As above, this could over time be integrated into a wider Nauru Land Use Plan.
- In the short term, establish a Task Force for coastal zone management, involving CIE, Foreign Affairs, NRC, the Chief Secretary's Office and NFMRA. In the longer term, establishment of a coastal zone management unit in the department of CIE – with close working links to NFRMA – which can build government capacity and coordinate the resources needed to sustainably manage Nauru's coastal zones.
- Integrate recognition of potential climate change and disaster impacts, and thinking about vulnerability and risk reduction, into future updates of the NEISIP. The approach used for prioritising infrastructure should specifically consider the needs of Nauru's most vulnerable people and also explicitly emphasise how different activities will function under future conditions (i.e. how well "climate proofed" key infrastructure is).
- Support human capacity development in maintenance and management of core infrastructure assets. The NEISIP identifies proper asset maintenance as a much more cost-effective approach to service delivery than capital expenditure.

4.9. Biodiversity and environment

A range of issues that affect the health of Nauru's environment and its access to natural resources have been highlighted in other sections. In addition to those mentioned already, other problematic issues include:

- Wastewater treatment and disposal. Septic tank sludge and the salt water sewage system at Location discharge directly onto the reef (and close to the intake for the desalination plants), while the desalination units discharge saline wastewater directly into the sea. The consequences of these discharges on near-shore ecology have not been assessed. Sludge management is made difficult at present by there being no sludge truck, meaning sludge pits sometimes overflow (especially when it rains) leading to contamination of flood waters and consequent health risks.
- Invasive species pose a threat to native biodiversity.

Protection of scarce land and soil resources is an important issue for reducing environmental degradation and improving the overall health of Nauru's environmental resources, as is addressing water contamination.

A *National Biodiversity Strategic Action Plan* (NBSAP) was first prepared in 2010, and updated in 2014. A goal of the 2010 plan was "an annual increase of 2% to enhance, develop and manage current conservation and rehabilitation of biological diversity and ecosystems to increase the percentage of Nauru's protected and conserved areas from the existing 2% of total land, including coastal areas, to 30% by 2025". Successfully implementing the NBSAP will improve Nauru's environmental health, and thus its resilience to climate change and extreme events. In 2013, SPREP undertook a Rapid Assessment of Biodiversity, which identified the presence of invasive species. This assessment led into a review of the NBSAP, and a second version was completed in 2014. Table 34 summarises priority biodiversity actions that contribute to CCA and DRR.

Table 34: Priority activities for environment and biodiversity related to CCA and DRR

Strategy	Activity	Lead
Designate areas for conservation of biodiversity	Land use planning to **identify and protect areas of high conservation value** Establish conservation areas, in **partnership with the community** Encourage **breeding of resilient indigenous livestock** species, especially of pigs and poultry	CIE
Protection of flora and fauna	Implement programmes for the **eradication and control of invasive species**	

Institutional strengthening and mainstreaming

- The revision of the *National Biodiversity Strategic Action Plan* should be endorsed by Cabinet.
- The draft *Environment Act 2006* needs updating and formal endorsement by Cabinet.
- Environmental Impact Assessment (EIA) legislation needs to be developed, adopted and enforced, to minimise the impacts of future development activities on Nauru's environment.
- Facilities and procedures for border control and quarantine services need to be strengthened.

4.10. Community development and social inclusion

Strong social linkages, a sense of culture, empowerment of disadvantaged individuals or groups, and greater engagement of people in managing their local environment and supporting their local community can all play an important role in strengthening the resilience of Nauru to future scenarios in which climate change, disasters or other stresses may present new challenges. Community development activities encompass a wide range of issues, from empowerment of women, youth development and engagement in community building activities, the strengthening of social networks and improving livelihood opportunities for households and small businesses.

Important strategies identified in Nauru as important for building community include actions to:

- Preserve *Nauruan language and cultural heritage*. Through collecting and preserving cultural resources including historical books about Nauru, translation into Nauruan language resource books found abroad such as about Nauruan myths or traditional medicines, including Nauruan language components in the school curriculum, and undertaking research into, and encouraging sharing of, traditional knowledge possessed by elders - the longer term, the vision is development of a museum archive to give communities access to important cultural resources.
- Support for *Women's and Youth Affairs.* Through the operation of safe houses or shelters from domestic violence, counselling services, improving access of women to education, health services, the protection of women from violence, and forums that provide support for men (such as through the SHED program), focusing on men's behaviour in the household and society, particularly with respect to violence.
- Support for *Family and Community Services*. Through child protection programs, improving the livelihood and participation of disabled Nauruans (such as the development of a "disability village"), and engaging youth in community initiatives.
- *Promote community participation in livelihood opportunities from small business.* For instance, in the tourism sector the aims is to establish tourism as a viable, commercial livelihood strategy for Nauru, with a focus in the near term on developing services and

products, through incentive programs and capacity building for communities to be better able to pursue opportunities.

In complement to these, it is important for CCA and DRR planning, including the RONAdapt, to take account of gender. Men and women often have different roles and responsibilities in Nauruan society, as well as different entitlements or access to resources. These gender differences create differences in people's livelihoods, health, mobility, financial capabilities, and access to information, amongst other things. Empowerment of both men and women is important if Nauru is to become more resilient to future threats, and also to take advantage of future opportunities.

Nauru is a signatory to the Convention for the Elimination of all Forms of Discrimination against Women (CEDAW). The Government has emphasised gender equality and empowerment of women through, for instance, the establishment of the Women's Office in 1997. The work of the Department of Women's Affairs is directed by a five year *Plan of Action for Women* which is closely linked to the NSDS, and a Women's Policy is also in development. Gender is an important theme in the 2009 revision of the NSDS, which highlights that as of 2009 only 34% of females over the age of 15 were in paid work; there were no women in parliament and very few in positions of influence in government departments or State Owned Corporations, and high rates of gender-based violence.

Like CCA and DRR, gender is a cross-cutting theme, which means it should be incorporated into the planning, design and implementation of activities by all government ministries and utilities. Through the priorities described in other subsections, the importance of addressing gender is already embedded in a number of ways:

- Some actions generate outcomes that are particularly beneficial for certain groups. For example, those which increase water security have important benefits for women in particular, since in Nauru the burden of water management at the household level tends to fall disproportionately upon women and thus water stress imposes greatest hardship on women;
- Some actions imply understanding how vulnerability to climate change is unevenly distributed in the community, and how gender and other factors place some people at greater risk than others. Understanding this means that future actions can then be directed more at higher risk individuals or groups. For example, those which fill information gaps by data collection and vulnerability assessments should specifically collect information on differences by gender; and
- Some actions aim to empower and harness the potential of women as agents of change in Nauru. For example, those which build capacity of households to participate in kitchen gardening, or community-based approaches to fisheries management, where these include women.

In addition, addressing gender as an issue in CCA and DRR means ensures equal and meaningful participation by men, women and youth in planning and decision making. The views and needs of each should be sought and taken into account when climate- and disaster-related activities are designed, implemented and evaluated. It also means ensuring equitable access to resources, not only financial resources but also access to information and knowledge, to empower individuals to be able to plan and respond to different situations. Table 35 identifies several priority actions related to community development and the promotion of social inclusion, which represent important steps towards increasing community empowerment, and hence also increasing resilience.

Table 35: Priority actions relating to community development and social inclusion contributing to CCA and DRR

Strategy	Activity	Lead
Take greater account of gender in planning	Introduce **gender budgeting at the national level**. This provides a breakdown of how resources are benefiting men and women and is a tool for helping to ensure the most vulnerable are given priority. Introduce a requirement for **gender budgeting in all future projects** supported by development partners. Support more widespread use of **gender disaggregation in national and sectoral data collection programs**, for instance in assessments of vulnerability or disaster losses, land ownership, formal and informal labour participation, and energy usage.	PAD, Ministry of Finance Development partners
Strengthen communities	Continue to implement the strategies of the Ministry of Home Affairs, focusing on **women's affairs, family and community services, youth affairs,** and the **preservation of culture and language**.	Ministry of Home Affairs

Institutional strengthening and mainstreaming

- Finalise and implement the Women's Policy.
- Develop nationally suitable template for gender budgeting, and train staff from Finance and other departments in how to implement gender budgeting.

4.11. Education and human capacity development

Limited human capacity is a major challenge for delivering on sustainable development aspirations in Nauru, and also constrains the country's capacity to adapt to climate change. Few students are pursuing education in technical fields such as science, technology, ICT and healthcare, meaning Nauru is heavily dependent on expatriate expertise. Education deficits also limit the possibilities for Nauruans to participate in labour migration schemes in the Pacific, which could otherwise help boost local revenues and support livelihoods. Education is an important factor in developing the human capacity necessary for sustainable development and for building resilience to climate change and to potential disasters.

In addition to building the basic capacities needed to implement Nauru's development strategy, various sectors have emphasized the need to build into the school curriculum and other community education channels a greater focus on social and environmental vulnerability, including the way this may be influenced by climate change and potential disaster events. Table 36 identifies an additional action to those already raised elsewhere which can contribute to improving the resilience of Nauru to climate change and to future disaster events.

Table 36: Priority education sector activities contributing to CCA and DRR

Strategy	Activity	Lead
Skills transfer to local Nauruans during development projects	Require that development partners specifically **build a skills transfer component into projects and programmes** which they support in Nauru.	PAD

5. National and Sectorial Adaptation Programs

Table 37 shows the adaptation projects and programs in Nauru.

Table 37: Adaptation Projects and Programs in Nauru[25]

	Name	Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
Participation in Regional and Global Actions								
1.	Pacific Islands Adaptation to Climate Change Project (PACC)[2]	PACC will implement long-term adaptation measures to increase the resilience of a number of key development sectors in the Pacific Islands to the impacts of climate change. This objective will be achieved by focusing on adaptation response strategies, policies and measures to bring about this result. The key development sectors this project will focus on are: 1. water resources management; 2. food production and food security; and 3. coastal zone and associated infrastructure (roads and breakwater). To ensure sustainability of the project, regional and national adaptation financing instruments will constitute a fourth component of the project.	SCCF, co-financing *Budget:* US$59,526,299	UNDP, ADB, SPREP	Capacity building; Policy formation and integration	2008–2012	Agriculture; Coastal zone management; Freshwater supply	*Regional:* Cook Islands, FSM, Fiji, Nauru, Palau, PNG, Solomon Islands, Tonga, Tuvalu, Vanuatu
			In Nauru: Demonstration measures to reduced vulnerability in coastal areas and crop production. Groundwater prospecting and monitoring. Water tanks and water catchment.					
2.	Strengthening the Capacity of Pacific Developing Member Countries to Respond to Climate Change (Phase 1)[3]	Incorporation of climate risk management, adaptation practices, and greenhouse gas mitigation measures into infrastructure and key sector investment plans and project designs. Adaptation related actions include: • Pacific Climate Change Program–will assist participating countries to improve their resilience to climate change impacts through (i) mainstreaming of the	ADB, Canada *Budget:* US$4.965 million	ADB	Capacity building; Policy formation and integration	2009–?	Government	*Regional:* Cook Islands, Fiji, FSM, Kiribati, Marshall Islands, Nauru, Palau, PNG, Samoa, Solomon Islands,

	Name	Objectives	Funder(s)	Implementing Agency(s)	Type of project	Duration	Priority Sector(s)	Geographic focus (if any)
		adaptation in their policies, plans, programs, and projects; and (ii) strengthening their systems and capabilities to foster the adaptation process; and • Adaptation preparation–up to five countries will be supported in preparing the implementation of climate change adaptation plans, including further capacity building						Tonga, Tuvalu, Vanuatu. *Plus:* Timor-Leste
			In Nauru: Additional information required					
3.	Coping with Climate Change in the Pacific Island Region[4]	Enhance the competence and capabilities of the local population, the national governmental authorities and regional organizations—SPC and SPREP—in order to cope with the effects of climate change and combat its causes. It includes reviewing policies and integrating adaptation considerations into them, and focuses on the management of land and coastal natural resources, as well as tourism. At the regional level, the program aligns with the Pacific Island Framework for Action on Climate Change 2006–2015. Originally only involving Fiji, Tonga, Vanuatu, the project has been expanded and extended.	German Federal Ministry for Economic Cooperation and Development *Budget:* €17.2 million	GIZ, SPC	Capacity building; Policy formation and integration; Field implementation	2009–2015	Agriculture; Forestry; Tourism	*Regional:* FSM, Fiji, Kiribati, Marshall Islands, Nauru, Palau, PNG, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu
			In Nauru: Additional information required.					
4.	Mainstreaming Gender Aspects in Climate Change Adaptation and Low-Carbon Development[5]	This project contributes to mainstreaming gender into climate change adaptation and low-carbon development measures in climate policy. It produces training material and over the long term will improve the	German Federal Ministry for the Environment	GenerCC–Women for Climate Justice, Centre for Global Change,	Capacity building;	2010–2013	Gender	*Asia-Pacific:* Bangladesh, Kiribati, Marshall Islands,
		adaptive capacity of local communities in Bangladesh and the Pacific region.	, Nature Conservation, and Nuclear Safety *Budget:* €451,339	Secretariat of the Pacific Community				Nauru
			In Nauru: Additional information required.					

[25] http://www.adaptationlearning.net/adaptationpartnership_review

Table 38 shows the major current and proposed projects of Nauru

Table 38: Nauru Economic Infrastructure - Major Current & Proposed Projects[26]

Ref	Project	Cross Sectoral	Estimated Cost ($m)	Status	Funding Source
WATER					
W1	EU Envelope B - Risk Reduction Project (C1-C6) & water tankers (1@10kl)	S1	0.76	F	EU
W2	Solar Power RO Unit	P5	3.00	F	PEC
W3	Supply and commissioning of 300kL RO Unit (AusAID	W2	0.60	C	AusAID
W4	Water Delivery - Additional Water tankers (3 x 4kl)	S2	0.50	P	U
W5	Repairs and Upgrade Tanks (B13, B4, B5)[2]	S1	0.40	I	U
W6	Runway rainwater harvesting (* contingent on Runway resurfacing A3)	A3, R3	8.00	I	U
W7	Additional large community rainwater storage tanks (15x100kL)	W2	0.80	I	U
W8	Rehabilitation & filling of bulk storage tanks (golf course) for emergencies	W2	0.40	I	U
POWER & WATER					
PW1	O&M spare parts store and workshop (shared with Utilities and Menen Hotel)	W4	3.00	P	U
POWER & ENERGY					
P1	Jet Fuel Supply		0.40	F	AusAID
P2	Bulk Saltwater Emergency Response	S4	1.00	P	U
SANITATION & WASTE MANAGEMENT					
S1	Mainstreaming IWRM	W2, W3	0.30	F	GEF
S2	New lined Landfill & Compactor Trucks (BOT??)	S5	1.40	I	U
S3	Pump Out "Alternative Disposal Options" Recycling Project	S3	0.50	P	U
S4	Location Saltwater flush (* contingent on P2)	P3	0.30	I	U
S5	Hospital Hazardous Waste Incinerator	BH2	0.30	C	?
TELECOMMUNCIATIONS & MEDIA					
T1	New Telecom Towers		0.15	C	AusAID
AIRPORTS					
A1	PAPI System		0.10	F	AusAID
A2	Runway Resurfacing & Fencing	W6, R3	3.80	P	U
A3	Navaids -DME		0.40	I	U
A4	Navaids -VOR		0.40	I	U
ROADS & ROAD TRANSPORT					
R1	Solar Street Lighting	W2	0.30	F	ROC
R2	Fleet Augmentation		0.15	F	Azerbaijan
R3	Road Rehabilitation (* contingent on Runway resurfacing (A3) & (R4)	W6, A3	1.00	P	
MARITIME					
M1	Omega 65 tonne Crane		0.50	P	AusAID
M2a	New Quay wall - Scenario 2 & Anibare Mooring		14.40	P	
M2b	All Season Berthing Facility - Scenario 4 (Stage 2 contingent on M2a)		32.00	P	Long term
M2c	All-vessel quay wall - - Scenario 3		14.00	P	long term
BUILDINGS - ADMINISTRATIVE					
BA1	Police HQ		2.70	F	AFP
BA2	Police Youth Club		0.20	C	AusAID
BA3	Indoor Stadium and sports field		0.60	C	U
BUILDINGS - HEALTH					
BH2	Annual Refurbishment to Hospital		1.10	C	AusAID
BH3	New Hospital		12.00	P	U
	Hospital refurbishment funds (2011 - 2015)		1.20	P	AusAID
BUILDINGS - EDUCATION					
BE1	Schools Annual Refurbishment Program		0.60	C	AusAID
BE2	Aiwo School Rebuilding and Disability Access		14.10	P	U
BE3	Learning Village Project		3.60	P	U
	School Refurbishing Funds (2011 - 2015)		0.60	P	AusAID
I	Identification		C	Commmitted	
P	Planned		F	Funded	

[26] http://www.theprif.org/components/com_jomcomdev/files/2014/09/39/16-NEISIP%20Full%20Final%20Report.pdf

6. Barriers and Opportunities

Adaptation action in Nauru is relatively low as compared to other Pacific Island countries. However, Nauru is participating in multi-country regional projects that address several of its priority areas for adaptation, as well as gender, forestry and tourism. The limited current programming in the country means that some gaps remain within the priority adaptation areas identified by the country, including health and marine resources.

Nauru exemplifies the 'special case' as described during the Earth Summit. Specifically, its small size, extreme isolation, narrow resource base, isolation from markets, diseconomies of scale, and capacity limitations pose major challenges for sustainable development in Nauru. The constrained resource base, dependency on imports for food and energy security and high level of aid received have resulted in extreme vulnerability to external forces, such as global food and energy price changes and financial and economic crises.

Virtually all Nauruan residential buildings and most economic infrastructure are located along the narrow coastal flat. Marine and coastal fisheries continue to be a source of food security for most people, particularly low-income households. Due to the proximity to the coast and the dependence on coastal and marine resources for livelihood and food security, Nauru is highly vulnerable to climate change, sea level rise, ocean acidification and natural disasters. Nauru has limited resources. Its main exports are fish and phosphate soil, which is a finite resource. The mining of phosphate has degraded the land to a useless state, which is about 80% of the islands surface area. The Earth Summit 'special case' of Nauru is amplified by the limited availability of fresh water and the environmental damage caused by mining.

Based on the vulnerabilities and challenges faced, the priority issues for national sustainable development include but not limited to:

1.) **Water:** Freshwater resources in Nauru are very limited and it has been estimated at 32 litres fresh water per person, well below the recommended WHO standard of 50 litres per person per day for domestic use. Much of the surface and ground water is not suitable for human consumption and some of it is not suitable for agricultural use. Frequent droughts and a lack of proper rainwater storage facilities compound water scarcity issues. Climate change, particularly prolonged droughts and increasing water salinity, further threaten water security. Fully utilizing groundwater could improve water security; however, much of the ground water has been contaminated as a side effect of the phosphate mining and other pollutants, including sewage.

   Water quality issues have caused water-borne illnesses, including skin and eye diseases. The price of delivering water for human consumption is also a concern, especially, since the provision of affordable water is dependent on global fuel prices. As water, even for domestic consumption is limited, the amount of water available for agriculture and aquaculture is highly limited. The lack of water for agriculture threatens Nauru's food security and the well-being of people. Prolonged droughts and increased water salinity may also threaten biodiversity and the natural ecosystem health.

2.) **Waste:** Limited availability of suitable land for landfills and the distance from markets makes waste management in Nauru a challenge. The fragile natural ecosystem, biodiversity and public health are threatened by the accumulation of wastes on the island, particularly liquid and hazardous wastes. Much of the waste generation in Nauru is 'imported wastes' – the by product of an imported product. Properly managing wastes and minimizing wastes, especially those from imports, within the small land mass will continue to be a problem for Nauru.

3.) **Education:** Education is the key to both improving sustainable livelihoods and addressing national capacity gaps. In Nauru, most children attend primary school but only roughly a quarter complete secondary school and even fewer attend trade or tertiary school. It was identified that the high and persistent unemployment rates in Nauru is linked to poor education outcomes with the lack career counselling for students to achieve their educational goals and aspirations.

Additionally, the poor educational outcomes limited the ability of individual Nauruans to participate in labour migration schemes. Therefore education is a major limiting factor in developing the human capacity necessary for sustainable development, particularly in building science or technical capacity gap. The lack of education for sustainable development increased the dependence of Nauru on expatriate workers and consultants.

4.) **Energy:** Nauru is highly dependent on the import of fossil fuels to meet energy demands, especially the high demands in the transport sector. Due to the small population and isolation from markets it lacks economies of scale for importing fuel. The small landmass of Nauru restricts the space available for solar panels. Nauru has set a target of achieving 50 % renewable energy by 2015; however, progress toward this target has been limited. It is likely that Nauru will continue to be dependent on imported fuel in the near future and is highly vulnerable to global fuel price increases and to global supply shortages. High fuel prices place an increasing burden on households, which in turn affects their ability to meet other basic needs. The increasing population will increase future fuel demands, adding additional pressure to the energy sector.

5.) **Environmental damage and Rehabilitation:** Phosphate mining has damaged about 80% of terrestrial ecosystem habitat on Nauru. The mined phosphate land is currently not suitable for either habitation or agriculture. The lack of arable land for agriculture has created additional challenges in ensuring food security and has amplified the dependency on imports. The lack of forest and natural vegetation threatens biodiversity and erodes the national culture by reducing the ability to practice traditional medicine, traditional agricultural practices and create cultural products. The mining has also had an impact of the aesthetic value of the land, which impacts both the well-being of the Nauruan people and the potential of Nauru as a tourist destination. The lack of either natural or regenerated forests has translated into a lower resilience of the natural environment (for example, poor water quality due to poor filtration, higher possibilities of erosion, poor precipitation, higher droughts, higher CO2 emissions, etc.). In addition to the physical damage from the mining, the mines have also generated air, water and solid wastes. The environmental disaster caused by the mining affects virtually sectors of development and rehabilitation is a prerequisite for improving the well-being of the people, including for food security and water security.

CHAPTER 4

MITIGATION MEASURES AND ANALYSIS

1. Background

Climate Change mitigation by reducing GHG emissions and enhancing sinks and reservoirs is essential to meet the UNFCCC's objective of stabilizing GHG concentrations in the atmosphere. The mitigation measures are defined as any anthropogenic intervention that can either reduce the sources of greenhouse gas emissions or enhance their sinks (abatement or sequestration).

A range of policies and various economy-wide packages of policy instruments have been effective in reducing GHG emissions in different sectors. However it is crucial that Annex I countries take the lead in the global mitigation efforts by providing adequate level of financial and technical support to developing countries in order for them to contribute towards global climate change mitigation efforts.

