



## **Final Report**

# **Republic of Nauru's Third National Communication (TNC) to the United Nations Framework Convention on Climate Change**

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Submitted to:

**Government of Nauru**

# Table of Contents

<b>1</b>	<b>NATIONAL CIRCUMSTANCES</b>	<b>12</b>
1.1	GEOGRAPHY	12
1.2	CLIMATE	13
1.3	POPULATION	13
1.4	ECONOMY	15
1.5	LAND OWNERSHIP AND TENURE	15
1.6	AGRICULTURE, FOREST & LIVESTOCK	16
1.7	FISHERIES	16
1.8	BIODIVERSITY	17
1.9	ENERGY	18
1.10	WATER	18
1.11	WASTE – SOLID WASTE AND WASTEWATER	18
1.12	TRANSPORT	19
1.13	INSTITUTIONAL ARRANGEMENTS FOR CLIMATE CHANGE	19
<b>2</b>	<b>VULNERABILITY AND ADAPTATION ASSESSMENT</b>	<b>28</b>
2.1	BACKGROUND	28
2.2	CLIMATE CHANGE SCENARIO	28
2.3	TEMPERATURE	29
2.4	WIND-DRIVEN WAVES	33
2.5	VULNERABILITY ASSESSMENT	40
2.6	ADAPTATION AND RESILIENCE	42
2.7	V&A POLICIES & PLANS	43
2.8	CASE STUDY	45
2.9	CURRENT ADAPTATION ACTION	46
2.10	CONCLUSION	47
<b>3</b>	<b>GREENHOUSE GAS INVENTORY</b>	<b>51</b>
3.1	BACKGROUND	51
3.2	FIRST NATIONAL COMMUNICATION-1999	51
3.3	SECOND NATIONAL COMMUNICATION – 2014	52
3.4	INTENDED NATIONALLY DETERMINED CONTRIBUTION (INDC) -2015	53
3.5	NAURU'S THIRD NATIONAL GHG INVENTORY	54
3.6	NATIONAL GHG INVENTORY PREPARATION	55
3.7	NAURU - GHG EMISSIONS: 2007-2014	57
3.8	GAS BY GAS EMISSION INVENTORY	62
3.9	GHG EMISSION TREND ANALYSIS (1994-2014)	66
3.10	NAURU: SECTORAL GHG EMISSIONS: 2007-2014	68
3.11	INDUSTRIAL PROCESSES	75
3.12	AGRICULTURE, FORESTRY AND OTHER LAND USE	76
3.13	WASTE SECTOR	78
<b>4</b>	<b>MITIGATION ASSESSMENT</b>	<b>88</b>
4.1	BACKGROUND	88
4.2	MITIGATION RELATED KEY NATIONAL/REGIONAL POLICIES AND PROGRAMS	89
4.3	CLIMATE CHANGE MITIGATION SECTORS	96
4.4	KEY MITIGATION ACTIONS UNDER THE NAURU ENERGY ROAD MAP 2018 TO 2020 (UPDATED)	102
4.5	NAURU MITIGATION ACTION PLANS	107
<b>5</b>	<b>OTHER INFORMATION CONSIDERED RELEVANT TO THE ACHIEVEMENT OF THE OBJECTIVES OF THE CONVENTION</b>	<b>110</b>
5.1	RESEARCH AND SYSTEMATIC OBSERVATION	110
5.2	NAURU'S METEOROLOGICAL SERVICE	110
5.3	INFORMATION ON CLIMATE CHANGE EDUCATION, TRAINING AND PUBLIC AWARENESS	110
5.4	TRAINING AND PUBLIC AWARENESS AND INFORMATION AND NETWORKING	111
5.5	GENDER AND CLIMATE CHANGE	112

5.6	CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS.....	113
5.7	CONSTRAINTS, GAPS AND NEEDS.....	113
5.8	CONCLUSION.....	121
<b>REFERENCES.....</b>		<b>122</b>
<b>6</b>	<b>ANNEXURES.....</b>	<b>124</b>

## List of Tables

Table 1. 1 The population size and growth rate by district in the years 2002, 2011 and 2021.....	14
Table 1. 2 Key agencies within the TWGs .....	22
Table 2. 1. An overview of Nauru’s temperature change projections (°C) u .....	30
Table 2. 2: Sea-level rise projections for Nauru .....	36
Table 2. 3 Estimates of global mean sea-level rise by rate and total rise compared to 1986–2005.....	39
Table 2. 4: Key V&A Policies and Plans.....	43
Table 3. 1: First National Greenhouse Gas Inventory – 1994.....	51
Table 3. 2: Second National Greenhouse Gas Inventory – 2000.....	52
Table 3. 3: Second National Greenhouse Gas Inventory – 2000, 2003, 2007 and 2010.....	53
Table 3. 4: Sectorial GHG Inventory of Anthropogenic Emissions-Nauru.....	54
Table 3. 5: GHG Emissions in Nauru – 2007-2014.....	58
Table 3. 6: Total GHG Emissions in Nauru: 2007-2014.....	58
Table 3. 7: Total Emissions by Sector (in Gg CO2-equiv): 2007-2014 .....	60
Table 3. 8: Total Emissions by Sub-Sector (in Gg CO2-equiv): 2007-2014.....	62
Table 3. 9: Nauru Total GHG emissions in Gg, 1994-2014.....	66
Table 3. 10: International Bunkers (Aviation) GHG emissions Gg CO2e trend, 1994-2014.....	68
Table 3. 11: Energy Sector Emissions (in Gg CO2-equiv): 2007-2014.....	69
Table 3. 12: Estimated Average Petroleum Fuel Demand in Nauru.....	70
Table 3. 13: Percentage distribution of fuel consumption in energy sector.....	71
Table 3. 14: Annual Phosphate Production and Diesel Consumption by RONPHOS: 2007-2014.....	73
Table 3. 15: Population and Households: 2007-2014.....	74
Table 3. 16: Residential Sector -Cooking Fuel (LPG) Consumption and GHG emissions Gg CO2e : 2013-2014 75	75
Table 3. 17: Energy Sector CO2 Emissions using Reference and Sectoral Approach, 2014 .....	75
Table 3. 18: Livestock Population in Nauru: 2007-2014.....	77
Table 3. 19: Livestock Emissions in Nauru: 2007-2014.....	77
Table 3. 20: Waste Sector Emissions in Nauru: 2007-2014.....	78
Table 3. 21: Waste Sector CH4 and N2O Emissions Gg: 2007 – 2014.....	79
Table 3. 22: Wastewater generation in Nauru: 2007 – 2014.....	82
Table 3. 23: Wastewater GHG emissions in Nauru: 2007 – 2014.....	82
Table 4. 1: Nauru – Key Policies and Actions.....	88
Table 4. 2: NSDS:2005-2025 – Strategies and Milestones.....	89
Table 4. 3: NSDS:2005-2025 – Sector Goals .....	90
Table 4. 4: Nauru Energy Road Map Summary Strategies .....	97
Table 4. 5: Nauru N-2 Security Levels for Production of Electricity.....	97
Table 4. 6: NERM:2018-2020 –Action Plan, Activities and Outcome.....	102
Table 4. 7: NERM:2014-2020 –Activities Completed (as on 2017).....	103

## List of Figures

Figure 1. 1 Map of Nauru .....	12
Figure 1. 2. Total population size, Nauru: 1921–2021 .....	13
Figure 1. 3. Average annual population growth rate (%), Nauru: 1921–2021 .....	14
Figure 1. 4: Institutional Arrangements and Organization structure for Nauru’s TNC.....	21
Figure 2. 1: Carbon dioxide concentrations.....	29
Figure 2. 2: Seasonal temperature at Nauru.....	29
Figure 2. 3. Historical and simulated surface air temperature time series for the region surrounding Nauru .....	31
Figure 2. 4: Seasonal Rainfall of Nauru .....	32
Figure 2. 5. Historical and projected annual average rainfall time series for the region surrounding Nauru .....	33
Figure 2. 6: Mean annual cycle of wave height and direction .....	34
Figure 2. 7: High water Level Climatology - Nauru (1974-2011).....	36
Figure 2. 8: Observed and projected Sea-level change near Nauru.....	37
Figure 2. 9: Maximum annual Aragonite saturation state- Nauru.....	38
Figure 2. 10: Projected changes in aragonite saturation state in Nauru from CMIP5 models under RCP2.6, 4.5 and 8.5.....	39
Figure 3. 1: Nauru GHG Emissions -1994 .....	52
Figure 3. 2 : Nauru GHG Emissions -2000 .....	53
Figure 3. 3: Nauru GHG Emissions by Gas (Gg): Average 2007-2014.....	59
Figure 3. 4: Total Emissions by Gas Type (Gg) – 2007-2014.....	59
Figure 3. 5: Total Emissions by Sector (in Gg CO <sub>2</sub> -equiv): 2007-2014 .....	60
Figure 3. 6: Nauru Total Emissions by Sector (Gg): Average 2007-2014.....	61
Figure 3. 7: Total Emissions by Sub-Sector (in Gg CO <sub>2</sub> -equiv): 2007-2014.....	61
Figure 3. 8: Nauru Total Emissions by Subsector (Gg): Average 2007-2014 .....	62
Figure 3. 9: Total CO <sub>2</sub> emissions in Gg: 2007-2014.....	63
Figure 3. 10: Sub-Sectoral CO <sub>2</sub> emissions in Gg CO <sub>2</sub> -equiv: 2007-2014 .....	63
Figure 3. 11: Total Methane (CH <sub>4</sub> ) emissions in Gg – 2007-2014.....	64
Figure 3. 12: Sub-Sectoral Methane (CH <sub>4</sub> ) emissions in Gg: 2007-2014.....	64
Figure 3. 13: Total Nitrous Oxide (N <sub>2</sub> O) emissions in Gg: 2007-2014.....	65
Figure 3. 14: Total Sub-Sectoral Nitrous Oxide (N <sub>2</sub> O) emissions in Gg: 2007-2014 .....	65
Figure 3. 15: Nauru Total GHG Emissions in Gg: 1994-2014.....	66
Figure 3. 16: Nauru GHG emissions by Gas Type trend 1994-2014 (Gg) .....	67
Figure 3. 17: Nauru Sectoral GHG emissions trend 1994-2014 (Gg CO <sub>2</sub> e).....	67
Figure 3. 18: Nauru Aviation Sector GHG emissions Gg CO <sub>2</sub> e: 2007-2014.....	68
Figure 3. 19: Energy Sector GHG Emissions: 2007-2014.....	69
Figure 3. 20: Energy Industry (Electricity Generation) subsector GHG Emissions: 2007-2014 .....	72
Figure 3. 21: Road Transport subsector GHG Emissions: 2007-2014.....	73
Figure 3. 22: RONPHOS (Mfg, INd & Cont subsector) GHG emissions: 2007-2014 .....	74
Figure 3. 23: Livestock Emissions in total GHG Gg CO <sub>2</sub> e: 2007-2014.....	76
Figure 3. 24: Livestock Emissions Gg CO <sub>2</sub> e: 2007-2014 .....	76
Figure 3. 25: Waste Sector Emissions Gg CO <sub>2</sub> e: 2007-2014.....	78
Figure 3. 26: Waste sub-sectoral GHG Emissions Gg CO <sub>2</sub> e: 2007-2014 .....	79
Figure 3. 27: Waste sub-sectoral Methane Emissions Gg: 2007-2014.....	79
Figure 3. 28: Population and MSW Generation in Nauru: 2007-2014.....	81
Figure 3. 29: MSW Composition - Weight of waste component (wt%).....	81
Figure 3. 30: Wastewater N <sub>2</sub> O Emissions in Nauru: 2007-2014.....	82
Figure 4.1: Electricity Generation and Supply (in kWh): 2015-2017.....	98
Figure 4.2: Diesel Generation Augmentation till 2020 (NUC strategic plan) .....	99
Figure 4.3: Renewable Energy (Solar) Generation (in kWh): 2015-2017.....	99

## Abbreviations

<b>Abbreviation</b>	<b>Full Form</b>
ADO	Automotive Diesel Oil
AOSIS	Alliance of Small Island States
AR5	Fifth Assessment Report by the IPCC
CCA	Climate Change Action
CASA	Civil Aviation Safety Authority
CC	Climate Change
CCU	Climate Change Unit
CIE	Department of Commerce, Industry, and Environment
CMIP	Consolidated
COP	Conference of Parties
CREWS	Climate Risk and Early Warning Systems
DPK	Dual-purpose Kerosene
DSM	Demand Side Management
EEAP	Energy Efficiency Action Plan
EEZ	Exclusive Economic Zone
ENSO	El Niño-Southern Oscillation
FOLU	Forestry and other land use
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEH	Greenhouse Gases
GEF	Global Environment Facility
GHG	Greenhouse Gases
GWP	Global Warming Potential
INC	Initial/First National Communication
IPCC	Intergovernmental Panel on Climate Change
ITCZ	Inter-Tropical Convergence Zone
kM	Kilometres
LDC	Least Developed Countries
LEG	Least Developed Countries Expert Group
LPG	Liquefied Petroleum Gas
MSW	Municipal Solid Waste
NCCSC	National GHG Inventory Improvement Plan
NC	National Communications to UNFCCC
NE	Not Estimated
NER	National Energy Roadmap
NFPC	Nauru Regional Processing Centre
NDC	Nationally Determined Contributions
NIIP	National Inventory Improvement Plan
NPE	National Policy of Energy
NRC	Nauru Rehabilitation Corporation
NUC	Nauru Utilities Corporation
PA	Paris Agreement
PHES	Pumped Hydroelectric Storage

PIGGAREP	Pacific Islands Greenhouse Gas Abatement through Energy Project
PIFACC	Pacific Island Framework for Action on Climate Change
PPSRCI	Pacific Plan for Strengthening Regional Cooperation and Integration
PV	Photovoltaic (Solar)
RCP	Representative Concentration Pathway
RPC	Nauru Regional Processing Centre
RO	Reverse Osmosis
RON	Republic of Nauru
RONAdapt	Republic of Nauru Framework for Climate Change Adaptation and Disaster Risk Reduction
RONPHOS	Nauru Phosphate Corporation
SAMOA	SIDS Accelerated Modalities of Action Pathway
SNC	Second National Communication
SOPAC	South Pacific Applied Geoscience Commission
SPCZ	South Pacific Convergence Zone
SPREP	Secretariat of the Pacific Regional Environment Programme
TNA	Technical Need Assessment
TNC	Third National Communication
TWGs	Thematic Working Group
UNITAR	United Nations Institute for Training & Research
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization
WW	WasteWater

## Report Overview and Executive Chapter Summaries

Nauru, a non-Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC), submitted its First National Communication in October 1999, followed by its Second National Communication (SNC) in December 2014. As a Party to the Convention, Nauru continues to receive financial support to fulfil its reporting obligations.

This **Third National Communication (TNC)** is organized into **five chapters**, each addressing a core component of Nauru's climate change context and UNFCCC reporting requirements. **A concise executive summary is provided at the beginning of each chapter** to highlight its key findings and messages.

- **Chapter 1 – National Circumstances:** Provides background on Nauru's geographic, climatic, economic, and social context.
- **Chapter 2 – Vulnerability and Adaptation:** Describes climate change vulnerabilities and outlines ongoing, planned, and proposed adaptation measures.
- **Chapter 3 – Greenhouse Gas Inventory:** Presents GHG emissions and removals across major sectors, based on available national data.
- **Chapter 4 – Mitigation Assessment:** Outlines mitigation options and sector-specific potential for reducing emissions.
- **Chapter 5 – Other Relevant Information:** Covers information relevant to the objectives of the Convention, including constraints, gaps, and Nauru's finance, technology, and capacity-building needs.

## Executive Summary: National Circumstances

**Geography:** Nauru, the world's third-smallest country, is situated in the Pacific Ocean. It is a single raised phosphatic island with a maximum elevation of 71 meters and is known for its phosphate rock reserves. The island is divided into "bottom side" and "topside" areas, with the former being the residential area. Nauru is geographically located west of Kiribati, east of Papua New Guinea, south of the Marshall Islands, and north of the Solomon Islands.

**Climate:** Nauru experiences a tropical equatorial climate with no recorded cyclones but variable rainfall. The average annual rainfall is about 80 inches, and the island relies on roof catchment systems and imported water. Climate variability is influenced by El Niño-Southern Oscillation (ENSO) and the Inter-tropical Convergence Zone (ITCZ), affecting temperature and rainfall patterns throughout the year.

**Population:** Nauru's population of 11,680 individuals in 2021 has seen a consistent upward trend, with some fluctuations over the years. Due to phosphate mining, a significant portion of the island is uninhabitable. The high population density of 554 people/km<sup>2</sup> poses challenges.

**Economy:** Phosphate mining was historically vital for Nauru's economy but was exhausted in 2006. Mining of "secondary phosphate" began in 2007, providing continued income. Economic statistics are limited, but investments in trust funds aim to secure Nauru's economic future. The Australian Regional Processing Center and fishing licenses contribute to economic growth, but infrastructure challenges persist. Recent economic growth is projected to continue, driven by infrastructure projects.

**Land Ownership and Tenure:** Nauruan citizens hold individual rights to land, a fundamental aspect of their identity. Landownership is passed down through generations and divided into coconut land (for residential purposes) and phosphate land (not for residential use). Lease agreements are common, but non-Nauruans cannot own land.

**Agriculture, Forest, & Livestock:** Nauru faces agricultural challenges due to limited fertile land, conflicts over land tenure and water rights, and poor soil quality. Addressing water scarcity and improving irrigation are top priorities. Mining has depleted much of the original forest, and limited revegetation efforts have been made. Fruit and flower trees are present, and livestock is limited to pigs, chickens, and ducks due to the scarcity of pastures.

**Fisheries:** Fisheries are crucial for Nauru's food security and economy, primarily through license fees for foreign fishing boats in its substantial Exclusive Economic Zone (EEZ). Limited coastal fishing exists due to deep ocean surrounding the island. Subsistence fishing is significant, but more fishermen could benefit from Fish Aggregating Devices (FAD) with improved materials and know-how. Milkfish farming in Buada lagoon and aquaculture operations contribute to local food needs. The Nauru Agreement, established in 2010, enables sustainable management of tuna stocks in the region through the Vessel Day Scheme (VDS).

**Biodiversity:** Nauru's terrestrial biodiversity faces challenges, with native flora and fauna at risk. New records of species have been documented, but invasive species and habitat loss are concerns. Marine biodiversity is unique, with low coral diversity but the presence of rare species. Overfishing of reef fish is a concern. Nauru's marine environment holds potential with abundant tuna stocks in its EEZ.

**Energy:** Nauru aims to increase the use of renewable energy sources to reduce dependency on fossil fuels. Historically reliant on imported fossil fuels for electricity generation, recent

efforts have focused on solar photovoltaic systems. The target is to achieve 50% of energy from renewables by 2020. The Nauru Utility Corporation (NUC) is responsible for electricity and water supply.

**Water:** Potable water in Nauru primarily comes from rainwater collection and a reverse osmosis (RO) desalination plant due to limited surface runoff and no rivers. Increasing salinity in groundwater and high energy demand for desalination pose challenges. Nauru's water supply is vulnerable to climate variability.

**Waste – Solid Waste and Wastewater:** Rapid population growth, economic development, and changing consumption patterns have led to increased waste generation and poor waste management practices. Wastewater from domestic, commercial, and industrial sources is disposed of into the sea without treatment, posing environmental and health risks. Solid waste management challenges include medical, quarantine, metal, and electronic waste.

**Transport:** Nauru's transportation infrastructure includes a paved road around the island, a dirt track to the Nauru Rehabilitation Corporation (NRC), and a simple airport. Public transport has improved, with buses serving the population. Marine transport enhancements include efficient cargo handling and safety measures. The aviation sector focuses on safety and service improvements.

**Institutional Arrangements for the preparation of NCs and BURs:** The third national communication and national GHG inventory involved following steps:

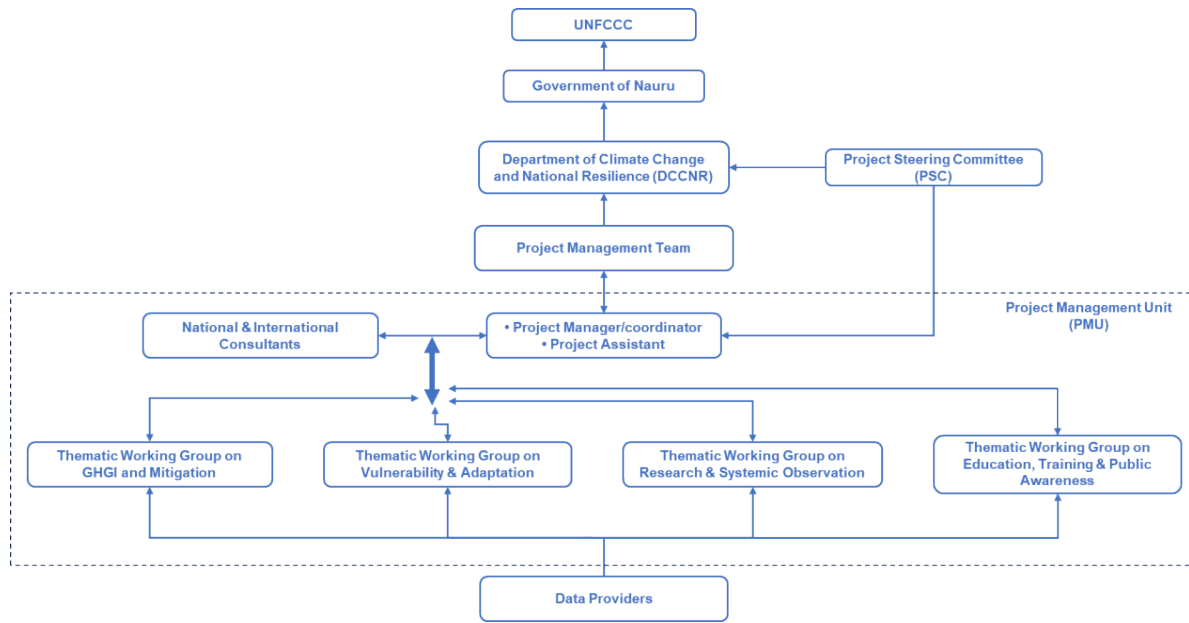
- Project Organization Structuring
- Thematic Working Group (TWGs) formation
- Stakeholder Consultation Process
- Training and Capacity building Programme
- Data collection, Identification of data gaps and uncertainty assessment
- Documents/data review for quality assurance
- Preparation of GHG Inventory Report
- Review and approval of the GHG Inventory Report

### **Project Organization Structure**

The institutional arrangements for regular preparation of national communications have been established. The structure is depicted in Figure ES.1.1.

Nauru has established clear institutional arrangements for the regular preparation and submission of its National Communications. The Department of Climate Change and National Resilience (DCCNR), created in 2020, is the central coordinating authority for all climate change policies, programmes, and reporting obligations. As the National Focal Point to the UNFCCC and the GEF Operational Focal Point, DCCNR is formally responsible for overseeing and submitting Nauru's National Communication to the UNFCCC. All nationally implemented and externally supported climate change initiatives—whether bilateral, regional, or international—are managed and coordinated through the DCCNR, with UNDP serving as the primary GEF Implementing Agency for Nauru.

Figure ES 1.1: Institutional Arrangements and Organization structure for Nauru's TNC





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<sup>2</sup>.

## 1.2 Climate

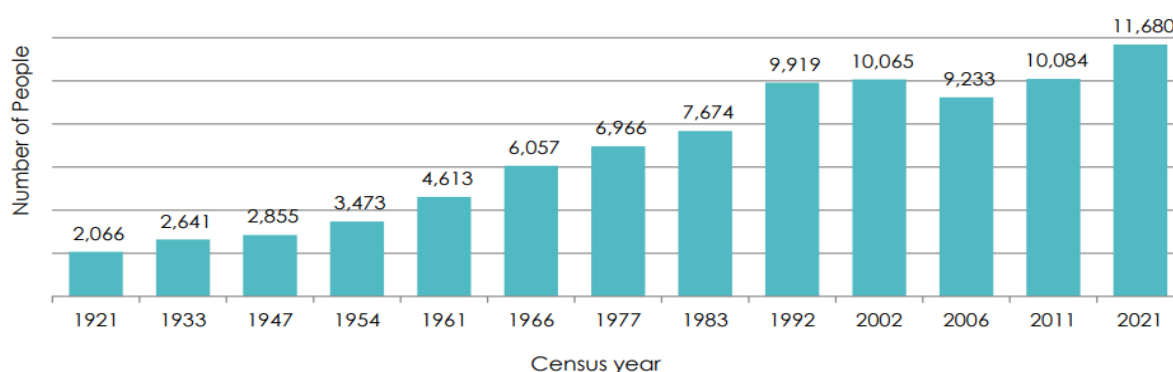
Nauru, located in Oceania, experiences an equatorial and maritime climate characterized by a notable absence of recorded cyclones. Nauru's climate is tropical, with daytime temperatures in the low 80s F (about 28 °C<sup>3</sup>, tempered by ocean breezes. Rainfall, averaging about 80 inches (2,000 mm) annually, is extremely variable, and prolonged droughts occur. The only locally available water is collected from roof catchment systems, and water is imported as ballast on ships returning to Nauru for loads of phosphate. There are no rivers or streams<sup>4</sup>.