As discussed in the GHG inventory chapter, the total GHG emissions by source for Nauru for the year 2000 was 19.294 Gg CO_2equivalent (excluding removals from Agriculture, Forestry and other land uses). This includes the sector wise contribution from Energy (13.34 Gg CO_2e) 69.13 %; Industrial Processes & Product Use (0 Gg CO_2e) 0 %; Agriculture (1.61 Gg CO_2e) 8.33 %; Forestry & Other Land Use (excl. removals) (0 Gg CO_2e) 0 % and Waste (4.35 Gg CO_2e) 22.54 %. The contribution of individual GHGs include Carbon Dioxide (CO_2) 98.09 %; Methane (CH_4) 1.899 %; Nitrous Oxide (N_2O) 0.014 %. Emissions from per fluorocarbons (PFCs), hydro fluorocarbons (HFCs) and sulphurs hexafluoride (SF_6) in Nauru are negligible, as the products containing these gases are not produced in the country. The primary sources for CO_2 emissions are from combustion of fossil fuels for power generation and transportation; CH_4 and nitrous oxide (N_2O) emissions are primarily due to agricultural (livestock) activity and waste disposal.

Nauru is committed to formulating strategies, national policies and best practices for addressing GHG emissions and making a practical contribution towards global mitigation efforts, while at the same time pursuing its national and regional development priorities and sustainable development objectives. The country plans to achieve this by integrating GHG abatement efforts with other social, environmental and economic priorities.

This chapter outlines Nauru's contribution towards global climate change mitigation efforts, including effectiveness of potential greenhouse gas abatement actions for long-term sustainable development. The chapter also outlines priority climate change mitigation areas that require international support.

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 an aim to present Nauru's capacity to mitigate climate change including long-term mitigation scenarios.

Energy Sector

Energy is one of the crucial development indicators in any country and like the other Pacific Island Countries, Nauru's primary energy needs are met by imported petroleum fuel. Imported, refined petroleum fuel is the primary energy source in Nauru. Fuel imports are delivered by either medium range (MR) tanker ships directly from Asian refineries, from high seas bunkering vessels that service the Pacific fishing fleet or occasionally via local coastal tanker (LCT) from a Pacific large regional bulk fuel supplier such as Fiji.

The Government and Republic of Nauru Phosphate (RONPHOS) are the two main importers of fuel into Nauru. Joint procurement was carried out until 2000 when RONPHOS, then the Nauru Phosphate Company (NPC), was still part of Government. At present, fuel procurement and supply by the Government and RONPHOS is carried out separately. All fuel imports into Nauru are retained, there is no re-export, although facilities were installed recently which would be capable of re-fuelling passing fishing vessels (limited compare to actual fuel consumption in the other sectors in Nauru).

The basis for Nauru's economy since the early 1900s has been phosphate exports. The exports peaked during 1970's and after the mid-1990s, production gradually fell reaching almost zero by 2004. Phosphate mining is one of the bigger petroleum fuel private importer (by their-own) and consumer (diesel for self-electricity generation and waste fuel oil for drying process).Heavy oil and waste oil are used only in the phosphate drying kiln.

Since 2004, successive governments have been dealing with the near-exhaustion of primary phosphate reserves and the legacy of years of economic mismanagement. In 2005, the Nauru Phosphate Corporation became the Republic of Nauru Phosphate Corporation (RONPHOS). RONPHOS then began work on accessing the leftovers from earlier mining and phosphate shipments again began, though at a lower level. Some income flow resumed in 2007 and production in 2009 was 41,549 tonnes. In 2012 phosphate exports from Nauru reached 519,000 tons, the highest annual figure since production recommenced in 2007, and contributed strongly to economic growth of 4.9% in fiscal year (FY) 2012. Phosphate exports are expected to hold steady in FY2014 as mining exhausts primary phosphate reserves and taps into deeper secondary phosphate resources.

Government of Nauru's fuel supply is broken down between diesel fuel, mainly for electricity generation, dual purpose kerosene (DPK) for jet fuel and cooking and petrol. The fuel oil was also imported by Government in the 1990s for the phosphate industry. Imports of fuel oil continue today but are handled by RONPHOS directly. These are estimated at 4 million litres per year but may vary from year to year depending on phosphate production. LPG is also imported into Nauru by two private sector companies with imports around 9.5 tonnes per year.

Total fuel demand in Nauru is estimated at 14 million litres per year, which is around half of what it was in the 1990s. The decrease in fuel imports can be attributed to the significant decline of the phosphate mining industry in the recent years. Nauru is almost entirely dependent on diesel fuel for electricity generation. Electricity is supplied by a single power station operated by Nauru Utility Corporation (NUC). Currently, most of the power is

generated by four ageing medium-speed Ruston stationary engines with a high-speed Cummins generator providing essential supplementary capacity.

Table 39: Estimated breakdown of fuel demand in Nauru

Energy Sub-sector	Type of Fuel	Quantity
Electricity	Diesel	6-7 million litres per year
Phosphate (RONPHOS)	Fuel Oil (for drying process)	Self-imported: 4 million litres per year
	Diesel (for own generators)	Self-imported: no data
Our Airline	Kerosene (DPK)	0.5-1 million litres per year
Transport	Diesel	1 million litres
	Petrol	2 million litres
Cooking	Kerosene (DPK)	0.1 million litres per year
	LPG	9.5 tonnes per year

The average amount of petrol purchased by the Government for its own use and for distribution is around 1.5 million litres (ML) a year (Table 40). Automotive diesel oil import is around 8.8 ML and jet fuel is estimated at around 1.3 ML. The Government regulates the resale price of these fuels. Shortages have occurred due to a lack of funds in the government budget to make timely purchases, resulting in occasional voluntary petrol rationing and rolling blackouts of electricity.

Table 40: Fuel imports 2006–2010

Fuel Type	2006	2007	2008	2009	2010
Diesel	8 144 167	5 334 340	8 074 821	8 671 864	8 842 138
Petrol	1 092 549	1 164 518	1 409 669	1 447 507	1 467 753
Jet Fuel (DPK)	520 245	954 996	963 200	N/A	N/A

An estimated 9.5 tonnes of liquefied petroleum gas (LPG) are used by households each year for cooking. LPG is provided by two private importers. Information about kerosene use was not available, but the level is reportedly low relative to electricity and LPG.

Nauru's electricity supply comes from a single power station operated by NUC (Table 41). The engines have a total nameplate generation capacity of 12.3 MW, but have been de-rated to 5.3 MW. If an engine breaks down, load shedding is necessary. The distribution system is in a ring main configuration and includes 11 kV, 3.3 kV and 415 V sections. Maximum demand was once in excess of 7 MW but has dropped, largely due to the loss of industrial demand, to around 3.3 MW. The electricity generation between 2008 and 2012 is given in Table 42.

During the years of high phosphate production, industrial use dominated the Nauru energy economy. However, that use has now diminished and the domestic sector is now the dominant user of energy in Nauru (Table 6).

Table 41: Installed Diesel Capacity

Engine	Deliverable MW Maximum	Rated (MW)
Ruston #1	1.40	2.6
Cummins	0.5	1.0
Ruston #4	Not installed	2.0
Ruston #5	0.8[27]	1.0
Ruston #6	1.7	2.0
Ruston #7	1.7	2.7
Cat genset	Not installed	2.0
TOTAL	5.3	12.3

Source: Provided through communication by NUC (2013)

Table 42: Total generation and fuel use 2008–2010

Year	Actual generation (MWh)	Fuel used (litres)
2008	19 382	5 929 740
2009	21 174	6 299 460
2010	22 462	7 181 100
2011	23 024	7 360 628
2012	23 600	7 544 644

Source: Provided through communication by NUC (2013).

As the electricity tariffs are kept artificially low and bill collection is not enforced, the average household use of electricity is very high, estimated at around 400 kWh/month. Electric cookers, freezers and refrigerators are common, as is home ownership of multiple air-conditioners (though units are often unused due to their high operating cost). To gradually shift the population to paying for electricity, prepaid meters have been installed for most domestic and commercial customers (Table 43).

Table 43: Customer meters (2011)

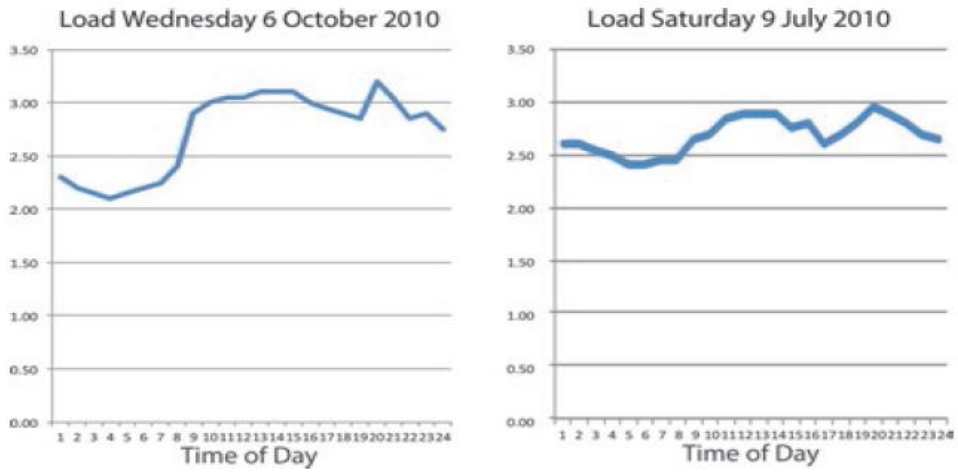
Sector	Number of prepaid customers	Number of billed customers
Residential	1 980	42
Commercial	124	48
Industrial	0	2
Government	0	32

Source: Provided through communication by NUC (2012).

Even though there are only 20 public streetlights on the island and their energy consumption is very small, conversion to high-efficiency Light Emitting Diode (LED) lights is being considered. A number of LED-type street lights powered directly by solar energy have been provided by a donor but some are no longer operating due to vandalism and technical problems. Daily load curves for 2010, as shown in Figure 34 below, indicate a weekday base load of around 2 MW and an evening peak of around 3.2 MW, probably due to cooking using electric ovens. The weekend load varies from around 2.5 to 3 MW with the peak again in the evening. There is little energy demand for water heating.

[27] currently out of service

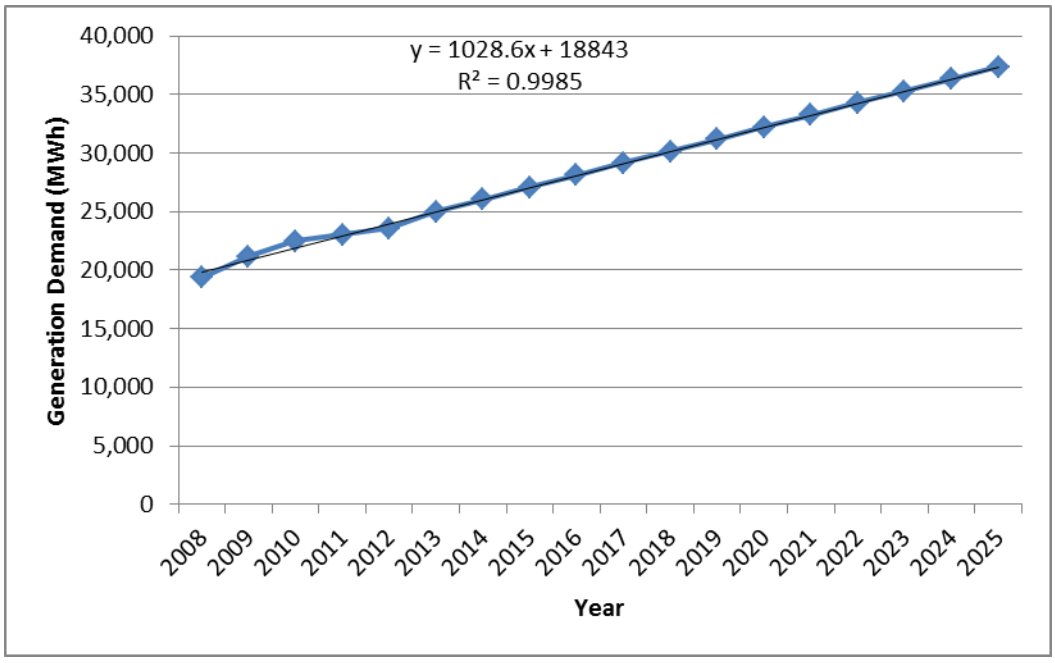
Figure 33: Load curves for 2010 (MW)



Due to major structural changes taking place in the economy, precise energy demand forecasts are not possible. The fuel consumption might not increase, and may even decrease, over the next decade as a result of energy efficiency drives and electricity prices rising from the heavily subsidised levels of today to a tariff that recovers full cost. Also, industrial fuel use is closely tied to phosphate production, which has a long-term downward trend. Only the use of jet fuel is expected to raise much over the next 10 years, and even that looks unlikely if Our Airline (the national carrier of Nauru) cannot expand its operations.

The electricity demand forecast for Nauru has been estimated assuming the current actual generation for residential, commercial, industrial and government. In reality, during the years of high phosphate production, industrial use dominated the Nauru energy economy. That use has diminished and the domestic sector is now the dominant user (as in Table 42).

Figure 34: Electricity Generation Demand Forecast for Nauru, 2008-2025



According to the records available for the year 2008, the electricity generation was about 19,382 MWh. The electricity generation demand forecast shows average growth of 4% over a period of 18 years and generation demand is estimated to be around 37,357 MWh in the year 2025. This forecast shows an increasing trend in GHG emissions in the energy sector.

Energy efficiency and renewable energy are considered to be the sustainable energy options for Nauru. These options offer considerable potential to provide Nauru with diverse energy supply sources and reduction in energy consumption and reduce its dependence on imported fossil fuels. GoN has taken various initiatives to mitigate GHG emissions of the energy sector as discussed later in this chapter.

Transport Sector

As described in the GHG inventory, the transport sector has the largest share (17.27 % - 3.332 Gg CO2e) in GHG emissions for the base year 2000. This includes emission from road transportation which includes the CO2 emissions from combustion of fossil fuel (Gasoline and Diesel) used in internal combustion engines. The road sector constitutes 100% of GHG emissions under transportation which is dominated by cars and other light multi utility vehicles (About half of all households own a motorbike (45%) and 37% own a car, with Land Rovers (21%) and minivans/trucks (18%) providing other forms of popular household transport.[28]). There is no domestic aviation and national navigation is not estimated

According to 2011 census, a total of 573 motor cars, 1066 motor bikes, 98 trucks, vans or mini buses, and 763 bicycles were counted in Nauru. The census found that 29% of households owned at least one car, while motor bikes were much more common than cars, with 46% of households having at least one motor bike available. The census also found that only 5% of households owned a truck, van or mini bus and just over one-quarter of all households in Nauru owned at least one bicycle.

As per the census, only 6% of all households in Nauru owned a boat in working order and even fewer, 4%, owned a traditional canoe. Only 28 households (2% of all households) owned an outboard motor in working order. Retail fuel rationing affected the transport sector between 2010 and 2012. There have also been interruptions in the supply of jet fuel to the air transport sector (in 2008 and in 2013) due to inadequate fuel testing and storage.

There is no public transport system apart from very limited bus services in the morning and afternoons to take children to school and civil servants to work. The use of bicycles is not widespread and is constrained due to the large number of dogs freely roaming the island which are not afraid to attack cyclists. There has been almost no investigation or action into energy efficiency and renewable energy options for the transport sector in the past and the Nauru Energy Road Map 2014-2020 will constitute the first effort to examine this area.

As the majority of fuel use is for land transport and the other major user of fuel is the airline industry where international regulations limit scope for national interventions, the Nauru Energy Road Map 2014-2020 essentially focuses on land transport.

On the renewable energy and alternative fuel front, as noted in the renewable energy section of the Nauru Energy Road Map 2014-2020, there is limited short-term potential for biofuel to be grown on the island, although this is an option that should be studied for the long-term. LPG cars and hybrid electric-diesel vehicles may also be options to investigate for the future. It may also be worth examining the feasibility of fully electric vehicles with solar (or wind)

[28] 2002 Nauru Census Main Report

charging. However, fully electric vehicles are far from becoming a commercial reality in practice even worldwide. Due to Nauru's size the infrastructure investment would not be as high as elsewhere as Nauruan's would be able to keep their vehicle charged from their own home. However, there would be a need for additional generating capacity. Therefore, a preliminary investigation into the benefits and costs of LPG, hybrid and electric vehicles would be needed before any further concrete steps are taken in this direction.

A target for the transport sector is not foreseen in the Nauru Energy Road Map 2014-2020 due to lack of baseline data against which to set a target. However, as data becomes available and is analysed, a review of the effectiveness of a transport sector target may be carried out. Therefore one of the major activities which need to be undertaken is the systematic collection of data regarding energy use in transport.

Residential

Residential sub-sector in Nauru constitutes for 0.6 % of energy sector emissions. As per Nauru Census Report 2011, the main and almost exclusive source of energy for lighting in Nauru was electricity, apart from very few households in Uaboe, Baitsi, and Location that used kerosene or gas as the main source of lighting. The main source of energy for cooking was electricity for 60% of all households in Nauru, followed by gas (31%) and wood or open fire (6%). More than three-quarter of households in Location and Uaboe relied on electricity as energy for cooking, while half of all households in Ijuw used wood or open fire for cooking.

Manufacturing Industries and Construction

Total emissions from Manufacturing Industries and Construction sub sector accounts for 20.3 % of GHG emissions under the energy sector. Domestic aviation is not occurring in the country, only one airline is there that is international, however this does not include emissions due to international flights, such emissions are estimated separately and are reported as memo items as international bunker (aviation) in this report.

Industrial Processes

This sector covers GHG emissions from industrial processes as an output of non-energy related activities. In Nauru this sector is negligible except phosphate mining. Hence GHG emissions from this sector are not estimated, only phosphate mining (in terms of energy consumption, as phosphate mining uses only diesel based self-generated electricity and fuel oil based drying process and no other chemical process) estimated and reported in this report as manufacturing industries & construction.

Solvents and Other Products Use

This sector comprises emissions (primarily Non Methane Volatile Organic Compounds) from solvents and other products use containing volatile compounds. However in Nauru there are no solvents and other products use industries and process; hence GHG emissions from this sector are not estimated.

Agriculture, Forestry & Other Land Use

Emissions due to rice cultivation and burning of Savannas do not occur in Nauru while emissions from field burning of agricultural residues have not been estimated.

In the year 2000, the GHG emissions from Agriculture (excluding removals) contributed about 8.33% of total GHG emissions (19.294 tCO2e). GHG emissions (primarily CH4 and N2O) from these sectors are mainly attributed to livestock farming, Enteric Fermentation, Manure Management and N2O emissions from agricultural soil.

The open source (*www.factfish.com*), which uses UN data as source, estimates 2,800 pigs, 5,000 poultry birds and 5,000 chickens for years 2000 and 2003 respectively. As per the 2007 survey by Agriculture Division the livestock population included 563 pigs, 948 chickens and 53 ducks.The 2011 survey counted 1,306 pigs, 4,683 chicken, 167 ducks, and 18 other not further identified livestock. Most pigs were counted in Buada (233), and Meneng (172); the most chicken in Meneng (957) and Aiwo (771); and the most ducks were raised in Aiwo (34) and Anetan (21). In addition, households in the district of Boe raised 11 other livestock.

The number of pigs, chickens and ducks/birds decreased from 2000 to 2007, however the number of pigs increased by 57% from 563 in 2007 to 1306 in 2010; number of chicken increased by 80% from 948 in 2007 to 4683 in 2010 and number of ducks increased by 68% from 53 in 2007 to 167 in 2010.. The GHG emissions from this sector are mainly attributed to poor infrastructure and land use practices, inadequate and unsystematic manure management. Due to lack of data, it is difficult to gauge the contribution forests and land use make to Nauru's GHG emissions profile, hence these sectors are not estimated in this inventory.

Waste Sector

The GHG emissions from the Waste sector include, emissions from (a) solid waste management and disposal and (b) domestic and commercial wastewater handling. The GHG emission from waste sector in Nauru for the year 2000 was about 22.54% (4.3491 Gg CO2e). The key source of methane emissions under the solid waste management and disposal include emissions from anaerobic decomposition of waste.

In Nauru, common methods of disposal include open backyard dumpsites, disposal at sea or on unused land, and burning. The management and control of the landfill has been, and continue to be a challenge. Nauru lacks national environmental and health laws to regulate the dumping of hazardous waste and general rubbish. Municipal waste is taken to the landfill, which is also operated by NRC. It is located on top of an aquifer, which does not have appropriate lining of waste disposal cells or leachate collection. The waste is usually burned first and then pushed into old mined-out areas. Occasionally, the landfill area is bulldozed and covered with a thin layer of soil. Only one bulldozer is working at the dumpsite, and sometimes the waste accumulates since the bulldozer is also used for other jobs on the island. The landfill is reaching the end of its life; and if the landfill is not rehabilitated, seepage from the site will cause major contamination of underground sources of water.

Bio-waste from medical facilities has, at times, been burned at the landfill because of operational problems with the hospital incinerator. With little segregation of wastes and proper disposal of hazardous waste, chemical substances pose a risk to public health and the environment. One particular area of concern is the disposal of asbestos. An estimated 90% of Nauru's houses are built with asbestos roofing, which is now being replaced because

of the health risks it presents. Special training is needed in the handling and disposing of asbestos. Phosphate processing, which releases cadmium-rich waste, also poses an environmental threat.

There is not appropriate information available for sanitation system in Nauru, however common practice would be decentralized system, consisting of privately managed household and commercial septic tanks for the collection of human waste. These allow the decomposition of the waste but the process leaves sludge as a by-product. Emissions from incineration and open burning of waste have not been estimated in the current inventory.

International Bunkers

International bunkers include aviation and navigation. Emissions from marine transportation are not estimated due to lack of data. CO_2 emissions from international aviation for the year 2000 were estimated to be 0.87 Gg CO2e, while emissions from other gases were insignificant. These emissions are not counted under national totals.

Biomass

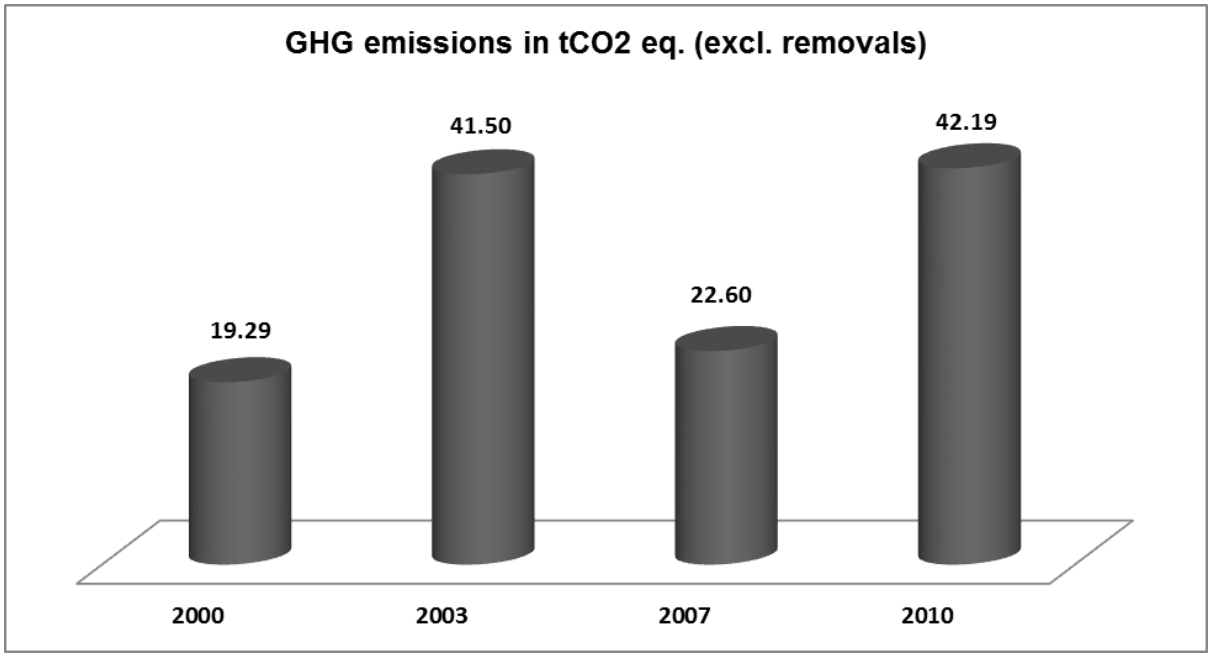
The limited availability of biomass in Nauru would make it difficult to support a biofuels industry, unless that changed dramatically in the future. One possibility for this would be if the centre of the island were planted with a potential fuel crop such as coconut, oil palms, pongamia, jathropha or other fast growing vegetation that could be converted into biofuel using advanced biofuel technologies that are currently being developed. However, the issues of food versus cash crops as well as water availability would have to be carefully examined, among others.

As mentioned earlier, the main source of energy for cooking was electricity for 60% of all households in Nauru, followed by gas (31%) and wood or open fire (6%). More than three-quarter of households in Location and Uaboe relied on electricity as energy for cooking, while half of all households in Ijuw used wood or open fire for cooking. By 2004, virtually all but a small coastal area had been stripped of trees. Although it is conceivable that rehabilitation efforts could recover a major part of the biomass resource lost to mining, for the near term the resource is inadequate to form the basis of any significant energy producing effort. Less than 15% of the land area has not been mined or cleared for human habitation. This represents only about 3 km^2 of land available for biomass production, insufficient to provide much energy benefit. Biofuels also are conceptually possible for future development with coconut plantations being possible as part of the topside development. However, the concept lies many years into the future and at present the coconut resource is only sufficient for household use.

3. Nauru's GHG Emissions Scenario

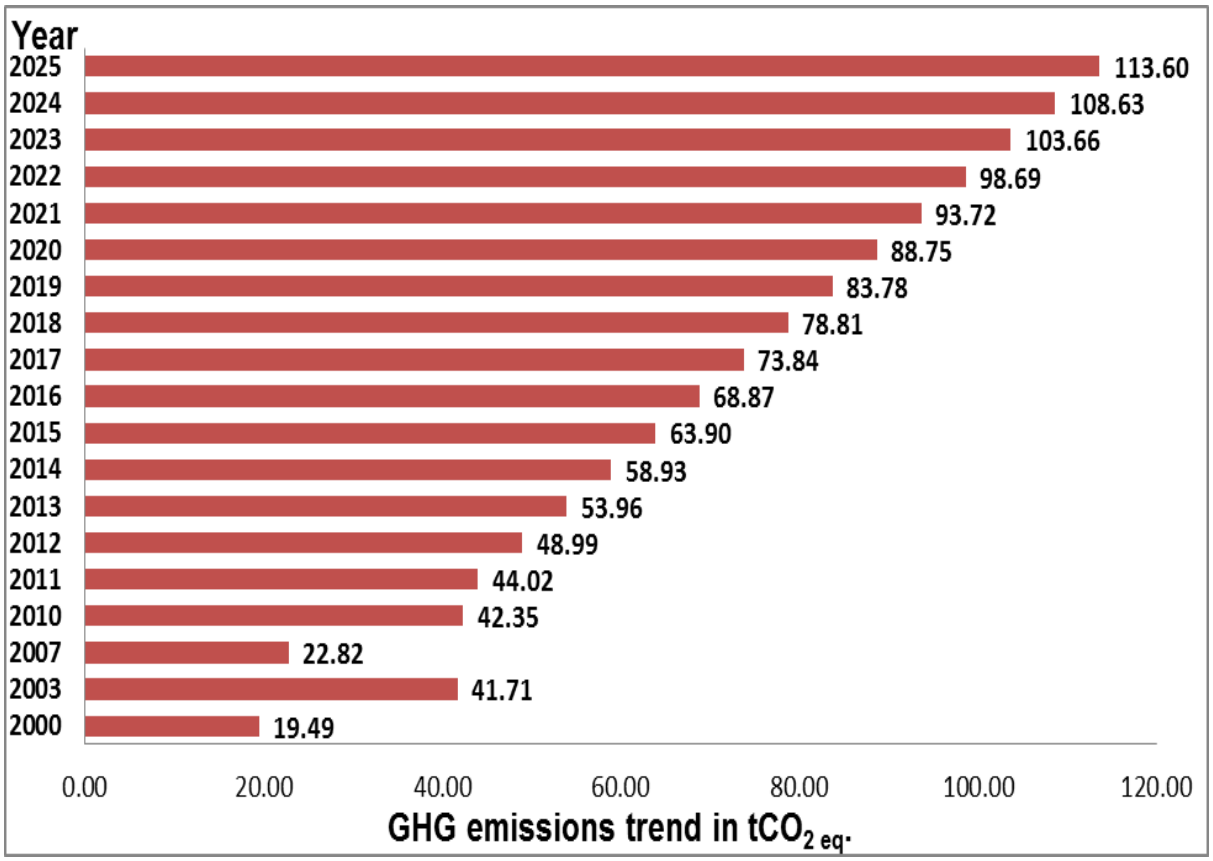
The GHG emission scenario for Nauru presents business as usual total GHG emissions (excluding the removals) during the years 2000 and 2025. The sectoral GHG emissions calculated for the base year 2000 and for 2003, 2007 and 2010 are presented in the figure 35 below:

Figure 35: Total GHG Emissions (excluding removals) $GgCO_2e$, 2000-2010



Based on the input data available for the year 2000, 2003, 2007 and 2010, GHG emissions profile (excl. removals) for Nauru has been prepared for year 2025 (figure 36). Under the baseline scenario, Nauru's total GHG emissions (excluding removals) were projected to increase by 83 % between 2000 and 2025, with average increase rate of 6% per year. The GHG emission profile of Nauru is presented in the figure below:

Figure 36: Projected Total GHG Emissions (excl. Removal) $GgCO_2e$, 2000-2025



The projected GHG emissions for Nauru do not include sinks and removals. Further, the projected GHG emission could be reduced with intervention of various GHG mitigation options proposed by GoN.

The emissions scenarios illustrate that without intervention, emissions are projected to rise sharply over the next decade. It is important, however, to note that even with this growth Nauru's emissions will still be small compared to other developing countries, in both absolute and per capita terms. There is significant potential for Nauru to reduce the GHG emissions by implementing renewable energy technology in the energy sector and energy efficiency in supply and demand side. This investment is largely beyond Nauru's financial capacity and is only achievable with support from development partners. New breakthroughs will be needed to tackle other sectors' emissions. This will also depend largely on progress made in developing viable options for the reduction of emissions from other sectors.

4. National/Regional Policies and Programs

In accordance with the principles of common but differentiated responsibilities and capabilities; it is crucial that Annex I countries take the lead in the global mitigation efforts. The GoN is committed to making a practical contribution to global climate change mitigation efforts and has taken up various policies, legislations and program based initiatives towards climate change mitigation and GHG emission reduction with the support of various development partners and agencies. The main mitigation policy and programs pursued by Nauru government are discussed in the following section.

(A.) National Sustainable Development Strategy (NSDS), 2005-2025 (October 2009):

A National Sustainable Development Strategy (NSDS) 2005-2025, which sets out strategies for economic, social, infrastructural and cross-cutting sectoral reforms, was announced in 2005. It was reviewed in 2009 while keeping its long-term vision, "A future where individual, community, business and government partnerships contribute to a sustainable quality of life for all Nauruans".

Long-term Goals:

a) Stable, trustworthy, fiscally responsible government
b) Provision of enhanced social, infrastructure and utilities services
c) Development of an economy based on multiple sources of revenue
d) Rehabilitation of mined out lands for livelihood sustainability
e) Development of domestic food production

Areas that have been significantly strengthened with new NSDS Strategies and Milestones are:

- ***Environment –*** *the NSDS coverage of this was largely limited to rehabilitation of mined out areas in topside. Whilst this is a very important issue, there are many other critical environmental issues that Nauru needs to address and these have been included in this revised NSDS update. These include the need to build resilience to climate change as well as the need for a comprehensive law on environmental management that would include a requirement for new projects to be assessed for their environmental impact.*

- ***Gender issues –*** *the NSDS update expands the coverage of gender issues in various sectors.*

- ***Community development –*** *this section of the NSDS has been strengthened and is more explicit about how to involve communities in the development process and there is more emphasis on the culture and traditions of Nauru.*

- ***Youth –*** *this group only had limited coverage in the NSDS which provided for the development of a youth policy. Issues that affect youth and children have been included in various sectors of the updated NSDS.*

- ***Law and Justice –*** *this is a major issue, especially with regard to young people (50 per cent of the population) and gender based violence. The 2009 revised NSDS update includes more coverage of these issues and strategies to address them.*

- ***Land issues –*** *have insufficient emphasis in the 2005 NSDS despite these issues proving an obstacle to many important developments projects. A new section has been included in the updated NSDS to address land management including land-use plans.*

- ***Fisheries –*** *this had limited coverage in the 2005 NSDS and has been expanded in the 2009 revised NSDS to more accurately reflect current practices and structures in Nauru.*

Sectors under NSDS with consideration:

Economic Sector

1. *Fully rehabilitate topside with a greater area of rehabilitated land utilised for livelihood sustainability including environment conservation and protection.*
2. *Increase revenue generation through the efficient and effective use of the few available remaining resources such as phosphate reserves and fish stocks and establishment of a national Trust Fund.*
3. *Increase level of domestic agricultural production initiatives such as kitchen gardens, fish farms, milk, fish and yabbie ponds to reduce dependence on imported food and to address food security.*
4. *Develop an SME sector that includes the participation of the community, as the basis for the economy supported by the development of a conducive business services environment.*
5. *Improve labour market access for Nauruans leading to a higher flow of remittances.*

Social Sectors

1. *Improve the educational system, focusing on the quality (to regional standards), scope (primary, secondary, vocational and life & trade skills) and reach (new audiences such as the mature age).*
2. *Provision of effective preventative health services reducing lifestyle related illness.*
3. *An efficient and effective judicial system with strong, functioning law and order.*
4. *Increase the use of traditional values, knowledge, skills and practices to strengthen cultural and national identity.*

Infrastructure Sectors

1. *Provision of enhanced utilities and transport services including the increased use of renewable energy, power (non-diesel generation i.e. OTEC and solar), water, waste management, roads, sea and air services.*

Cross-cutting

1. *Develop the human resources in technical, organisational and financial management capacities.*
2. *A stable, trustworthy, fiscally responsible government with transparent and accountable Parliamentarians, cabinet and public service.*
3. *Establish a legislative and institutional framework conducive to foreign investment and the setting up of companies to generate employment and income including, foreign banking presence and clear tenure/rental laws.*
4. *Maintain good bilateral, region-wide and international relations and comply with international standards.*

Following consultation with the Government, the community, business groups and individuals Nauru"s revised sector goals are listed below. These sector goals have been

developed to achieve Nauru"s vision and long-term goals (above) as well as to be consistent with the sector strategies and milestones presented in the NSDS.

Economic Sector Goals

Macroeconomic management

- *A stable macroeconomic environment conducive to private investment established*

Agriculture

- *Increased level of domestic agricultural production aimed at addressing food security and healthy livelihoods*

Fisheries

- *Enhance development and sustainable management of marine and fisheries resources to provide sustainable economic returns*

Mining & Quarrying

- *Efficient and effective use of mining and quarrying resources*

Commerce, Industry & Business Development

- *Promote development of small and micro enterprises, foreign investment and economic integration into the global economy*

Tourism

- *Promote development of small-scale sustainable eco-tourism*

Financial Services

- *An effective, competitive and stable financial system that will enhance economic growth and development*

Social & Community Sector Goals

Education

- *Improve the quality and broaden the scope and reach of education*

Health

- *A healthy and productive population*

Sports

- *Enhanced quality of life through Sports for All*

Traditional Leadership & Culture

- *A healthy, socio-cultural, inclusive, cohesive and self reliant community with sustainable livelihoods*

Women & Development

- *A just society that recognizes and respects the rights of women and promotes equal opportunities*

Youth Development

- *Investing in Youth – A sustained future for Nauru*

Civil Society

- *A robust, vibrant and effective civil society for a just and peaceful Nauru*

Infrastructure Sector Goals

Energy

- *Provide a reliable, affordable, secure and sustainable energy supply to meet socio-economic development needs*

Water & Sanitation

- *Provide a reliable, safe, affordable, secure and sustainable water supply to meet socio-economic development needs*

Waste & Sewerage

- *Effective management of waste and pollution that minimizes negative impacts on public health and environment*

Transport

- *Improve transport infrastructure and provide reliable and affordable public transport service*

Communications and media

- *Provide universal and reliable access to internationally competitive communication services and an independent and commercially viable media*

Cross Cutting Sector Goals

Public Administration

- *Strengthen and develop the institutional capacity of the Nauru Public Service*

Governance Institutions

- *Strengthen Parliament, Audit, Justice, Law, Order and Border Control*

Land

- *A transparent and fair land management system that supports social, economic and private sector development*

Environment

- *Sustainable use and management of the environment and natural resources for present and future generations*

(B.) National Energy Policy Framework (NEPF)

According to the NSDS, the energy sector goal is to provide a reliable, affordable, secure and sustainable energy supply to meet socio-economic development needs through implementing a National Energy Policy Framework (NEPF), which addresses (i) cost effective, secure and sustainable procurement and supply of fuel, (ii) reliable and efficient energy supply and distribution, (iii) management of demand focusing on consumption efficiency and conservation, and (iv) increased use of renewable energy and other alternative forms of energy.

Since 2007, the National Energy Policy Framework (NEPF) was being developed by the government with help of the Secretariat of the South Pacific Applied Geoscience Commission (SOPAC) through PIEPSAP project. The NEPF was approved by cabinet in mid-2008.

According to the NSDS, the medium term targets (2015) for the energy sector are: 50% of energy demand covered by alternative energy sources, including renewable; electricity losses and leakage reduced to less than 10% of power production and distribution; and electricity power demand reductions maintained at least 30% levels.

The Strategic Action Plan for Renewable Energy in Nauru's Energy Framework has a policy of a "10% increase in the share of renewable in the energy mix of Nauru by year 2020." This is to be achieved through various means including the harnessing of Nauru's wind resources.

Nauru started a Nauru Energy Efficiency Training and Public Awareness Campaign as part of an overarching project with the primary objective of poverty alleviation by improving access to electricity to ameliorate living conditions. The specific aim of the campaign is to improve the demand side efficiency of the energy sector in Nauru, and has been structured to: commence an energy efficiency awareness raising and public education programme; conduct energy audits at Government buildings and selected residential houses; and build capacity of local agencies including the training of the Energy Efficiency Officer to carry out energy efficiency programmes such as information dissemination and public awareness activities with energy audits and implementation.

(C.) Nauru Energy Road Map 2014 – 2020

The GoN has an ambitious plan for developing the energy sector in a systematic, rational, strategic and sustainable manner over the medium term, for the benefit of all its citizens.

The Nauru energy vision is taken from the energy sector goals of the National Sustainable Development Strategy 2005 -2025 (NSDS, revised 2009): *"Provide a reliable, affordable, secure and sustainable energy supply to meet the socio economic development needs of Nauru"*

The NSDS developed Nauru's long term vision, message and goals, including those for the energy sector. The NSDS overall vision for development is stated as: *"A future where individual, community, business and government partnerships contribute to a sustainable quality of life for all Nauruan's".*

The outcomes and targets:

Box 1: The outcomes of the Nauru Energy Road Map are taken from the policy statements of the 2009 National Energy Policy Framework (NEPF).

The outcomes are:

1. A reliable, affordable and safe power supply and services.
2. A reliable and safe supply of fossil fuels.
3. Universal access to reliable and affordable energy services.
4. An efficient supply and use of energy.
5. A significant contribution from renewable energy towards electricity supply1
6. Financial sustainability of the energy sector.

The targets of the Energy Road Map are based on existing targets in the NSDS and on guidance from the NEPF and the Nauru Government[2].

The targets are:

1. 24/7 grid electricity supply with minimal interruptions
2. 50% of grid electricity supplied from renewable energy sources
3. 30% improvement in energy efficiency in the residential, commercial and government sectors Efficient, robust and well-resourced institutions for energy planning and implementation.

A target for the transport sector is not foreseen in the Road Map due to lack of baseline data against which to set a target. However, as data becomes available and is analysed, a review of the effectiveness of a transport sector target may be carried out.

As well as the goals of the NSDS and NEPF, in May 2012 stakeholders in Nauru identified the following as drivers for the energy Road Map (the order below does not indicate any ranking in terms of importance):

1. Reduce dependence on fossil fuels
2. Improve planning and coordination
3. More reliable energy supply
4. Improve energy efficiency
5. More sustainable, cleaner energy
6. Improve cost-effectiveness of energy services
7. Attract funding for energy sector development

At a more fundamental level, the Road Map is seen as a means to address unreliable energy supply for households and businesses, constraints in improving the standard of living of Nauruan households, need for changes in attitudes and awareness on the use and cost of energy, limited technical knowledge and capacity in the energy sector, shortage of spare parts for repairs and maintenance and financial constraints to energy sector development.

(D.) Energy Efficiency Action Plan (EEAP) 2008-2015

An Energy Efficiency Action Plan (EEAP) 2008-2015 has been developed as part of the campaign by EDF-9 funds managed and implemented by it-Power of UK through REP-5, and executed by the South Pacific Applied Geoscience Commission (SOPAC) and Live & Learn. It has been developed through a consultative process involving stakeholders from the public sector, private sector and civil society groups in order to contribute to the improvement of the energy sector and livelihoods in Nauru. The overarching vision of the EEAP is as in the Nauru National Energy Policy vision statement: “Secure and sustainable energy, enabling the social and economic development of Nauru”.

The EEAP provides a guideline for the development and implementation of energy efficiency strategies for short-term priorities for 2008-2010 and a medium to long-term plan for 2010-2020. The latter includes strategies to establish a Demand Side Management Team within the Power Utility, conduct loss-analysis of the electricity transmission and distribution, build capacity of local personnel, promote and demonstrate EE and conservation measures, conduct energy audits, strengthen legal and regulatory frameworks, and promote the use of alternative/EE technologies.

The EU-funded Support to the Energy Sector in five ACP Pacific Islands Countries (REP-5) supported Nauru to achieve the overall objective of poverty alleviation by improving the access to electricity and thus the living conditions through energy efficiency and renewable energy activities, and was completed in 2009.

With regard to RE activity, a 40 kWp grid-connected PV system has been installed at Nauru College; and the PV system has been generating 4,500 kWh per month on average since its installation in October 2008 which translates to a fuel saving of 1,325 L per month at the power station. As for EE, over 1,800 prepayment meters were installed by August 2009 for all residential and commercial customers and the prepayment metering system came online. The prepayment meters were supplied to the NUA as part of its reform strategy, which aims at recovering its generation costs through a mix of demand-side management and a user-pays tariff structures.

Within the EE projects, the REP-5 formulated a new tariff schedule that gradually increases in the tariffs to move towards a cost-recovery regime. The tariff structure was approved by Government in July 2008, and came into force in August when the prepayment system was activated. To assist customers to adjust to the new system, an extensive energy efficiency

awareness campaign is underway. At the same time, an overall Energy Efficiency Action Plan for Nauru is being developed and renewable energy is being introduced. In addition, an Energy Efficiency Officer was recruited in November 2007, and oversaw the energy efficiency actions contained in Nauru's Energy Efficiency Action Plan (EEAP) until May 2009. External technical assistance was contracted in March 2008 to develop the EEAP in conjunction with the Energy Efficiency Officer. The EEAP was finalized in December 2008, and the activities contained within were implemented until June 2010 by two new Energy Efficiency Officers hired in July 2009. The Nauru Energy Efficiency Community Awareness Programme was launched in August 2009.

Nauru signed the financing agreement for the European Union's 10th EDF in October 2007 to implement a Renewable Energy Programme worth €2.3 million. EDF 10 involves activities in EE and RE projects as well as distribution/transmission line review and refurbishment.

Nauru participates in the Pacific Islands Greenhouse Gas Abatement through Energy Project (PIGGAREP) of the Secretariat of the Pacific Regional Environment Programme (SPREP). In 2008, IGGAREP introduced its assistance for Nauru to expand the Nauru RE market beyond those provided through the REP-5 and EDF 10. It includes key activities: a study of the potential productive uses of solar energy for desalination, laundry and catering purposes at the hospital and in fisheries; wind power feasibility study at the highest areas of Nauru (the topside); and strengthening the capacity of the NUA. The study of the potential use of solar energy is timed to take place after the adoption of the tariff study under REP-5 (in mid-2009) since the power tariff has a significant impact on the commercial viability of the solar energy applications. The strengthening of the capacity at NUA involves three activities including a small island states capacity building workshop on renewable energy technology applications, local training workshops on renewable energy, and extension of the employment of the Energy Officer at NUA which was financed by the REP-5.