The main drivers of climate variability on Nauru are the El Niño-Southern Oscillation (ENSO) and the Inter-tropical Convergence Zone (ITCZ). During El Niño events, the island experiences warmer temperatures due to elevated sea temperatures, along with increased rainfall and cloud cover. Conversely, La Niña events are associated with delayed wet seasons and drier-than-normal conditions, often leading to extended drought periods. The ITCZ, which affects Nauru throughout the year, undergoes a seasonal north-south movement that drives the island's seasonal rainfall cycle, peaking between December and February. Additionally, the South Pacific Convergence Zone (SPCZ) exerts its influence on Nauru when it reaches its maximum northward displacement in July and August.

## 1.3 Population

Nauru's population and environment are largely, if not entirely, affected by its phosphate deposits. The country consists of one main island, divided into 14 small districts of various sizes and populations. Due to phosphate mining, at least three-quarters of the island is deemed uninhabitable and unsuitable for any kind of livelihood<sup>5</sup>.

Figure 1. 2. Total population size, Nauru: 1921–20216



In 2021, the total enumerated population of Nauru reached 11,680 individuals, marking a notable increase of 1,596 persons compared to the figures recorded during the 2011 census. Figure 1 provides an overview of the population trend spanning from 1921 to 2021, revealing

<sup>2</sup> Pacific climate Change portal [Nauru | Pacific Climate Change Portal](#)

<sup>3</sup>Nauru island country, Pacific Ocean [Nauru | Land, People, Culture, Economy, Society, & History | Britannica](#)

<sup>4</sup> Pacific climate Change portal [Nauru | Pacific Climate Change Portal](#)

<sup>3</sup> [Nauru 2021 population and housing Census - Analytical report \(spc.int\)](#)

<sup>6</sup> [Nauru 2021 population and housing Census - Analytical report \(spc.int\)](#)

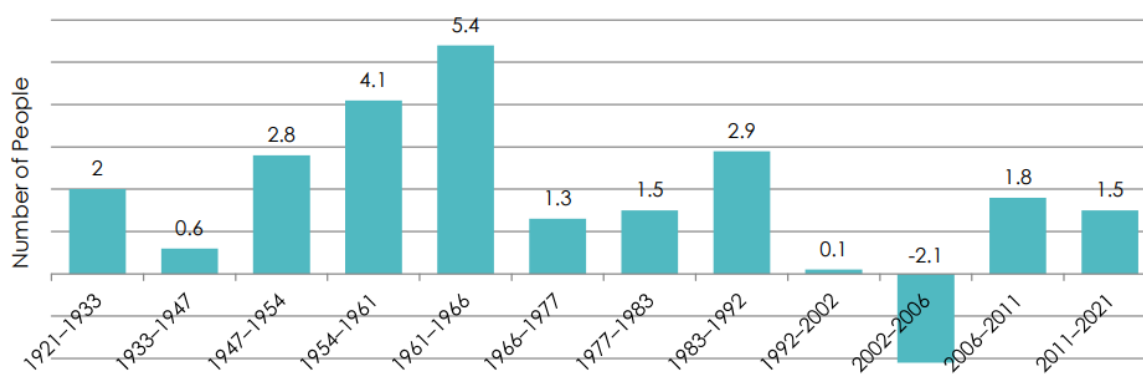
a consistent upward trajectory over the years, with the exception of a temporary contraction experienced between 2002 and 2006.

**Population density:** With a total land area of 21.1 km<sup>2</sup>, Nauru's average population density, according to the 2021 census, was 554 people/km<sup>2</sup> compared to 478 people/km<sup>2</sup> in the 2011 census. This is a very high population density compared to most other countries in the Pacific region or even worldwide.

*Table 1. 1 The population size and growth rate by district in the years 2002, 2011 and 2021.*

District	Total population size			Population change					
				(in numbers)		(in%)		Average annual growth rate	
	2002	2011*	2021	2002-2011	2011-2021	2002-2011	2011-2021	2002-2011	2011-2021
Yaren	632	747	803	115	56	18.2	7.5	1.8	0.7
Boe	731	851	845	120	-6	16.4	-0.7	1.7	-0.1
Aiwo	1,051	1,220	1,258	169	38	16.1	3.1	1.6	0.3
Buada	673	739	969	66	230	9.8	31.1	1	2.7
Denigomodu	292	307	348	15	41	5.1	13.4	0.6	1.3
Nibok	479	484	724	5	240	1	49.6	0.1	4.1
Uaboe	386	318	341	-68	23	-17.6	7.2	-2.1	0.7
Baitsi	443	513	523	70	10	15.8	1.9	1.6	0.2
Ewa	397	446	537	49	91	12.3	20.4	1.3	1.9
Anetan	498	587	795	89	208	17.9	35.4	1.8	3.1
Anabar	378	452	565	74	113	19.6	25	2	2.3
Ijuw	169	178	276	9	98	5.3	55.1	0.6	4.5
Anibare	232	226	373	-6	147	-26	65	-0.3	5.1
Meneng	1,323	1,380	1,797	57	417	4.3	30.2	0.5	2.7
Location	2,381	1,497	1,526	-884	29	87.1	1.9	-5.1	0.2
Total	10,065	9,945	11,680	-120	1,735	-1.2	17.4	-0.1	1.6

*Figure 1. 3. Average annual population growth rate (%), Nauru: 1921–2021<sup>7</sup>*



<sup>7</sup> Nauru 2021 Population and Housing Census [Nauru 2021 population and housing Census - Analytical report \(spc.int\)](#)

## 1.4 Economy

Reserves of phosphate were essential for Nauru's economy, with most necessities being imported, primarily from Australia, its former occupier and a significant source of support. However, the primary phosphate reserves were exhausted in 2006, leading to a cessation of mining operations. Fortunately, in 2007, mining of a deeper layer of "secondary phosphate" within the island's interior commenced, extending the potential lifespan of phosphate exports for another 30 years. These exports continue to be a crucial income source for Nauru, although comprehensive economic statistics for the country are scarce and estimates of its GDP vary widely.

One of Nauru's long-term challenges is the rehabilitation of mined land and the need to replace income previously generated by phosphate exports. To address this issue, substantial amounts of phosphate income were wisely invested in trust funds to help ease the transition and secure Nauru's economic future<sup>8</sup>.

Despite limited revenue sources for the government, the establishment of the Australian Regional Processing Center for asylum seekers in 2012 has contributed to economic growth. Additionally, revenue from fishing licenses, operating under the "vessel day scheme," has boosted government income. However, critical infrastructure like housing and hospitals is deteriorating, and the cost to Australia of supporting Nauru's government and economy continues to rise.

In recent years, the Nauruan economy showed signs of recovery, with a growth rate of 1.5% in fiscal year 2021, an improvement over the 0.8% growth in the previous fiscal year. Despite the ongoing impact of pandemic-related restrictions, the government increased expenditures by 22.3%, primarily in health facilities and state-owned enterprises providing essential public services. Nevertheless, the current account surplus decreased to 4.6% of GDP from 10.4%, mainly due to reduced operations of Nauru Airlines. The GDP growth is projected to slow to 1.0% in FY2022 as activities associated with the Australia-financed Regional Processing Centre wind down. However, growth is expected to rebound to 2.4% in 2023, driven by infrastructure projects and related activities<sup>9</sup>

## 1.5 Land Ownership and Tenure

In accordance with the constitution of Nauru, every Nauruan citizen holds individual rights to land, which is a fundamental aspect of their identity. Landownership is a generational tradition, with lands passing from parents to their children. The two primary categories of land in Nauru are coconut land and phosphate land. Coconut land is typically reserved for residential purposes, with houses constructed beneath the shade of coconut trees. In contrast, phosphate land, located at the topside, is not intended for residential or building use.

Land in Nauru is usually owned by individuals or groups of landowners. It is often leased for specific periods, serving various purposes such as general, commercial, or developmental activities. Lease agreements are common between landowners and the government or corporate entities. It's important to note that foreign individuals or non-Nauruans do not have the entitlement to own land in Nauru, as landownership is reserved for Nauruan citizens.

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<sup>8</sup> Country Reports 2023 [Nauru | Culture, Facts & Travel | - CountryReports](#)

<sup>9</sup> [Nauru Country/Economy Profile \(adb.org\)](#)

## 1.6 Agriculture, Forest & Livestock

Agriculture in Nauru faces significant challenges due to limited fertile land (only about 4 km<sup>2</sup>, much of it used for housing), conflicts over land tenure and water rights, and poor soil quality with limited water-holding capacity. Irrigation relies on brackish underground water and fragile rainwater collection. Frequent droughts make rainwater supply uncertain. To improve agricultural production, addressing water scarcity through conservation, enhanced rainwater catchment systems, and better irrigation practices is a top priority.

The mining activity has removed a large proportion of original forest; however, there has been limited revegetation during this period, but sufficient data is not available on the forest cover in Nauru. There are some fruit and flower trees present on the land area like coconut, mango, pawpaw, lime, breadfruit, sour sop, pandanus. The indigenous hardwood is the tomano tree and couple of variety of flower trees/plants but the most widely used/favoured are the franjipani, iud, hibiscus, irimone (jasmine), eaquañeyi (from tomano tree), emet and yellow bells.

Livestock on Nauru is limited to Pigs, Chickens and Ducks due to this unavailability of pastures and free range/grazing land areas. The pigs, chickens and duck (eggs) provide the only locally produced food stocks aside from the odd local garden and tropical fruit trees.

## 1.7 Fisheries

Development of Fisheries is vital to food security in Nauru. Fisheries play an important role in the economy of the country from license fees for foreign fishing boats fishing in the substantial EEZ. The limited reef areas and very deep ocean surrounding the island, limits the importance of coastal fishing. Deep sea game fishing is limited to those with powerboats with outboard motors. During the heydays of phosphate mining, game fishing dominated the scene. Currently however, the few fishermen having canoes contribute significantly to food needs at the subsistence level. Materials and know-how to build fishing canoes are needed to enable more fishermen to take advantage of six existing Fish Aggregating Devices (FAD) that have been strategically placed around the island. Milk fish have been successfully farmed at Buada lagoon as well as in other aquaculture operations<sup>10</sup>.

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).

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<sup>10</sup> Situation Analysis and Agriculture Sector Overview [Nauru.pdf \(fao.org\)](#)

## 1.8 Biodiversity<sup>11</sup>

### Terrestrial Biodiversity of Nauru:

Nauru's terrestrial biodiversity is relatively limited and faces several challenges, as highlighted in a 2013 UNEP-GEF funded project known as the 'Biodiversity Rapid Assessment.'

**Flora:** Nauru's flora consists of around 56 native and 125 naturalized species, with none of the native species being endemic. Many native species are extirpated or on the brink of extinction, with new weed species emerging.

**Invertebrates:** The 2013 assessment revealed new records of 51 moth species, 13 land snail species, 17 ant species, and 6 dragonfly species. Some are endemic, while all ant species are exotic. Challenges include the presence of invasive species and limited native invertebrates.

**Reptiles:** Nauru recorded 8 reptile species, including ground skinks, geckos, and an invasive snake. One ground skink species may potentially be a new endemic species to Nauru.

**Birds:** There are 36 bird species in Nauru, primarily seabirds. Notably, masked booby and Audubon's shearwater were identified as new seabird records. Only two land bird species are present, including Nauru's endemic reed warbler.

### Marine Biodiversity of Nauru:

Nauru's marine biodiversity presents unique characteristics, influenced by its geographical isolation.

**Coral Reefs:** Nauru's coral reefs exhibit low diversity in hard coral species, with around 51 species identified. Some rare colonies of Acropora coral and several IUCN Red Listed coral species were found, with some species extending their bio-geographic range.

**Invertebrates:** The marine invertebrate diversity in Nauru is low due to limited habitat types, the island's small size, and isolation from areas of higher diversity. The study recorded 79 invertebrate species, including giant clams thought to be locally extinct and five species of sea cucumbers.

**Reef Fish:** Nauru's reef fish fauna comprises approximately 407 species, with Labridae, Pomacentridae, and Acanthuridae among the dominant families. Overfishing is a concern, with signs of low numbers of large-sized fish.

**Marine Plants & Algae:** Apart from a few mangrove strands along the coastline, marine plants like seagrasses are absent. Different groups of algal species dominate the reef flats, with concerns about marine fouling organisms and recently introduced marine species.

**Offshore Marine:** Nauru's Exclusive Economic Zone (EEZ) is sizable, known for abundant tuna stocks, especially skipjack and yellowfin. Tuna stocks are influenced by El Niño Southern Oscillation events, with fluctuations during El Niño and La Niña periods.

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<sup>11</sup> Nauru's Fifth National Report to the Convention on Biological Diversity <https://nauru-data.sprep.org/system/files/nr-nr-05-en.pdf>

## 1.9 Energy

Nauru has had a National Energy Policy Framework (NEPF) in place since 2009, aligning with government goals to increase the utilization of renewable energy sources, with a target of achieving 50% of the overall energy supply from renewables. The government is also focused.

Like most of the Island nations, Nauru is totally depending on import of fossil fuels mainly Diesel, Petrol, Liquefied petroleum gas (LPG), Fuel Oil, Lubricants and aviation fuel (Jet Kerosene) to fulfil the requirements of energy sector. Historically, electricity generation was totally dependent on imported fossil fuel. By 2006, the total installed electricity generation capacity was 4 MW; presently the installed capacity of the power stations is 15.5MW comprising of eight medium and high-speed diesel generators. Electricity generation and availability are a *function* of the energy demand (mostly mining industry, which uses approximately 43% of the energy generated) and availability of the fuels varies over the year.

Nauru Utility Corporation (NUC – a government entity) responsible for supply of electricity and water in Nauru. Vital Energy operates the fuel tank farm (Diesel, Petrol and kerosene) and LPG is sold by separate, private importers (*Lavages*); however, there is limited use of LPG reported on Nauru, in the domestic sector, commercial sector (Hotels and restaurants) also uses LPG for cooking purposes, though to a limited extent. This situation has arisen due to the long-term reliance on electricity as an energy source, which in the earlier days of the mining operation (pre-1990s) was free and changed the electricity use pattern/habits. This led to the use of electricity for cooking purposes in domestic and commercial kitchens and the use of less efficient electrical appliances.

In recent years, Nauru realized the other alternative source of energy using the renewable energy from Sun and installing solar photovoltaic systems with an ambition to achieve energy security and reduce the expenditure on fossil fuels. The specific target for renewable energy is 50% of grid electricity to be supplied from renewable energy sources by 2020. The energy sector will be discussed in more detail later in the report.

## 1.10 Water

Potable water availability and storage is an important aspect of Nauru's sustainability strategy. Potable water coming only from rainwater collection and reverse osmosis (RO) desalination plant; a permeable island with very little surface runoff and no rivers or reservoirs makes Nauru more vulnerable. Annual precipitation has ranged from severe drought at 280 mm to very wet at 4590 mm, making water supply a particularly difficult problem. Water for non-potable uses is obtained from domestic bores at houses around the island and 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. Nauru is highly dependent on the operation of Reverse Osmosis (RO) desalination units for water supply and further roughly 20% of electrical energy supplied by NUC is used for water desalination.

## 1.11 Waste – Solid Waste and Wastewater

Increasing population, growing economy and change in lifestyle and consumption pattern have increase the waste generation both Municipal Solid Waste (MSW) and Wastewater (WW). Further, poor waste management practices, i.e. ineffective waste collection, uncontrolled disposal and unscientific management have increased the severity of problem.

Further, lack of solid-waste management of medical waste generated from hospital, quarantine waste, metal waste and electronic waste, leads to future potential environmental and health risks, some of which already exist.

Wastewater generated from houses, shops, commercial buildings and RPC, is not being treated and *disposed of in sea*. The domestic and commercial wastewater and sewage are collected by large tanker trucks from septic and wastewater storage tanks and along with *NPC's wastewater is disposed of through a seawater pipe outfall close to the edge of the reef*. There is no alternate domestic, commercial or industrial wastewater treatment available on Nauru. This lack of primary treatment for liquid wastes provides potential environmental and health risks. The absence of appropriate infrastructure and organized waste management systems are a major source of pollution.

## 1.12 Transport<sup>12</sup>

Nauru's transportation infrastructure comprises a 24 km paved road that encircles the island and a dirt track leading to the Nauru Rehabilitation Corporation (NRC) stockpile and offices. In 2011, approximately 29% of households in the country owned at least one car, and 46% had at least one motorbike. The public sector transport has seen improvements, benefiting schools, public sector employees, and the general population through an enhanced public bus system.

The island's airport is relatively simple, featuring a road serving as a runway and a functional airline terminal. The airline, formerly known as Air Nauru, resumed operations in October 2006 after facing challenges in December 2005 when its only plane was impounded. The aviation sector has now adopted Civil Aviation Safety Authority (CASA) standard certification, focusing on infrastructure, safety, and service.

Marine transport has also seen improvements in reliability and operations, including the introduction of barges for efficient cargo loading and unloading. Additionally, a pilot boat aids in port entry and provides emergency support at sea, while NFMRA boats are deployed for in-shore Search and Rescue (SAR) operations, enhancing safety measures in marine transportation.

## 1.13 Institutional Arrangements for Climate Change

The national institutional arrangements facilitate individual Parties in ensuring that nationally appropriate procedures for collecting, processing, reporting and archiving required data and information are established and operational in a sustainable manner on a continuous basis. It also helps to facilitate effective coordination among all relevant stakeholders from the public and private sectors, in meeting the reporting requirements under the Convention, as well as addressing the broader issue of climate change at the national level. Institutional arrangements assist Parties to:

- a) Meet reporting requirements under the Convention.
- b) Further build national capacities and ensure sustainability of reporting processes.
- c) Inform national and international policymakers, at different levels.
- d) Assist in institutionalizing activities relating to reporting on climate change.

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<sup>15</sup> [Naurus Second national communication](#)

### **1.13.1 Institutional Arrangements for the preparation of NCs and BURs**

According to the UNFCCC Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention<sup>13</sup> the non-Annex I Parties may provide a description of existing institutional arrangements relevant to the preparation of their national communications on a continuous basis.

The Nauru has prepared and submitted two national communications to the United Nations Framework Convention on Climate Change, i.e., the First National Communication (1999) and the Second National Communication (2004). Given the status and its obligation as a non-annex 1 party, Nauru shall submit its Third National Communication (present document) to the Conference of Parties (COP) of the UNFCCC.

The Third National Communication for Nauru and GHG inventory has been implemented by the Department of Commerce, Industry and Environment, with the support of Planning and Aid Division, Ministry of Foreign Affairs, Agriculture Division and other government ministries, Nauru Utilities Corporation (NUC), tertiary institutions and relevant stakeholders.

The following thematic working groups were formed to assist with the preparation of various components of the national communication:

- (i) National Greenhouse Inventory,
- (ii) Vulnerability and Adaptation.
- (iii) Mitigation.
- (iv) Technology transfer, Research and systematic observation; and
- (v) Education, training, public awareness and information and networking and Capacity-building.

Each thematic working group comprised a number of experts drawn from both public and private sectors, communities, and NGOs, as appropriate.

Key steps towards the preparation of third national communication and national GHG inventory was as follows:

- Project Organization Structuring
- Thematic Working Group (TWGs) formation
- Stakeholder Consultation Process
- Training and Capacity building Programme
- Data collection, Identification of data gaps and uncertainty assessment
- Documents/data review for quality assurance
- Preparation of GHG Inventory Report
- Review and approval of the GHG Inventory Report

### **1.13.2 Project Organization Structure**

The institutional arrangements for regular preparation of national communications have been established. The structure is depicted in Figure 1.4.

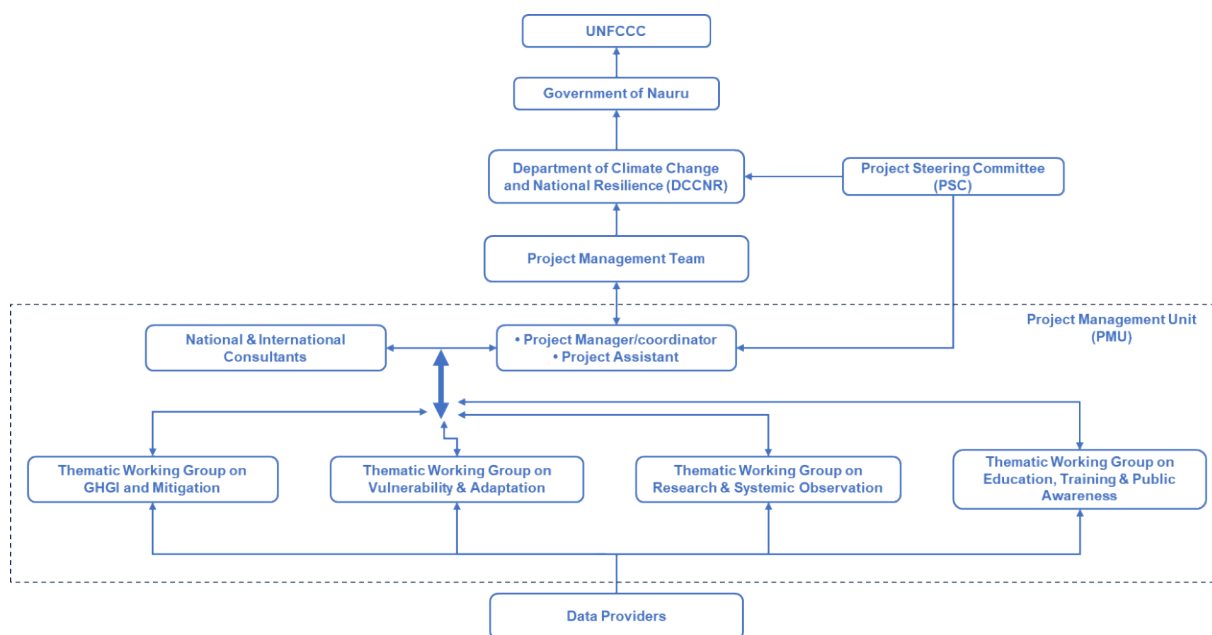
The Department of Climate Change and National Resilience (DCCNR) is a government department in Nauru established on September 10, 2020, to mitigate the effects of climate

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<sup>13</sup> UNFCCC guidelines for the preparation of national communications from Parties not included in Annex I to the Convention (Non-Annex I Parties)", contained in decision 17/CP.8. <https://unfccc.int/resource/docs/cop8/07a02.pdf#page=2%3E>.

change and improve Nauru's resilience. Its activities include developing policies, raising awareness, and implementing adaptation strategies such as land rehabilitation, sustainable resource management, and strengthening environmental institutions. Management of climate change is coordinated and facilitated through the DCCNR and is also the National Focal Point for the United Nations Framework Convention on Climate Change (UNFCCC) and serves as the Global Environment Facility (GEF) Operational Focal Point. The United Nations Development Programme (UNDP) is the main Implementing Agency of the GEF for Nauru. All climate change and climate change-related programmes, projects and activities implemented nationally and through bilateral, regional and international support and assistance are managed and coordinated through DCCNR.

**Figure 1. 4: Institutional Arrangements and Organization structure for Nauru's TNC**



The Project Director identifies a Project Manager/Coordinator to oversee the preparation of the reports and manage coordination among the different stakeholders assisting in developing the different components. The Project Manager/Coordinator liaise with the national technical experts, consultants appointed for drafting of the National Circumstances, Mitigation, Adaptation, Constraints & Gaps and related financial, technological, and capacity building needs and support needed and received, and Other Information. This Project Manager/Coordinator also plays a part in facilitating communication, technical cooperation and coordination among stakeholder agencies and other project partners at national level. The Project Assistant is responsible for the overall administration and/or additional support of the project (organizational and logistical).

The Project Steering Committee (PSC) was established to provide financial, policy and administrative oversight. The function of the PSC is to focus mainly on final decisions on procurement, institutional arrangements, and financial management of the project. This PSC consists of the Project Director, National Departmental Representatives, UNDP Representative, Project Manager/Coordinator and Project Assistant.

The Steering Committee will provide technical and policy oversight to the project, facilitated by the National Climate Change Steering Committee (NCCSC) who will be assisted by the

TNC Project Coordinator and project staff. The project management team will report to the Director of the DCCNR.

The flow of information is from the data providers to the Thematic Working Groups (TWGs) and consultants and draft reports are submitted by these teams to the Project Manager/Coordinator that shares these with the project management team. Upon finalizing the report, the Project Manager/Coordinator finalizes the documents for submission to the Director of DCCNR for approval. Lastly, DCCNR submits the finalized NC and BUR reports to the UNFCCC.

### 1.13.3 Thematic Working Groups

To facilitate the preparation of TNC, various thematic working groups were created, and each group is formed up the experts both from public and private sectors, education institutions, local communities, and NGOs with links to expertise and data used in national communications.

*Table 1. 2 Key agencies within the TWGs*

TWGs	Members
TWG - National Circumstances	Central Statistics Division (CSD) Ministry of Local Government and Agriculture (MLG&A) Electricity Corporation (EC) National Disaster Management Office (NDMO) Department of Women & Social Development Affairs Meteorological Service (MS) Department of Education and Sport
TWG- GHG Inventory	Department of Commerce, Industry and Environment (DCIE) Environment Division Nauru Utilities Corporation (NUC) RONPHOS Bureau of Statistics Lands and Survey Planning and Aid Division (PAD) Utilities Tank Farm Department of Agriculture
TWG- Mitigation Analysis	National Disaster Management Office Ministry of Commerce, Industry and Resources Central Statistics Division (CSD) National Climate Change Advisory Council (NCCAC) Nauru Island Association of Non-Government Organizations (NIANGO) Electricity Corporation Ministry of Transport, Energy and Tourism Ministry of Public works, Infrastructure, Environment, Labour, Meteorology and Disaster Department of Waste management Department of Agriculture Department of Environment
TWG- Vulnerability Assessment and Adaptation (V&A)	Climate Action Unit under DCCNR Dept. of Environment Dept. of disaster Management Dept. of Marine Coastal Fisheries Dept. of Agriculture Dept. of Labour Home Affairs & Rural Development Ministry of Health Ministry of Public Utilities & Industries Public Works Dept., Energy, TEC Ministry of Finance & Economic Planning

	Ministry of Trade, Tourism & Commerce Ministry of Transport & Communication Ministry of Education Information and Communications Technology (ICT) Dept.
TWG- Research & Systematic Observation	National Disaster Management Office (NDMO) Meteorological Service (MS) Lands & Survey Department
TWG- Education, Training & Public Awareness	Climate Action Unit under DCCNR Department of Environment Department of Education Nauru Rehabilitation Commission Department of Women & Social Development Affairs

#### **1.13.4 Stakeholder Consultation**

Stakeholder consultation was carried out among the stakeholders from government departments, public and private sectors, local and international development partners, NGOs, and public groups. The first phase of the stakeholder consultation focused on the key objective of the TNC and NIR project, inception, approach & methodology, and processes. The stakeholders were updated on the key steps of TNC and consulted on various aspects of GHG inventory sectors e.g., data collection process, climate change mitigation, adaptation, and V&A management. The stakeholders were also updated on IPCC 2006 Guidelines and Best Practices to develop the national GHG Inventory.

The second phase of stakeholder consultation involved the presentation of the results i.e., the National GHG Inventory, data, standards, and assumptions applied for the estimation and compilation of Nauru's National GHG inventory, key sector, and categories, data gaps, assumptions, and uncertainties, etc. The objective of this phase was also to validate the assumptions and standards used for GHG inventory and seeks inputs from a wider stakeholder group. An important aspect of the stakeholder consultation was to update on the data gaps, uncertainties, etc. and issues and activities to be considered to improve the quality, completeness, and transparency of GHG inventory and updates on the national GHG inventory improvement plan (NIIP).

#### **1.13.5 Training and Capacity Building**

The training and Capacity Building program was designed and delivered to the PIU/PMU team and other key stakeholders. The overall objective was to develop the capacity, share experiences, and learnings from the previous NIRs, data, and information communication protocols (data collection, archiving, reporting, and quality management in the context of existing national statistical data collection systems) and best practices with the stakeholders; to achieve the necessary level of expertise to develop national GHG inventory through data collection, analysis, monitoring and reporting guidelines, and procedures as required by UNFCCC. The stakeholders were also updated on IPCC 2006 Guidelines, updates, and best practices. The training exercise was focused on the following key areas: (i) GHG estimation methods in the latest IPCC Guidelines (2006 and 2019 enhancement, GPGs); (ii) Application of the IPCC Guidelines to the national circumstances; and (iii) QA/QC and Review processes.

Similarly, training was also provided on concepts, structure, steps and tool for conducting Mitigation analysis and vulnerability and adaptation assessment.

#### **1.13.6 Quality Assurance/Quality Control and Review Mechanism**

A quality assurance/quality control (QA/QC) and review mechanism was an integral part of the process and was devised in order to improve transparency, consistency, comparability,

completeness, and accuracy of third national communication and national greenhouse gas inventory. An internal QA/QC plan was developed, and roles and responsibilities were defined for the inventory GHG Inventory Team Members. The QA/QC process and review mechanism have been implemented at all levels of data collection, inventory preparation, and reporting.

The team routinely conducted checks on the consistency of the data and information provided by the different stakeholders (line ministries, government departments, Organizations, Public and private sector, etc.), to ensure data integrity, correctness, and completeness. In case of discrepancy or incompleteness, the inventory team consulted the relevant stakeholders and experts to reduce the data uncertainty, appropriate corrections, and address errors and omissions. The sub-sectoral and sectoral calculations of GHGs were shared with the experts for technical review of categories and sub-category activity data, emission factors, estimation parameters, and calculation methods. The inputs provided by the experts were addressed and the GHG emission reduction calculation was revised. On finalization of the GHG Inventory calculations, the draft report was prepared and shared with the key Stakeholders.

Further, the draft report and GHG inventory calculations were presented during the stakeholder consultation to seek input and finalize the report. Similarly, draft report on mitigation analysis, and vulnerability and adaptation were also presented during the stakeholder consultation to seek inputs and finalize the reports. The main outcomes of QA/QC and review process were overall improvement in the quality of data collection, calculations, reporting, and inclusion of the key criteria analysis, uncertainty estimates, and subsequent improvements in the future GHG Inventory i.e., National Inventory Improvement Plan (NIIP).

## Executive Summary: Vulnerability & Adaptation Assessment

This Vulnerability and adaptation assessment chapter of Third national communication outlines the present and future climate change scenarios in Nauru. By prioritizing the specific needs arising from Nauru's vulnerability, this chapter aims to implement effective measures and ensure the long-term sustainability and well-being of the country in the face of climate change.

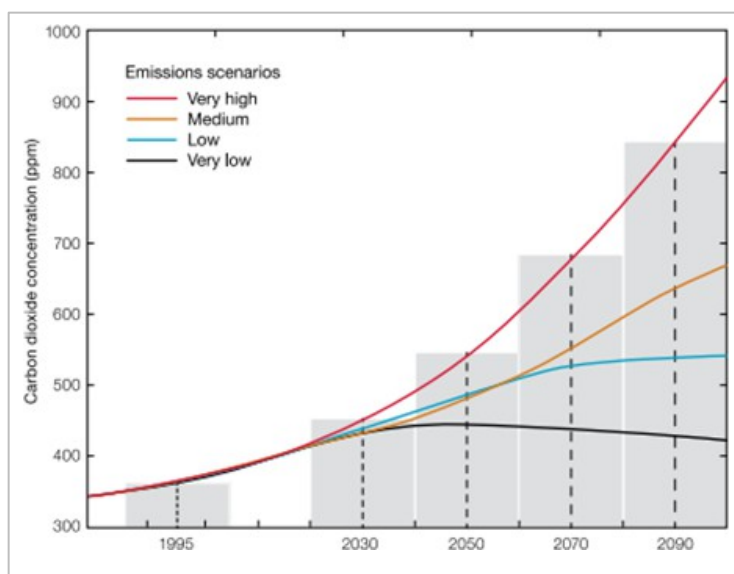
### Climate Change Scenario

This section provides a description of the climatic scenario for the Nauru including its past and present climate as well as projections for the future.

Global climate models are the best tools for understanding future climate change. There are many different global climate models, and they all represent the climate slightly differently. Scientists from the Pacific Climate Change Science and Adaptation Planning Program have evaluated 26 models from around the world and found that 24 best represent the climate of the Nauru region of the western tropical Pacific. These 24 models have been used to develop climate projections for Nauru.

The climate projections for Nauru are based on the four IPCC RCPs: very low emissions (RCP2.6), low emissions (RCP4.5), medium emissions (RCP6.0) and very high emissions (RCP8.5), for four 20-year time periods centered on 2030, 2050, 2070 and 2090, relative to a 20-year period centered on 1995. Since individual models give different results, the projections are presented as a range of values. When interpreting projected changes in the mean climate in the Pacific, it is important to keep in mind that natural climate variability, such as the state of the El Niño-Southern Oscillation, strongly affects the climate from one year to the next.

**Figure ES-2.1: Carbon dioxide concentrations (parts per million, ppm) associated with the very low (RCP2.6), low (RCP4.5), medium (RCP6.0) and very high (RCP8.5) emissions scenarios for 20-year time periods (shaded) centered on 1995 (the reference period), 2030, 2050, 2070 and 2090**



The historical, Future projections and extremes are presented and discussed. Nauru's future projections demonstrate the challenges and opportunities it faces as a small island nation. Climate impacts almost all aspects of life in Nauru. Understanding the possible future climate

of Nauru is important so people and the government can plan for changes. Some key observations are.

- El Niño and La Niña events will continue to occur in the future, but there is little consensus on whether these events will change in intensity or frequency.
- Annual mean temperatures and extremely high daily temperatures will continue to rise.
- Ocean rainfall is projected to increase, along with more extreme rain events.
- Droughts are projected to decline in frequency.
- Sea level will continue to rise.
- Ocean acidification is expected to continue.
- The risk of coral bleaching is expected to increase.
- Wave height and period are projected to decrease in December–March but no significant changes are projected in June–September

**Vulnerability assessment:** Nauru confronts significant challenges in its pursuit of sustainable social and economic development, as outlined in the National Sustainable Development Strategy (NSDS). Limited arable land and freshwater resources, geographic isolation, dependence on imports for basic needs, environmental degradation, and the emergence of chronic health issues complicate the path toward sustainable development. Moreover, these challenges compound Nauru's vulnerability to additional stressors like climate change and disasters.

To address the risks posed by climate change and disasters to sustainable development, the Government of Nauru has formulated the Republic of Nauru Framework for Climate Change Adaptation and Disaster Risk Reduction (RONAdapt). RONAdapt underscores the government's commitment to aligning national development priorities and environmental sustainability goals by incorporating vulnerability reduction and risk management into planning and activities across all sectors of the economy and society. The priority actions identified within RONAdapt aim to comprehensively address climate change adaptation (CCA) and disaster risk reduction (DRR) needs.

These priorities articulated in RONAdapt contribute significantly to the achievement of the NSDS's goals and the enhancement of Nauru's resilience to climate change and disasters. These priorities specifically target essential areas:

*Water:* Nauru faces challenges in ensuring access to clean water due to groundwater contamination from mining and inadequate waste management practices. Climate change is expected to worsen water stress, impacting availability and quality.

*The Coastal Zone:* Rising sea levels pose significant threats to Nauru's coastal areas, leading to concerns about coastal erosion and saltwater intrusion.

*Island Ecology:* Historical environmental degradation due to phosphate mining and the introduction of non-native species has significantly damaged terrestrial and marine biodiversity. Climate change further threatens local species and habitats.

*Communities:* Nauru's remote location, weak infrastructure, high poverty rates, and reliance on imports for basic needs make vulnerable populations susceptible to climate change impacts.

*Gender:* Climate change impacts are not gender-neutral, with women and children at higher risk. Understanding the gendered impacts of climate change is essential for addressing specific needs and challenges faced by women.

*Migration:* Climate change-induced factors such as droughts, sea-level rise, and water scarcity affect Nauru's population and are linked to remittances and economic opportunities. Future migration patterns are a concern.

*Human Health:* Climate change poses risks to human health in Nauru, including heat-related illnesses, waterborne diseases, and non-communicable diseases.

*Infrastructure:* Nauru's infrastructure is vulnerable to climate change impacts, including rising sea levels, extreme weather events, coastal erosion, and water resource constraints.

*Adaptation & resilience:* It is imperative to address climate change with sustainable development efforts to strengthen resilience against climate change and enhance the well-being of all Nauruans.

### **Key adaptation measures**

*Water Management:* Implementing strategies to enhance water efficiency, including rainwater harvesting, desalination, and wastewater treatment systems. These measures aim to safeguard freshwater resources and ensure their sustainable use.

*Coastal Protection:* Developing comprehensive strategies to mitigate coastal erosion and safeguard critical infrastructure. This includes the construction of seawalls, artificial reefs, and beach nourishment projects to protect Nauru's vulnerable coastlines.

*Coral Reef Conservation:* Implementing measures to safeguard and rejuvenate coral reefs, a vital marine ecosystem. Actions include establishing marine protected areas, reducing pollution, and promoting sustainable fishing practices to preserve these critical habitats.

*Diversifying the Economy:* Investing in alternative sources of income to reduce dependence on vulnerable sectors. Initiatives include the development of renewable energy sources, eco-tourism, and sustainable agriculture to bolster economic resilience.

*Strengthening Healthcare Systems:* Enhancing healthcare infrastructure and capacity to address health risks associated with climate change.

*Improving Disaster Preparedness:* Enhancing early warning systems, emergency response mechanisms, and community resilience to effectively respond to and recover from climate-related disasters.

### **V&A Policies & Plans**

Nauru has developed a range of policies, plans, and legislations to address the challenges of climate change adaptation. These frameworks provide a strategic direction and guidance for integrating climate change considerations into national development efforts.

## 2 Vulnerability and Adaptation Assessment

### 2.1 Background

The objective of this chapter is likely to provide an updated assessment of Nauru's vulnerability to climate change impacts, identify new challenges, and outline enhanced strategies for adaptation. It aims to showcase the country's ongoing efforts in integrating climate considerations into policies, promoting resilience, and seeking international support to address its unique challenges as a small island developing state. By prioritizing the specific needs arising from Nuvu's vulnerability, this chapter aims to implement effective measures and ensure the long-term sustainability and well-being of the country in the face of climate change.

### 2.2 Climate Change Scenario

This section presents a concise overview of the climate scenario for Nauru, encompassing the historical climate trends since 1950, the current climate conditions, and future projections. The information provided is derived from collaborative research conducted by Nauruan and Australian climatologists as part of the Pacific Climate Change Science Joint Program (PCCSP)<sup>14</sup>, Pacific- Australia Climate Change Science Adaptation Planning (PACCSAP) reports and World Bank Climate change knowledge portal<sup>15</sup>.

The climatic scenario analysis incorporates various factors such as air temperature, rainfall patterns, extreme weather events, sea-surface temperature, ocean acidification, and mean and extreme sea levels. It draws on observed trends and analyses to understand the past and present climate conditions in Nauru. Furthermore, projections for the 21st century are presented, focusing on air and sea surface temperature, rainfall, sea level, ocean acidification, and extreme weather events.

**Climate Models for Projections:** Global climate models are the best tools for understanding future climate change. Climate models are mathematical representations of the climate system that require very powerful computers. They are based on the laws of physics and include information about the atmosphere, ocean, land, and ice. There are many different global climate models, and they all represent the climate slightly differently. Scientists from the Pacific Climate Change Science and Adaptation Planning Program have evaluated 26 models from around the world and found that 24 best represent the climate of the Nauru region of the western tropical Pacific. These 24 models have been used to develop climate projections for Nauru.

The Intergovernmental Panel on Climate Change (IPCC) has developed a set of scenarios known as Representative Concentration Pathways (RCPs)<sup>16</sup> that represent different pathways of greenhouse gas emissions and their impacts on the climate system. The climate projections for Nauru are based on the four IPCC RCPs: very low emissions (RCP2.6), low emissions (RCP4.5), medium emissions (RCP6.0) and very high emissions (RCP8.5), for four 20-year time periods centered on 2030, 2050, 2070 and 2090, relative to a 20-year period centered on 1995 Figure 2.1. Since individual models give different results, the projections are presented as a range of values. When interpreting projected changes in the mean climate in

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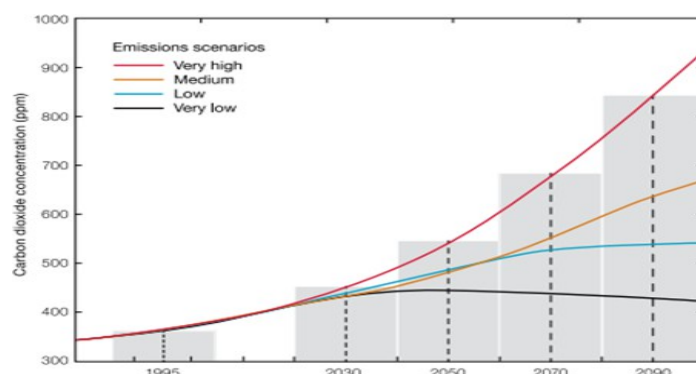
<sup>14</sup> Pacific-Australia Climate Change Science and Adaptation Planning Program, 2011 <https://www.pacificclimatechangescience.org/>

<sup>15</sup> Climate change Knowledge portal, 2021 <https://climateknowledgeportal.worldbank.org/>

<sup>16</sup> Climate Change 2022: Impacts, Adaptation and Vulnerability <https://www.ipcc.ch/report/sixth-assessment-report-working-group-ii/>

the Pacific, it is important to keep in mind that natural climate variability, such as the state of the El Niño-Southern Oscillation, strongly affects the climate from one year to the next.

**Figure 2. 1: Carbon dioxide concentrations**

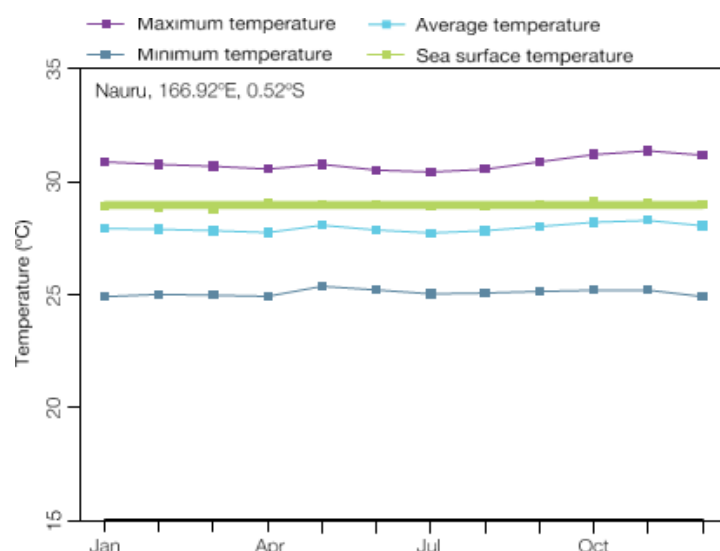


Above figure represents, Carbon dioxide concentrations (parts per million, ppm) associated with the very low (RCP2.6), low (RCP4.5), medium (RCP6.0), and very high (RCP8.5) emissions scenarios for 20-year time periods (shaded) centered on 1995 (the reference period), 2030, 2050, 2070 and 2090<sup>17</sup>

## 2.3 Temperature

Nauru experiences a consistent monthly average temperature throughout the year, which is closely linked to the surrounding ocean temperature. This relationship between air and ocean temperatures influences the climatic conditions on the island (refer to Figure 2.2). The wet season typically commences in November and extends until April of the following year. During this period, Nauru receives higher amounts of rainfall. Conversely, drier conditions prevail from May to October, characterizing the dry season on the island.

**Figure 2. 2: Seasonal temperature at Nauru<sup>18</sup>**



<sup>17</sup> Pacific-Australia Climate Change Science and Adaptation Program 2015 [6\\_PACCSAP\\_Nauru\\_8pp\\_WEB \(pacificclimatechange.net\)](https://www.pacificclimatechange.net/6_PACCSAP_Nauru_8pp_WEB)

<sup>18</sup> Pacific-Australia Climate Change Science and Adaptation Program 2015 [6\\_PACCSAP\\_Nauru\\_8pp\\_WEB \(pacificclimatechange.net\)](https://www.pacificclimatechange.net/6_PACCSAP_Nauru_8pp_WEB)

### 2.3.1.1 Temperature projections

Projections of future temperature change in Nauru, a small island state, indicate that temperatures are expected to rise, albeit at a level below the global average. The presence of large amounts of nearby ocean cover has a moderating effect on the temperature increase. However, it's important to approach these projections with caution due to the limitations of current global models in accurately capturing climate processes over small island states.

**Table 2. 1. An overview of Nauru's temperature change projections (°C) under four emissions pathways.**

Scenario	Mean Surface Air Temp					
	Max Temp (Annual) (1-in-20 Year Event)		Min Temp (1-in-20 Year Event)		Min Temp (1-in-20 Year Event)	
	2050	2090	2050	2090	2050	2090
RCP2.6	0.9 (0.6–1.4)	0.9 (0.6–1.5)	0.7 (0.2–1.2)	0.8 (0.4–1.3)	0.8 (0–1.6)	0.8 (0.4–1.2)
RCP4.5	1.1 (0.6–1.5)	1.5 (1.1–2.5)	0.9 (0.5–1.3)	1.4 (0.8–2.2)	1 (0.6–1.3)	1.4 (0.8–2.1)
RCP6.0	1 (0.7–1.6)	1.9 (1.1–3)	NA	NA	NA	NA
RCP8.5	1.5 (1–2.2)	3 (2–4.5)	1.5 (0.8–2.4)	3 (1.9–4.4)	1.5 (0.8–2.8)	3 (2–4.3)

*Note: Projected changes over the 1986–2005 baseline is given for 20-year periods centered on 2050 and 2090 with the 5th and 95th percentiles provided in brackets<sup>19</sup>*

Under the highest emissions pathway (RCP8.5), it is projected that Nauru's average monthly temperatures could increase around 3.0°C by the 2090s, compared to a global average temperature increase of around 3.7°C. These projections suggest a significant warming trend for the region, which could have implications for various aspects of daily life.

The dashed lines , showthe 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 surface air temperature could be above orbelow the projected long-term averages due to interannual variability. The ranges of projectionsfor a 20-year period centered on 2090 are shown by the bars on the right for RCP8.5, 6.0, 4.5 and 2.6.

The projections for Nauru include changes in both maximum and minimum temperatures, indicating that temperature extremes are expected to increase in magnitude as well. These extremes can have profound effects on ecosystems, human health, labor productivity, and crop yields, emphasizing the need to consider not only the average temperature but also the daily temperature range when assessing the potential impacts of climate change.

It's worth noting that the presence of ocean cover can affect the accuracy of model simulations, and the current generation of global models may lack the spatial precision necessary to reliably capture climate processes specific to small island states. Therefore, while these temperature projections provide valuable insights, they should be interpreted with caution and supplemented with additional localized research and data.