Nauru has endorsed the UNFCCC and is an active participant in the Pacific Islands Climate Change Action Program (PICCAP). It is also a full member of an independent, intergovernmental, regional organisation established by South Pacific nations in order to provide geotechnical services, the SOPCA, and of the Secretariat of the Pacific Regional Environment Programme (SPREP).

(E.) National Environmental Management Strategy (NEMS) and National Environmental Action Plan (NEAP)

Preparation of NEMS was commissioned by the Department of Island Development and Industry (IDI) on behalf of the Government of Nauru and funded by the South Pacific Regional Environment Programme (SPREP).

There were four guiding principles for the preparation and implementation of the NEMS that will, hopefully, ensure it's workability and success. These were:

1. That there must be an exhaustive, and continuing, process of consultation and consensus building;
2. That the NEMS must be based on what is currently known about the environment, and equally important, what is not known;
3. That priorities, the formulation of policy, and the resultant National Environmental Action Plan (NEAP), as the most important component of the NEMS, should depend on the results of the first two stages; and,
4. That the implementation of programs and activities suggested in the NEMS and the NEAP be constantly monitored, modified or changed over time based on both changing priorities of the Nauruan people and on the acquisition of new information or feedback on existing programs or activities and the state of Nauru's environment.

National Environmental Action Plan (NEAP) for Nauru is the most important part of the National Environmental Management Strategy. The NEAP consists of a range of Action Plan "Objectives" and associated "Programs" under each Objective that can be implemented to address the main issues and constraints to environmentally and culturally sustainable development.

The Objectives and Programs suggested under the National Environmental Action Plan include:

1. **Land rehabilitation and protection**, including the rehabilitation of the mined-out phosphate lands, a rehabilitation trial, soil manufacture, and erosion assessment and control.

2. **Strengthening environmental education**, including the development of a master environmental education plan, the establishment of an environmental education sub-committee and an environmental resource centre, a traditional environmental awareness campaign, a "keep Nauru a pleasant island" competition, an "enviro-media" campaign, a pilot "operation clean-up Nauru" campaign, the upgrading of science education, and tertiary training in environmental science and environmental management.

3. **Strengthening environmental institutions and legislation**, including the establishment of a Nauru environmental coordinating committee, adoption of the environmental impact assessment (eia) process, development of a land use planning system, land tenure reform, conduct of relevant environmental baseline studies, establishment of a Nauru environmental information system, review and enforcement of existing legislation, and enactment of new environmental legislation.

4. **Conservation of biodiversity including the survey and selection of priority conservation sites**, establishment of pilot conservation areas under the spbcp, protection and rehabilitation of endangered plants and animals, a noddy bird population biology study and conservation initiative, the development of a forestry and agroforestry development plan, establishment of a nursery system for endangered and culturally-important plants, establishment of a rehabilitation nursery, and the establishment of a Nauru national botanical garden and arboretum.

5. **Promotion of the sustainable use of marine resources, including the establishment of marine reserves**, improvement of the fisheries resources data base, control of overexploitation of marine resources, improved exploitation of pelagic and deep water marine resources, reinstitution of appropriate traditional marine resources management strategies, and rehabilitation of aquaculture in buada lagoon.

6. **Pest and disease control** including the establishment of an integrated pest and disease control program and a quarantine service.

7. **Pollution and waste management** including the development of an integrated waste management plan and the establishment of a waste management authority, a waste reduction campaign, an education program for the safe handling and proper disposal of pesticides and chemicals, strengthening of recycling capabilities, green waste recycling, establishment of a sewage treatment plant, a composting toilet trial, air pollution monitoring and control, and noise pollution control.

8. **Control of population and urban growth** including the implementation of an effective family planning program, development of new residential and agricultural

areas as part of the rehabilitation of nauru, and controlling immigration into nauru.

9. **Health and nutrition improvement** including a health and nutrition awareness and improvement campaign and a physical fitness campaign.

10. **Promotion of sustainable economic development** including the strengthening of local production systems, the development of a tourism master plan, and the promotion of ecotourism.

11. **Appropriate infrastructural development** including the coordination of infrastructure and services planning, obtaining consensus agreement of landowners on the easement or right-of-way over private property for the installation and maintenance of essential services, design of an energy management plan, development of a storm water collection and disposal system that minimises erosion and maximises the recycling of water for irrigation, and the establishment of an integrated water conservation program.

12. **Addressing and preparation for global climate change and sea-level rise** including a continuing strong commitment to international initiatives addressing global climate change and sea-level rise, development of an integrated coastal zone management and coastal protection plan, coastal forest protection and reforestation, and protection from ultraviolet radiation.

13. **Maintenance of a strong anti-nuclear stance** including a continued commitment to all international anti-nuclear initiatives and the initiation of a local nuclear awareness campaign.

14. **Maintenance of a strong stance against trade in toxic and hazardous wastes** including support of regional initiatives to ban the importation of hazardous and radioactive wastes.

(F.) Other National Acts in the Nauru

Nauru Rehabilitation Corporation Act 1997

- Year passed: 1997 (No. 10); Date of effect: 13th June 1997; Administered by the Nauru Rehabilitation Corporation
- To establish a Corporation charged with responsibility for coordinating, promoting, carrying out, managing and participating in rehabilitation works in Nauru.

Nauru Fisheries And Marine Resources Authority Act 1997

- Year passed: 1997 (No. 17); Date of effect: 13th June 1997; Amended: 2004 Administered by the Nauru Fisheries and Marine Resources Authority
- To establish the Nauru Fisheries and Marine Resources Authority and to provide for its powers and functions.

Port Authority Act 2006

- Year passed: 2006 (No.4); Date of effect: 17th June 2006; Repealed the following laws: Nil; Administered by the Port Authority of Nauru
- To establish the Port Authority of Nauru and provide for the sea port management in Nauru.

Litter Prohibition Act 1983

- Year passed: 1983 (No. 6); Date of effect: 14th October 1983; Repealed the following laws: Section 15 of the Public Health Ordinance 1967

- To make provision for the abatement of litter. Dealing with littering is an important aspect of environmental management.

Motor Traffic Ordinance 1937 – 1960

- Year passed: 1937; Date of effect: 3rd November 1937; Amended: 1967 (3 amendments)
- To provide for the registration of motor vehicles and of motor traffic.

Marine Pollution Prevention Bill

- Year drafted – 2000;
- To implement the provisions of the MARPOL Convention and to make comprehensive provision for matters relating to marine pollution and responses to marine pollution incidents.

Wild Birds Preservation Ordinance 1937

- Year passed: 1937 (No. 14); Date of effect: 30th November 1937; Repealed the following laws: The Wild Birds Preservation Ordinance (N0. 12 of1924) and the Wild Birds Preservation Ordinance 1936.
- To provide for matters related to the preservation of wild birds.

Fisheries Act 1997

- Year passed: 1997 (No. 18); Date of effect: 13th June 1997; Repealed the following laws: The Marine Resources Act 1978; Administered by the Nauru Fisheries and Marine Resources Authority
- To make provision for the management, development, protection and conservation of Nauru's fisheries and living marine resources.

Agricultural Quarantine Act 1999

- Year passed: 1999 (No. 5) 41;Date of effect: 18th October 1999
- To provide for the protection of plants, animals and public health and the protection, development and utilization of natural resources and the environment by preventing the introduction and spread of diseases and pests.

Public Health Ordinance 1925 - 1967

- Year passed: 1925; Amended: 1967; Repealed the following laws: Administered by the Department of Health 45
- To make provision for the safety of the public health of Nauru.

Lands Act 1976

- Year passed: 1976 (No. 13); Date of effect: 23rd September 1976; Repealed the following laws: The Lands Ordinance 1921 – 1968 and section 4 of the Laws Repeal and Adopting Ordinance 1922 - 1967
- To make provision for the leasing of land for industry and public purposes and for the removal of trees, crops, soil and sand, and the payment of compensation and other monies.

Nauru Lands Committee Ordinance 1956 - 1963

- Year passed: 1956
- To provide for the establishment of a Nauru Lands Committee and related purposes. Relevance to this Review This law is of marginal relevance but is a key law applying to lands in Nauru.

Fisheries Regulations 1998

- Year passed: 1998; Administered by the Nauru Fisheries and Marine Resources Authority

- To provide for the registration and licensing of fishing vessels, and other matters under the Fisheries Act.

Biosecurity Bill 2004

- To protect the health, environment and agriculture of Nauru and to facilitate trade in its animal and plant products.

(G.) Pacific Island Regional Policies and Programs

Nauru is an active participant in Pacific island regional affairs and has signed on to a number of regional policies and initiatives that have implications for climate change mitigation. These are briefly outlined below:

Pacific Plan for Strengthening Regional Cooperation and Integration (PPSRCI): Endorsed by Pacific Island leaders in October 2005, the PPSRCI includes some strategies to help promote environmentally sound energy options and facilitate international financing for action on climate change.

Pacific Island Framework for Action on Climate Change (PIFACC): Approved by Pacific island leaders in June 2005, the PIFACC includes regional activities aimed at contributing to global greenhouse gas reduction. Expected mitigation outcomes by 2015 include:

- Promotion of improved energy efficiency in all sectors
- Introduction of cost-effective renewable energy technologies
- Promotion of local sources and knowledge
- Development and implementation of Clean Development Mechanisms.

Pacific Islands Energy Policy: Adopted in November 2004, the policy includes a number of important goals relevant to mitigation such as efficient power generation, environmentally clean and efficient transportation, development of renewable energy and improved energy efficiency.

Solid Waste Management Strategy for the Pacific Region: Developed by SPREP and adopted by Pacific Island countries and territories in 2005, the Strategy does not make specific references to GHG emissions. Its implementation, however, may help promote recycling and reduce the amount of waste going to landfills, which in turn may contribute to GHG abatement.

(H.) Nauru Action Plans

The Energy Road Map sets out the key activities for the period 2014 to 2020 that are required by different stakeholders to reach the targets of the Road Map. The action plans are applicable to all stakeholders in the energy sector, although most actions are led by NUC and CIE.

There are six action plans, one for each of the six themes of the Road Map:

- Power (including supply side energy efficiency)
- Petroleum
- Renewable Energy
- Demand Side Energy Efficiency
- Transport
- Institutional Strengthening and Capacity Building

These lay out the strategies and activities needed to progress towards the vision, outcomes and targets of the Road Map, the NEPF and the NSDS.

Each action plans include:

- Policy statement (where available from the NEPF)
- Strategies
- Activities under each strategy
- Organisation responsible for each activities and supporting organisations
- Activity importance: the importance of each activity to progress towards the desired outcomes classified as very high, high and medium. Low importance activities are not included in the Road Map.
- Timeframe: the estimated timeframe for completion of the activity
- Expected Results: expressed as outputs and/or outcomes
- An estimated budget based on available information. This is expected to change as the action plans are revised on a yearly basis.
- Many of the indicative timeframes are dependent on each other and therefore they will need to be updated regularly based on progress.

The aim of the action plans is to provide a basis for all partners in Nauru to work together and avoid partial or incomplete solutions and different kinds of energy sector equipment and regulations being implemented which may not be compatible.

Cross-cutting themes such as health, education, gender and youth, environment and climate change, and community participation are not addressed explicitly in the action plans.

A brief overview of the Action Plans is provided in the annexure-c.

5. Existing and Identified Mitigation Options

The GoN has identified and is implementing various GHG mitigation projects in energy, transportation waste and forestry sectors. The key GHG mitigation options including potential projects and opportunities are discussed below:

(A.) Existing Mitigation Activities

- Solar energy was used to some extent in the 1980s for water heating but most of the systems that were installed failed after a few years of use and were not repaired. Currently there is little demand for water heating systems of any type.
- The Japanese utility company, Tokyo Electric Power Corporation, undertook a technical trial of OTEC in 1981 with an experimental plant on the west coast of Nauru that produced a net power of around 15 kW for a short time before a storm damaged the intake pipe and the system was disassembled. Despite over 30 years of development, that trial remains the only time electricity has been delivered to a commercial grid by an OTEC plant. The trials were mainly designed as engineering tests for TEPCO to gain experience with the technology and have not resulted in further development of OTEC in Nauru.
- In 2006, the REP-5 project of the EU installed a 40 kWp grid-connected PV system on the roof of Nauru College.
- Sixty solar home systems of 130 Wp capacity, which included LED lights, have been funded by Chinese Taipei institutions.
- Chinese Taipei institutions also funded a solar street lighting project which included 155 units installed around the island following the main road, with some of the larger units installed in community areas and government buildings.
- Some 160 Wp arrays for solar-powered district water pumps have been installed through Japan International Cooperation Agency (JICA) funding, although details are not available.
- Solar-powered LED torches donated by Chinese Taipei institutions were recently distributed to households. Further information was not available at the time of writing.
- A grid-connected PV system with an installed capacity of 15.84 kWp was provided by Chinese Taipei institutions and installed at the government offices building in 2012. In late 2012 this was expanded to a total of 30 kWp
- A pipeline project for grid-connected solar PV installation of 132 kWp is to be funded by Japan to offset the electricity use of an additional reverse osmosis plant funded through the PEC Fund of Japan.

Table 44: Summary of current measures contributing to climate change mitigation in Nauru

Initiative	Description
Solar Power Initiatives	EU Funded REP-5 (Nauru College Project) 40kWp 15.84kWp grid connected small scale solar plant funded by ROC Taiwan
Solar Power Initiatives	**Community Underground solar water pump** (JICA) – *Responsibility handed over to Climate Change Unit, Dept of CIE.* Previously managed by Planning and Aid Division (PAD).
Solar Power Initiatives	**Taiwan Solar Street Lighting project** – *Units handed over to government*

	CIE assisted in the process and main responsibility is Utilities (Maintenance and Monitoring) Labor & construction provided by Eigigu. 155 units donated to government 2 types of units (smaller units and the larger variety)
Solar Power Initiatives	**Nauru College PV Project** – CLOSED Nauru Utilities Corporation has the main responsibility in managing the project EU REP-5 Daily output – 40kWp Total budget allocations = € 300,000
Solar Power Initiatives	**Taiwan stand alone household units** – 60 units in total donated by ROC Taiwan and installed around the island. Installed in 15 communities including location community; Disbursement – 4 units in each community
Solar Power Initiatives	**Government solar project – funded by ROC Taiwan** – Solar PV units installed at government office. Inverters located at Department of Education. Monitor outside DFAT office. Solar module - 66pcs 1piece Inverter Total energy output – 15.84kW Budget – USD$100,000
Energy Efficiency	**Community Awareness (Energy Efficiency) and drafting of the EEAP** – Funded by EU and implemented by NUC REP 5 Project; Household appliances, Household Energy saving practices, Household energy audit Budget allocations = €150,000

(B.) Planned Mitigation Initiatives

A number of activities have been planned, which are likely to reduce GHG emissions in Nauru. This section provides the details of these activities. It is important, however, to note that most of the planned activities remain heavily dependent on continued international support.

i. Renewable Energy

Recently, the level of attention given to renewable energy in Nauru has increased substantially, reflecting a number of factors. The main driver behind the push for renewable energy in Nauru is to reduce the country's dependence on imported petroleum products. In particular, Nauru is focusing on alternative sources of energy to improve economic efficiency in its mining and aviation industry. Reducing GHG emissions, however, has also become a central goal of Nauru's renewable energy programme.

The Government's mitigation assessment reviewed all renewable energy technologies to assess their suitability to Nauru over the coming decade. Small-scale solar operations is currently the dominant source of renewable energy in Nauru and has significant potential for expansion. Wind energy may also offer some diversification opportunities. Beyond expansions already planned, it is unlikely that biofuels will be a significant source of abatement before 2020. Specific details of the potential for renewable energy are outline below.

Beyond the planned rural electrification programme, household solar use nationally is likely to be the main significant contribution to GHG abatement in Nauru before 2020. Solar PV systems may, however, be viable for some hotel developments, where grid connection costs are high or where the scale is large enough to justify the investment.

ii. Energy Efficiency

The efficient generation, distribution and use of electricity helps to minimise diesel consumption, which in turn helps reduce GHG emissions. To date, there has been very little emphasis on energy efficiency in Nauru. There are, however, a number of plans to improve both supply- and demand-side efficiency in the coming years, and these are outlined below:
A national demand-side energy efficiency strategy is planned to be prepared as part of the Power Sector Expansion Programme. This strategy needs to be based on the findings of the national energy efficiency assessment.

Key elements of the strategy are expected to include:

- Commercial energy use: In 2006, commercial customers accounted for 45% of total electricity consumption in Nauru. The relevant authority should develop a programme to improve energy efficiency in this sector. Ideally, this should start by targeting the biggest users.
- Household energy efficiency: In 2006 domestic customers accounted for approximately 24% of all electricity sales. Anecdotal evidence suggests domestic energy efficiency could be significantly improved through education, behavioural change programmes and the promotion of more efficient technology. Lighting is believed to be a key opportunity to improve efficiency.
- Government departments: Government departments accounted for 10% of electricity sales in 2006. There are many opportunities to cut demand in this sector, particularly through simple changes such as turning off computers and air conditioning overnight.
- Other electricity users: Hotels, industrial customers, churches and schools account for the remaining 21% of electricity users in Nauru. Energy efficiency programmes may be particularly effective by targeting these customers.

iii. Transport Initiatives

The Government of Nauru is seeking to reduce emissions in the transport sector. Measures include public awareness programmes, vehicle emission standards, promoting fuel-efficient and alternative fuel vehicles, improving public transport services, introducing financial incentives to encourage energy efficiency and promoting non-motorised transport, including fishing canoes for use over and the deeper ocean waters. The potential GHG abatement from these activities has not been calculated.

The South Pacific Applied Geosciences Commission (SOPAC) has designed the Promotion of Environmentally Sustainable Transportation in the Pacific Islands (PESTRAN) project, which has been submitted to the Global Environment Facility (GEF) for consideration as part of the Pacific Alliance for Sustainability. If this regional project receives GEF approval, it will include a number of activities to promote sustainable transport in Nauru.

iv. Other initiatives planned for the energy Sector

Other planned initiatives that will contribute to GHG abatement in the energy sector include:

a. ***Clean Energy Fund:*** The aim of the CEF is to "improve the coordination of financing sources for clean energy resources in Nauru through a revolving fund".

v. Forestry Sector Initiatives

a. *National Parks, Reforestation Programme, Grow and Green (Agriculture)*

"Grow and Green" is a government initiative and will be implemented by the Agriculture division within the Department of CIE. The program focuses on giving away 1200 fruit trees to communities per year. This activity's main goal is to contribute in achieving food security (one of Agricultures goal within the NSDS).

(C.) Additional Mitigation Opportunities

The Government of Nauru has assessed potential mitigation options for the period 2009 to 2020, taking into account the following criteria:

- Technical feasibility
- Economic efficiency
- Sustainable development
- Social and cultural appropriateness
- Environmental consequences

1.1 Summary of additional mitigation opportunities

Table 45 presents a summary of the additional mitigation opportunities that are available for Nauru, with further details presented below. The most promising option is the expansion of Nauru community households' solar energy supply system, while fuel-efficiency improvements for vehicles and greater demand-side energy efficiency also hold significant abatement potential. As discussed in more detail below, Nauru will depend on financial and technical support to implement these additional abatement opportunities.

Table 45: Summary of additional mitigation opportunities and associated GHG savings

Additional Mitigation Opportunities	Potential GHG savings in 2020 (t CO_2-e pa)
Energy Efficiency	
Demand-side management	230-1,380
Renewable Energy	
Expanded solar power capacity	Not assessed
Wind power	992
Biogas digester capacity	Not assessed
Transport	
Fuel Efficiency Improvements	6,617
Forests	
Reforestation	Not assessed
Waste	
Organic waste recycling	Not assessed
Phase out of open burning	Not assessed

1. Transport

Nauru's land and sea transport sector is small but if all of the actions that are currently planned can be implemented successfully, this will go some way towards reducing GHG emissions from the transport sector. In the longer term, the aim should be to ensure that these short-term activities are adopted as on-going strategies for controlling fuel use and minimising GHG emissions.

a. Fuel efficiency

A key element that is missing from the current plans is an analysis of potential fuel and emissions savings that can be achieved in the transport sector. Review of various reports affirmed that, energy efficiency measures could reduce fuel consumption in the road transport sector by approximately 10%. Savings of this magnitude are unlikely to be achieved in the short term, but are possible through incremental progress between now and 2020. If this target is achieved, the corresponding GHG savings in 2020 is estimated to be 6,617 tonnes of CO2-e per annum.

b. Improving the efficiency of existing vehicle stock

Most vehicles on Nauru's roads are performing well below optimal levels of fuel efficiency. This is due to a range of factors including poor maintenance and servicing, the condition of the roads and limited driver awareness about fuel-efficient driving practices. The fuel-efficiency activities planned for the coming years should improve this situation. Stricter testing and enforcement as part of warrant-of-fitness inspections provides a further opportunity to enhance existing vehicles' fuel efficiency.

c. Efficiency of vehicle imports

Efficiency of vehicles that are imported into Nauru are largely controlled by the manufacturers in the US, Australia and Japan as they also control the design of new vehicles. The Government of Nauru can, however, aim to influence the purchasing decisions of local consumers by implementing measures that favour fuel-efficient vehicles. Import duties, registration fees and other Government taxes can be structured to provide incentives for people and organisations to purchase cars with high fuel-efficiency ratings.

d. Public Transport, carpooling and non-motorised transport

Public transport, carpooling and walking and bicycling are non-existent in Nauru as the vast majority of households do own a car. However there is a growing number of Nauruans that rely exclusively on local bus networks and taxis, as well as walking and sharing rides with neighbours, friends and relatives. It is unlikely that further promotion of these transport options will lead to higher usage. Instead, the challenge for the Government will be to maintain the high usage of these low-emission transport options.