<sup>19</sup> Climate change knowledge portal 2021, [15819-WB\\_Nauru Country Profile-WEB.pdf \(worldbank.org\)](#)

Figure 2. 3. Historical and simulated surface air temperature time series for the region surrounding Nauru

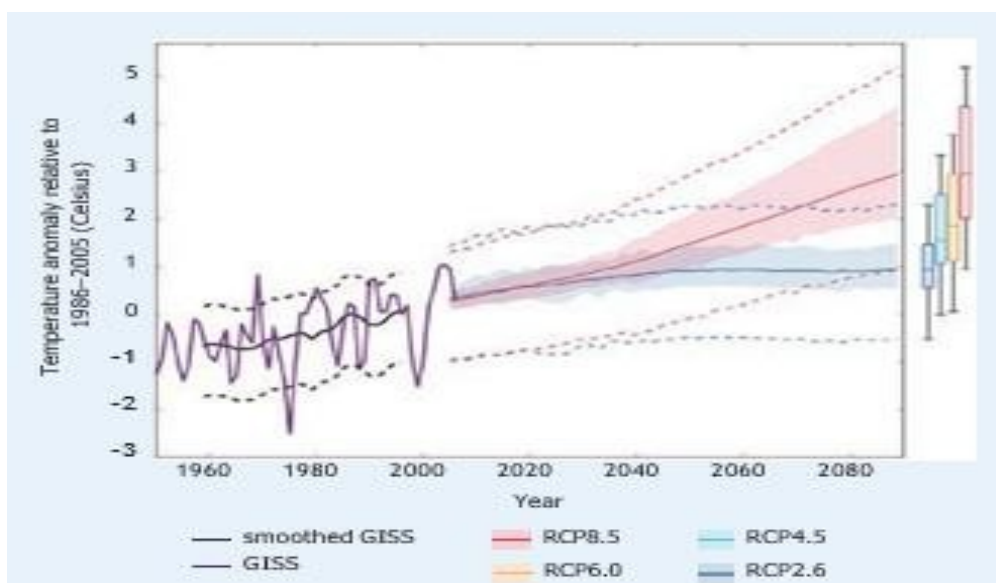


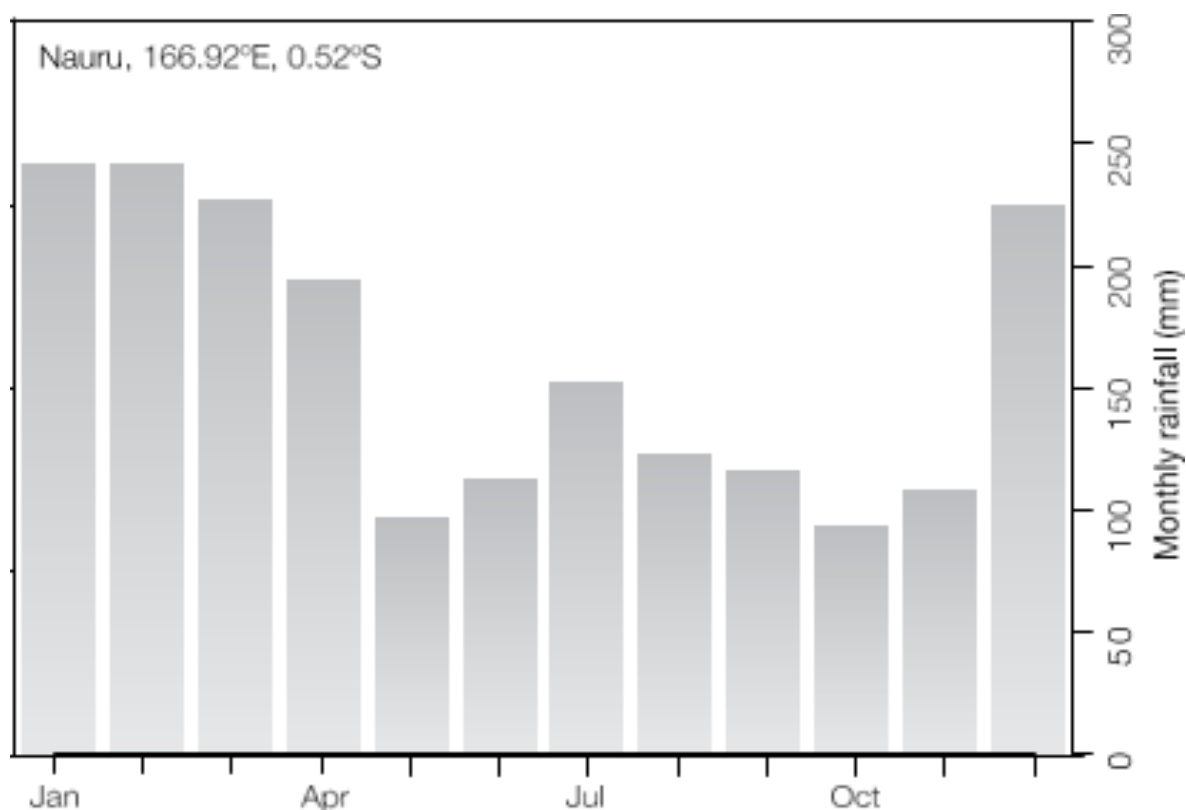
Figure No. 2.3 shows Historical and simulated surface air temperature time series for the region surrounding Nauru. The graph shows the anomaly (from the base period 1986–2005) in surface air temperature from observations (the GISS dataset, in purple), and for the CMIP5 models under the very high (RCP8.5, 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)<sup>20</sup>.

### 2.3.2 Precipitation

Nauru's wet season is influenced by the movement of the South Pacific Convergence Zone (SPCZ) and the Intertropical Convergence Zone (ITCZ). These weather phenomena are depicted in Figure No. 3. The SPCZ, located south of Nauru, is a band of heavy rainfall caused by converging winds over warm waters. The ITCZ, situated north of Nauru, is a belt of low pressure where trade winds converge. Both zones bring thunderstorm activity and heavy rainfall to Nauru during the wet season.

<sup>20</sup> Climate change knowledge portal 2021 [15819-WB\\_Nauru Country Profile-WEB.pdf \(worldbank.org\)](https://www.worldbank.org/publications/ccckp/15819-WB-Nauru-Country-Profile-WEB.pdf)

Figure 2. 4: Seasonal Rainfall of Nauru<sup>21</sup>



### 2.3.2.1 Precipitation Projections

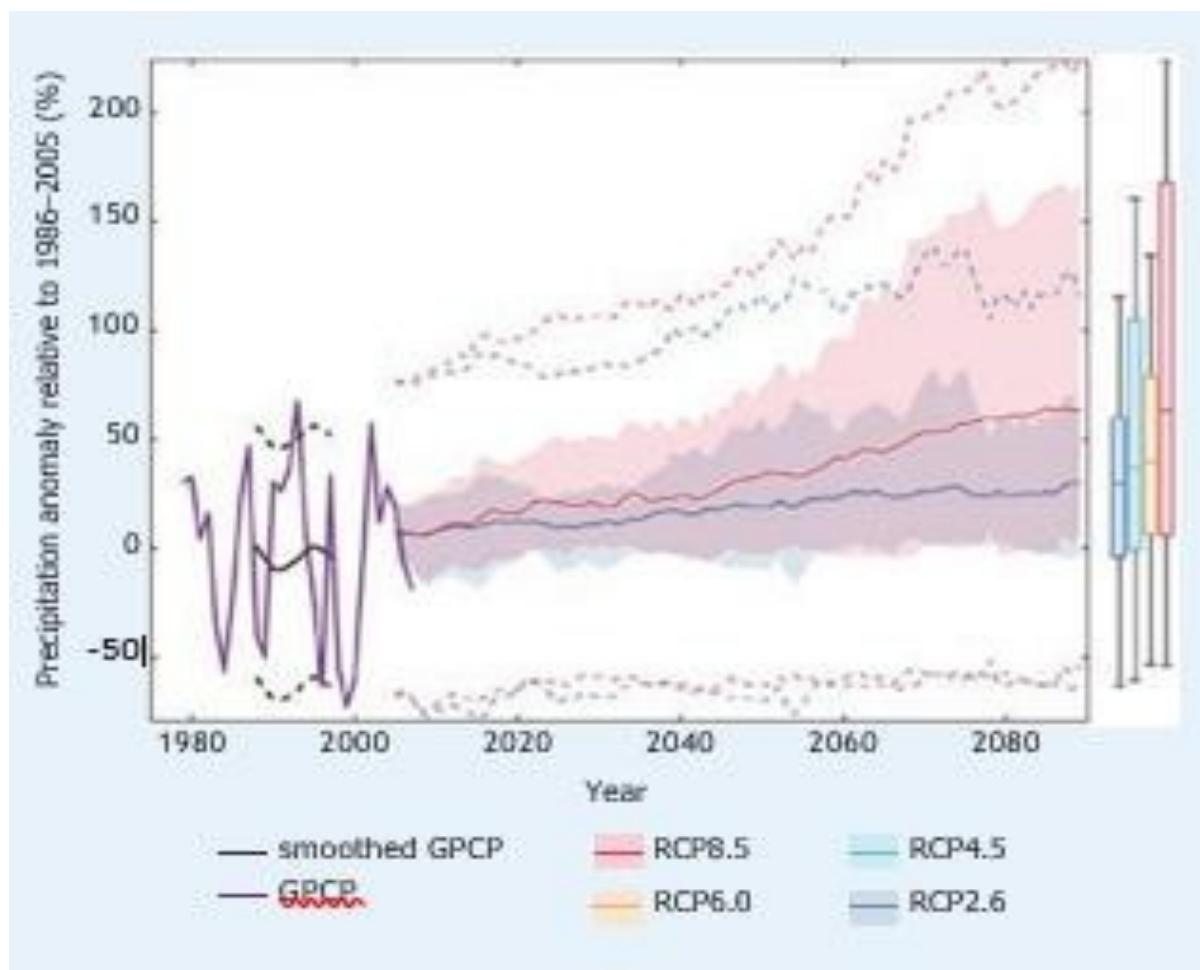
**Projected Increase in Average Annual Precipitation:** According to the models, there is a likely increase in average annual precipitation in Nauru in the coming decades. Under the highest emissions pathway, by the 2090s, a substantial increase of 20% to 40% in average annual precipitation is expected. The magnitude of the increase is projected to be smaller under lower emissions pathways.

**Uncertainty in Long-Term Precipitation Trends:** Despite the consensus on increased precipitation, there is still considerable uncertainty regarding long-term precipitation trends in Nauru, as depicted in Figure 4. Further research is needed to provide more accurate projections.

**Increasing Intensity of Extreme Rainfall Events:** One notable observation is that as temperatures rise, the intensity of sub-daily extreme rainfall events appears to be increasing. However, the impact of this phenomenon in Nauru is highly dependent on local geographical factors. More research is necessary to better understand and quantify its implications for the region.

<sup>21</sup> Pacific-Australia Climate Change Science and Adaptation Planning Program [6\\_PACCSAP\\_Nauru\\_8pp\\_WEB \(pacificclimatechange.net\)](#)

Figure 2. 5. Historical and projected annual average rainfall time series for the region surrounding Nauru.



The graph in Figure No. 2.5 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 centered on 2090 are shown by the bars on the right for RCP8.5, 6.0, 4.5 and 2.6<sup>22</sup>

## 2.4 Wind-driven Waves

The wind-wave variability in Nauru is influenced by two main factors: the trade winds seasonally and the El Niño-Southern Oscillation (ENSO) from year to year. This variability is depicted in Figure 2.6.

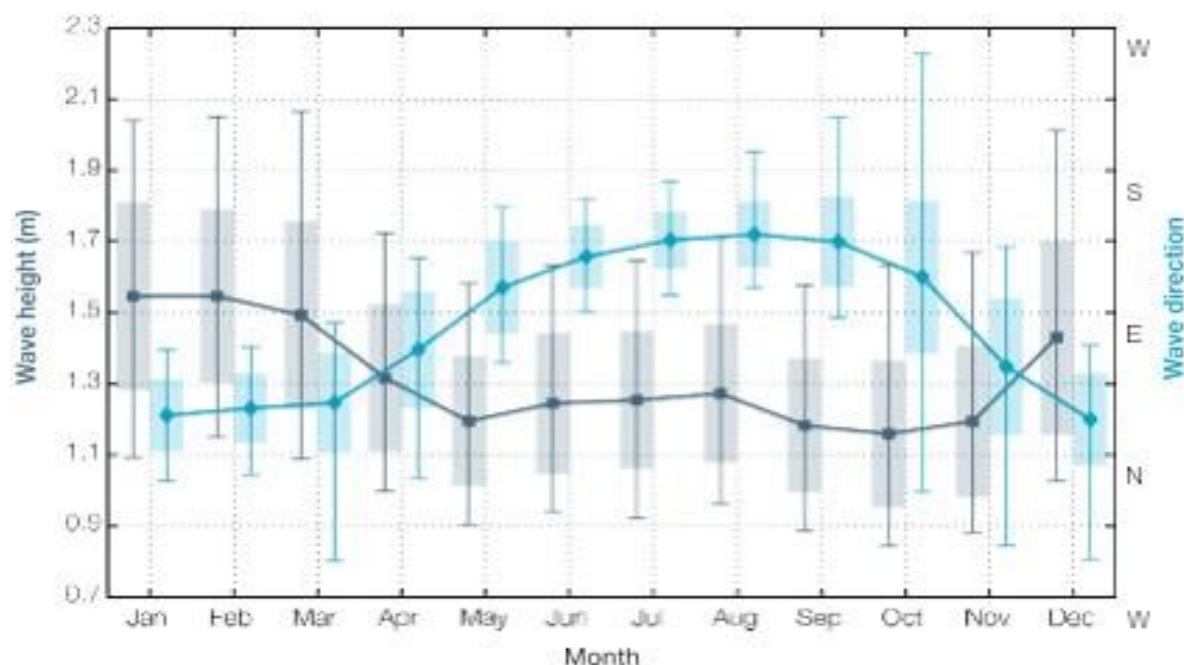
**Trade Winds:** Nauru experiences trade winds, which are prevailing winds that blow from the east or northeast. These winds have a seasonal pattern and play a significant role in shaping the wind-waves around the island. In June to September, Nauru experiences swell waves that

<sup>22</sup> Climate change knowledge portal 2021, [15819-WB\\_Nauru Country Profile-WEB.pdf \(worldbank.org\)](https://www.worldbank.org/publications/cccp/15819-WB-Nauru-Country-Profile-2021)

originate from the south. These waves result from extratropical storms located in the southern hemisphere. These storms generate swells that travel northward towards Nauru, causing wave activity from the southern direction. In December to March, Nauru observes waves from two additional directions. Monsoon systems contribute to waves from the west, while North Pacific extratropical storms generate waves from the north. The combination of these systems leads to wave activity from multiple directions during this period.

**El Niño-Southern Oscillation (ENSO):** The El Niño-Southern Oscillation is a climate phenomenon that occurs over a longer time scale, spanning several months to years. It involves changes in sea surface temperatures and atmospheric pressure patterns in the Pacific Ocean. During El Niño events, when sea surface temperatures are warmer than average in the central and eastern Pacific, the wave climate at Nauru can be affected. El Niño conditions may lead to altered wind patterns and potentially impact the generation and direction of wind-waves around the island.

Figure 2. 6: Mean annual cycle of wave height and direction.



Annual cycle of wave height (grey) and wave direction (blue) at Nauru based on data from 1979–2009. The shaded boxes represent one standard deviation around the monthly means, and the error bars indicate the 5–95% range, showing the year-to-year variability in wave climate. The direction from which the waves are travelling is shown (not the direction towards which they are travelling).<sup>23</sup>

#### 2.4.1.1 Wave Projections:

December to March: Projections indicate a decrease in wave height and period during the months of December to March. However, it's important to note that there is significant year-to-year variability in these projections. While an overall decrease is expected, the specific magnitude and consistency of the changes can vary.

<sup>23</sup> Pacific-Australia Climate Change Science and Adaptation Planning Program [6\\_PACCSAP\\_Nauru\\_8pp\\_WEB \(pacificclimatechange.net\)](https://www.pacificclimatechange.net)

June to September: In contrast to the December to March period, no significant changes are projected in wave height and period during the months of June to September. The wave conditions during this period are expected to remain relatively stable compared to the current conditions.

### **2.4.2 Heat Waves**

Climate change is expected to push Nauru's temperatures above 33°C regularly, posing an increased risk to human health in combination with high humidity levels. Further research is needed to understand the implications of climate change and its interaction with the ENSO phenomenon on Nauru's temperature regime and potential heatwaves<sup>24</sup>.

### **2.4.3 Sea level Rise**

Sea-level rise near Nauru is caused by ocean water expansion and melting glaciers. Satellite data and tide gauges are used to measure sea level. Since 1993, the sea level near Nauru has risen at a rate of about 5 mm per year, higher than the global average. This variation may be influenced by natural fluctuations like the El Niño-Southern Oscillation.<sup>25</sup>

#### *2.4.3.1 Extreme Sea Level events*

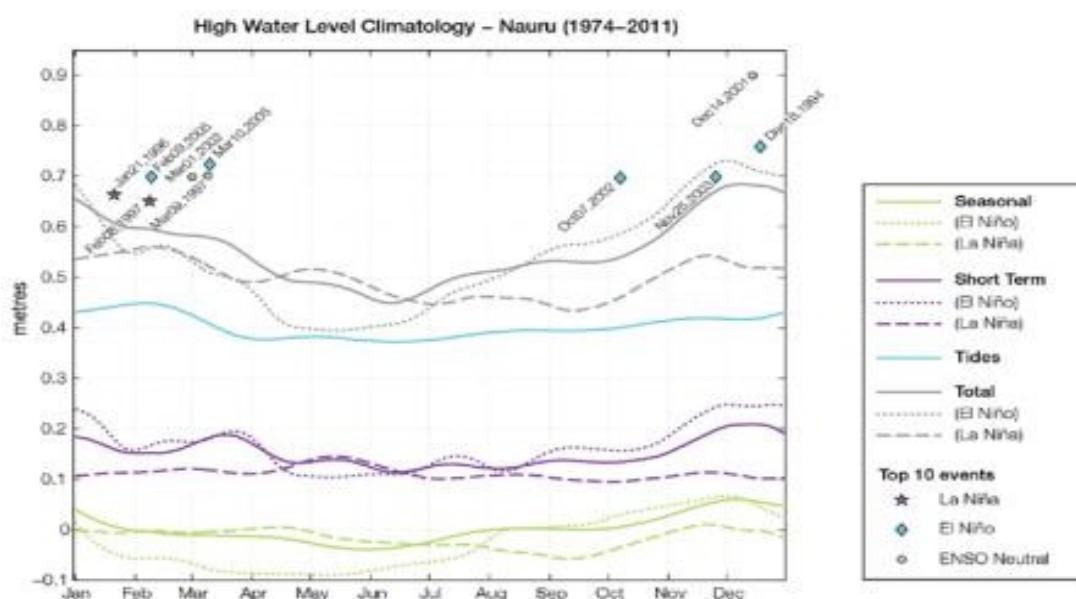
The annual climatology of the highest daily sea levels was assessed using hourly tide gauge measurements taken at Nauru (Figure 2.7). High tides exhibit relatively minor fluctuations throughout the year, peaking in December and January. The seasonal component of sea level remains constant, likely due to Nauru's nearly equatorial position (0.5°S). However, the short-term component varies across the year, indicating the occurrence of extreme water levels primarily from November to March, with notable peaks in March and December. Remarkably, the top 10 sea-level events in the recorded data all transpired between November and March. During La Niña years, sea levels tend to be near average from January to July but lower from July to December. Conversely, El Niño years are associated with higher short-term water levels, which is reflected in the majority of the top 10 sea-level events occurring during El Niño or ENSO-neutral years.

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<sup>24</sup> Climate change knowledge portal 2021 [15819-WB\\_Nauru\\_Country\\_Profile-WEB.pdf \(worldbank.org\)](#)

<sup>25</sup> Pacific-Australia Climate Change Science and Adaptation Planning Program [6\\_PACCSAP\\_Nauru\\_8pp\\_WEB \(pacificclimatechange.net\)](#)

Figure 2. 7: High water Level Climatology - Nauru (1974-2011)



The above figure shows the annual cycle of high waters relative to Mean Higher High Water (MHHW) due to tides, short-term fluctuations (most likely associated with storms) and seasonal variations for Nauru. The tides and short-term fluctuations are respectively the 95% exceedance levels of the astronomical high tides relative to MHHW and short-term sea level fluctuations. Components computed only for El Niño and La Niña 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.<sup>26</sup>

#### 2.4.3.2 Sea level Rise Projections

Sea level is expected to rise in Nauru, with a projected range of 8-18 cm by 2030 under a high emissions scenario. This increase, combined with natural variations, will amplify the impact of storm surges and coastal flooding. Scientists warn that larger sea-level rises beyond current predictions are possible due to uncertainties in the contributions of large ice sheets. Ongoing research and proactive measures are necessary to address the risks and protect coastal communities.

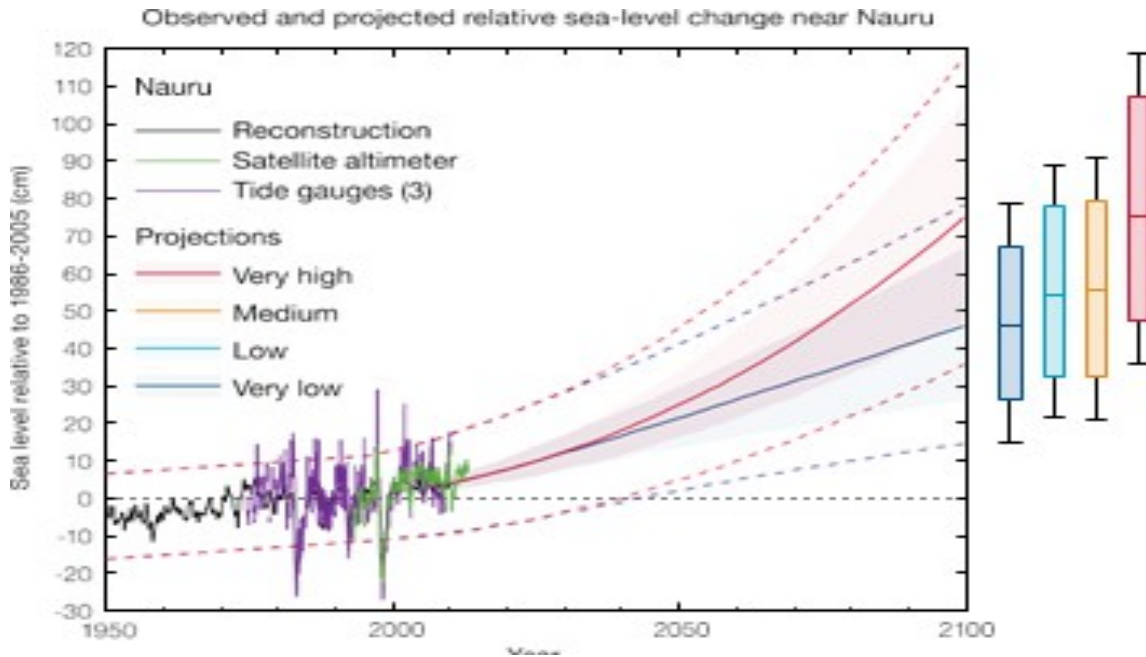
Table 2. 2: Sea-level rise projections for Nauru.<sup>27</sup>

Scenarios	2030 (cm)	2050 (cm)	2070 (cm)	2090 (cm)
Very low emissions scenario	8–17	14–30	19–45	24–60
Low emissions scenario	7–17	14–31	22–48	29–68
Medium emissions scenario	7–16	14–30	21–48	30–69
Very high emissions scenario	8–18	17–34	28–58	41–89

<sup>26</sup> Climate Change in the Pacific: Scientific Assessment and New Research | Volume 2: Country Report [Climate Change in the Pacific | Volume 2: Country Reports | Chapter 8: Nauru \(pacificclimatechangescience.org\)](#)

<sup>27</sup> Pacific-Australia Climate Change Science and Adaptation Planning Program [6\\_PACCSAP\\_Nauru\\_8pp\\_WEB \(pacificclimatechange.net\)](#)

Figure 2. 8: Observed and projected Sea-level change near Nauru



In the above figure tide-gauge records of relative sea level (since 1974) are indicated in purple, and the satellite record (since 1993) in green. The reconstructed sea level data in Nauru (since 1950) is shown in black. Multi-model mean projections from 1995–2100 are given for the very high (red solid line) and very low emissions scenarios (blue solid line), with the 5–95% uncertainty range shown by the red and blue shaded regions. The ranges of projections for the four emissions scenarios by 2100 are also shown by the bars on the right. The dashed lines are an estimate of year-to-year 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<sup>28</sup>

#### 2.4.4 Ocean acidification

Human activities release carbon dioxide, and a quarter of it is absorbed by the oceans. This makes the ocean slightly more acidic, affecting the growth of corals and organisms that rely on carbonate minerals. These species are vital for tropical reef ecosystems. Over time, ocean acidification in Nauru's waters has been gradually increasing since the 18th century.

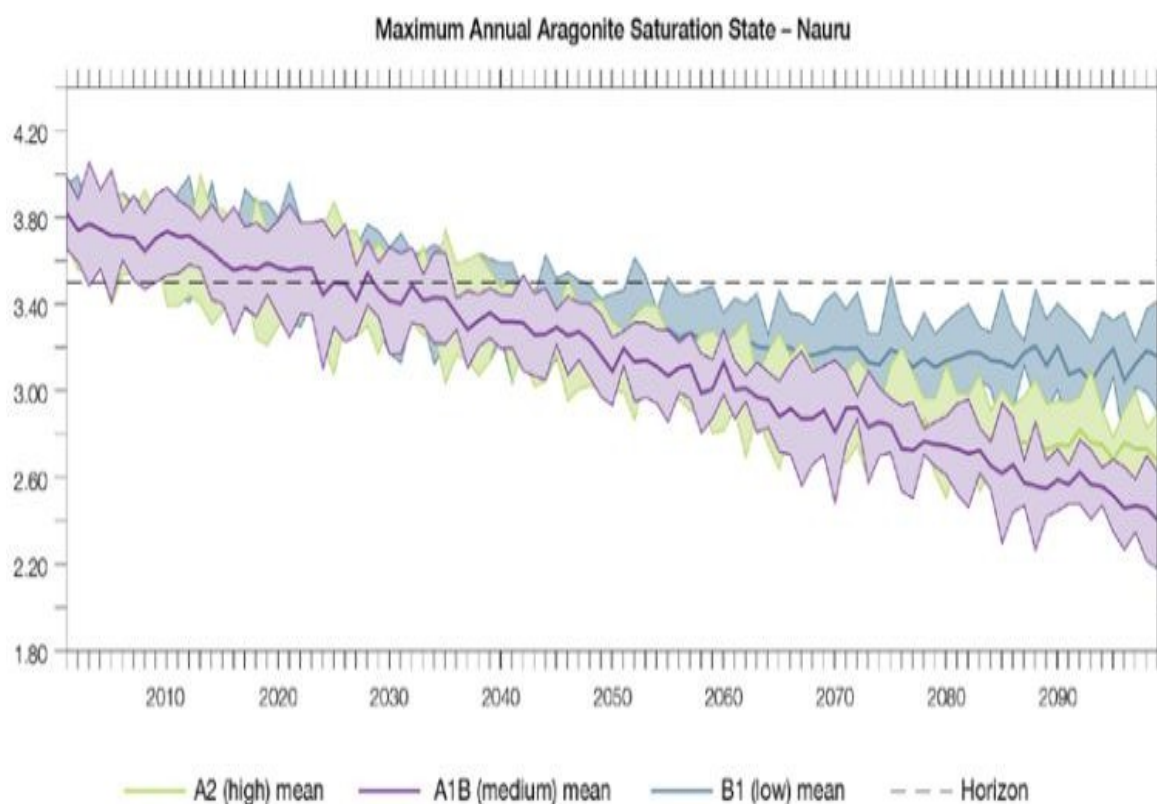
##### 2.4.4.1 Ocean acidification Projections

Ocean acidification is expected to continue increasing throughout the 21st century due to the rising uptake of carbon dioxide by the oceans. This projection is highly confident as it is primarily driven by the increasing atmospheric carbon dioxide concentrations. Projections from various climate models indicate that the aragonite saturation state, important for marine organisms, will decline below 3.5 by approximately 2040 and continue to worsen thereafter. While there is moderate confidence in these projections due to model limitations, it is crucial to consider that the impact of

<sup>28</sup> Pacific-Australia Climate Change Science and Adaptation Planning Program [6\\_PACCSAP\\_Nauru\\_8pp\\_WEB \(pacificclimatechange.net\)](https://www.pacificclimatechange.net)

acidification on reef ecosystems will be compounded by other stressors like coral bleaching, storm damage, and fishing pressure, posing significant challenges for the health of these ecosystems <sup>29</sup>

Figure 2. 9: Maximum annual Aragonite saturation state- Nauru



In the above figure, multi-model projections, and their associated uncertainty (shaded area represents two standard deviations), of the maximum annual aragonite saturation state in the sea surface waters of the Nauru region under the different emissions scenarios. The dashed black line represents an aragonite saturation state of 3.5.

#### 2.4.5 Coral Reefs and Fisheries

Increased atmospheric carbon dioxide levels contribute to ocean acidification, affecting the saturation of calcium carbonate, which is crucial for marine organisms like coral reefs. Projections indicate a decline in aragonite saturation state, which can undermine current ocean ecosystems, including coral reefs. Nauru's fishing industry is limited to small-scale subsistence fishing, and climate change threatens both coral reefs and fisheries. Changes in temperature, dissolved oxygen, and acidity pose extinction risks to coral reef species, while shifts in tropical tuna stocks distribution may affect the overall productivity of Nauru's Exclusive Economic Zone.

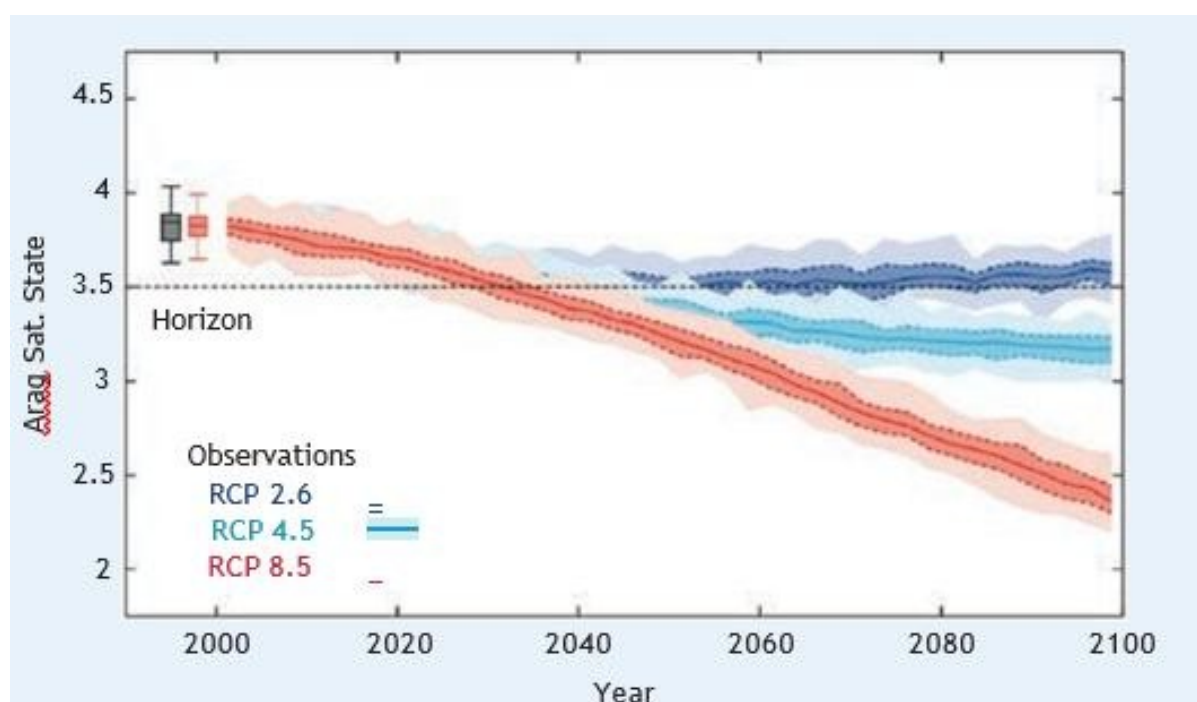
<sup>29</sup> Climate Change in the Pacific: Scientific Assessment and New Research | Volume 2: Country Report [Climate Change in the Pacific | Volume 2: Country Reports | Chapter 8: Nauru \(pacificclimatechangescience.org\)](#)

**Table 2.3** Estimates of global mean sea-level rise by rate and total rise compared to 1986–2005 including likely range shown in brackets

Scenario	Rate of Global Mean Sea-Level Rise in 2100	Global Mean Sea-Level Rise in 2100 Compared to 1986–2005
RCP2.6	4.4 mm/yr (2.0–6.8)	0.44 m (0.28–0.61)
RCP4.5	6.1 mm/yr (3.5–8.8)	0.53 m (0.36–0.71)
RCP6.0	7.4 mm/yr (4.7–10.3)	0.55 m (0.38–0.73)
RCP8.5	11.2 mm/yr (7.5–15.7)	0.74 m (0.52–0.98)

Note: this data is from Chapter 13 of the IPCC’s Fifth Assessment Report with upper-end estimates based on higher levels of Antarctic ice-sheet loss from Le Bars et al. (2017)

**Figure 2.10:** Projected changes in aragonite saturation state in Nauru from CMIP5 models under RCP2.6, 4.5 and 8.5



In the above figure, the median values are shown as solid lines, the interquartile range as dashed lines, and 5% and 95% percentiles as light shading. The horizontal line represents the threshold at which transition to marginal conditions for coral reef health typically occurs<sup>30</sup>

#### 2.4.6 Drought

Drought in Nauru primarily takes the form of meteorological drought, caused by a lack of precipitation. It is the main contributor to disaster risk, leading to water scarcity and contamination. While La Niña is typically associated with meteorological drought, its frequency is expected to decrease due to projected rainfall increases. However, uncertainties regarding the interaction between climate change and ENSO result in low confidence in this prediction. This uncertainty poses a significant risk as Nauru heavily relies on rainwater for subsistence<sup>31</sup>.

<sup>30</sup>Climate change knowledge portal 2021, [15819-WB\\_Nauru\\_Country\\_Profile-WEB.pdf \(worldbank.org\)](#)

<sup>31</sup>Climate change knowledge portal 2021, [15819-WB\\_Nauru\\_Country\\_Profile-WEB.pdf \(worldbank.org\)](#)

### **2.4.7 Flood, Cyclones, and Storm Surge**

Nauru's proximity to the equator makes cyclone formation unlikely, but the impact of climate change on cyclones is not well understood. However, there is a risk of enhanced storm surges and increased intensity of cyclones. Nauru may experience more frequent cyclones during El Niño events but fewer during La Niña events. Although cyclone impacts are not a major concern, Nauru faces an increased risk of extreme rainfall events, surface flooding, and the spread of vector-borne diseases due to rising temperatures and precipitation. Further research is needed to understand and manage these risks<sup>32</sup>.

### **2.4.8 Summary**

Nauru's future projections demonstrate the challenges and opportunities it faces as a small island nation. Climate impacts almost all aspects of life in Nauru. Understanding the possible future climate of Nauru is important so people and the government can plan for changes. Some key observations are.

- El Niño and La Niña events will continue to occur in the future, but there is little consensus on whether these events will change in intensity or frequency.
- Annual mean temperatures and extremely high daily temperatures will continue to rise.
- Ocean rainfall is projected to increase, along with more extreme rain events.
- Droughts are projected to decline in frequency.
- Sea level will continue to rise.
- Ocean acidification is expected to continue.
- The risk of coral bleaching is expected to increase.
- Wave height and period are projected to decrease in December–March but no significant changes are projected in June–September

## **2.5 Vulnerability Assessment**

A vulnerability assessment to climate change is a process of identifying and analyzing the potential impacts of climate change on a system, organization, or community. The assessment helps to determine the extent to which a system or community is vulnerable to the effects of climate change, and to develop strategies to mitigate or manage these impacts. Vulnerability assessments to climate change are crucial in identifying potential risks and developing strategies to reduce or manage those risks. They are essential in helping to increase the resilience and sustainability of a system or community in the face of climate change.

Nauru faces significant challenges in achieving sustainable social and economic development, as highlighted by the National Sustainable Development Strategy (NSDS). Limited arable land and freshwater resources, geographical isolation, dependence on imports for basic food and energy needs, environmental degradation, and the emergence of chronic health issues all complicate the pursuit of sustainable development. Furthermore, these challenges contribute to Nauru's vulnerability to additional stressors such as climate change and disasters.

Given this context, climate variability and climate change further intensify Nauru's pursuit of sustainable development. Rising sea levels pose threats of saltwater intrusion into valuable groundwater reserves, exacerbation of coastal erosion and flooding during storms, alterations

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<sup>32</sup> Climate change knowledge portal 2021, [15819-WB Nauru Country Profile-WEB.pdf \(worldbank.org\)](#)

in rainfall patterns leading to water scarcity, and potential impacts on vital fish resources due to changes in ocean temperature and acidification.

To address the risks posed by climate change and disasters to sustainable development, the Government of Nauru has developed the Republic of Nauru Framework for Climate Change Adaptation and Disaster Risk Reduction (RONAdapt). RONAdapt represents the government's commitment to aligning national development priorities and environmental sustainability goals by incorporating vulnerability reduction and risk management into planning and activities across all sectors of the economy and society. The identified priority actions within RONAdapt are not exhaustive and aim to address climate change adaptation (CCA) and disaster risk reduction (DRR) needs comprehensively.

The priorities outlined in RONAdapt contribute to achieving the goals of the National Sustainable Development Strategy (NSDS) and enhancing Nauru's resilience to climate change and disasters. These priorities specifically target the following areas<sup>33</sup>:

- Water security
- Energy security
- Food security
- A healthy environment
- A healthy population
- Productive and secure land resources

**Water:** The low-lying small island state of Nauru faces challenges in ensuring access to clean water. Contamination of groundwater supplies due to mining and poor waste management practices has led to limited freshwater availability. Climate change is expected to exacerbate water stress in Nauru, including issues caused by extreme rainfall events. If rainfall is delivered in short, intense events, water harvesting becomes challenging. Additionally, Nauru's water infrastructure located in the coastal zone is at risk from high sea-level events, further impacting water availability and quality.

**The Coastal Zone:** Sea-level rise poses significant threats to coastal zones worldwide, including Nauru. The rate of sea-level rise in Nauru has been higher than the global average, leading to concerns about coastal erosion and saltwater intrusion. While Nauru is protected by coral reefs and has varying elevations, the intersection of sea-level rise with other climate change impacts on coral health and the increased frequency of extreme sea-level events poses risks to the coastal zone.

**Island Ecology:** Historically, Nauru had abundant marine biodiversity and relatively healthy coral reefs. However, extensive phosphate mining and the introduction of non-native species have significantly degraded terrestrial and marine biodiversity. As climate changes, suitable habitats for species shift, but the limited capacity for species to migrate increases the likelihood of species loss and extinction. Concerns have been raised about the impacts on terrestrial ecology, including endemic species at risk of habitat shrinkage.

**Communities:** Nauru faces challenges due to its remote location, weak infrastructure, and limited access to sustainable revenue sources. Poverty rates are relatively high, and the

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<sup>33</sup> Climate change knowledge portal 2021, [15819-WB\\_Nauru Country Profile-WEB.pdf\(worldbank.org\)](#)

country heavily depends on imports for food and necessities. The closure of phosphate mining has impacted the economy, and Nauru struggles to develop alternative sources of income. The vulnerability of the poorest groups in society to climate change impacts is a significant concern. Climate displacement, migration, and its links to remittances play a role in the socio-economic landscape of Nauru.

**Gender:** Climate change impacts are not gender-neutral, with women and children among the highest risk groups. Gender-based differences in access to resources, decision-making, and data availability contribute to differential vulnerabilities. Understanding the gendered impacts of climate change is essential to address the specific needs and challenges faced by women.

**Migration:** Nauru is vulnerable to climate change, with droughts, sea-level rise, coastal erosion, and water scarcity affecting the population. Migration is closely linked to remittances, and economic opportunities are among the main drivers of migration. Climate change impacts on agriculture and fish production have a lesser impact due to the country's heavy reliance on imports. However, limited resources and the long-term viability of residence in the region raise questions about future migration patterns.

**Human Health:** Climate change poses risks to human health in Nauru. Import-dependent food security has resulted in health issues such as diabetes and child malnutrition. Extreme weather events, heat-related illness, water security, food security, vector-borne diseases, and non-communicable diseases are identified as health risks. Rising temperatures can have severe health impacts such as heat stress, heatstroke, and respiratory problems. Changes in rainfall patterns can also affect water quality and increase the risk of waterborne diseases.

**Infrastructure:** Nauru's infrastructure is vulnerable to climate change impacts. Rising sea levels and increased frequency of extreme weather events can damage roads, buildings, and other critical infrastructure. Coastal erosion poses a significant threat to infrastructure located in the coastal zone. Additionally, the limited availability of freshwater resources can strain the existing water infrastructure, further impacting the overall resilience of the country's infrastructure systems.

## 2.6 Adaptation and Resilience

The Republic of Nauru is confronted with the urgent and undeniable reality of climate change. The unique geographical characteristics, isolation, environmental degradation, and limited availability of natural resources make Nauru exceptionally susceptible to the current and escalating consequences of climate change. Without the implementation of effective adaptation measures, the island nation faces an existential threat from these impacts. It is crucial to address climate change hand in hand with sustainable development endeavors to fortify resilience against climate change and enhance the well-being of all Nauruan. Key adaptation measures include:

- **Water management:** Implementing measures to improve water efficiency, such as rainwater harvesting, desalination, and wastewater treatment systems.
- **Coastal protection:** Developing strategies to mitigate coastal erosion and protect infrastructure using seawalls, artificial reefs, and beach nourishment.
- **Coral reef conservation:** Implementing measures to protect and restore coral reefs, including the establishment of marine protected areas, reducing pollution, and promoting sustainable fishing practices.

- Diversifying the economy: Investing in alternative sources of income, such as renewable energy, eco-tourism, and sustainable agriculture, to reduce dependence on vulnerable sectors.
- Strengthening healthcare systems: Enhancing healthcare infrastructure and capacity to address the health risks associated with climate change, including heat-related illnesses, vector-borne diseases, and waterborne diseases.
- Improving disaster preparedness: Enhancing early warning systems, emergency response mechanisms, and community resilience to effectively respond to and recover from climate-related disasters.

## 2.7 V&A Policies & Plans

Nauru has developed a range of policies, plans, and legislations to address the challenges of climate change adaptation. These frameworks provide a strategic direction and guidance for integrating climate change considerations into national development efforts. The key policies and plans, which are outlined in the following table, include frameworks for climate change adaptation and disaster risk reduction, sustainable development, climate change policy, national communication with the UNFCCC, nationally determined contributions, energy road map, and integrated environment policy. These policies and plans provide a comprehensive framework for addressing climate change impacts, enhancing resilience, and ensuring sustainable development in Nauru<sup>34</sup>.

*Table 2. 4: Key V&A Policies and Plans*

Policies	Description
<b>Republic of Nauru Framework for Climate Change Adaptation and Disaster Risk Reduction (RONAdapt) – 2015</b>	The Government of Nauru developed and approved in 2015 the RONAdapt framework to address the risks of climate change and disasters on sustainable development in the country. The RONAdapt actively supports the NSDS goals so that both policies benefit from the efforts of increasing Nauru’s resilience to climate change and disasters and striving for sustainable development. There are 6 goals outlined in the RONAdapt: <ul style="list-style-type: none"> <li>1) Water security</li> <li>2) Energy security</li> <li>3) Food security</li> <li>4) A healthy environment</li> <li>5) A healthy people</li> <li>6) Productive, secure land resources</li> </ul> The framework provides a platform for future revisions of national and sectoral plans to integrate considerations of climate change and disasters. Complementarity: The RONAdapt framework is highly complementary with the NAP proposal, which will apply the lessons learned from the implementation of the framework and building on the progress made towards identifying vulnerabilities and adaptation approaches.
<b>National Sustainable Development Strategy (NSDS) 2019-2030</b>	The Nauru’s National Sustainable Development Strategy (NSDS) was updated in 2019 and builds on the roadmap of short, medium and long-term milestones set in the 2009-2025 NSDS. The

<sup>34</sup> [nauru-sprep-nap-nru-rs-002.pdf \(greenclimate.fund\)](#)

Policies	Description
	<p>updated NSDS maintains the same national vision of “A future where individual, community, business and government partnerships contribute to a sustainable quality of life for all Nauruans”. There are seven long-term goals in the NSDS to achieve this vision:</p> <ol style="list-style-type: none"> <li>1) Stable, trustworthy, fiscally responsible government</li> <li>2) Access to quality education, formal and non-formal</li> <li>3) Improved health and well-being</li> <li>4) Provision of enhanced social, infrastructure and utilities services</li> <li>5) Development of an economy based on multiple sources of revenue</li> <li>6) Enhance resilience against the impacts of climate change that is inclusive of rehabilitating and restoring degraded lands</li> <li>7) Development of domestic food production for food security</li> </ol> <p>These goals, and their associated activities, are grouped under three sectors: economic, social and infrastructure.</p>
<p><b>Nauru Climate Change Policy (NCCP) 2021</b></p>	<p>Nauru Climate Change Policy 2021 sets the overarching policy framework to guide climate change adaptation and mitigation across all relevant sectors, Government agencies, civil society and private sector to address the impacts of climate change on Nauru. It provides clear linkages to the other relevant national policy frameworks and strategies such as the Nauru Sustainable Development Strategy, RONAdapt and Nauru Energy Roadmap to name a few. The Policy sets out the overarching strategy to address climate change in Nauru:</p> <ol style="list-style-type: none"> <li>1. improve resilience to climate change through adaptation and mitigation measures such as for protecting infrastructure from rising sea levels including the Higher Ground Initiative;</li> <li>2. Increase uptake of renewable energy to improve grid security, reduce electricity costs and lower greenhouse gas emissions;</li> <li>3. Ensure climate change information is available to end-users in ways that are accessible and relevant; and</li> <li>4. Monitor and evaluate implementation of the policy.</li> </ol>
<p><b>Republic of Nauru Second National Communication with the UNFCCC (2015)</b></p>	<p>Nauru’s comprehensive Second National Communication to the UNFCCC (SNC) is a valuable resource for guiding mitigation and adaptation efforts in the country. The SNC also includes a national greenhouse gas inventory, a vulnerability and adaptation assessment and outlines the country’s mitigation measures. The extensive document provides a baseline for the development of future adaptation activities and supports the delivery of the NSDS goals and RONAdapt framework.</p>

Policies	Description
<p><b>Nauru Nationally Determined Contributions (NDC) – 1 January 2021 – 31 December 2030 (this has replaced Nauru’s September 2015 INDCs)</b></p>	<p>Nauru submitted their initial intended NDC in September 2015 and has been recently replaced by an undated NDC covering the period 1 January 2021 to 31 December 2030. While it pledges to transition a ‘substantial’ part of the country’s power generation from diesel to solar (subject to financial support), the main focus of Nauru’s iNDC is adaptation. Mirroring the goals of the NSDS, the NDC discusses the need for environmental rehabilitation, developing the topside for future relocation of vulnerable coastal communities, ensuring water security and healthy communities, as well as developing on-island food production. The NDC also includes loss and damage as a key priority particularly focusing on climate change action to address impacts that exceed Nauru’s adaptive capacity.</p>
<p><b>The Republic of Nauru National Integrated Environment Policy (NIEP) 2018 Funded by: GEF through the Ridge to Reef Project implemented by UNDP. Developed with technical guidance/assistance from SPREP and UNEP</b></p>	<p>The aim of the policy is to strengthen international, regional and national coordination of government’s effort to cope with and manage complex environment issues faced by Nauru and its people. The Policy sets out seven thematic areas and strategies for implementation to achieve the goals and objectives of the Policy. These thematic areas and strategies include:</p> <ol style="list-style-type: none"> <li>1. Environment governance with a focus on strengthening of decision-making processes, enforcement and monitoring of compliance with relevant environmental laws.</li> <li>2. Land – the focus is on land-use planning, sustainable land management and land rehabilitation of the phosphate mined site;</li> <li>3. Resource management and biodiversity conservation aim at ensuring effective management of inshore marine ecosystems, invasive and threatened species and conservation of biodiversity of national significance and establishing financing mechanism for conservation.</li> <li>4. Build an environment aimed at effective waste, water and sanitation management.</li> <li>5. Atmosphere and climate thematic area focuses on reduction to GHGs, phasing out ozone depleting substances, adaptation and ensuring climate information is available to users.</li> <li>6. Culture and heritage strategies focuses on conservation of historical and cultural sites and maintenance of traditional consumption and production of food and medicine</li> <li>7. Environment education and capacity building is to strengthen awareness, skillsets and knowledge</li> </ol>

## 2.8 Case study

The Pacific islands face significant vulnerability to the devastating impacts of natural disasters, posing substantial threats to their human and economic well-being. This case study explores the efforts undertaken by the Asian Development Bank (ADB) to increase resilience to climate change, disasters, and economic shocks in the Pacific region. It highlights the implementation of a five-tool approach and showcases specific initiatives and achievements in countries such as Cook Islands, Fiji, Kiribati, Nauru, and Tonga.