6. Barriers and Opportunities

Opportunities for immediate GHG mitigation in Nauru appears to be good in energy sector although the increase in population, phosphate mining scenario and change in lifestyle is expected to increase the GHG emissions in future. Energy, Transport, Waste Management, Agriculture and Forestry are the sectors considered strategic to low carbon development and GHG emission reduction in Nauru. The sector specific key mitigation options are illustrated below:

Table 46: Climate Change Mitigation Opportunities

Sector	Mitigation
Energy Sector	• Promotion of Renewable Energy technologies (Grid connected and off grid) i.e. solar, wind, biomass etc. • Small and mini grid for renewable energy electrification • Promotion of Bio-Fuels • Promotion of Renewable biomass at top-side land • Demand Side energy efficiency measures • Supply side energy efficiency measures • Promotion of energy efficient appliances (standardization and labelling of energy consuming appliances) • Green and energy efficient building standards • Promotion of building energy efficiency • Encourage public energy awareness to reduce use of high power consuming appliances • Promotion of cleaner fuels, efficient cook stove sand solar lanterns • Efficiency and Emission norm for Generators • Awareness, Training and capacity building programs • Provision of information on low carbon development and clean technologies
Transport Sector	• Promotion of fuel and pollution efficient vehicles, boats and planes • Norms for efficiency & pollution for vehicles • Promote public transportation services • Upgrading of road network and Traffic Management
Agriculture Sector	• Labelling of energy consuming appliances (pumps etc.) • Promotion of Renewable energy technologies (Solar Dryers etc.) • Land use management • Awareness, Training and capacity building programs
Waste Sector	• Promotion of waste Management (Reduce, Reuse, Recycle) • Landfill or composting of solid waste • Waste water treatment • Promotion of Biogas technology

Some of the proposed GHG mitigation initiatives are already under action plans. However, despite many projects led by the development partners and others over the past years, adoption has yet to materialize due to a variety of context-specific barriers. Financing and working capital, private sector development and market mobilization remain major challenges, while lack of information, awareness, and cultural barriers are very common for consumers.

Box 2: Main issues and constraints in planning, implementation of mitigation measures

- Limited capacity to prepare and carry out complex project proposals and provide project management for renewable energy projects.
- No single agency has renewable energy responsibility in the government.
- High logistics cost to access to the island.
- Land tenure issues may be a problem for large-scale installations.
- Nauru's high ambient temperatures, moisture, coral dust and high levels of atmospheric salt create a difficult environment for electrical and mechanical equipment.
- Lack of adequate technical capacity for maintenance and repair.
- Small population, with few resulting economies of scale.
- Insufficient institutional and financial capacity, lack of resources to properly develop and implement the mitigation measures.
- Limited knowledge of renewable energy at decision-making levels of government.
- Lack of a realistic and well-defined action plan to achieve fuel import reduction targets.
- The national utility, NUC, is in transition as industrial use declines, tariffs rise, and users adopt energy-efficiency measures, all of which make energy usage and cost difficult to predict. This also makes it difficult to readily determine how much renewable energy should be added to meet government goals.
- Collaborate with annex-1 countries to obtain high-quality satellite data and aerial imagery needed for forestry and land use sector.
- Need of proper sustainable master plan and its application in the Island to manage the land tenure issues, which may be a problem for large-scale installations.
- Land rehabilitation may eventually result in topside biofuel plantations if suitable fast growing plants can be grown in the rehabilitated area. There may be scope for domestic-scale piggery biogas projects for cooking but the number of pigs needs to be quantified before the level of contribution to the energy mix from biogas can be assessed.

7. Conclusion

As a small island nation, Nauru's in the global GHG emission is very minor both in terms of total emissions and per capita emission. Further, the country's capacity to contribute to global mitigation efforts is limited by a number of constraints which include lack finance to invest in mitigation efforts an limited technological capacity and human resources.

However GoN is extending all possible efforts to contribute to climate change mitigation. These efforts represent a fair share of the global mitigation task, in line with Nauru's responsibility, capabilities and right to sustainable development. The potential to contribute to global climate change mitigation efforts by Nauru will not be realised without greater support from the international community. This includes financial support as well as technology transfer and capacity-building initiatives.

CHAPTER 5

OTHER INFORMATION

1. Background

The section details Nauru's capacity to respond to climate change including implementation strategies and key initiatives. This section also discusses issues and challenges to integrate climate change with long term sustainable development goals such as the need for technology transfer, appropriate policies, research, data and information gaps.

In order to address climate change, the need for development of new technologies and transfer of existing appropriate technologies (for both mitigation and adaptation) cannot be overstated. New and clean energy technologies need to be developed to reduce greenhouse gas emissions while technologies also need to be developed to address climate change. Development and technology transfer is one of the four pillars of the Bali Action Plan which are critical to the achievement of both adaptation and mitigation initiatives.

As Nauru's greenhouse gas emissions are limited to a small number of well-defined sectors, the opportunities to reduce these emissions are relatively clear. Although Nauru's emissions are relatively small, Nauru still remains very mindful of its vulnerability to climate change and the future potential effects predicted as a result of sea-level rise. In consideration of these, Nauru has taken a positive approach towards improving its own situation as well as actively participating at both the regional and international levels.

2. Technology Transfer

The purpose of TNAs is to assist in identifying and analysing priority technology needs, which can be the basis for a portfolio of environmentally sustainable technology (EST) projects and programmes. This can facilitate the transfer of, and access to, ESTs and know-how in the implementation of Article 4.5 of the Convention. TNA includes:

I. a set of country-driven activities that identify and determine the mitigation and adaptation technology priorities of developing country Parties.

II. Involve different stakeholders in a consultative process to identify the barriers to technology transfer and measures to address these barriers through sectoral analyses.

III. May address soft and hard technologies for both mitigation and adaptation, identify regulatory options and develop fiscal and financial incentives and capacity-building.

TNA development is a key component of the Poznan Strategic Programme on Technology Transfer supported by the GEF. UNEP, on behalf of the GEF, implemented a round of TNAs with objectives going beyond the identification of technology needs. The TNAs facilitated the development of national Technology Action Plans (TAPs) that prioritized technologies, recommended enabling frameworks for the diffusion of these technologies and facilitated the identification of good technology transfer projects and their links to relevant financing sources. The TAPs systematically addressed practical actions necessary to reduce or remove policy, finance and technology related barriers.

TNA is one of the tools for the development, implementation and transfer of environmentally sound technologies (ESTs). The goal of a TNA is to identify technologies for mitigation and adaptation that also support a country's development objectives.

The TNA process contains following key steps:

(a) To identify key priorities, based on a country's long term vision of climate and development;

(b) To identify strategic sectors or areas to support these priorities;

(c) To prioritize technologies for mitigation and adaptation within the prioritized sectors;

(d) To identify barriers to, and enabling frameworks for, development and transfer of these technologies;

(e) To formulate technology action plans (TAPs) for projects, programmes or strategies;

(f) To prepare specific project ideas for each prioritized sector

TNAs helps countries to track their needs for new equipment, techniques, services, capacities and skills necessary to mitigate GHG emissions and reduce the vulnerability of sectors and livelihoods to climate change. Possible integration of the TNA process with NAMA and NAP processes: TNAs can be used for identifying and preparing actions under NAMA and NAP. TNAs can be used for identifying and preparing actions under NAMAs and NAPAs.

As discussed in the GHG inventory and mitigation chapters, the key source of GHG emission is from energy sector, a resource which the country is very dependent on petroleum fuel imports. Technology development and transfer is an essential strategy for Nauru 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".

Technology Needs Assessment (TNA) is the first step in understanding the needs for technology transfer in the host country. TNA is a country driven activity to assist in identifying and analysing the priority technology needs for mitigating and adapting to climate change. However, TNA has not been initiated in Nauru due to various constraints including lack of institutional and financial capacity. Carrying out the TNA could provide an opportunity to realize the need for new techniques, equipment, knowledge and skills for mitigating GHG emissions and reducing vulnerability to climate change.

The steps for sector analysis and prioritization under TNA, as well as the outputs, are summarized in Table 47.

Table 47: Steps for sector analysis and prioritization under TNA

Steps	Description	Output
Step 1	**Identifying development priorities in light of a changing climate:** **Step 1** Understanding the country's development priorities, based on existing national development strategies (e.g., poverty reduction strategies, national climate change plans) **Step 2** Discussing the short and long term implications of climate change for the country's development priorities **Step 3** Clustering development priorities, as a basis for guiding subsequent technology prioritization processes	The main output is a list of clustered development priorities for the country concerned which fully takes into account climate change implications.
Step 2	**Priority sectors for climate change mitigation and adaptation:** **Step 1** Initially identifying (sub)sectors **Step 2** Describing (sub)sectors in terms of sustainable mitigation and adaptation priorities **Step 3** Finalizing a short list of prioritized (sub)sectors according to their maximum mitigation and adaptation benefits	The main output is a short list of prioritized (sub) sectors for adaptation and mitigation in guiding subsequent technology prioritization processes.
Step 3	**Priority technologies for climate change mitigation and adaptation:** **Step 1** Identifying and categorizing technologies/measures for mitigation and adaptation **Step 2** Assessing technologies through multi criteria analysis **Step 3** Making final decisions	The main output from this chapter is a prioritized portfolio of technologies for mitigation and adaptation for each priority (sub) sector.
Step 4	**Preparing strategy and action plan for prioritized technologies:** **Step 1** Clarifying priorities and establishing key milestones **Step 2** Identifying measures to develop capacities and enabling frameworks **Step 3** Compiling an overall national strategy and action plan	The main outputs are a national strategy with implementation action plan to accelerate the adoption of prioritized technologies for adaptation and mitigation at each main technology stage (R&D, deployment and diffusion). The strategy and the action plan should be presented as an integral part of a country's national climate change strategy (e.g., NAMAs, NAPAs and low emission development strategies). The analysis also provides suggestions on developing projects or sector programs for rapid implementation of prioritized technologies available in the short term.

Source: TNA Handbook

3. Mitigation Opportunities

On 28th February 2012, Republic of Nauru has submitted the work plan on enhancing mitigation on behalf of the Alliance of Small Island States (AOSIS) pursuant to decision -/CP.17, paragraph 8. Nauru welcomed this opportunity to present views on behalf of the 43 members of the Alliance of Small Island States (AOSIS) on options and ways for further increasing the level of mitigation ambition.

i. Energy Sector Opportunities

1. Renewable Energy Opportunities

The 2005 National Sustainable Development Strategy (NSDS) and the 2009 Energy Policy Framework both state Nauru's aim to make 50% of energy provided through renewable energy by 2015.

The development of a 'Strategy for Renewable Energy' was included in the 2011 Nauru Economic Infrastructure Strategy and Investment Plan (NEISIP) with the aim to progressively replace the use of fossil fuels with solar energy.

a. Solar Energy

Measurements show an average resource of over 6 kWhr/m2/day (with solar panels tilted to the angle that maximises energy input) with a seasonal variation of around 10-15%. Solar PV matches well with mid-day demand for the use of air conditioners but cannot meet the demand for the mid-evening cooking-related peak. Therefore, although solar PV offers electricity generation that can supplement the existing diesel generation, due to the intermittency of the resource, expensive electrical storage systems will be required for it to be included into the grid at high levels of penetration.

A dynamic model has not yet confirmed the maximum possible level of solar penetration before grid stability issues occur, but it is likely to be limited to around 20% - 30% of the midday demand which is typically 3 to 3.5 MW. This represents a maximum grid-connected solar capacity of between 700 kWp to 1 MWp when the solar is connected without storage. Above this threshold, storage and control systems will probably have to be introduced to ensure grid stability. In terms of energy production, a 30% midday demand penetration (1 MWp of solar) represents around a 5% energy penetration for the conditions in Nauru so the 50% goal cannot be reached without substantial additional solar (above 1 MWp) which would need to be accompanied by associated energy storage such as large batteries.

b. Wind Energy

Wind data collection, funded by PIGGAREP and the EU36, has been carried out for more than three years at a telecommunications tower at Anabar District on the northern part of the island where the wind resource is expected to be greatest. However, the telecommunications tower includes components near the wind measurement instruments that may change both the speed and direction of the wind seen by the instruments thus lowering the confidence in the data collected to date. Measurements already made indicate an annual average wind resource of 4.22 m/sec at 30 meters (about 4.7 m/sec if extrapolated to 50 meters) for the period 2009-2010. This is at the low end of practicality for cost-effective wind energy generation.

A further resource assessment using a more suitable 50 metre low-profile guyed mast in Anabar has been underway since 2012 and is intended to determine the appropriateness of further wind energy development and to assess the quality of the data already collected from the nearby telecommunications tower instruments.

c. Geothermal

There is no evidence of a cost effective geothermal resource for Nauru and geothermal is not considered appropriate for development during the Energy Road Map period of 2014 to 2020.

d. Bio Energy

Wood is presently used as the main fuel for cooking by 6% of Nauruans. However, with little or no biomass present Topside, there are presently insufficient biomass resources for either electricity generation by combustion or gasification or for significant production of biofuel. Land rehabilitation may eventually result in topside biofuel or biomass plantations if suitable fast growing plants can be grown in the rehabilitated area, but it is not likely that production will be seen in time to help meet the 2020 goal of 50% electrical generation from renewables.

As Nauru has significant areas of unused land (topside) there is the potential to grow biomass that could become a future energy source. This would depend on the plans and timetable for secondary mining and rehabilitation. This needs to be investigated in a future study looking at the long-term options. There are number of issues that have already been identified such as the need for land reforming, soil damage from UV sunlight and the need for extensive rehabilitation.

There may be scope for domestic-scale piggery biogas projects to replace LPG for cooking and possibly some transport but the number of penned pigs and chickens in Nauru and their distribution over the island needs to be quantified before their contribution to the energy mix through biogas production can be assessed.

e. Ocean Energy

i. Wave energy

Wave energy in the equatorial region is generally low with around 10-15 kW/m estimated from satellite observations. Many different types of wave energy devices are being tested at the prototype stage around the world. However, none are yet commercially proven. Even if wave conversion systems become commercially available for utility scale generation, the low resource will make it difficult for Nauru to economically develop wave power at a cost competitive with other more significant renewable resources.

ii. Ocean Thermal Energy Conversion (OTEC)

In 1981 and 1982, the Tokyo Electric Power Company (TEPCO) in association with Toshiba of Japan installed and began technical trials of a mini-OTEC facility on the west coast of Nauru on the shore across from the current location of the Civic Centre in Aiwo. The facility had a gross power continuous rating of 100 kW and provided a maximum net power of 31.5 kW. At the time, the Nauru installation was the first land based OTEC plant in the world to produce net power, it was also the highest power OTEC plant ever operational and the first

(and last) to feed power to an operating commercial grid. It was known that it would not be a cost effective power supply for Nauru when it was installed and was not intended purely as a technical trial; it actually operated as a power generator feeding the Nauru grid for only 240 hours. The actual cost is not available but estimates go higher than US$1 million, all paid by TEPCO and Toshiba.

Since that early installation, there have been significant improvements in high efficiency low temperature heat exchanger designs eliminating the need for the use of very expensive titanium metal. Additionally, an open cycle OTEC design has been successfully operated in Hawaii. That design would be of particular interest to Nauru since a side benefit is the production of large amounts of fresh water. Also, the large volume of nutrient rich 7º C water from the deep water intake could be used for district air conditioning and cold water aquaculture thereby possibly providing significant additional side benefits.

With the very rapid drop-off that occurs beyond the reef in Nauru, there is an opportunity for OTEC energy development once engineering and commercial trials are completed elsewhere. However, the 1981-82 installation in Nauru remains the only OTEC facility that has actually delivered power to a public grid. Several engineering trials have been attempted, up to 1 MW of gross power capacity, but no plants have yet to be built that are suitable for commercial utility use and it does not appear likely that OTEC can be a part of the Nauru energy economy within the next 10 years, since there still are no OTEC plants anywhere in the world currently producing electricity commercially. Even if the go-ahead for utility scale trials were to occur today, it would be at least five years before an operational, utility scale plant would be commissioned and another five years should be allowed to work out the problems and to determine the real costs that such a plant has for O&M before committing to a Nauru installation.

f. Summary of Renewable Energy Options

Given the available resources and the state of renewable energy technology, only solar energy appears to be clearly appropriate for development to replace fossil fuels during the Energy Road Map period of 2014-2020. After further data collection and analysis, wind energy may also be shown to be a cost effective option and if so, can be integrated into the renewable energy action plan in the future.
There is significant future potential for bio-energy but this will depend on the greening of the Topside with suitable vegetation. This work should be progressed as a matter of priority since it offers significant potential for a low-cost, sustainable energy source over the medium to long term. It also offers the opportunity to develop an indigenous energy industry, encourage private sector participation, increase local employment opportunities and significantly reduce expensive energy imports. All of this without impacting and possibly synergising local food production on what is currently unutilized land.

Given that the existing wind data indicates a marginal resource plus the fact that the existing 202 kWp of grid-connected solar has performed well and met or exceeded expectations while there have been no trials of utility grade, grid-connected wind generation on Nauru, only solar development is presently considered as appropriate for the renewable energy component of the Road Map. Other renewable technologies, including ocean energy and biomass, may be practical for the period beyond 2020. Table 48 shows the summary of past, current and proposed renewable energy projects in Nauru

Table 48: Summary of past, current and proposed renewable energy projects

Technology	Installation Date	Capacity	Implementing Entity	Funding Entity	Operating in 2013
Solar Water Heaters	1980s	Unknown	GoN	GoN	No
OTEC	1981	150 kW gross, ~15kW net	TEPCO	Japan	No
Grid Connected solar PV	2008	40 kWp	GoN/NUC/IT Power	European Union	Yes
Solar PV and small wind turbine system	2009	Unknown	GoN	Unknown	No
Solar home systems	2010	7.8 kWp (60 SHS at 130 Wp each)	GoN/NUC	Chinese Taipei Inst.	Yes
Solar street lights	2011	155 units (130Wp)	GoN/NUC	Chinese Taipei Inst.	Some
Solar water pumps	Unknown	160Wp (quantity unknown)	GoN/NUC/ private	JICA/private	Yes
Solar LED lights	2011	Unknown	GoN/NUC	Chinese Taipei Inst.	Unknown
Solar stills	2011	20 units with 4 panels per unit	GoN/PACC project	GEF	Yes
Grid connected solar PV	2012	30 kWp	GoN/NUC	Chinese Taipei Inst.	Yes
Grid connected solar PV	2013	132 kWp	GoN/NUC	PEC Fund	n/a
Grid connected solar PV	Proposed	1 MWp	GoN/NUC	Unknown	n/a

Above mentioned table shows the existing renewable energy mitigation technologies in the Nauru.

2. Energy Efficiency Opportunities

a. Supply side energy efficiency

A general survey of the existing distribution system should be carried out and, if shown to be economically reasonable, a plan prepared for upgrading and/or changing to an underground system. This would allow better management of energy flows in the distribution system through centralized controls at the power house and reduce basic losses in the system components.

More fuel efficient engines are available and fuel efficiency should be a high priority when replacing existing engines or adding capacity. The NUC generators are aged and in poor condition, as indicated by the high level of de-rating of all the units. The average fuel efficiency of the diesel generators is 3.3 kWh/litre, which is significantly lower than the Pacific average of 3.8 kWh/litre.

Non-technical losses in NUA are considered excessive and need to be addressed by management but though a reduction of those losses will provide benefits with regards to the tariff that needs to be set to break even, it will have little or no effect on the quantity of fuel used per kWh generated. Table 49 shows the initial supply-side energy efficiency opportunities.

Table 49: Summary of initial supply-side energy efficiency opportunities

Area	Item	Description
Unbilled usage	Street lights	Replace existing street lights with energy efficient street lights, bill communities or GoN for street lighting, investigate and stop electricity theft.
Non-technical losses other than unbilled usage	Unpaid or extraordinarily late payments of bills	Install prepaid meters for all customers on standard meters who are not paying bills on time.
Technical losses	Distribution system	A general survey of the existing distribution system should be carried out and, if shown to be economically reasonable, a plan prepared for upgrading.
Technical losses	Generation	Selection of more fuel efficient engines when replacing existing engines or adding capacity

b. Demand side energy efficiency

Decades of very low (or no) electricity costs for energy consumers has resulted in a much higher per-capita energy usage than is seen in most island countries (SPREP, 2005). In a general sense, it can therefore be expected that there are many opportunities for demand side energy efficiency improvements, particularly in the residential and government sectors. However, until there is a better understanding of the actual energy use patterns and the energy using equipment's characteristics, well targeted programmes to help electricity consumers reduce energy cannot be confidently prepared. Surveys (household and businesses) and audits where appropriate should precede the design of programmes for demand side management (DSM).

ii. Industrial Sector

Industrial usage is limited to phosphate processing by RONPHOS. There has been no energy audit of RONPHOS industrial activities since it was established as a company in its current form in 2005. All of the electricity for phosphate processing is generated by RONPHOS itself, not by NUC. Therefore the industrial activity of RONPHOS is not considered a high priority of the Energy Road Map energy efficiency effort. However there may be possibility of energy efficiency and renewable energy in phosphate mining and processing industry, for that purpose there is need of detailed energy assessment/audit.

An audit could examine amongst others, the drying plant and consider more energy efficient ways of drying the phosphate product. An industrial energy audit, if recommendations are implemented, could result in lower costs to RONPHOS which could in turn be passed on to its shareholders, i.e. the Nauru Government and the people of Nauru.

iii. Transport Sector

An estimated 3.5 million litres or approximately 35% of Nauru's fuel imports are used for transport. The majority of transport energy is for land transport (estimated at 2.5 million litres of fuel), although some fuel is also used for small domestic fishing boats and cooking (31.3% of households use LPG as their main cooking fuel and 1.3% use kerosene39) and jet fuel is used for air transport (0.5 – 1 million litres). Air transport to Nauru is provided by the national airline, Our Airline. Retail fuel rationing affected the transport sector between 2010 and 2012. There have also been interruptions in the supply of jet fuel to the air transport sector (in 2008 and in 2013) due to inadequate fuel testing and storage. Programmes need to be developed that improve the average efficiency of vehicles on the road plus programmes that increase average vehicle occupancy per trip. At the same, non-motorised transport needs to be promoted as a viable alternative.

Options to improve land transport efficiency include:

1. Restricting the import of vehicles that have a larger engine displacement than is considered appropriate for the Nauru transport requirements.
2. Imposing significant extra import duty for large capacity engines while reducing import duty on more efficient vehicles. Reduce to a minimal level, import duty on motorcycles, bicycles and electric bicycles.
3. Programmes to provide incentives and facilities to improve the quality of maintenance of vehicles.
4. Implementation of a privately operated public transport system on Nauru following a study of public transport systems in Pacific Islands, with similar traffic patterns. These include the approach used on Majuro in the Marshall Islands which is based on private vehicles that can be flagged down at any point on the main roads and deliver passengers to their specifically desired destination for a flat fee and that on Tarawa in Kiribati that depends on a number of private passenger vans that regularly ply specific routes with charges based on zones or on distance travelled. Another option could be two buses going around the island, one going clockwise and one counter-clockwise. If waiting times are too long, the number of buses can be increased (or smaller mini-vans used instead of buses which would be more cost-effective to run in greater numbers).
5. Consideration of incentives to increase the use of bicycles and small motorcycles for personal transport and measures to control the number of dogs on the island.