**Increasing Resilience through Financing Climate-Resilient Infrastructure:** ADB recognizes the crucial role of climate-resilient infrastructure in safeguarding Pacific Island countries from the impacts of natural disasters. Through concessional financing from the

Green Climate Fund, ADB has assisted five Pacific Island countries in accessing and administering \$133 million. These funds have been utilized to develop climate-resilient infrastructure projects that enhance the ability of these nations to withstand and recover from disasters.

**Improving Disaster Risk Reduction, Response, and Management:** ADB places significant emphasis on enhancing disaster risk reduction, response, and management capacities in the Pacific region. The establishment of disaster contingent financing arrangements in five countries, such as Samoa, Tonga, and Tuvalu, has provided timely access to funds for early response and recovery activities following disasters. The disbursement of Tonga's \$6 million contingent financing just three days after Tropical Cyclone Gita in 2018 exemplifies the effectiveness of this instrument.

**Promoting Low-Carbon Development:** Recognizing the interconnectedness of climate change and disaster resilience, ADB promotes low-carbon development strategies in the Pacific islands. By supporting initiatives that reduce carbon emissions and increase energy efficiency, ADB contributes to building long-term resilience against climate-related risks while simultaneously addressing the causes of climate change.

**Increasing Access to Climate and Disaster Risk Finance:** ADB has played a crucial role in increasing access to climate and disaster risk finance in the Pacific region. By mobilizing funds for post-disaster reconstruction and recovery, such as the \$50 million support for school reconstruction in Fiji following Tropical Cyclone Winston, ADB helps countries build back better and become more resilient to future disasters.

**Building Core Capacities for Climate Change and Disaster Management:** ADB emphasizes the importance of strengthening core capacities in Pacific Island countries to effectively plan for and respond to climate change and disasters. By integrating climate change risk assessments into all infrastructure investments in the region, ADB ensures that resilience measures are integrated into the planning and design stages, reducing vulnerability and enhancing adaptive capacity.

**Conclusion:** The Pacific islands face heightened vulnerability to natural disasters, necessitating focused efforts to enhance resilience. Through its five-tool approach, the Asian Development Bank has made significant strides in increasing climate resilience in the Pacific region. By financing climate-resilient infrastructure, improving disaster risk reduction and response, promoting low-carbon development, increasing access to climate and disaster risk finance, and building core capacities, ADB has supported Pacific Island countries in their efforts to prepare for and respond to the impacts of climate change and natural disasters. The integration of climate change and disaster risk management into national development plans and programs remains a priority for future resilience-building endeavors.

## 2.9 Current Adaptation Action:

Nauru is involved in many of adaptation projects at the regional level and national level. Some of the focused adaptation projects have been identified. A list of the projects is given in the annexure. Through these projects, adaptation action is being implemented on the ground that addresses needs related to agriculture, coastal zone management, water, forestry, tourism, gender and policy and planning.

Nauru is participating in multi-country 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.

## **2.10 Conclusion**

Addressing the challenges posed by changing climate is a task of utmost importance for Nauru. Adapting to these changes is not just a choice but a necessity for the country. It means by focusing on protecting the most vulnerable sectors, such as agriculture, fisheries, water, and energy, Nauru can become more resilient and build a safer future in the face of climate change's unpredictable impacts.

## Executive Summary: National Greenhouse Gas Inventory

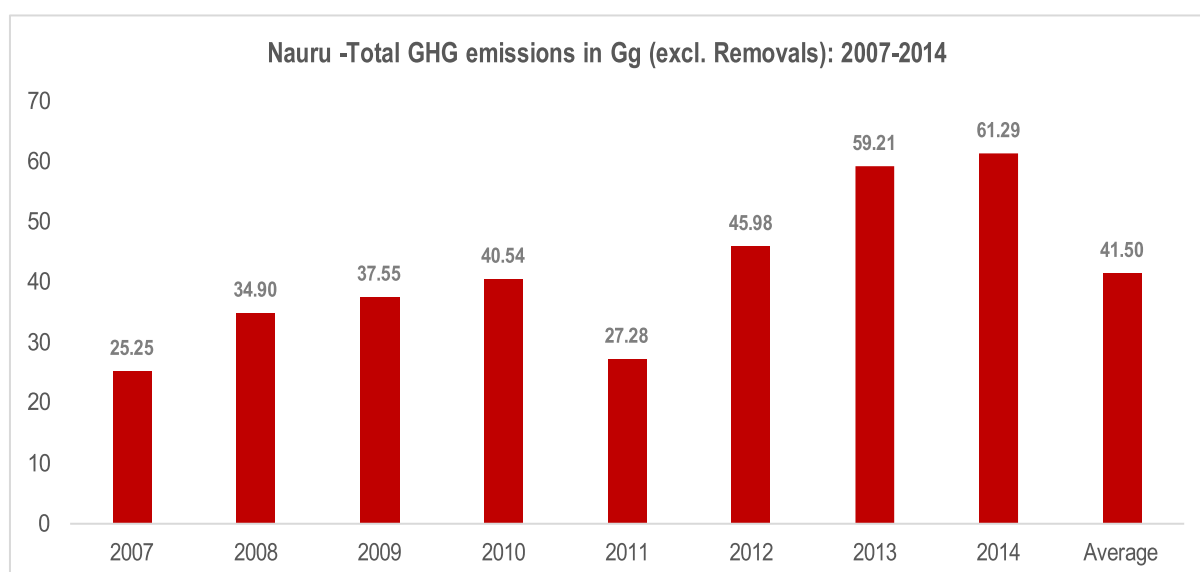
The national GHG inventory of Nauru's indicates main gases and major sources of greenhouse gas emissions; mainly comprised carbon dioxide (CO<sub>2</sub>) from the Energy sector with smaller amounts of Methane (CH<sub>4</sub>) and Nitrous-Oxide (N<sub>2</sub>O) from Agriculture and Waste Sector. Considering the small land area of Nauru (22 km<sup>2</sup>) and limited information on Forestry and Other Land Use, GHG emissions from Forestry and LULUCF Sectors have not been calculated.

Total national GHG emissions excluding removals in year 2014 reached to 61.293 Gg CO<sub>2</sub>e (in comparison to 38.282 Gg CO<sub>2</sub>e estimated for year 1994 under the first national communication and 19.294 Gg CO<sub>2</sub>e estimated for year 2000 under the second national communication); This comprises direct CO<sub>2</sub> emission 58.567 Gg, CH<sub>4</sub> emission 0.087 Gg and N<sub>2</sub>O emissions 0.0011 Gg during 2014 in comparison to 28.318 Gg CO<sub>2</sub> emissions, 0.346 Gg CH<sub>4</sub> emission and 0.001 Gg N<sub>2</sub>O during year 1994; there is no significant change in N<sub>2</sub>O emissions observed during this period. Emissions of other GHGs like per fluorocarbons (PFCs), hydro fluorocarbons (HFCs) and sulphur hexafluoride (SF<sub>6</sub>) were negligible in Nauru as the products containing these gases are not produced and significantly used in the country.

By way of comparison, the total world emissions (2010 from IPCC 2014) were around 49 Gt of which 65% were CO<sub>2</sub> emissions from fossil fuels, 11% CO<sub>2</sub> FOLU emissions, 16% methane emissions, 6% nitrous oxide emissions and 2% other gases. For Nauru 94% (average 2007 – 2014) were CO<sub>2</sub> emissions from fossil fuel, 6% CH<sub>4</sub> emissions and <1% N<sub>2</sub>O emissions observed from agriculture and waste sector (emissions from Forestry and Other Land Use not estimated for Nauru).

The global per capita GHG emissions (in terms of tonnes of CO<sub>2</sub>e per person) for the year 2010 was about 7 tonnes of CO<sub>2</sub>e equivalent per person (Considering Global population for 2010 was 7 billion and global GHG emissions of 49 Gt of CO<sub>2</sub>e equivalent). The per capita emission for Nauru comes out 4 tonnes of CO<sub>2</sub>e equivalent for year 2010 (GHG emissions 40.536 Gg of CO<sub>2</sub>e equivalent and population of 10,031 persons); which is around 57% of the world average during that period. In absolute terms Nauru's total CO<sub>2</sub>e emissions was around 0.00008% of world emissions for year 2010.

Figure ES-3.1: GHG Emissions in Nauru – 2007-2014

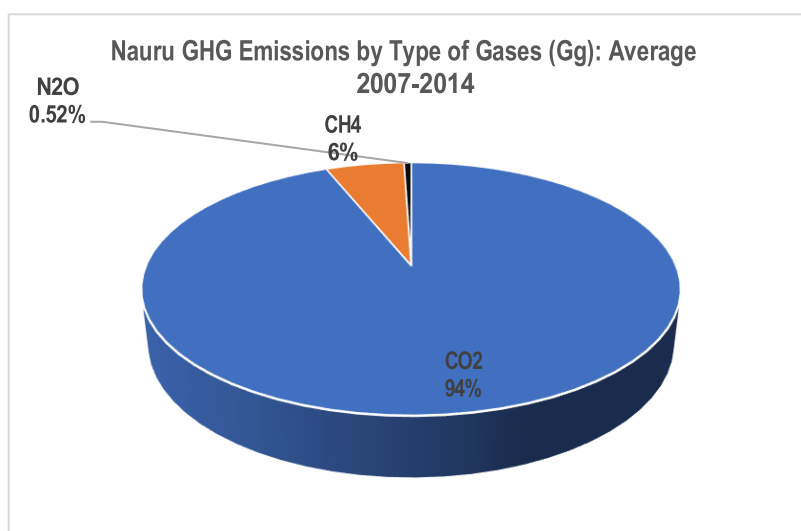


**Table ES-3.1: Total GHG Emissions in Nauru: 2007-2014**

Year	Nauru Total GHG emissions in Gg (2007-2014)			
	CO2-equiv (CO2, CH4 and N2O)	CO2	CH4	N2O
2007	25.25	22.93	0.077	0.0006
2008	34.90	32.46	0.080	0.0007
2009	37.55	35.14	0.078	0.0008
2010	40.54	38.09	0.080	0.0008
2011	27.28	24.68	0.087	0.0006
2012	45.98	43.46	0.082	0.0008
2013	59.21	56.34	0.093	0.0010
2014	61.29	58.57	0.087	0.0011
Average (2007-2014)	41.50	38.96	0.083	0.0008

As can be seen in Figure ES-3.2, the total GHG emissions from Nauru is increasing over the years with significant increase in energy sector emissions; the trend almost follows the economic growth in Nauru and is highly dependent on the electricity generation, mining activity and phosphate production.

**Figure ES-3.2 : Nauru GHG Emissions by Gas (Gg): Average 2007-2014**



Evidently the main GHG emissions from Nauru comprises of Carbon Dioxide (CO<sub>2</sub>) mainly from combustion of fossil fuel for generation of electricity, transportation and mining industry; Methane (CH<sub>4</sub>) from agriculture-livestock (Enteric fermentation and Manure management) and waste sector (Solid waste and wastewater). The estimated main GHGs (CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O) for the years 2007 to 2014 are depicted in the following graph. The graph clearly establishes that CO<sub>2</sub> is the main contributor of GHG emissions and there are very minor emissions from CH<sub>4</sub> and N<sub>2</sub>O.

Figure ES-3.4: Nauru GHG Emissions by Gas Type (Gg): Average 2007-2014

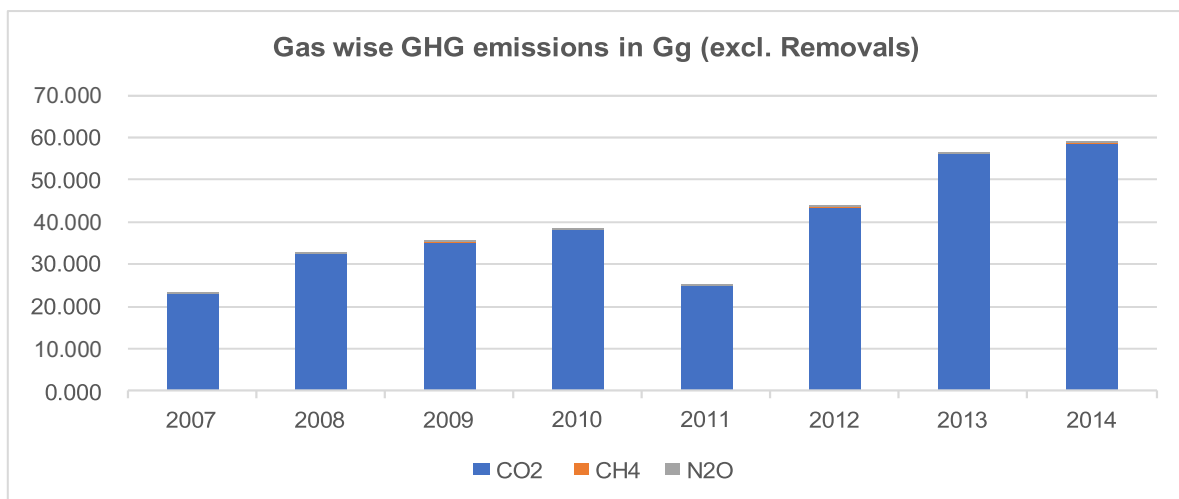


Figure ES-3.5: Nauru: total GHG emissions by sector

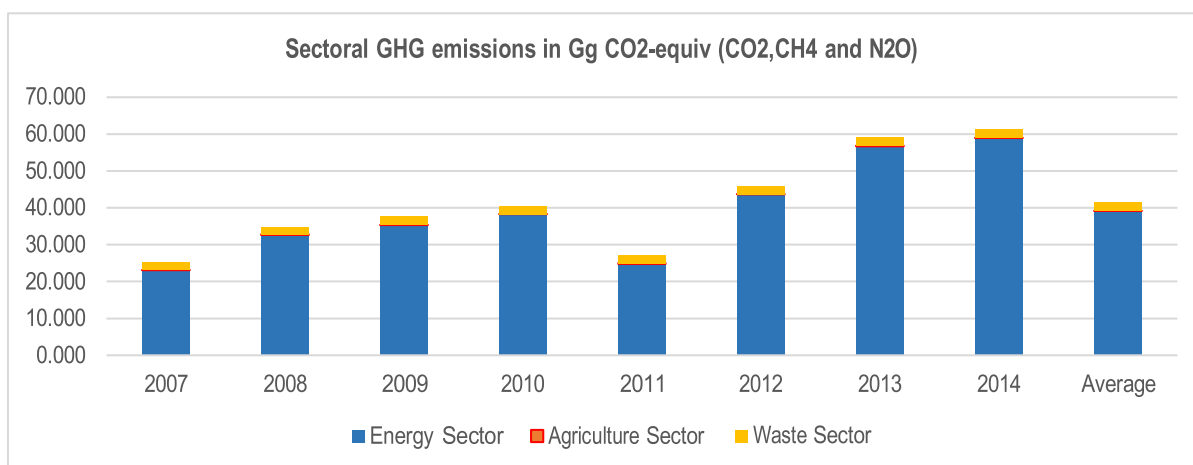
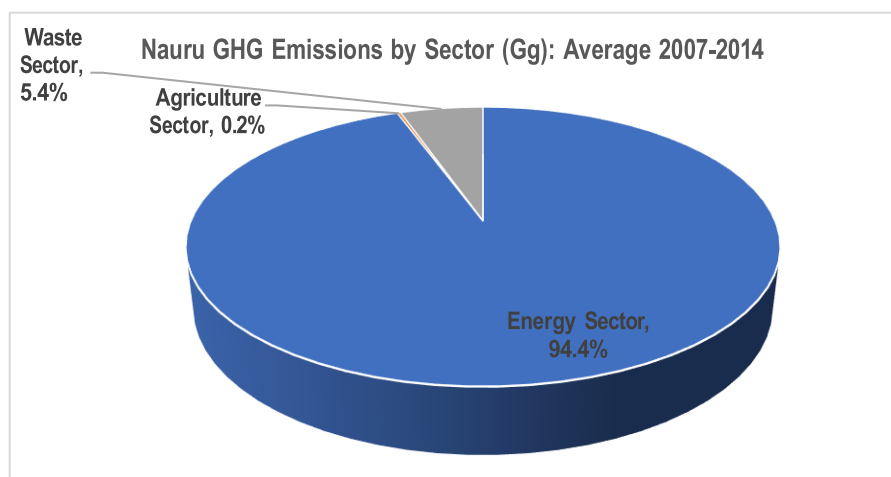


Figure ES-3.6 : Nauru: total GHG emissions by sector (Gg)



## 3 Greenhouse Gas Inventory

### 3.1 Background

Despite the small size Nauru is committed to play its role in combating global climate change issues by exploring and implementing climate change mitigation and adaptation initiatives. Nauru has negligible contribution in global GHG emission and climate change; however, Nauru and its leaders were in forefront of international climate change initiatives; notably Nauru was the first signatory to the Climate Change Convention at Vienna in 1985. Since, then Nauru has a long history of displaying international environmental concerns, and sustainable development is high on Nauru's agenda. Nauru being a responsible party to the international climate change negotiations and processes, actively involved in the decision making and submitted the requisite communications, the brief background of these is highlighted here:

### 3.2 First National Communication-1999

The Republic of Nauru submitted its first National Communication (INC) to United Nations Framework Convention on Climate Change (UNFCCC) in October-1999. The first national communication was prepared by Nauru's National Committee on Climate Change with the assistance of the Energy Unit of the South Pacific Applied Geoscience Commission (SOPAC) and approved by the Government of the Republic of Nauru.

First national communication also presented the Nauru's First Greenhouse Gas (GHG) Inventory and position as at 1994 (as per IPCC-1996, reference approach); was prepared by the Department of Islands Development and Industry in conjunction with assistance from the Energy Unit of the South Pacific Applied Geoscience Commission (SOPAC). The Greenhouse Gas (GHG) emissions and removal from sink in Nauru for the year-1994 was totaled as:

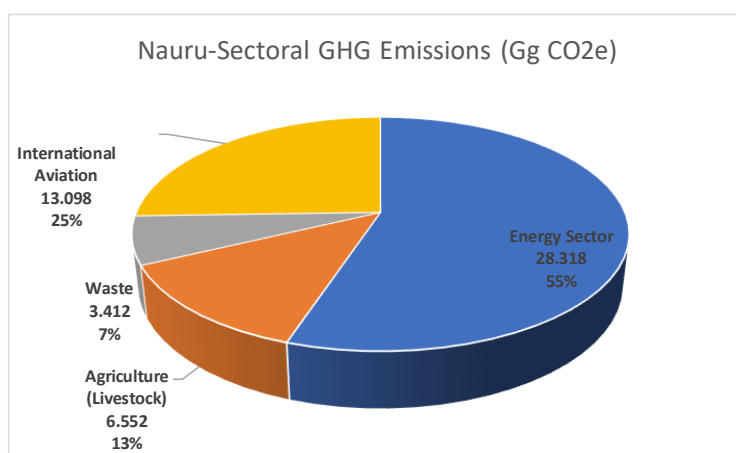
- 29.229 Gg CO<sub>2</sub>e (CO<sub>2</sub> 19.265 Gg; CH<sub>4</sub> 0.346 Gg and N<sub>2</sub>O: 0.001 Gg).
- 97% of total GHG emissions was from Energy Sector i.e. combustion of fossil fuel (Diesel and Petrol),
- 22% from Agriculture Sector i.e. Livestock emissions from Enteric Fermentation and Manure waste and
- 12% from waste sector i.e. municipal solid waste and waste water.

An uptake or sink of 9.035 Gg CO<sub>2</sub> has been estimated, based on the remaining 68 hectares of very tall, closed forest (Natural Vegetation), the reported 1366 hectare of regenerated vegetation after mining and the calculated area of 200 hectare as a provision for the coastal perimeter.

**Table 3. 1: First National Greenhouse Gas Inventory – 1994**

GHG Sources & Sinks	Sectoral Total GHG emissions in Gg			
	CO <sub>2</sub> equiv	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
Energy	28.318	28.318	0.000	0.000
Industrial Processes	0.000	0.000	0.000	0.000
Solvent and Other Product Use	0.000	0.000	0.000	0.000
Agriculture (Livestock)	6.552	0.000	0.234	0.000
Land-Use Change & Forestry	-9.053	-9.053	0.000	0.000
Waste	3.412	0.000	0.112	0.001
Total GHG Emissions, excl. Removals	38.282	28.318	0.346	0.001
Total GHG Emissions, incl. Removals	29.229	19.265	0.346	0.001
International Bunkers (Aviation)	13.098	13.098	0.000000	0.000000

Figure 3. 1: Nauru GHG Emissions -1994



Nauru’s first national communication established a baseline to work from and assisted Nauru in drawing a plan to meet its own national commitments and the commitments it has under the United Nations Framework Convention on Climate Change (UNFCCC).

### 3.3 Second National Communication – 2014

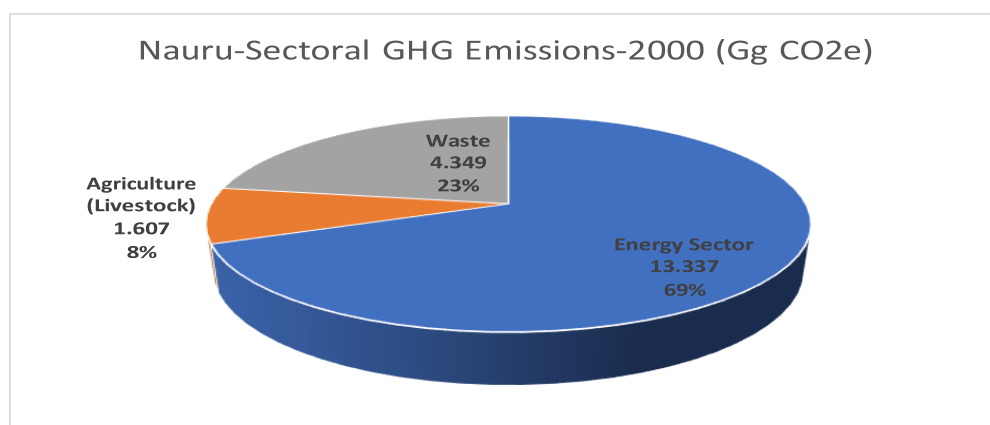
The Republic of Nauru has submitted its second national communication (SNC) to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2014. The second national communication was supported by the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF) and approved by the Government of the Republic of Nauru.

The SNC also presented the national GHG inventory for the base year 2000 using the revised 1996 IPCC Guidelines. The data on Land use, land-use change, and forestry (LULUCF) activities has not been considered for year 2000. Total GHG emissions were estimated excluding Forestry and other land use (FOLU).

Table 3. 2: Second National Greenhouse Gas Inventory – 2000

GHG Sources & Sinks	Total GHG emissions in Gg			
	CO2-equiv	CO2	CH4	N2O
Energy	13.337	13.289	0.001	0.00009
Industrial Processes	0.000	0.000	0.000	0.00000
Solvent and Other Product Use	0.000	0.000	0.000	0.00000
Agriculture (Livestock)	1.607	0.000	0.059	0.00119
Land-Use Change & Forestry	0.000	0.000	0.000	0.00000
Waste	4.349	0.000	0.197	0.00067
Total GHG Emissions, excl. Removals	19.294	13.289	0.257	0.002
International Bunkers (Aviation)	Not Estimated			

Figure 3. 2 : Nauru GHG Emissions -2000



The second national communication also presents the GHG emission for Nauru for the year 2003, 2007 and 2010, based on the similar data source and methodology used for estimation of GHG emissions for Nauru year 2000.

Table 3. 3: Second National Greenhouse Gas Inventory – 2000, 2003, 2007 and 2010

GHG Sources & Sinks	Sectoral Total GHG emissions in Gg			
	2000	2003	2007	2010
	CO <sub>2</sub> -equiv	CO <sub>2</sub> -equiv	CO <sub>2</sub> -equiv	CO <sub>2</sub> -equiv
Energy	13.337	35.280	17.314	37.733
Industrial Processes	0.000	0.000	0.000	0.000
Solvent and Other Product Use	0.000	0.000	0.000	0.000
Agriculture (Livestock)	1.607	1.607	0.318	0.751
Land-Use Change & Forestry	0.000	0.000	0.000	0.000
Waste	4.349	4.615	4.967	3.702
Total GHG Emissions, excl. Removals	19.294	41.503	22.600	42.186

The quantity of CO<sub>2</sub>e emissions increased from 19.294 Gg CO<sub>2</sub>e in 2000 to 42.186 Gg CO<sub>2</sub>e in 2010. The sectoral GHG emissions trend, shows that, the trend of major GHG emissions' fluctuations was in energy sector since 2000 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 second national communication leads to more focus approached and policy decision at national level.

### 3.4 Intended Nationally Determined Contribution (INDC) -2015

The Republic of Nauru communicated its initial national determined contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) as per the requirement of the Paris Agreement (PA). Nauru with support from United Nations Environment Programme (UNEP) initiated the INDC preparation activities during June 2015 and has successfully submitted the same on 17<sup>th</sup> November 2015. In view of the successful adoption of the Paris agreement, Nauru intends to initiate the preparatory activities for moving from INDCs to Nationally Determined Contributions (NDCs). The iNDC of Nauru hinged on its National Sustainable Development Strategy (NSDS) 2005 – 2025 (revised in 2009), the Nauru Energy Road Map 2014-2020, the Second National Communication (SNC), the Republic of Nauru Climate Change Adaptation and Disaster Risk Management Framework (RONAdapt) together

with other data and information obtained from subsequent consultations with government departments, private and civil society organizations.

## 3.5 Nauru's Third National GHG Inventory

### 3.5.1 Introduction

The third National Greenhouse Gas (GHG) Inventory of Nauru is intended to communicate to the United Nations Framework Convention on Climate Change (UNFCCC) and Conference of Parties (COP) the anthropogenic GHGs emissions from the Republic of Nauru by sources and removals by sinks, of all greenhouse gases not controlled by the Montreal Protocol

The third national communication (TNC), details out anthropogenic Greenhouse Gases (GHGs) emissions from Nauru for the years 2007-2014 utilizing the 2006 IPCC Guidelines for Greenhouse Gas Inventories, IPCC Good Practice Guidance (GPG) 2000 and 2003 where appropriate; and using the IPCC Inventory Software (Version 2.54- June 2017) for the preparation of national GHG inventories according to Tier1 and Tier2 methodologies of 2006 IPCC guidelines, of the IPCC Task Force on National Greenhouse Gas Inventories. The national GHG Inventory for each year from 2007-2014 has been prepared with all Greenhouse Gas emissions divided into 2006 IPCC Guidelines Categories i.e. Sectoral, Sub-sectors and Gas type categorization.

The sectors and gases assessed for the estimation of third national GHG inventory includes the emissions by sources (excluding removals by sinks) of all anthropogenic GHGs. As per the 2006 IPCC guidelines, the inventory estimates the GHG emissions from following sectors which are relevant for Nauru: (i) Energy Sector; (ii) Agriculture Sector and (iii) Waste Sector. In addition to the sectoral approach, the reference approach has also been used to estimate equivalent CO<sub>2</sub> emissions from the energy sector for the year 2014. Emissions from International bunker is 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 sector and sub-sectors considered for the sectoral greenhouse gas inventory of anthropogenic emissions of Nauru has been listed in the following Table:

*Table 3. 4: Sectorial GHG Inventory of Anthropogenic Emissions-Nauru*

Sectors	Remarks
Energy Sector	
Fuel Combustion Activities – CO <sub>2</sub> and Non-CO <sub>2</sub> Emissions	Estimated
Fugitive Emissions from Fuels	Not Estimated (NE)
Industrial Processes and Product Use (IPPU) Sector	Not Estimated (NE)
Agriculture Sector	
Enteric Fermentation	Estimated
Manure Management	Estimated
Emissions from Animal Waste Management Systems	Estimated
Rice Cultivation	Not Estimated (NE)
Agricultural Soils	Estimated
Prescribed Burning of Savannas – Non – CO <sub>2</sub> Gases	Not Estimated (NE)
Field Burning of Agricultural Residues – Non – CO <sub>2</sub> Gases	Not Estimated (NE)
Land-Use, Land-Use Change & Forestry Sector (LULUCF)	
Forest Land	Not Estimated (NE)

Sectors	Remarks
Cropland	Not Estimated (NE)
Grassland	Not Estimated (NE)
<i>Other CO<sub>2</sub> and non-CO<sub>2</sub> Categories</i>	Not Estimated (NE)
Waste Sector	
Solid Waste Disposal	Estimated
Biological Treatment of Solid Waste	Not Occurring
Incineration and Open Burning of Waste – CO <sub>2</sub> and Non-CO <sub>2</sub> Gases	Not Estimated (NE)
Wastewater Treatment and Discharge	Estimated
Other (Memo Items)	
International bunkers	
Aviation	Estimated
Marine	Not Estimated (NE)
CO <sub>2</sub> emissions from biomass	Not Estimated (NE)

The direct GHG emissions estimated in this third national GHG inventory are: (i) Carbon dioxide (CO<sub>2</sub>); (ii) Methane (CH<sub>4</sub>) and (iii) Nitrous oxide (N<sub>2</sub>O). Further, emissions from the following indirect GHGs are not estimated and reported here: Oxides of Nitrogen (NO<sub>x</sub>), Carbon Monoxide (CO), Non-Methane Volatile Organic Compounds (NMVOC) and Sulphur dioxide (SO<sub>2</sub>). 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) and the aggregated GHG emissions and removals are expressed in CO<sub>2</sub> equivalents (Gg CO<sub>2</sub>e) using the Global Warming Potential (GWP) defined by Fifth Assessment Report (AR5) by the Intergovernmental Panel on Climate Change (IPCC).

## 3.6 National GHG Inventory Preparation

### 3.6.1 Data collection methodologies

The data for GHG inventory for the years 2007-2017 from different sectors and sub-sectors was collected using the two methodologies i.e. first the “top down” or reference approach and second the “bottom up” or sectoral approach. The data for each sector and sub-sector were 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. Where actual data was not available judgment of sectors experts was relied on.

The challenges and barriers faced during data collection and methodologies adopted for data collection are discussed in detail in the following section of the report and under sectoral and sub-sectoral analysis. A few countries' specific and regional assumptions were used to represent the local conditions of the country. These assumptions have been verified by the local sector experts and cross checked with other resources for correctness. Wherein no formal data is available, are not considered in the study. Justification on choice of data and limitations discussed in following section of the report and under the sectoral/sub-sectoral analysis.

### 3.6.2 Energy sector data collection methodology

The energy sector data was collected using both the methodologies i.e. “top down” (Reference approach) and “bottom up” (sectoral approach); both the methodologies poses different

challenges. However, the combination of both methodologies used for this GHG inventory. The fuel import and supply to the major consumers (Govt., NUC, RONPHOS, Rehab) were obtained from the fuel tank farm (currently managed by Vital Energy) along with the government reports and budget. Further the production of phosphate and fuel consumed by RONPHOS for their operations (drying etc.) is obtained directly from them. Apart from the above discussed sources, government reports and previously submitted national communications referenced for confirming the suitability of data.

### **3.6.3 Agriculture sector data collection methodology**

As discussed above, due to lack of information and data from all the sub-sectors of the Agriculture Sector and very limited agriculture activity, the only sub-sector consider for GHG emission inventory was Livestock sub-sector. The Livestock data for Nauru sourced from Animal Livestock Survey-2007, Census of 2011 and Nauru Household Income and Expenditure Survey (HIES)-2012/2013. Livestock data for the rest of the years under this GHG inventory, estimated using the percentage growth rate of animal population. Further, IPCC 1994 and IPCC 2006 methodologies and default values have been used for GHG emission calculation i.e. Methane (CH<sub>4</sub>) and Nitrous-Oxide (N<sub>2</sub>O).

### **3.6.4 Waste sector data collection methodology**

The waste sector (both municipal, solid waste and wastewater generation) data was not monitored in the Nauru for the year 2007-2014; hence the data for MSW and WW generated estimated using the population of Nauru (2006 and 2011 Census Report), Data and information available from study reports mainly “Pacific Regional Solid Waste Management Strategy 2010-2015” and “Solid Waste Management in the Pacific - Nauru Country Snapshot”. Further, IPCC 1994 and IPCC 2006 methodologies and default values have been used for GHG emission calculation i.e. Methane (CH<sub>4</sub>) and Nitrous-Oxide (N<sub>2</sub>O).

### **3.6.5 Key category analysis**

The inventory estimates the GHG emissions from following sectors which are relevant for Nauru: (i) Energy Sector; (ii) Agriculture Sector (Livestock) and (iii) Waste Sector. In addition to the sectoral approach, the reference approach has also been used to estimate equivalent CO<sub>2</sub> 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 estimated in this national GHG inventory are: (i) Carbon dioxide (CO<sub>2</sub>); (ii) Methane (CH<sub>4</sub>) and (iii) Nitrous oxide (N<sub>2</sub>O). Further, emissions from the following indirect GHGs are also estimated and reported in this third national GHG inventory: Oxides of Nitrogen (NO<sub>x</sub>), Carbon Monoxide (CO), Non-Methane Volatile Organic Compounds (NMVOC) and Sulphur dioxide (SO<sub>2</sub>). 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<sub>2</sub> equivalents (Gg CO<sub>2</sub>e) using the Global Warming Potential (GWP) defined by Intergovernmental Panel on Climate Change (IPCC).

### **3.6.6 Completeness, and 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 advance and technical uncertainty analysis. Such a detailed analysis is beyond scope of Nauru's second GHG inventory.

The uncertainty analysis and aggregated categories is based on Table 4.1 of Volume 1, Chapter 4 of 2006 IPCC Guidelines. Uncertainties from disaggregated levels are combined by multiplication according to Equation 3.1 of Volume 1, Chapter 3 of 2006 IPCC Guidelines using the default uncertainty values.

### **3.6.7 Energy sector Gaps and Uncertainty**

For the energy sector reference approach, there were uncertainties in the data from the Tank Farm that need to be addressed in future reports as well as instituting some level of quality control and independent assurance of data integrity. No national energy balance available, further energy datasets available are fragmented with irregular data reporting.

For the sectoral approach, it is recognized that there are considerable gaps in information regarding sectoral usage in the energy sector that need to be addressed by obtaining data directly from the fuel supply companies. In addition, having two independent data sources would then lead to better data quality assurance and the ability to cross check quantities.

In general uncertainties of around  $\pm 1\%$  would not be unreasonable for the energy sector.

#### *3.6.7.1 Agriculture Gaps and Uncertainty*

Uncertainties in the agricultural sector are inherent due to the lack of detailed census data in animal numbers and manure management practices. The uncertainties are suggested to be higher than the energy sector and amount to around  $\pm 30\%$ .

#### *3.6.7.2 Waste gaps and Uncertainties*

Although there were several limitations in the data quality for the waste sector, the overall relatively low emissions from this sector made the final uncertainties not a large problem in terms of the total emissions profile for Nauru.

## **3.7 Nauru - GHG Emissions: 2007-2014**

### **3.7.1 Overview**

The GHG emissions from Nauru has been estimated based on the methodology discussed in the previous section for the year 2007 – 2014; presented here. The following section presents the total GHG emissions by sources (excluding removals by sinks) for Nauru for the years 2007-2014; further trend analysis also incorporated against the GHG emissions estimated in year 1994 (as a part of First National Communication) and year 2000 (as part of Second National Communication; GHG emissions for years 2007 and 2010 recalculated in this report with the revised livestock and waste sector time series data and as per revised GWP as per IPCC AR5).

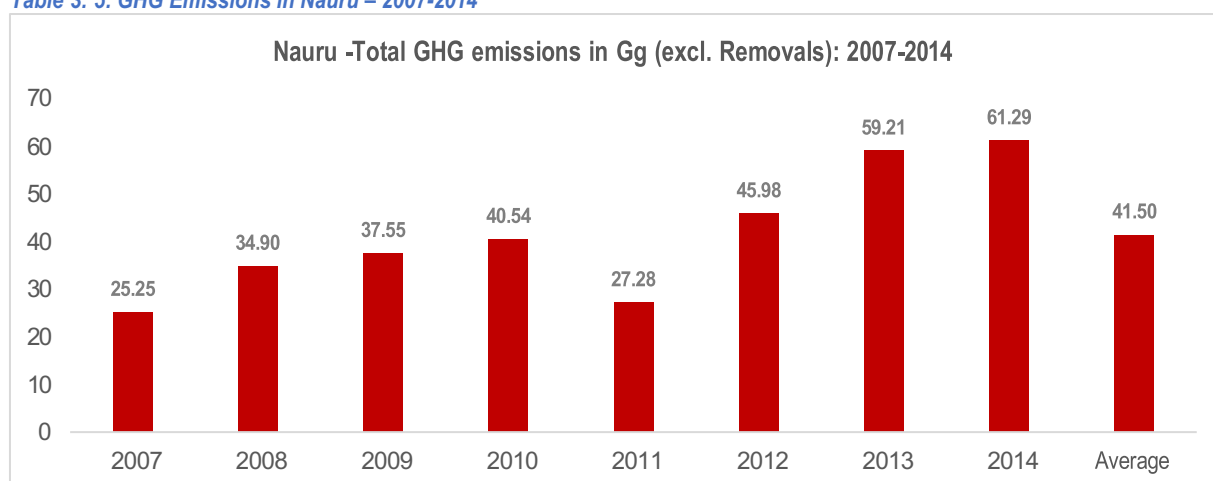
Total national GHG emissions excluding removals in year 2014 reached to 61.293 Gg CO<sub>2</sub>e (in comparison to 38.282 Gg CO<sub>2</sub>e estimated for year 1994 under the first national communication and 19.294 Gg CO<sub>2</sub>e estimated for year 2000 under the second national communication); This comprises direct CO<sub>2</sub> emission 58.567 Gg, CH<sub>4</sub> emission 0.087 Gg and N<sub>2</sub>O emissions 0.0011 Gg during 2014 in comparison to 28.318 Gg CO<sub>2</sub> emissions, 0.346

Gg CH<sub>4</sub> emission and 0.001 Gg N<sub>2</sub>O during year 1994; there is no significant change in N<sub>2</sub>O emissions observed during this period. Emissions of other GHGs like per fluorocarbons (PFCs), hydro fluorocarbons (HFCs) and sulphurs hexafluoride (SF<sub>6</sub>) were negligible in Nauru as the products containing these gases are not produced and significantly used in the country.

By way of comparison, the total world emissions (2010 from IPCC 2014) were around 49 Gt of which 65% were CO<sub>2</sub> emissions from fossil fuels, 11% CO<sub>2</sub> FOLU emissions, 16% methane emissions, 6% nitrous oxide emissions and 2% other gasses. For Nauru 94% (average 2007 – 2014) were CO<sub>2</sub> emissions from fossil fuel, 6% CH<sub>4</sub> emissions and <1% N<sub>2</sub>O emissions observed from agriculture and waste sector (emissions from Forestry and Other Land Use not estimated for Nauru).

The global per capita GHG emissions (in terms of tonnes of CO<sub>2</sub>e per person) for the year 2010 was about 7 tonnes of CO<sub>2</sub>e equivalent per person (Considering Global population for 2010 was 7 billion and global GHG emissions of 49 Gt of CO<sub>2</sub>e equivalent). The per capita emission for Nauru comes out 4 tonnes of CO<sub>2</sub>e equivalent for year 2010 (GHG emissions 40.536 Gg of CO<sub>2</sub>e equivalent and population of 10,031 persons); which is around 57% of the world average during that period. In absolute terms Nauru's total CO<sub>2</sub>e emissions was around 0.00008% of world emissions for year 2010.

**Table 3. 5: GHG Emissions in Nauru – 2007-2014**



The following table presents the total GHG emissions in Gg CO<sub>2</sub>e and gas wise GHG emissions in Gg (excl. Removals) from Nauru during the period 2007 to 2014:

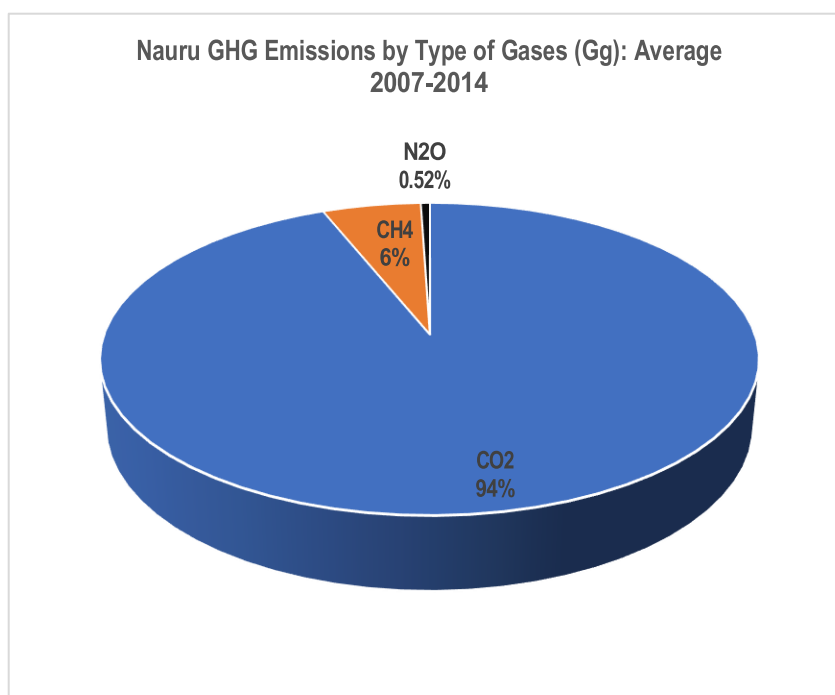
**Table 3. 6: Total GHG Emissions in Nauru: 2007-2014**

Year	Nauru Total GHG emissions in Gg (2007-2014)			
	CO <sub>2</sub> -equiv (CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O)	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
2007	25.25	22.93	0.077	0.0006
2008	34.90	32.46	0.080	0.0007
2009	37.55	35.14	0.078	0.0008
2010	40.54	38.09	0.080	0.0008
2011	27.28	24.68	0.087	0.0006
2012	45.98	43.46	0.082	0.0008

Year	Nauru Total GHG emissions in Gg (2007-2014)			
	CO2-equiv (CO2, CH4 and N2O)	CO2	CH4	N2O
2013	59.21	56.34	0.093	0.0010
2014	61.29	58.57	0.087	0.0011
Average (2007-2014)	41.50	38.96	0.083	0.0008

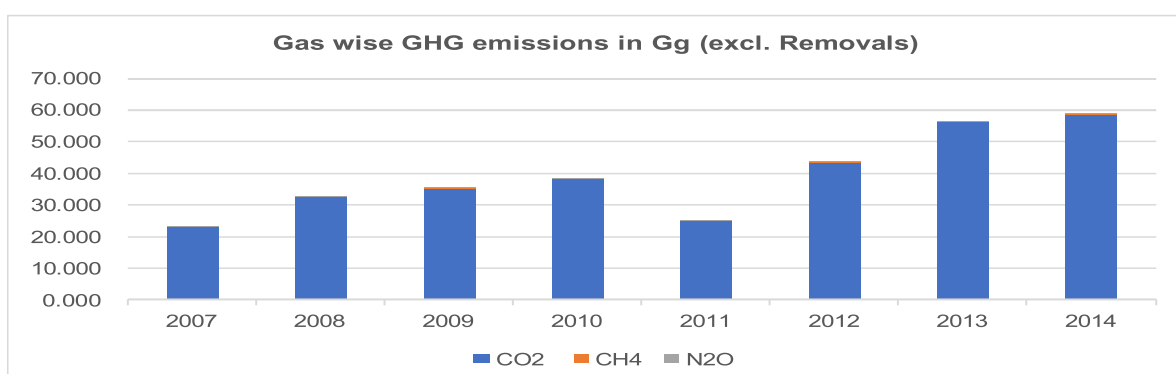
As can be seen the total GHG emissions from Nauru is increasing over the years and indicative increase in energy sector in Nauru; the trend almost follows the economic growth in Nauru and highly dependent on the electricity generation, mining activity and phosphate production.

Figure 3. 3: Nauru GHG Emissions by Gas (Gg): Average 2007-2014



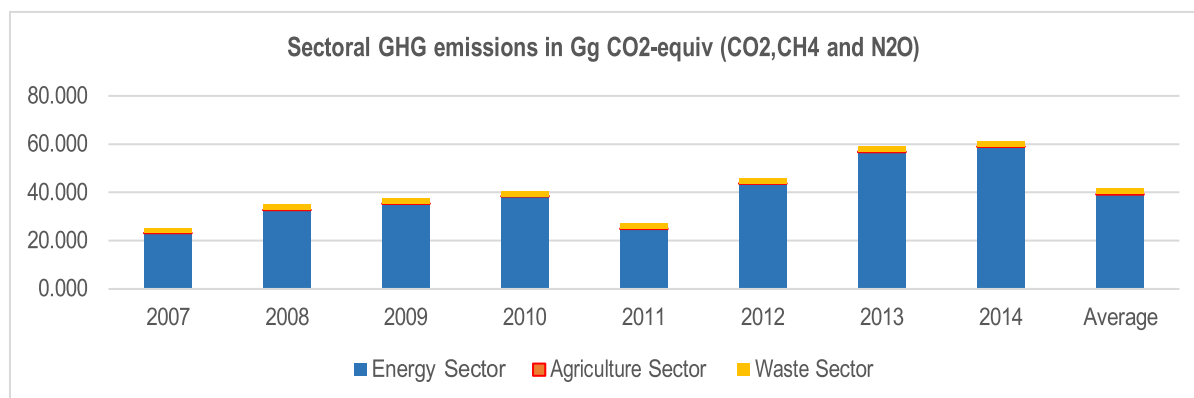
Evidently the main GHG emissions from Nauru comprises of Carbon Dioxide (CO<sub>2</sub>) mainly from combustion of fossil fuel for generation of electricity, transportation and mining industry; Methane (CH<sub>4</sub>) from agriculture-livestock (Enteric fermentation and Manure management) and waste sector (Solid waste and wastewater). The estimated main GHGs (CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O) for years 2007 to 2014 are depicted in the following graph. The graph clearly establishes that the CO<sub>2</sub> is the main contributor of total GHG emissions and there are very minor emissions of CH<sub>4</sub> and N<sub>2</sub>O in Gg.

Figure 3. 4: Total Emissions by Gas Type (Gg) – 2007-2014



As discussed above the total GHG emissions in Nauru contributed from three main sectors viz Energy, Agriculture (livestock) and Waste Sectors. The average contribution of these sectors for the year 2007-2014 was Energy (94.4%), Agriculture (0.2%) and remaining from Waste Sectors (5.4%). Sectoral contribution in Nauru's total GHG emissions for year 2007- 2014 are presented as follows:

**Figure 3. 5: Total Emissions by Sector (in Gg CO2-equiv): 2007-2014**

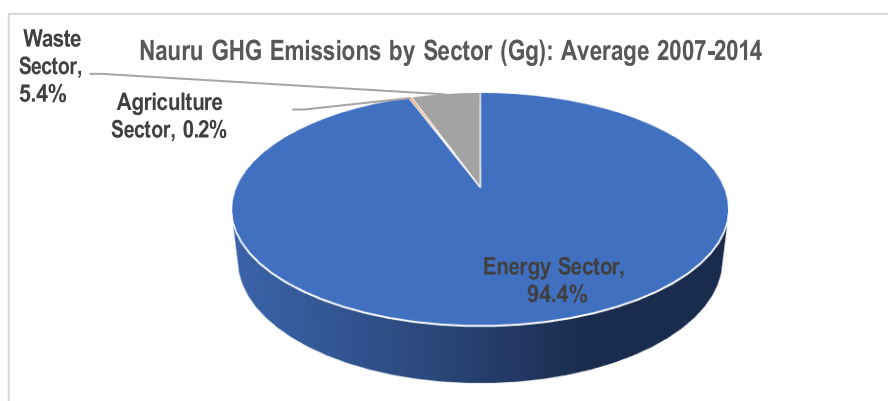


The above GHG emission for the years 2007-2014 shows that the waste and energy sectors are the biggest source of GHG emission in Nauru followed by the agriculture sector; there is negligible contribution from industrial process and solvent & other product use. Further; CO<sub>2</sub> is the main GHG emitted as result of energy sector activities in Nauru. The sectoral contribution of GHG emissions in Nauru during year 2007-2014 presented in table below.