4. Climate and Energy Institutional Framework

A number of policy instruments impacting the energy development on the island have been introduced since 2005 through the economic reform programme and these instruments are listed in Table 50 below. These predominantly focus on electricity supply and lack attention to petroleum and renewable energy supply, including fuel handling, storage and distribution.

Table 50: Key policy, legislation and strategic planning documents

Year	Legislation, policy, strategic planning document
2005 (rev. 2009)	National Sustainable Development Strategy 2005-2025
2006	Nauru's Utilities Sector – A Strategy for Reform
2008	Price Regulation Act
2009	National Energy Policy Framework
2011	Nauru Utilities Corporation Act
2012	Nauru Economic Infrastructure Strategic Investment Plan
2012	Nauru Utilities Corporate Strategy

i. National Sustainable Development Strategy

The NSDS is a 20 year plan that provides a roadmap for Nauru's development. The NSDS articulates the national vision, goals, strategies and priorities of Nauru and presents where Nauru wants to be in the medium term (5 to 10 years) and long term (10 – 20 years). The theme of the NSDS is "Partnerships for Quality of Life". Energy within the NSDS is included under the broader priority sector of "Infrastructure" with a priority of: Provision of enhanced utilities and transport services including the increased use of renewable energy, power (non-diesel generation i.e. OTEC and solar), water, waste management, roads, sea and air services".

ii. Nauru Energy Policy Framework

The Nauru Energy Policy Framework, developed and endorsed by the Nauru Government in 2009, was integrated into the revised NSDS (2009). The NSDS includes a goal for the energy sector to "Provide a reliable, affordable, secure and sustainable energy supply to meet socio-economic development needs" and includes energy under its major priorities and states that "whilst there has been considerable progress in achieving more stable electricity … services, the current way in which electricity … services are delivered is not sustainable for Nauru. Urgent measures need to be taken to upgrade infrastructure, raise efficiency, secure the benefits of renewable energy".

The 2009 Energy Policy Framework vision statement is "Reliable, affordable and sustainable energy, enabling the social-economic development of Nauru". The NEPF has seven strategic policy areas:

1. Power
2. Petroleum
3. Renewable Energy
4. Consumers
5. Finance

6. Institutional capacity
7. Energy conservation and efficiency

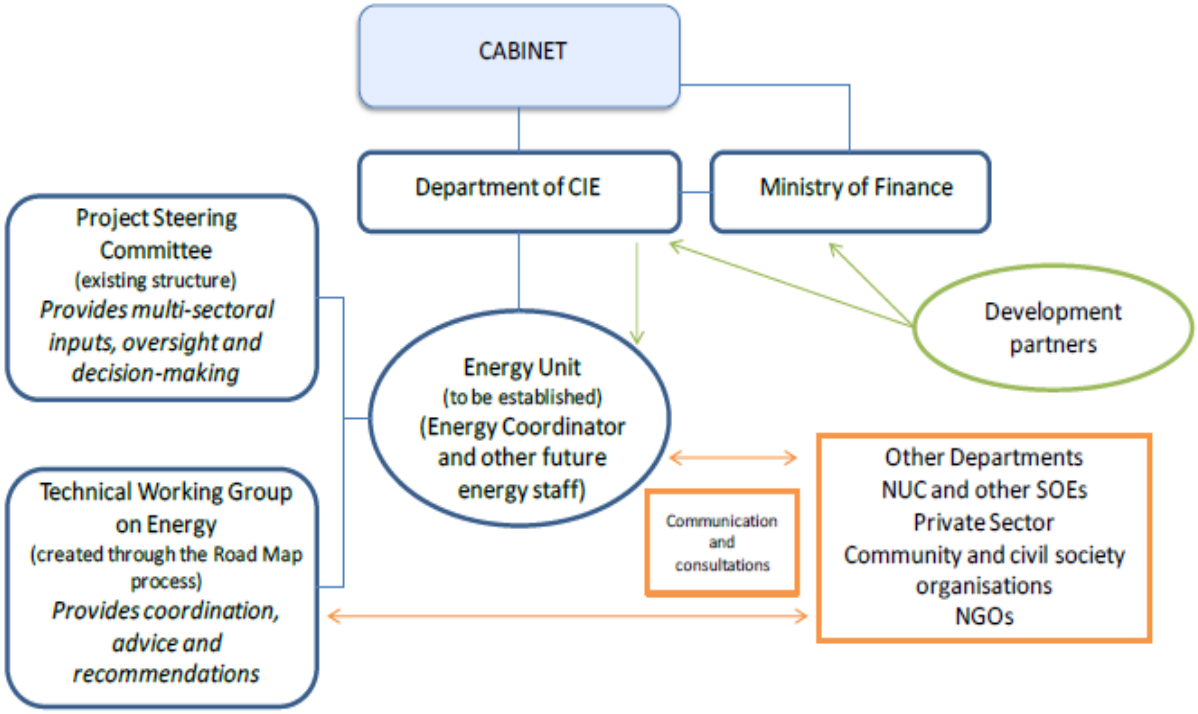
Under each policy area, there is a policy statement and broad strategies; although no specific activities are laid out.

iii. Energy Road Map Implementation Framework

The implementation of the National Energy Road Map (NERM) requires collaboration and commitment across the public and private sectors complemented by strong support of the local community and development partners. It requires that resources be used efficiently and effectively therefore it is important that the Government and development partners recognise and act in accordance with the Road Map implementation framework, strategies and activities. One of the purposes of the Road Map is to provide an implementation plan for all partners to work towards and thus avoid partial or incomplete solutions and different kinds of energy sector equipment and regulations being implemented which may not be compatible.

The implementation framework aims to be closely aligned with the National Sustainable Development Strategy (NSDS) monitoring and reporting process to reduce duplication and confusion amongst stakeholders. A proposed implementation structure is illustrated in Figure 37 below. This sits alongside and links directly to the existing NSDS and national budgetary framework and uses existing structures where possible but at the same time introduces two new institutional bodies, the Energy Unit under Commerce Industry and Environment (CIE) and the Technical Working Group on Energy, which will focus on the energy sector and facilitate the implementation of the NERM.

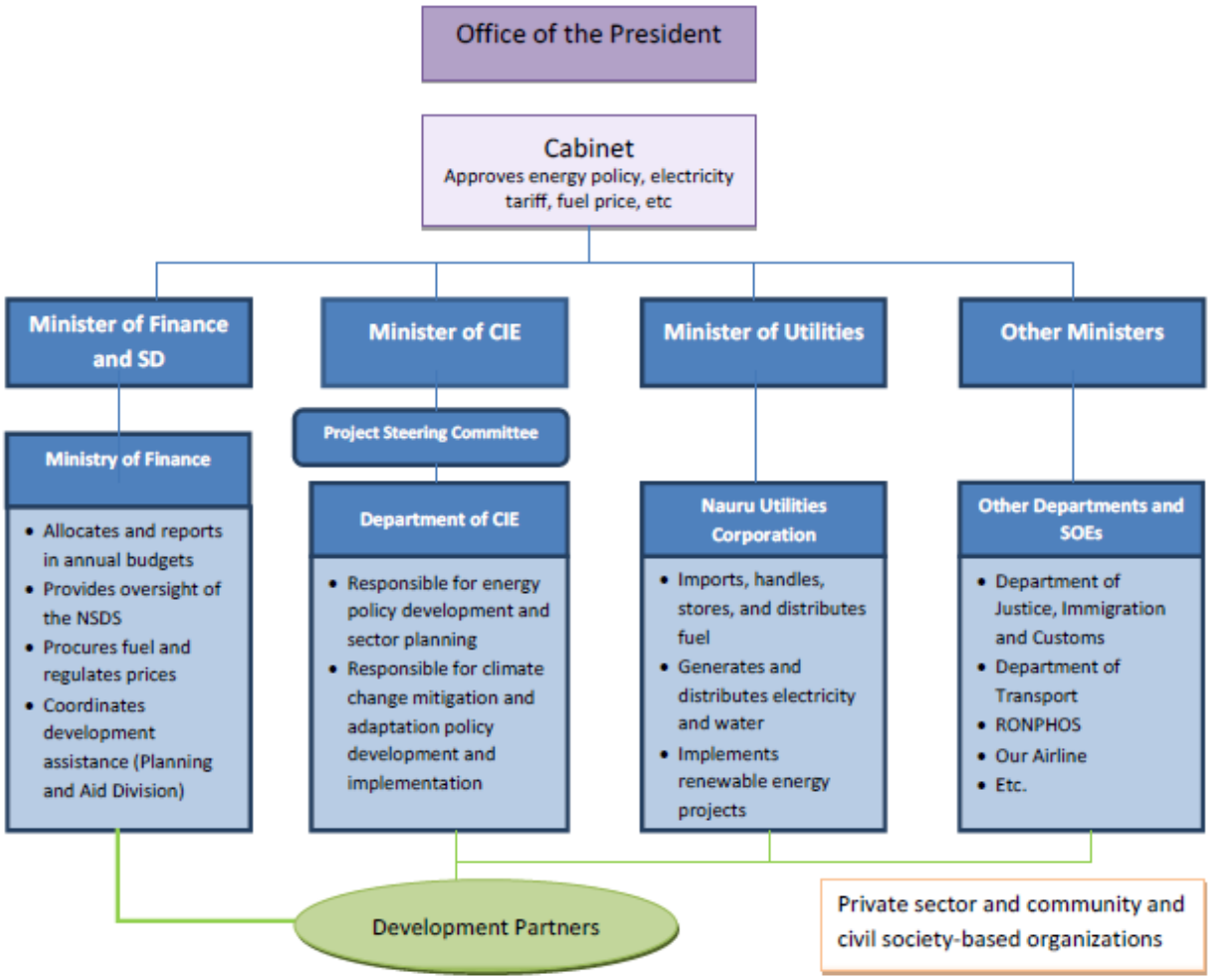
Figure 37: Road Map Implementation Framework



iv. Policy and Regulatory Framework

The role for planning, developing and regulating the energy sector has been shared amongst the key entities depicted in Figure 38 below. A clear structure is in place but there is a lack of formal mandate, the processes and procedures are not sufficiently developed and in some cases they are unclear. In addition, the functioning of institutions is constrained by limited financial resources and staff capacity. Energy investment on the island has been dominated by grant funding through various development partners.

Figure 38: Institutional Map



1. Ministry Of Finance

The Ministry of Finance is responsible for the overall planning, coordinating and accounting for the national budget including receipts and disbursements of aid funds received by the government. The Treasury Division of the Ministry allocates financial resources and regulates disbursements through the annual budgets.

Project funds from development partners' contribution are received by the government through the Ministry's Planning and Aid Division (PAD) and PAD reports to development partners on the disbursement of these funds.

2. Department Of Commerce, Industry and Environment

The Environment Division of the Department of Commerce, Industry and Environment (CIE) is responsible for energy policy development and coordinates and monitors the NEPF implementation. The Department has established and provides a secretariat for a multi-stakeholder Project Steering Committee (PSC) to advise the Secretary on project development and implementation issues. The PSC has been effective in serving the development and coordination of the water sector and has potential to do likewise for the energy sector.

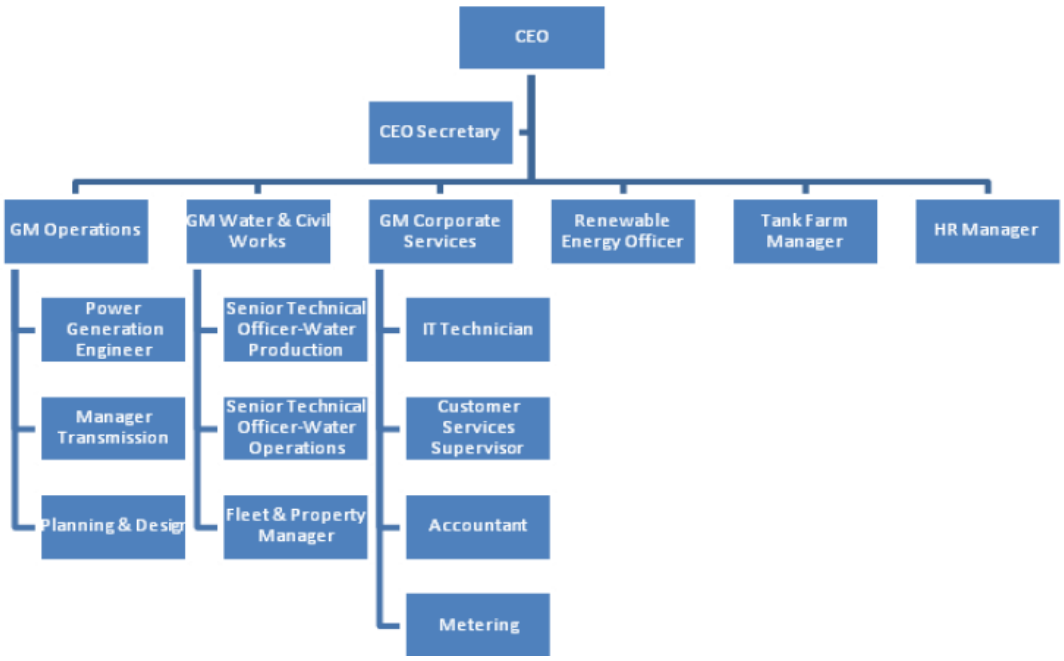
3. Nauru Utilities Corporation

Until 2005, the Nauru Phosphate Corporation provided all the island's electricity and water services. In 2005 the Nauru Utility Authority (NUA) was formed to separate the water and electricity utilities function from the phosphate corporation. It was later decided to corporatize NUA and the Nauru Utilities Corporation (NUC) was created. The current organizational structure of NUC is shown in Figure 39.

In June 2011, the status of the utility as a corporation was formalised with the passing of the Nauru Utilities Corporation (NUC) Act which states the legal obligations of the utility for the supply of electricity, water and fuel. Under the Act, the CEO of NUC reports directly to the Minister of Utilities. However, under the Act the process, including frequency and content of reporting of the CEO to the Minister are not specified and instead are agreed in the CEO's employment contract. The Act also sets up an Advisory Committee to "advise the Minister about matters related to the operations of NUC". The Advisory Committee is made up of 5 members, appointed by Cabinet.

In terms of governance, a further step in making the governance of NUC more transparent could be to define the performance reporting framework for the CEO and, or, convert the Advisory Committee into a Governing Board similar to the structure of many other Pacific Island state-owned utilities, where the CEO would then report directly to the Board.

Figure 39: Organizational structure of NUC



The NUC currently provides all electricity services to Nauru except for the RPC and the main processing plant of RONPHOS both of which generate their own power. Diesel, petrol and jet fuel (dual purpose kerosene - DPK) are purchased by the government for all customers except RONPHOS which procures its own fuel. The diesel, petrol and jet fuel are stored and distributed by NUC to all users except RONPHOS who maintains a separate diesel fuel storage facility for their industrial use. Jet fuel is used only by the national airline, Our Airline, which purchases it from the government. LPG is privately imported and distributed.

A Renewable Energy Officer is accommodated at NUC and is primarily responsible for renewable energy project implementation and for energy efficiency campaigns. There is also an Assistant Renewable Energy Officer, although this position does not seem to be formalised.
It should be noted that because NUC is responsible for both electricity and water supply at the operational level, there is an opportunity for synergies to be maximised for the development of both these sectors.

4. Other Departments and State Owned Enterprises

In addition to the key entities outlined in the above paragraphs, the entities shown in Table 51 also play an important role in developing and managing the energy sector.

Activities of the Road Map should coordinate closely with each of these entities as appropriate. For example, in developing programmes for energy and transport, a close working relationship with the Department of Transport should be developed.

Table 51: Other Entities playing a role in the energy sector

Entity	Role
Department of Justice	Oversees government contracts including CIE employment and service contracts. Drafts legislation.
Department of Transport	Regulates the transport sector which is a main user of fuel on the island.
RONPHOS	Imports its own fuel and stores it at the NUC fuel tank farm. Owns generators and produces its own electricity off the grid for industrial applications although does use grid-connected electricity for its offices.
Customs and Immigration	Implements border control.

5. Private Sector and Communities

Nauru has a limited private sector that is dominated by small grocery stores, a few restaurants and a handful of bigger trading companies. There are a few local electrical contractors engaged in wiring of new houses including repair services and a limited number of other skilled tradespeople operating on the island. There are no financing facilities available for new investment by local entrepreneurs. There is no local capacity to service the solar home systems currently operating on the island. Procedures for setting up new businesses are unclear and there is a lack of incentive for private sector participation in building the local economy.

Community groups are limited to district councils, the Community Based Organization (CBO), youth and women's groups and church groups. These on occasion interact with the Nauru island Association for Non-Government Organisation (NIANGO) which was established to represent community interests. NIANGO has not been able to serve its members effectively due to limited resources and it has relied heavily on external assistance through donor funded projects. NIANGO has participated in a number of energy awareness raising campaigns on the island and it has been active in engaging women and youth based groups. To facilitate increased participation of NIANGO and other NGOs and community groups in energy sector activities, they must be given the right level of resources and assistance to contribute in a meaningful away.

The Nauru Business Private Sector Organisation (formerly known as the Nauru Small Business Association) represents the business community interest has been functioning for some time and is a member of the Pacific Island Private Sector Organisation (PIPSO), although its development is highly affected by lack of financing facilities on the island. The Nauru Business Private Sector Organisation may become more involved in the energy sector in the medium term when the investment environment improves thus private businesses may be expected to play an important role in the process of increasing the share of renewable energy in the national energy mix.

v. Capacity Building, Education & Training

Nauru is making various efforts and prioritising both climate change mitigation and adaptation as one of the core development issues. To address the capacity building issues, Nauru in association with various development partners has been conducting many short term capacity development training programs and workshops for the policy makers, government and non-government staffs, students and local population. Both government and non-government institutions in Nauru have effectively stimulated interest and understanding of environmental issues through workshops, quiz contests, role-plays, theatre, radio, TV and Video shows.

Government of Nauru is seeking financial and infrastructure support to expand the capacity building and awareness raising at various levels. There are barriers in dissemination of the right information to the right target audience, alongside complications that can arise when specialised English terminology is used during consultation and awareness programmes. The key issues, barriers and opportunities are discussed below:

- The capacity building and public awareness program and activities need to be focused and relevant in the local context. Efforts should be focussed on making climate-change information available to a wider audience.
- Topics related to global climate change needs to be incorporated in the curricula of primary and secondary schools and appropriate training of teachers in environmental education.
- Provide incentives to the students for choosing higher education in environment, climate change and related development studies.
- Provide support for environment and climate change higher education.
- Start established institution for climate change & sustainable development
- Creating easy access to climate change information and make this information available in local languages
- Periodic assessment of impact and effectiveness of current awareness programmes should be undertaken.

5. Recommendations

- Poverty alleviation by improving access to electricity and thus the living conditions; and
- Reduce the amount of fossil fuel imports through the provision of affordable and environmentally sound technologies, as well as the implementation of energy efficiency and conservation measures.
- Focus on capacity assessment and development at the individual, organizational and societal levels before the implementation of technologies and projects.
- Initiate a capacity assessment, housed within GoN, and involving all relevant parties to create Nauruan ownership of a to-be-developed strategy for sustainable energy.
- Develop appropriate partnerships that bring together university expertise and Nauruan knowledge to design next steps toward a strategy for sustainable energy.
- Assign responsibility to a designation to manage and facilitate Sustainable Energy-related partnerships.
- Create an oversight and clearinghouse structure to direct the capacity development, technological projects and policy changes involved with a strategy for sustainable energy.
- Implement demand side management to increase energy efficiency.
- Create Policies requiring that new government buildings, residential housing, and retrofits to existing structures adhere to LEED standards.
- Secure funding to develop direct gird solar panel projects through conventional donors and sources, and attract funding from industrial nations through the Kyoto Protocol.
- Aggressively pursue the use and active maintenance of passive solar water heating systems using rainwater catchment systems.
- Conduct Studies using anemometers to determine the suitability of the wind region on the island for energy production using wind turbines.
- Centralize the sewage system to avoid reef contamination and the ensuing decrease in reef productivity. Utilize the sewage to produce biogas that can be used to power the centralized facility. Utilize the “sludge” leftovers from the biogas plant as initial nutrient input for rehabilitation of mined out phosphate areas.
- Begin planting coconut trees for the production of biofuels.
- A phase out of current energy subsidies that encourage fossil fuel consumption.
- Incentivize renewable energy technologies and conservation measures.
- Establishment of a Demand Side Management Team
- Loss-Analysis of the Electricity Transmission and Distribution System
- Capacity Development for Local Personnel
- Promote energy efficiency and conservation measures/practices through educational and awareness programmes
- Conduct Energy Audits
- Demonstration of Energy Efficient and Conservation Measures and Practices
- Strengthened Legal and Regulatory Frameworks
- Promote the Use of Alternative /Energy Efficient Technologies
- Need to conduct detailed Technology Need Assessment (TNA) work.

ANNEXURE-A

GHG Emissions UNFCCC Reporting Tables

2010 Emissions UNFCCC Reporting Tables

UNFCCC Reporting Table 1: Nauru's 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 (2010)

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	**37.584431**	NE	**0.197958**	**0.001434**	**0.149968**	**0.574185**	**0.109138**	**0.184116**
1 Energy	**37.584431**		**0.002582**	**0.000304**	**0.149968**	**0.574185**	**0.109138**	**0.184116**
A Fuel Combustion (Sectoral Approach)	37.584431		0.002582	0.000304	0.149968	0.574185	0.109138	0.184116
1 Energy Industries	18.844606		0.000771	0.000154	0.051400	0.003855	0.001285	0.019573
2 Manufacturing Industries and								
Construction	11.198510		0.000292	0.000088	0.029242	0.001462	0.000731	0.160068
3 Transport	7.255697		0.001514	0.000062	0.069282	0.568859	0.107120	0.004429
4 Other Sectors	0.2856187		0.00000449	0.00000027	0.00004494	0.00000899	0.00000225	0.00004486
5 Other (please specify)	0.000000		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
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								
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	NA	NA	NA	NA	NA	NA	NE	NA
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			**0.027538**	**0.000556**	NO	NO	NO	NO
A Enteric Fermentation			0.001306					
B Manure Management			0.026232	0.000198				
C Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO
D Agricultural Soils				0.000358				
E Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
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	NE	NE	NE	NE	NE	NE	NE	NE
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			**0.167839**	**0.000574**	0.000000	0.000000	0.000000	0.000000
A Solid Waste Disposal on Land	NA		0.151736	NE	NE	NE	NE	NE

B Wastewater Handling	NA		0.016103	0.000574	NE	NE	NE	NE
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	**2.574155**		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Aviation	2.574155		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Marine	NE	NE	NE	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass	NE							

UNFCCC Table 2. Nauru's National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF6 (2010)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs	PFCs	SF6
Total National Emissions and Removals			
1 Energy			
A Fuel Combustion (Sectoral Approach)	NE	NE	NE
1 Energy Industries	NE	NE	NE
2 Manufacturing Industries and	NE	NE	NE
Construction	NE	NE	NE
3 Transport	NE	NE	NE
4 Other Sectors	NE	NE	NE
5 Other (please specify)	NE	NE	NE
B Fugitive Emissions from Fuels	NE	NE	NE
1 Solid Fuels	NE	NE	NE
2 Oil and Natural Gas	NE	NE	NE
2 Industrial Processes			
A Mineral Products	NE	NE	NE
B Chemical Industry	NE	NE	NE
C Metal Production	NE	NE	NE
D Other Production	NE	NE	NE
E Production of Halocarbons and Sulphur	NE	NE	NE
Hexafluoride	NE	NE	NE
F Consumption of Halocarbons and Sulphur	NE	NE	NE
Hexafluoride	NE	NE	NE
G Other (please specify)	NE	NE	NE
3 Solvent and Other Product Use	NE	NE	NE
4 Agriculture			
A Enteric Fermentation	NE	NE	NE

B Manure Management	NE	NE	NE
C Rice Cultivation	NE	NE	NE
D Agricultural Soils	NE	NE	NE
E Prescribed Burning of Savannas	NE	NE	NE
F Field Burning of Agricultural Residues	NE	NE	NE
G Other (please specify)	NE	NE	NE
5 Land-Use Change & Forestry [(2)]			
A Changes in Forest and Other Woody	NE	NE	NE
Biomass Stocks	NE	NE	NE
B Forest and Grassland Conversion	NE	NE	NE
C Abandonment of Managed Lands	NE	NE	NE
D CO_2 Emissions and Removals from	NE	NE	NE
Soil	NE	NE	NE
E Other (please specify)	NE	NE	NE
6 Waste			
A Solid Waste Disposal on Land	NE	NE	NE
B Wastewater Handling	NE	NE	NE
C Waste Incineration	NE	NE	NE
D Other (please specify)	NE	NE	NE
7 Other (please specify)	NA	NA	NA
Memo Items			
International Bunkers			
Aviation	NE	NE	NE
Marine	NE	NE	NE
CO_2 Emissions from Biomass	NE	NE	NE

2007 Emissions UNFCCC Reporting Tables

UNFCCC Reporting Table 1: Nauru's 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 (2007)

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	**17.241191**	NE	**0.238418**	**0.001135**	**0.077096**	**0.336897**	**0.063849**	**0.015905**
1 Energy	**17.241191**		**0.001411**	**0.000141**	**0.077096**	**0.336897**	**0.063849**	**0.015905**
A Fuel Combustion (Sectoral Approach)	17.241191		0.001411	0.000141	0.077096	0.336897	0.063849	0.015905
1 Energy Industries	12.565442		0.000514	0.000103	0.034273	0.002570	0.000857	0.013051
2 Manufacturing Industries and								
Construction	0.000000		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3 Transport	4.452266		0.000897	0.000038	0.042823	0.334327	0.062992	0.002815
4 Other Sectors	0.2234825		0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00003894
5 Other (please specify)	0.000000		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
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								
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	NA	NA	NA	NA	NA	NA	NE	NA
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			**0.011846**	**0.000224**	0.000000	0.000000	0.000000	
A Enteric Fermentation	0.000000		0.000563					
B Manure Management	0.000000		0.011283	0.000080				
C Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO
D Agricultural Soils				0.000144				
E Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
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	NE	NE	NE	NE	NE	NE	NE	NE
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			**0.225161**	**0.000770**	0.000000	0.000000		
A Solid Waste Disposal on Land			0.203558				0.000000	

B Wastewater Handling			0.021603	0.000770				
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	**2.234825**		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Aviation	2.234825		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Marine	NE	NE	NE	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass	NE							

UNFCCC Table 2. Nauru's National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF6 (2007)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs	PFCs	SF6
Total National Emissions and Removals			
1 Energy			
A Fuel Combustion (Sectoral Approach)	NE	NE	NE
1 Energy Industries	NE	NE	NE
2 Manufacturing Industries and	NE	NE	NE
Construction	NE	NE	NE
3 Transport	NE	NE	NE
4 Other Sectors	NE	NE	NE
5 Other (please specify)	NE	NE	NE
B Fugitive Emissions from Fuels	NE	NE	NE
1 Solid Fuels	NE	NE	NE
2 Oil and Natural Gas	NE	NE	NE
2 Industrial Processes			
A Mineral Products	NE	NE	NE
B Chemical Industry	NE	NE	NE
C Metal Production	NE	NE	NE
D Other Production	NE	NE	NE
E Production of Halocarbons and Sulphur	NE	NE	NE
Hexafluoride	NE	NE	NE
F Consumption of Halocarbons and Sulphur	NE	NE	NE
Hexafluoride	NE	NE	NE
G Other (please specify)	NE	NE	NE
3 Solvent and Other Product Use	NE	NE	NE
4 Agriculture			
A Enteric Fermentation	NE	NE	NE

B Manure Management	NE	NE	NE
C Rice Cultivation	NE	NE	NE
D Agricultural Soils	NE	NE	NE
E Prescribed Burning of Savannas	NE	NE	NE
F Field Burning of Agricultural Residues	NE	NE	NE
G Other (please specify)	NE	NE	NE
5 Land-Use Change & Forestry [(2)]			
A Changes in Forest and Other Woody	NE	NE	NE
Biomass Stocks	NE	NE	NE
B Forest and Grassland Conversion	NE	NE	NE
C Abandonment of Managed Lands	NE	NE	NE
D CO_2 Emissions and Removals from	NE	NE	NE
Soil	NE	NE	NE
E Other (please specify)	NE	NE	NE
6 Waste			
A Solid Waste Disposal on Land	NE	NE	NE
B Wastewater Handling	NE	NE	NE
C Waste Incineration	NE	NE	NE
D Other (please specify)	NE	NE	NE
7 Other (please specify)			
Memo Items			
International Bunkers	NE	NE	NE
Aviation	NE	NE	NE
Marine	NE	NE	NE
CO_2 Emissions from Biomass	NE	NE	NE

2003 Emissions UNFCCC Reporting Tables

UNFCCC Reporting Table 1: Nauru's 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 (2003)

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	**35.075085**	**NE**	**0.273664**	**0.002196**	**0.209240**	**1.861301**	**0.349909**	**0.025666**
1 Energy	**35.075085**		**0.005418**	**0.000295**	**0.209240**	**1.861301**	**0.349909**	**0.025666**
A Fuel Combustion (Sectoral Approach)	35.075085		0.005418	0.000295	0.209240	1.861301	0.349909	0.025666
1 Energy Industries	16.884300		0.000691	0.000138	0.046053	0.003454	0.001151	0.017537
2 Manufacturing Industries and Construction	0.000000		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3 Transport	18.062602		0.004727	0.000157	0.163187	1.857847	0.348757	0.008106
4 Other Sectors	0.1281828		0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000223
5 Other (please specify)	0.000000		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
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								
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	NA	NA	NA	NA	NA	NA	NE	NA
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			**0.059030**	**0.001186**	0.000000	0.000000		
A Enteric Fermentation	0.000000		0.002800					

B Manure Management	0.000000		0.056230	0.000422				
C Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO
D Agricultural Soils				0.000764				
E Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
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	NE	NE	NE	NE	NE	NE	NE	NE
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			**0.209216**	**0.000715**	0.000000	0.000000	0.000000	0.000000
A Solid Waste Disposal on Land			0.189143					
B Wastewater Handling			0.020073	0.000715				
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	**1.281828**		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Aviation	1.281828		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							

UNFCCC Table 2. Nauru's National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF6 (2003)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs	PFCs	SF6
Total National Emissions and Removals			
1 Energy			
A Fuel Combustion (Sectoral Approach)	NE	NE	NE
1 Energy Industries	NE	NE	NE
2 Manufacturing Industries and	NE	NE	NE
Construction	NE	NE	NE
3 Transport	NE	NE	NE
4 Other Sectors	NE	NE	NE
5 Other (please specify)	NE	NE	NE
B Fugitive Emissions from Fuels	NE	NE	NE
1 Solid Fuels	NE	NE	NE
2 Oil and Natural Gas	NE	NE	NE
2 Industrial Processes			
A Mineral Products	NE	NE	NE
B Chemical Industry	NE	NE	NE
C Metal Production	NE	NE	NE
D Other Production	NE	NE	NE
E Production of Halocarbons and Sulphur	NE	NE	NE
Hexafluoride	NE	NE	NE
F Consumption of Halocarbons and Sulphur	NE	NE	NE
Hexafluoride	NE	NE	NE
G Other (please specify)	NE	NE	NE
3 Solvent and Other Product Use	NE	NE	NE
4 Agriculture			
A Enteric Fermentation	NE	NE	NE

B Manure Management	NE	NE	NE
C Rice Cultivation	NE	NE	NE
D Agricultural Soils	NE	NE	NE
E Prescribed Burning of Savannas	NE	NE	NE
F Field Burning of Agricultural Residues	NE	NE	NE
G Other (please specify)	NE	NE	NE
5 Land-Use Change & Forestry [(2)]			
A Changes in Forest and Other Woody	NE	NE	NE
Biomass Stocks	NE	NE	NE
B Forest and Grassland Conversion	NE	NE	NE
C Abandonment of Managed Lands	NE	NE	NE
D CO_2 Emissions and Removals from	NE	NE	NE
Soil	NE	NE	NE
E Other (please specify)	NE	NE	NE
6 Waste			
A Solid Waste Disposal on Land	NE	NE	NE
B Wastewater Handling	NE	NE	NE
C Waste Incineration	NE	NE	NE
D Other (please specify)	NE	NE	NE
7 Other (please specify)			
Memo Items			
International Bunkers	NE	NE	NE
Aviation	NE	NE	NE
Marine	NE	NE	NE
CO_2 Emissions from Biomass	NE	NE	NE

2000 Emissions UNFCCC Reporting Tables

UNFCCC Reporting Table 1: Nauru's 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	**13.288503**	**NE**	**0.257208**	**0.001948**	**0.050747**	**0.281421**	**0.053156**	**0.047679**
1 Energy	**13.288503**		**0.001029**	**0.000087**	**0.050747**	**0.281421**	**0.053156**	**0.047679**
A Fuel Combustion (Sectoral Approach)	13.288503		0.001029	0.000087	0.050747	0.281421	0.053156	0.047679
1 Energy Industries	7.186075		0.000294	0.000059	0.019600	0.001470	0.000490	0.007464
2 Manufacturing Industries and Construction	2.708496		0.000000	0.000000	0.000000	0.000000	0.000000	0.038317
3 Transport	3.307342		0.000735	0.000028	0.031147	0.279951	0.052666	0.001883
4 Other Sectors	0.0865906		0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000151
5 Other (please specify)	0.000000		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
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								
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	NA	NA	NA	NA	NA	NA	NE	NA
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			**0.059030**	**0.001186**	0.000000	0.000000		
A Enteric Fermentation	0.000000		0.002800					
B Manure Management	0.000000		0.056230	0.000422				
C Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO
D Agricultural Soils				0.000764				
E Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO
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	NE	NE	NE	NE	NE	NE	NE	NE
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			**0.197149**	**0.000674**	0.000000	0.000000	0.000000	0.000000
A Solid Waste Disposal on Land			0.178234					
B Wastewater Handling			0.018915	0.000674				
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	**0.865906**		0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Aviation	0.865906		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							

UNFCCC Table 2. Nauru's National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF6 (2000)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	HFCs	PFCs	SF6
Total National Emissions and Removals			
1 Energy			
A Fuel Combustion (Sectoral Approach)	NE	NE	NE
1 Energy Industries	NE	NE	NE
2 Manufacturing Industries and	NE	NE	NE
Construction	NE	NE	NE
3 Transport	NE	NE	NE
4 Other Sectors	NE	NE	NE
5 Other (please specify)	NE	NE	NE
B Fugitive Emissions from Fuels	NE	NE	NE
1 Solid Fuels	NE	NE	NE
2 Oil and Natural Gas	NE	NE	NE
2 Industrial Processes			
A Mineral Products	NE	NE	NE
B Chemical Industry	NE	NE	NE
C Metal Production	NE	NE	NE
D Other Production	NE	NE	NE
E Production of Halocarbons and Sulphur	NE	NE	NE
Hexafluoride	NE	NE	NE
F Consumption of Halocarbons and Sulphur	NE	NE	NE
Hexafluoride	NE	NE	NE
G Other (please specify)	NE	NE	NE
3 Solvent and Other Product Use	NE	NE	NE
4 Agriculture			
A Enteric Fermentation	NE	NE	NE

B Manure Management	NE	NE	NE
C Rice Cultivation	NE	NE	NE
D Agricultural Soils	NE	NE	NE
E Prescribed Burning of Savannas	NE	NE	NE
F Field Burning of Agricultural Residues	NE	NE	NE
G Other (please specify)	NE	NE	NE
5 Land-Use Change & Forestry [(2)]			
A Changes in Forest and Other Woody	NE	NE	NE
Biomass Stocks	NE	NE	NE
B Forest and Grassland Conversion	NE	NE	NE
C Abandonment of Managed Lands	NE	NE	NE
D CO_2 Emissions and Removals from	NE	NE	NE
Soil	NE	NE	NE
E Other (please specify)	NE	NE	NE
6 Waste			
A Solid Waste Disposal on Land	NE	NE	NE
B Wastewater Handling	NE	NE	NE
C Waste Incineration	NE	NE	NE
D Other (please specify)	NE	NE	NE
7 Other (please specify)	NE	NE	NE
Memo Items			
International Bunkers	NE	NE	NE
Aviation	NE	NE	NE
Marine	NE	NE	NE
CO_2 Emissions from Biomass	NE	NE	NE

ANNEXURE-B

Key Categories GHG Inventory Activity Data

ENERGY SECTOR

Energy Sector activity data has been used from**:**

Nauru Energy Sector Overview October 2013;

NAURU National Report, Volume 7, Pacific Islands Renewable Energy Project, SPREP, 2004;

Pacific Light houses, Renewable energy opportunities and challenges in the Pacific Islands region, IRENA, August 2013

Note: The best possible/applicable data and information has been used wherever it was possible to use in GHGI inventory of the Nauru.

Table 1. Estimated breakdown of fuel demand in Nauru

Sector	Type of fuel	Quantity
Electricity	Diesel	6-7 million litres per year
Phosphate (RONPHOS)	Fuel Oil (for drying process) Diesel (for own generators)	Self-imported ~ 4 million litres per year Self-imported – no data
Our Airline	Kerosene (DPK)	~ 0.5 – 1 million litres per year
Transport	Diesel Petrol	~ 1 million litres ~ 2 million litres
Cooking[32]	Kerosene (DPK) LPG[33]	~ 0.1 million litres per year ~ 9.5 tonnes per year

Table 2. Energy Sector GHG Inventory Activity Data

2010	
Fuels Consumption	
Fuel	**MT**
Diesel	7492.031949
Petrol	1089.64515
Jet Fuel (DPK)	1060.228

2010	
Transport Sector	
Fuel	**MT**
Diesel (Road)	847.31
Petrol (Road)	1484.78
Jet Fuel (DPK) (Aviation, International Bunker)	815.56

2010	
Electricity Sector	
Fuel	**MT**
Diesel	5931.17

2010	
Manufacturing & Construction Industrial Sector (RONPHOS is the only industrial activity)	
Fuel	**MT**
Fuel Oil (Residual Fuel)	3637.92

2010				
Residential Sector (Cooking)				
Fuel	**Liters**	**Density (Kg/L)**	**kg**	**MT**

2007	
Fuels Consumption	
Fuel	**MT**
Diesel	4519.84
Petrol	864.53
Jet Fuel (DPK)	778.86

2007	
Transport Sector	
Fuel	**MT**
Diesel (Road)	564.98
Petrol (Road)	864.53
Jet Fuel (DPK) (Aviation, International Bunker)	708.05

2007	
Electricity Sector	
Fuel	**MT**
Diesel	3954.86

2007	
Residential Sector (Cooking)	
Fuel	**MT**
Kerosene (DPK)	70.81

2003	
Fuels Consumption	
Fuel	**MT**
Diesel	6073.35
Petrol	5091.94
Jet Fuel (DPK)	446.73

2003	
Transport Sector	
Fuel	**MT**
Diesel (Road)	759.17
Petrol (Road)	5091.94
Jet Fuel (DPK) (Aviation, International Bunker)	406.12

2003	
Electricity Sector	
Fuel	**MT**
Diesel	5314.18

2003	
Residential Sector (Cooking)	
Fuel	**MT**
Kerosene (DPK)	40.61

2000	
Fuels Consumption	
Fuel	**MT**
Diesel	2584.86

Petrol	742.05
Jet Fuel (DPK)	301.78

2000	
Transport Sector	
Fuel	**MT**
Diesel (Road)	323.11
Petrol (Road)	742.05
Jet Fuel (DPK) (Aviation, International Bunker)	274.34

2000	
Electricity Sector	
Fuel	**MT**
Diesel	2261.75

2000	
Manufacturing & Construction Industrial Sector (RONPHOS is the only industrial activity)	
Fuel	**MT**
Waste Oil (No. 6 fuel Oil, considered)	870.8474319

2000	
Residential Sector (Cooking)	
Fuel	**MT**
Kerosene (DPK)	27.43

AGRICULTURE SECTOR

In agriculture sector only livestock i.e. Enteric Fermentation, Manure Management and N_2O from animal waste into the agriculture soils and its associated emissions has been considered and calculated (as per available data and information).

Table 3. Population of Livestock in Nauru

Year	Swine	Chicken	Duck/Birds	Source
2000	2800	10000		http://www.factfish.com/statistic-country/nauru/
2003	2800	10000		
2007	563	948	53	Undertaken by Agriculture Division (Nauru Govt.) with the assistance of community leaders and individual farmers for 2007
2010	1306	4683	167	Nauru National Census Report, Government of Nauru, 2011

WASTE SECTOR

In waste sector only considered Solid waste disposal on land and Waste water handling and its associated emissions (as per available data and information).

Table 4. Population in Nauru for GHGI estimation

Year	Population	Source
2000	11845	http://www.indexmundi.com/g/g.aspx?v=21&c=nr&l=en
2003	12570	
2007	13528	
2010	10084	Nauru National Census Report, Government of Nauru, 2011

Per capita waste generation and DOC calculation has been done as per ***"Solid Waste Education And Awareness In Pacific Island Countries, Pacific Regional Waste Awareness And Education Programme, SPREP"***

ANNEXURE-C

Nauru's Sectoral Action Plans

POWER SECTOR ACTION PLAN

Policy statement: A reliable, affordable and safe power supply and services

Strategy 1: Upgrade assets					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 1.1: Purchase and install new Transmission and Distribution (T&D) equipment	NUC	Very high	1 to 2 years	T&D equipment purchased and installed	2,000,000
Activity 1.2: Carry out structural repairs to the NUC powerhouse, including removal of the asbestos roofing and replacement	NUC	Very high	1 to 2 years	Roof and building refurbished.	1,500,000
Activity 1.3: Purchase and install power quality equipment at the power station including AVR replacement and governor and upgrade of controls	NUC	Very high	1 year	Power quality equipment purchased and installed	200,000
Activity 1.4: Purchase and install of a new generator	NUC	Very high	1 year	Generator installed	2,500,000
Activity 1.5: Carry out major overhaul of the newest existing generator	NUC	High	1 year	Generator overhauled; working at full capacity.	500,000
Activity 1.6: Purchase and install capacitor banks or batteries and advanced inverters to allow integration of high shares of variable renewables	NUC	Medium	3-5 years	Equipment purchased and installed.	500,000
Activity 1.7: Carry out safe and environmentally sound disposal of retired generators and other old equipment that is replaced	NUC	High	2-4 years	Safe and environmentally sound disposal of equipment.	200,000
				Sub-total Strategy 1	**7,400,000**

Strategy 2: *Improve planning and management*					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 2.1: Review the corporate governance of NUC	NUC (MoF)	Very high	1 year	Recommendations for corporate governance.	50,000
Activity 2.2: Carry out capacity planning exercise for 2014 to 2020 including projected demand and generation	NUC	Very high	6 months	Power development plan developed.	50,000
Activity 2.3: Establish process for long-term financial planning and develop first long-term financial plan	NUC	Very high	1 year	Process established. Plans developed.	20,000
Activity 2.4: Develop annual procurement plan and maintenance plan	NUC	Very high	Every year	Annual procurement and maintenance plan	5,000
Activity 2.5: Undertake comprehensive technical assessment of generation, transmission and distribution , including thermo-graphic analysis	NUC	High	6 months	Report on generation & T&D assets	200,000
Activity 2.6: Undertake comprehensive mapping, data compilation, inventory, storage planning and maintenance planning for all assets	NUC	High	1 to 2 years	GIS database. Asset Inventory. Asset management plan.	200,000
Activity 2.7: Develop manuals for operation, safety, maintenance and service for all key equipment	NUC	High	1 to 2 years	Manuals prepared.	20,000
Activity 2.8: Develop asset security, disposal and revaluation policy	NUC	Medium	3 to 4 years	Policy developed.	10,000
Activity 2.9: Collect baseline information and establish collection, storage, management and back-up processes for all financial and sales data	NUC	High	1 to 2 years	Baseline information established Processes established.	100,000

Strategy 2: *Improve planning and management*					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 2.10: Develop procedures for handling and monitoring customer complaints and train staff.	NUC	Medium	1 to 2 years	Procedure developed. Staff trained.	10,000
				Sub-total Strategy 2	**665,000**

Strategy 3: Improve supply-side energy efficiency					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 3.1: Establish a clear process for reconciling the fuel supplied by the tank farm and the fuel used by generating units.	NUC	Very high	6 months	Clear process established. New meters installed where needed.	50,000
Activity 3.2: Analyse fuel use data, identify opportunities to reduces losses and implement	NUC	High	1 to 2 years	Fuel losses reduced.	200,000
Activity 3.3: Develop new project proposals for improvement of transmission and distribution line losses as more information from metering becomes available	NUC	Medium	2 to 3 years	Proposals submitted to appropriate funding agencies. Securing of new funding.	10,000
Activity 3.4: Implement further T&D loss reduction projects	NUC	Medium	3 to 5 years	T&D losses reduced.	500,000

Strategy 3: Improve supply-side energy efficiency					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 3.5: Review opportunities for savings of electricity from water pumping and RO units and by reducing leakages in the reticulation, delivery and storage systems /tanks.	NUC	High	2 to 3 years	Opportunities for electricity savings identified.	20,000
Activity 4.6: Carry out feasibility study for most promising water sector opportunity and if favourable, implement		High	3 to 4 years	Feasibility study completed. Project implemented.	70,000[58]
				Sub-total Strategy 3	**850,000**

Strategy 4: Move toward full recovery of operating and maintenance costs					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 4.1: Carry out a cost-of-service study for NUC across all three service areas of fuel, water and electricity, including water and electricity tariffs study (price, structure, etc.)	NUC (CIE, PAD)	Very high	6 months	Cost-of-service defined for fuel, water and electricity. Electricity and water tariffs proposed.	200,000
Activity 4.2: Carry out willingness-to-pay and affordability studies (carried out in conjunction with the cost-of-service and tariff studies above)	NUC (with Government)	Very high	6 months	Better understanding of consumers' ability and willingness to pay.	100,000

Strategy 4: Move toward full recovery of operating and maintenance costs					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 4.3: Establish separate business unit financial information for water, electricity and fuel services	NUC	Very high	1 year	Separate business unit financial information available.	20,000
Activity 4.4: Improve accounting systems through integration of the asset registry and the financial management information system	NUC	High	1 to 2 years	Improved accounting systems.	50,000
Activity 4.5: Continue and strengthen prepayment and metering system, including a) Move all residences and businesses to prepaid; b) meter all industrial and government buildings; c) Check systematically correct functioning of meters; and d) develop measures to prevent meter tampering	NUC (CIE and other stakeholders)	Very high	1 year	All residences and businesses have pre-paid meters. Meter tampering reduced.	200,000
Activity 4.6: Develop and implement process to move fuel purchasing responsibility from government to NUC	MoF (NUC)	High	2 years	Fuel purchase cost appears in NUC annual budget	10,000
				Sub-total Strategy 4	**580,000**

Strategy 5: Develop and safeguard NUC staff					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 5.1: Identify training needs across all units and at all levels, develop a training plan and implement training programmes	NUC	Very high	6 months, ongoing training	Appropriately qualified staff. Improved staff retention.	40,000[59]
Activity 5.2: Develop and implement talent identification, apprenticeship and scholarship scheme for power sector	NUC (MoE, MoF, CIE)	High	1 to 2 years, ongoing	Appropriately qualified staff. Improved staff retention.	20,000[60]
Activity 5.3: Design and implement a Performance Management System for lower level NUC staff	NUC	High	1 to 2 years	Performance Management system implemented.	30,000
Activity 5.4: Develop and implement improved administrative procedures including payroll, job descriptions, workload planning and employee leave and related entitlements	NUC (with Public Service system)	Medium	2 to 4 years	Appropriate administrative procedures implemented.	50,000
Activity 5.5: Provide additional health and safety (H&S) training and enforce all H & S policies and practices	NUC	High	1 year	Training provided. H&S policies implemented.	20,000
Activity 5.6: Purchase sufficient personal protection equipment (PPE) for all staff	NUC	High	1 to 2 years	Equipment purchased. Fewer accidents.	50,000
				Sub-total Strategy 5	**150,000**
				TOTAL POWER SECTOR ACTION PLAN	**9,645,000**

[59] 20,000 for needs assessment and training plan development. 20,000 recurring annual training costs.
[60] 10,000 for setting up apprenticeship and scholarship scheme, 10,000 recurring annual apprenticeship and scholarship cost

PETROLEUM SECTOR ACTION PLAN

Policy statement: A reliable and safe supply of fossil fuels

Strategy 1 : Establish an economically efficient, secure and safe National Fuel Terminal and fuel supply					
Activity	**Organization Responsible (Supporting organization)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 1.1 - Establish a technical service agreement with a fuel testing laboratory to sample, test and certify jet fuel existing stocks and new deliveries	NUC	Very high	3 months	Certified, safe, quality compliant jet fuel.	10,000
Activity 1.2 – Prepare fuel pricing template and provide training to NUC and MoF staff	NUC (MoF)	Very high	6 months	Template developed. Staff trained.	10,000
Activity 1.3: Carry out training and recertification of staff at the fuel terminal including for shore officers, testing officers, terminal managers and aviation refuelers and fitters	NUC	Very high	6 months	Staff trained and certified	50,000
Activity 1.4 – Carry out a feasibility study for the tender of the fuel terminal operation and bulk fuel supply to a private sector operator	NUC (MoF)	Very high	6 months	Feasibility study completed.	100,000
Activity 1.5 – If feasibility study is favourable, prepare documents for tender for private fuel terminal operator and bulk fuel supplier	NUC (MoF)	High	1 year	Tender related documents prepared.	100,000
Activity 1.6 - Undertake tender for a terminal operator and defined term (3-5 years) bulk fuel supplier	NUC (MoF)	High	1 year to 2 years	Fuel Terminal operator contracted. Long term supply arrangement in place. Technical Service Agreement in place.	50,000

Strategy 1 : Establish an economically efficient, secure and safe National Fuel Terminal and fuel supply					
Activity	**Organization Responsible (Supporting organization)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 1.7 - Establish a fuel industry levy to support government administration and regulation of fuel operator	MoF	High	2 to 3 years	Fuel industry levy established.	20,000
Activity 1.8 – Develop mechanism using the TWGEn for decisions on future capital works related to fuel supply	CIE (TWGEn)	Medium	3 to 4 years	Mechanism established for decision making.	5,000
				Sub-total Strategy 1	**345,000**

Strategy 2 : Investigate ways to reduce use of or find alternatives to liquid fuels					
Activity	**Organization Responsible or Supporting**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 2.1 – Undertake a study to explore options for more economic supply of LPG	NUC (CIE)	High	1 to 2 years	Long term LPG supply options identified	30,000
Activity 2.2 – Identify barriers to the increased use of LPG for cooking and design actions to remove those barriers (parallel with activity 2.1)	CIE (Various stakeholders)	High	1 to 2 years	Barriers to increased LPG use for cooking identified and removed.	30,000
Activity 2.3 – Implement actions to remove barriers to use of LPG as identified in Activity 2.1 and 2.2	CIE (Various other stakeholders)	High	2 to 3 years	LPG use for cooking increased.	Depending on results of Activity 2.1 and 2.2
Activity 2.4 – Carry out a study on potential substitutes of petroleum (e.g. biofuel, biomass)	CIE (DoA, NRC)	Medium	2 to 3 years	Realistic alternative fuel options for Nauru identified	20,000
				Sub-total Strategy 2	**80,000**
				TOTAL PETROLEUM SECTOR ACTION PLAN	**425,000**

RENEWABLE ENERGY ACTION PLAN

Policy statement: 50% of electricity used in Nauru comes from renewable energy sources by 2020

Strategy 1: Phased implementation of large-scale solar up to 8.5 MWp[61]					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 1.1 – Prepare Solar Feasibility Study and technical standards and specifications for all phases of solar installations	NUC (CIE)	Very high	6 months	Location, specifications, grid connections and costs of all solar plants determined.	100,000
Activity 1.2 – Undertake a survey of roof tops and parking areas to establish locations for solar installations and locate land topside for potential large scale solar plants	NUC (CIE)	Very high	6 months	Sites (roofs, power poles and parking lots) suitable for grid-connected solar identified.	5,000
Activity 1.3 - Develop regulations, standards and payment methods for private generation using solar energy sources	NUC (CIE)	Medium	2 to 3 years	Incentives and information to support private investment in solar in place.	10,000
Activity 1.4 – Prepare tender documents and carry out tender for first 600 to 1000 kWp of grid-connected solar without storage	NUC (MoF, CIE)	Very high	1 year	Contract awarded for installation of up to 1000 kWp	10,000

[61] The final capacity of the total solar energy components, including energy storage size, required to meet the goal of 50% of generated electricity from renewables by 2020 will be defined by the solar feasibility study (Activity 1.1) to be carried out under this action plan when data has become available regarding the predicted level of load growth and load distribution. The results of the feasibility study may lead to modifications in Activities 1.4 to 1.7 of this action plan.

Strategy 1: Phased implementation of large-scale solar up to 8.5 MWp[61]					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 1.4 – Install 600 to 1000 kWp of grid-connected solar without storage "Bottomside" on government owned buildings, power poles, parking lots, etc.	NUC	Very high	1 year	600 to 1000 kWp installed.	5,000,000
Activity 1.5 - Install 2.5 MW solar plant including storage to maintain grid stability and decrease the generation requirement during the day and evening peak	NUC	High	3 years	2.5 MWp installed	15,000,000
Activity 1.6 – Install 2.5 MW solar plant including storage to maintain grid stability and decrease the generation requirement during the day and evening peak	NUC	High	5 years	2.5 MWp installed	15,000,000
Activity 1.7 – Install 2.5 MW solar plant including storage to maintain grid stability and decrease the generation requirement during the day and evening peak	NUC	High	6 years	2.5 MWp installed	15,000,000
				Sub-total Strategy 1	**50,125,000**

Strategy 2: Investigation and implementation of other renewable energy resources					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 2.1 – Carry out a wind resource assessment and feasibility study	NUC	High	1 year	Determination of feasibility of wind power project.	50,000
Activity 2.2 – Prepare and implement wind generation project if determined to be economically feasible	NUC	Medium	5 years	Wind project implemented.	1,000,000
Activity 2.3 – Undertake consolidated renewable energy options study for other possible sources of electricity generation	CIE (NUC)	Medium	By 2020	Study completed.	40,000
Activity 2.4 – Study the feasibility of back-up solar powered RO units in alternative locations	NUC (CIE)	Medium	1 to 2 years	Feasibility determined.	30,000
Activity 2.5 – Investigate the potential for and identify suitable plants that can be used to green the Topside and provide appropriate biomass for future biofuels production	CIE (DoA, NRC)	Medium	3 to 5 years	Level of potential determined and suitable plants identified.	50,000
Activity 2.6 – Investigate the potential for biogas from pigs (and other) for domestic cooking	CIE	Medium	2 to 3 years	Level of potential for biogas cooking identified	20,000
				Sub-total Strategy 2	**1,190,000**

Strategy 3: Build in-country capacity to operate and maintain solar PV systems					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 3.1 - Develop and implement installation, operating and maintanance training programmes for the solar installations	CIE (NUC, Ministry of Education, Nauru College and other stakeholders)	Very high	6 months to ongoing	Local persons capable of installing and O&M of solar plants	30,000
Activity 3.2 - Establish in a local college regular training in solar energy and other renewables and energy efficiency in a local training institution	CIE (NUC, Ministry of Education, Nauru College and other stakeholders)	High	2 to 3 years	Course on solar energy available locally	30,000[62]
				Sub-total Strategy 3	**60,000**
				TOTAL RENEWABLE ENERGY ACTION PLAN	**51,375,000**

DEMAND SIDE ENERGY EFFICIENCY ACTION PLAN

Policy statement: An efficient supply and use of energy

Strategy 1: Data collection and analysis for preparation for DSM implementation					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 1.1 – Carry out household energy use survey	Statistics Office (CIE, NUC, IUCN and UNDP)	Very high	3 months	Characteristics of energy use in residences determined.	30,000
Activity 1.2 – Procure the necessary software and analyse pre-payment meter data to identify customers tampering with meters and to categorize customers as to energy use to allow for targeted EE programmes	NUC	Very high	6 months	Software purchased. Pre-payment meter data analysed.	40,000
Activity 1.3 – Undertake energy surveys/audits of hotels and commercial buildings	CIE (NUC)	Very high	6 months	Identify measures to reduce electricity use in hotels and commerce	10,000
Activity 1.4 – Undertake industrial energy audits of RONPHOS and NRC facilities	CIE (RONPHOS and NRC)	Medium	1 to 2 years	Measures to reduce fuel use at RONPHOS and NRC identified.	50,000
Activity 1.5 – Assess feasibility of EE technologies, including cost benefit analysis and develop relevant financing options for end users to make EE investments which are compatible with local institutional and financing structures	CIE (MoF)	High	6 months to 2 years	List of EE technologies defined. Incentives and financing options for support investment into EE identified.	40,000
				Sub-total Strategy 1	**200,000**

Strategy 2: Implementation of demand side energy efficiency					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 2.1 – Prepare and implement energy efficiency campaign (NUC) to communities	NUC	Very high	6 months	Communities consider energy efficiency.	5,000
Activity 2.2 – Prepare and implement long term energy efficiency for communities campaign including financial incentives for people to exchange less energy efficient appliances for new, more efficient ones	NUC	Very high	6 months to ongoing	Communities and individuals chose more efficient appliances	10,000[63]
Activity 2.3 – Prepare and enact legislation making electricity theft a crime	CIE (Department of Justice)	High	6 months	Lowered non-technical losses for NUC.	5,000
Activity 2.4 – Establish guidelines and financial incentives for energy efficiency measures in construction or retrofitting of buildings	CIE	High	1 year	Guidelines and financial incentives in place.	150,000
Activity 2.5 – Undertake energy efficiency actions in Government Buildings	CIE (Government)	Medium	3 years	EE actions undertaken.	50,000
Activity 2.6 – Replace street lights to EE technologies combined with solar power	NUC	High	2 years	EE street lights installed.	100,000
Activity 2.7 – Study the feasibility of additional water storage with reticulated water distribution	NUC (CIE)	Medium	2 years	Reduce need for delivery of water by tankers.	30,000
				Sub-total Strategy 2	**335,000**

[63] Recurring annual budget

Strategy 3: Introduction of energy labeling and minimum energy performance standards					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 3.1 – Prepare feasibility study to determine the best approach to appliance testing and labelling for energy performance	CIE	Medium	1 to 2 years	Best approach to appliance testing and labeling determined.	30,000
Activity 3.2 – Introduce energy labelling of high electricity consumption appliances such as air conditioners, freezers, refrigerators, etc	CIE (NUC, private sector and other stakeholders)	High	2 years	Energy labeling for appliances introduced.	50,000
Activity 3.3 –Carry out awareness raising to communities, businesses and government	CIE	High	Ongoing for 3 years	Communities, businesses and government are aware of energy labeling.	60,000
Activity 3.4 - Prepare and enact appropriate legislation for energy labelling and MEPS	CIE (Department of Justice)	Medium	2 to 3 years	Legislation enacted.	20,000
Activity 3.5 - Training to customs and other government departments on labelling and MEPS, including enforcement	NUC (with CIE)	Medium	2 years and ongoing	Customs and other government departments trained.	10,000
				Sub-total Strategy 3	**170,000**
				TOTAL DEMAND SIDE ENERGY EFFICIENCY ACTION PLAN	**705,000**

TRANSPORT ACTION PLAN

Policy statement: to be developed as part of Road Map implementation

Strategy 1: Implementation of energy efficiency in transport					
Activity	**Organization Responsible (supporting organizations)**	**Activity Priority**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 1.1 – Develop a policy statement and if appropriate, a target, for the transport sector with regard to energy related issues	CIE (Department of Transport)	Very high	1 year	Policy statement developed. Target agreed.	10,000
Activity 1.2 – Design and implement programmes to provide incentives and facilities to improve the quality of maintenance for personal transport (cars)	CIE (Department of Transport, civil society)	High	1 year	Improved maintenance and fuel efficiency of land vehicles.	50,000
Activity 1.3 – Undertake a study of incentives to increase the use of bicycles and motorcycles for personal transport, as well as car pooling and other behavioural changes to encourage energy efficiency, and implement as appropriate	CIE (Department of Transport, civil society)	Very High	6 months	Options for incentives identified. If implemented, increase	25,000
Activity 1.4 - Undertake a study of public transport systems in Pacific Islands, with similar traffic patterns.	CIE (Department of Transport)	High	2 to 3 years	Study completed.	25,000
Activity 1.5 – Using results of Activity 1.3, deisgn and implement a public transport system for Nauru	Department of Transport (CIE)	High	3 to 4 years	Public transport system designed and implemented.	100,000

Strategy 1: Implementation of energy efficiency in transport					
Activity	**Organization Responsible (supporting organizations)**	**Activity Priority**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 1.6 – Assess options to discourage the importation of vehicles that have larger engines (e.g. through increased import duties, etc.)	CIE (MoF)	High	1 year	Options assessed.	10,000
Activity 1.7 – Implement appropriate options to discourage the importation of vehicles with large engines	CIE (MoF, Customs and others)	High	2 to 3 years	Options to discourage importation of vehicles with large engines implemented.	20,000
Activity 1.8 – Design and implement awareness campaign to communities on energy efficiency in transport	CIE (Department of Transport)	High	6 months and ongoing		10,000[64]
Activity 1.9 – Establish a data collection system for energy and transport data (related to other databases as appropriate)	CIE (Department of Transport, NBoS, Our Airline and others)	High	6 months to 1 year	Energy and transport data collected.	30,000
				Sub-total Strategy 1	**280,000**

Strategy 2: Investigate substitutes to diesel and petrol for transport					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 2.1 – Study the feasibility of LPG, hybrid and electric (powered by renewable electricity) vehicles, including buses	CIE	High	1 to 2 years	Feasibility of options established.	30,000
Activity 2.2 – Investigate the future potential of biofuel production on Topside for vehicles and small vessels	CIE	Medium	3 to 5 years	Potential for biofuel identified.	20,000
				Subtotal Strategy 2	**50,000**
				TOTAL TRANSPORT SECTOR ACTION PLAN	**330,000**

INSTITUTIONAL STRENGTHENING AND CAPACITY BUILDING ACTION PLAN

Policy statement: Efficient, robust and well resources institutions for energy planning and implementation

Strategy 1: Establish appropriate policies, regulations and legislation for the energy sector					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 1.1 - Develop a legislative and governance framework for the energy sector	CIE (DoJ and others)	Very High	1 to 2 years	Energy Act or similar appropriate legislation and regulatory instruments in place.	100,000
Activity 1.2 - Develop supporting regulations for the NUC Act	NUC (DoJ, CIE)	Very High	1 year	NUC regulations in place.	80,000
Activity 1.3 - Develop Petroleum Act	CIE (NUC, DoJ)	High	1 to 2 years	Petroleum Act and relevant regulatory instruments in place.	80,000
Activity 1.5 – Review of regulatory or policy barriers (e.g. import duties) to EE and RE investment	CIE (NUC, MoF, DoJ)	High	1 to 2 years	Changes that will enhance investment proposed.	20,000
Activity 1.6 – Investigate options, develop and implement a framework for private sector (IPPs, businesses and residences) renewable energy grid-connection and relevant supporting instruments (e.g. net-metering)	CIE (NUC, MoF, DoJ)	Medium	2 to 3 years	Appropriate framework developed and implemented.	150,000
				Sub-total Strategy 1	**430,000**

Strategy 2: Facilitate development of appropriate local skill base to meet ongoing demand in the energy sector					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 2.1 - Assess training needs and develop appropriate training strategy for secondary and primary school teachers, managers, small businesses, technicians, tradespeople, etc.	CIE	High	1 year	Training plan / strategies developed.	30,000
Activity 2.2 – Carry out training in technical skills for EE and RE as identified in Activity 2.1	CIE (NUC)	High	1 to 2 years	More people in key positions trained.	20,000
Activity 2.3 - Establish train the trainers programmes in EE and RE for local teachers, equipment operators, managers and technicians	CIE (NUC)	Medium	2 to 3 years	Qualified local trainers. Training programmes established.	60,000
Activity 2.4 - Develop energy curriculum for schools focusing on energy efficiency and RE	CIE (Education)	High	1 to 2 years	Increased knowledge base on energy	50,000
				Sub-total Strategy 2	**160,000**

Strategy 3: Improve governance and accountability in the energy sector					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 3.1 - Establish an Energy Unit within the Department of CIE	CIE (MoF, Public Service)	Very High	6 months	Functioning Energy Unit	20,000

Strategy 3: Improve governance and accountability in the energy sector					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 3.2 – Establish position of Energy Coordinator within public service	CIE	Very high	1 year	Position and annual salary integrated into national budget.	15,000[65]
Activity 3.3 - Recruit new staff to support the function of the Energy Unit and NERM implementation.	CIE	Very high	1 year to ongoing	Established Energy positions	20,000
Activity 3.4 - Support and facilitate the activities of the PSC and the Technical Working Group on Energy	CIE	Very high	Ongoing	Appropriate support provided to the TWGEn and the PSC.	10,000
Activity 3.5 – Carry out an assessment of the institutional arrangements for the implementation of the road map including recommendations for long-term implementation of the road map	CIE (TWGEn, MoF, Public Service)	High	2 years	Assessment carried out and appropriate recommendations made.	30,000
Activity 3.6 – Develop detailed monitoring and evaluation plan for the Energy Road Map	CIE (TWGEn)	Very high	1 year	M&E Plan for Road Map developed and used.	20,000
Activity 3.7 – Support capacity to collect and manage data and data sharing and reporting	CIE	High	Ongoing	Support provided to energy data systems.	5,000
				Sub-total Strategy 3	**140,000**

[65] Recurring annual budget

Strategy 4: Foster a culture of partnerships between public and private sectors including the community					
Activity	**Organization Responsible (supporting organizations)**	**Activity Importance**	**Time Frame**	**Expected results / outputs**	**Estimated budget / AUD**
Activity 4.1 - Develop private sector and community strategy, including engagement and multi-stakeholder partnerships	CIE (Private sector, civil society and others)	Very high	6 months to 1 year	Private sector and community strategy developed.	20,000
Activity 4.2 – Implement engagement and multi-stakeholder participatory activities as laid out in the strategy developed under Activity 2.1	CIE (Various stakeholders)	Very high	1 to 3 years	Greater engagement of private sector and communities in the energy sector. Development of multi-stakeholder partnerships.	50,000
Activity 4.2 – Disseminate information on EE measures, net metering and other information regarding changes in the power sector as and when appropriate	CIE (NUC, Civil society and others)	High	3 months to ongoing	Information on net metering and IPP policy and others disseminated	20,000
				Sub-total Strategy 4	**90,000**
				TOTAL INSTITUTIONAL STRENGTHENING AND CAPACITY BUILDING ACTION PLAN	**820,000**

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