**Table 3. 7: Total Emissions by Sector (in Gg CO2-equiv): 2007-2014**

GHG Sources	Sectoral GHG emissions in Gg CO2-equiv (CO2, CH4 and N2O)								
	2007	2008	2009	2010	2011	2012	2013	2014	Average
Energy Sector	23.063	32.639	35.353	38.289	24.792	43.682	56.663	58.925	39.176
Industrial Processes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Solvent and Other Product Use	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Agriculture Sector	0.095	0.127	0.019	0.018	0.222	0.018	0.229	0.011	0.093
Land-Use Change & Forestry	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Waste Sector	2.091	2.133	2.176	2.228	2.265	2.278	2.317	2.357	2.231
Total GHG Emissions	25.250	34.899	37.549	40.536	27.279	45.979	59.209	61.293	41.499

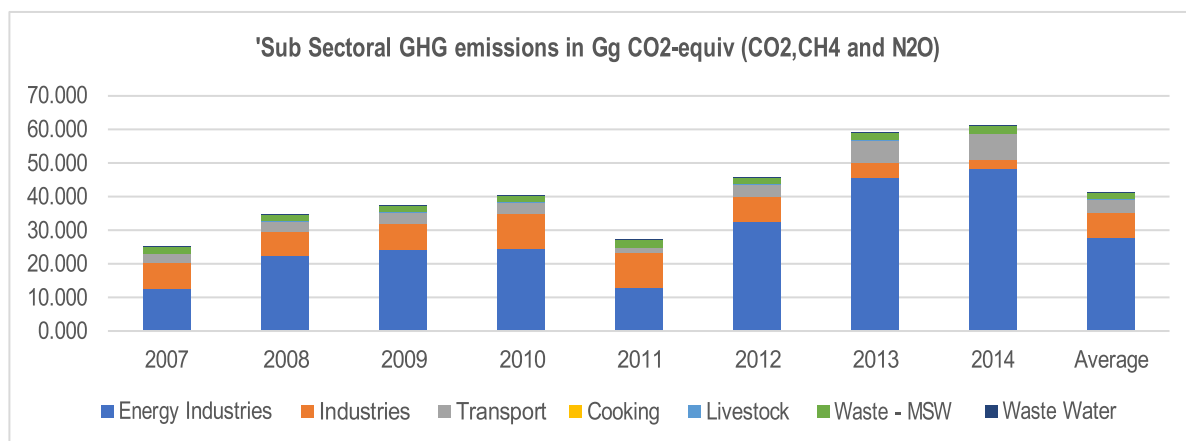
**Figure 3. 6: Nauru Total Emissions by Sector (Gg): Average 2007-2014**



The sectoral GHG emissions comes from different subsectors, the main subsectors of Energy Sector are Energy Industries, Manufacturing Industries and Construction, Transport and Residential (Cooking); In the absence of farming activity, the emissions from Agriculture Sectors is contributed by the Livestock (Enteric fermentation and manure management) and Waste sector emissions contributed by the Municipal Solid Waste (MSW) and Waste Water subsector.

The sub-sectoral contribution of Nauru’s total GHG emissions for year 2007-2014 are presented below shows the GHG emission for the years 2007-2014 shows that the energy industry (average 67.2%) and Manufacturing Industries and Construction (Industry) (average 17.4%) sub-sectors are the biggest source of GHG emission in Nauru followed by the transport (average 9.7%), waste-MSW (average 4.8%), waste water (average 0.5%), livestock (average 0.2%) and cooking (average 0.1%) sub-sector.

**Figure 3. 7: Total Emissions by Sub-Sector (in Gg CO2-equiv): 2007-2014**

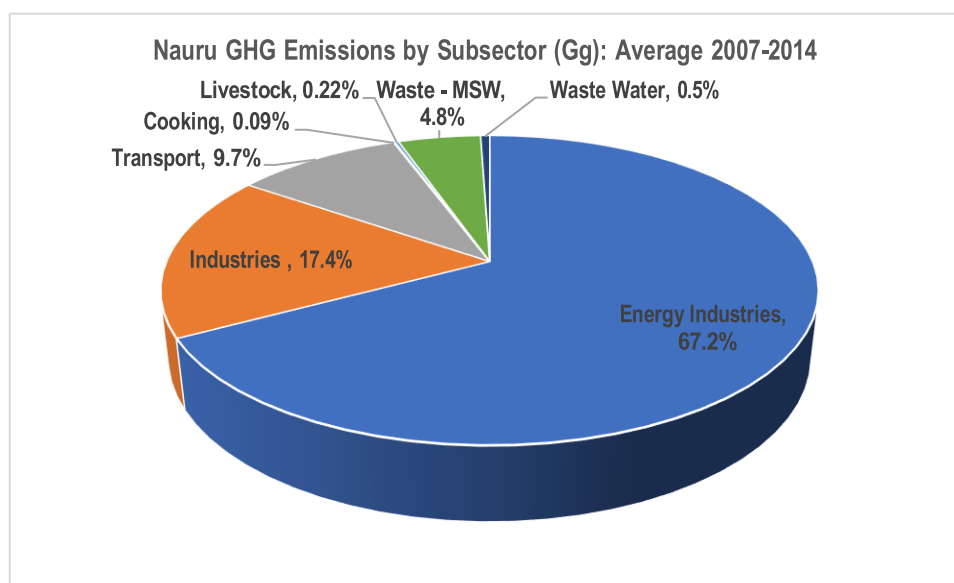


The sub-sectoral contribution of GHG emissions in Nauru during year 2007-2014 presented in table below.

Table 3. 8: Total Emissions by Sub-Sector (in Gg CO2-equiv): 2007-2014

GHG Sources	Sub Sectoral GHG emissions in Gg CO2-equiv (CO2, CH4 and N2O)								
	2007	2008	2009	2010	2011	2012	2013	2014	Average
Energy Industries	12.643	22.457	24.118	24.592	13.073	32.399	45.677	48.175	27.892
Industries	7.696	6.897	7.863	10.278	10.224	7.421	4.321	2.928	7.203
Transport	2.725	3.284	3.373	3.420	1.495	3.862	6.580	7.625	4.045
Cooking	0.000	0.000	0.000	0.000	0.000	0.000	0.0847	0.1976	0.035
Livestock	0.095	0.127	0.019	0.018	0.222	0.018	0.229	0.011	0.093
Waste - MSW	1.877	1.917	1.957	1.998	2.040	2.050	2.087	2.124	2.006
Waste Water	0.214	0.217	0.219	0.231	0.226	0.228	0.230	0.233	0.225
Total GHG Emissions	25.250	34.899	37.549	40.536	27.279	45.979	59.209	61.293	41.499

Figure 3. 8: Nauru Total Emissions by Subsector (Gg): Average 2007-2014



### 3.8 Gas by Gas Emission Inventory

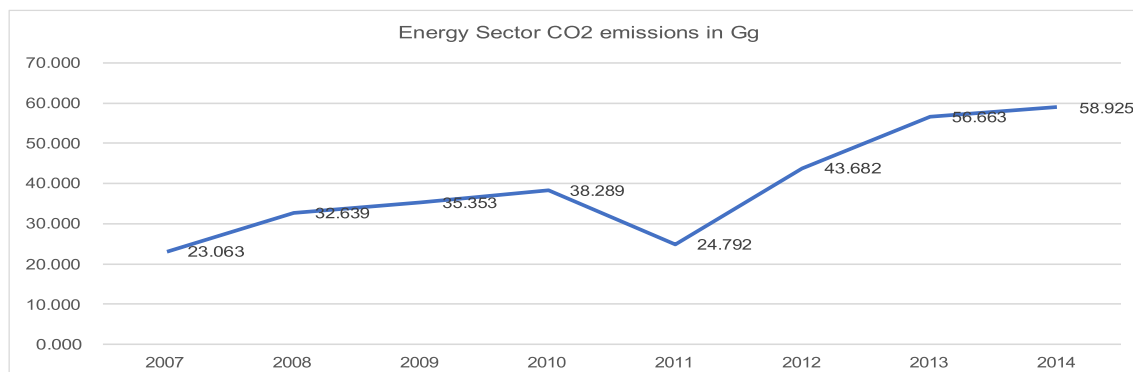
The gas-by-gas GHG emission inventory for Nauru for year 2007-2014 has included in this section. The GHG emissions mainly contributed from Energy, Waste and Agriculture sector. Greenhouse gases covered in this analysis include CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and estimated quantum presented in prior section. The data analysis confirms that CO<sub>2</sub> is the most potent GHG in Nauru. This is primarily due to emissions from energy industries, manufacturing industries & construction, transport and residential. Next most prominent GHG in Nauru is CH<sub>4</sub> followed by N<sub>2</sub>O.

#### 3.8.1 Carbon dioxide (CO<sub>2</sub>)

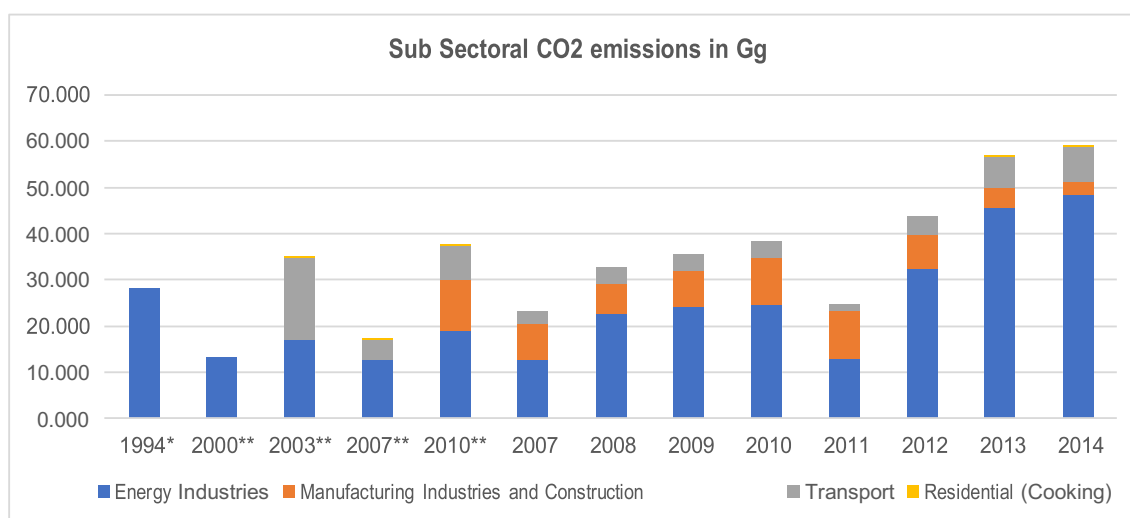
Net CO<sub>2</sub> emissions in Nauru were estimated for the period 2007-2014 presented in the graph below. The energy sector is the main source of CO<sub>2</sub> emissions, accounting for approximately 94% of emissions. The CO<sub>2</sub> emissions from Nauru has shown the increasing trend historically

and under the inventory period 2007-2014, the net CO<sub>2</sub> emissions in year 2007 was 22.93 Gg and increase to 58.57 Gg (146%) in 2014; the marginal dip in 2011 is due to less petroleum consumption and mining activity in the year; further the combustion of fossil fuels remain the main contributor of CO<sub>2</sub> emissions in Nauru.

**Figure 3. 9: Total CO<sub>2</sub> emissions in Gg: 2007-2014**



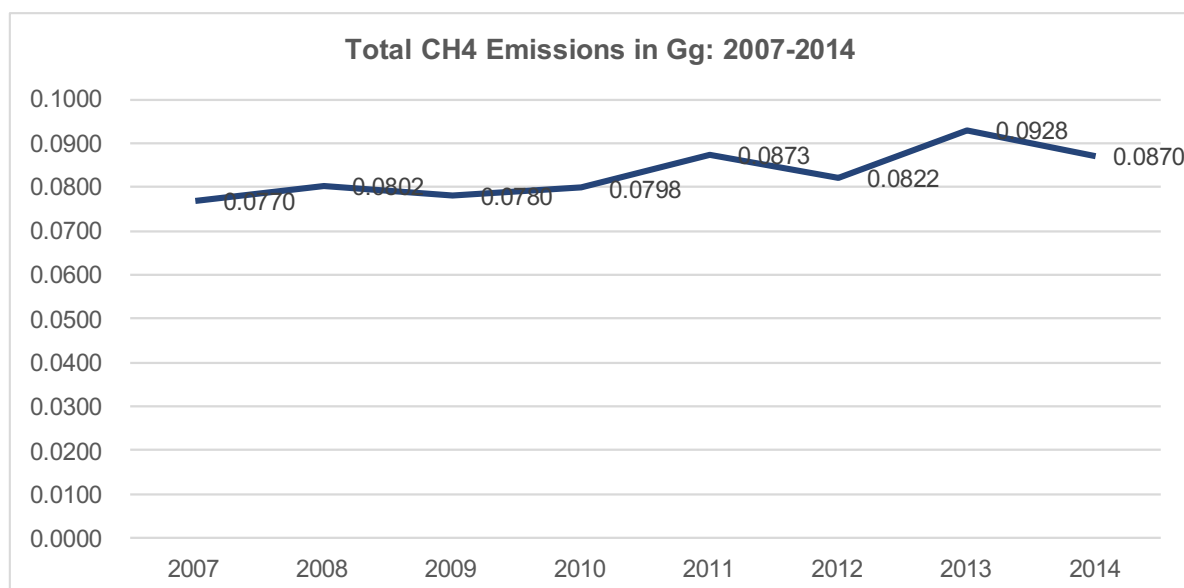
**Figure 3. 10: Sub-Sectoral CO<sub>2</sub> emissions in Gg CO<sub>2</sub>-equiv: 2007-2014**



### 3.8.2 Methane (CH<sub>4</sub>)

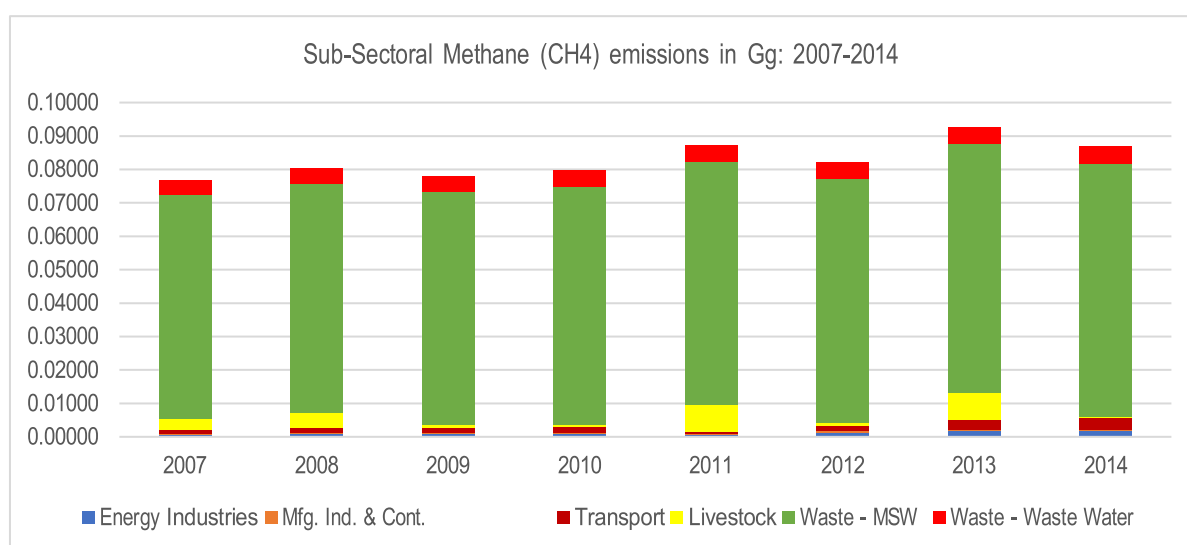
Net Methane (CH<sub>4</sub>) emissions in Nauru are estimated for the period 2007-2014 presented in the graph below. The waste (MSW, Wastewater) sector is the main source of CO<sub>2</sub> emissions, accounting for over 92% of emissions, small amount (<4%) of methane comes from the agriculture sector i.e. from Livestock- Swine, Chicken and Ducks: enteric fermentation and manure management. A minor fraction of methane comes from the energy sector; mainly as the emissions from combustion of fossil fuel (<4%). The CH<sub>4</sub> emissions from Nauru has shown linear increasing trend over the years 2007-2014, the net CH<sub>4</sub> emissions in year 2007 was 0.077 Gg and increase to 0.087 Gg (13%) in 2014; the increase in methane emission is due to increase in waste generation and unscientific and unorganised waste management practices during the years; the open dumping and decay of waste increased the net methane emissions in Nauru.

Figure 3. 11: Total Methane (CH4) emissions in Gg – 2007-2014



The contribution of Methane in Nauru’s net GHG emission is increasing rapidly and calls for serious action on improving the municipal solid and wastewater management practices. The following graph presents methane emission in Nauru from different sub-sectors.

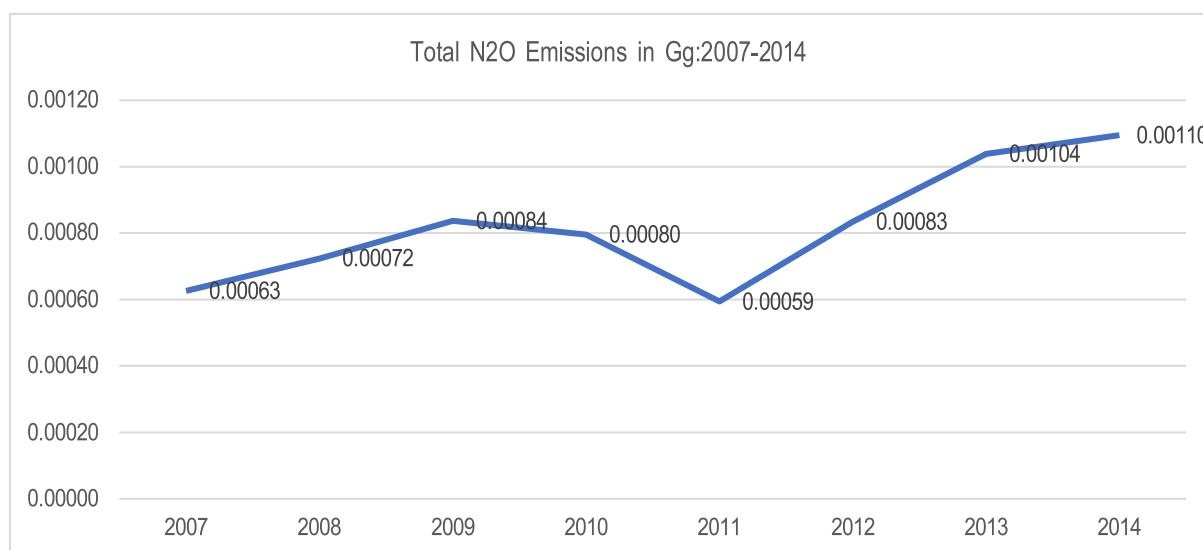
Figure 3. 12: Sub-Sectoral Methane (CH4) emissions in Gg: 2007-2014



### 3.8.3 Nitrous Oxide (N<sub>2</sub>O)

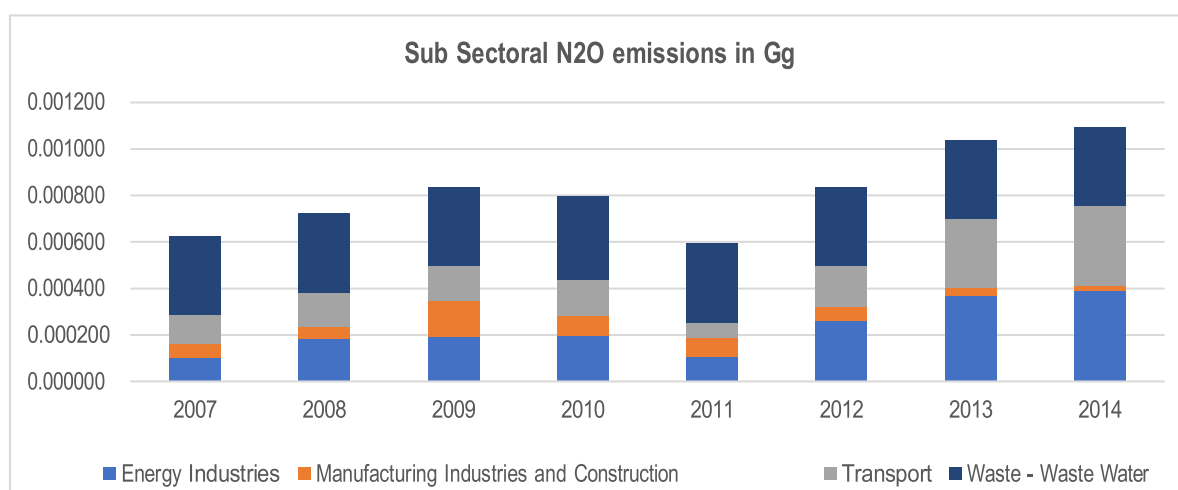
The net Nitrous oxide (N<sub>2</sub>O) emissions in Nauru are estimated to be 0.000626 Gg in 2007 and there is about 75% increase over the period till 2014 (0.0011 Gg); However, the average contribution on Net N<sub>2</sub>O in Nauru’s total GHG emission is very minimal about 0.52% of total GHG emissions for the years 2007-2014. The main source of N<sub>2</sub>O emissions in Nauru is from energy sector and wastewater sector and negligible contribution from livestock and agriculture soil (both not estimated in this GHG inventory). The following figure represents N<sub>2</sub>O emission in Nauru for the year 2007-2014.

**Figure 3. 13: Total Nitrous Oxide (N2O) emissions in Gg: 2007-2014**



As discussed above the main source of N<sub>2</sub>O emission in Nauru are energy and waste sector-mainly waste water discharge and combustion of fossil fuel; in the absence of sufficient data N<sub>2</sub>O emissions from the other sub-sectors like livestock manure management etc. are not being calculated here. The following figure represents sub-sectoral N<sub>2</sub>O emission in Nauru for the year 2007-2014.

**Figure 3. 14: Total Sub-Sectoral Nitrous Oxide (N2O) emissions in Gg: 2007-2014**



### 3.8.4 Other GHGs (PFCs, HFCs and SF<sub>6</sub>)

Emissions from per-fluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF<sub>6</sub>) in Nauru are negligible; as the products containing these gases are not produced in the country. Emissions from the consumption of Halocarbons and SF<sub>6</sub> were not estimated due to lack of activity data.

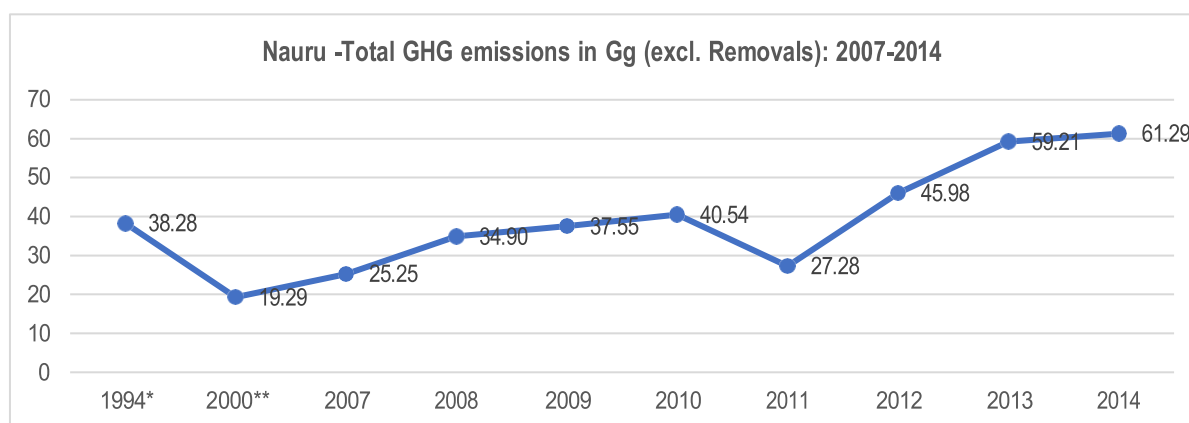
### 3.8.5 Indirect Greenhouse Gases (NO<sub>x</sub>, CO, NMVOC)

Apart from the direct GHG emissions in Nauru; the other indirect emissions of NO<sub>x</sub>, CO, NMVOC and SO<sub>2</sub> takes place; however, they are not main source of the GHGs and have very negligible quantum. Due to lack of data and due to high uncertainty involved estimation of emissions from indirect gases in Nauru e.g. NO<sub>x</sub>, CO, NMVOC, SO<sub>2</sub> not accounted under this GHG inventory for year 2007-2014.

### 3.9 GHG Emission Trend Analysis (1994-2014)

The total GHG emissions (excluding removals) from Nauru presented in the graph below. The total GHG emissions of Nauru increased from 38.28 Gg in 1994 to 61.29 Gg in 2014 over 20 years; which amount over 60% increase in total GHG emissions. The increase in emission is evidenced with the increase in economic activities in Nauru during the period. The GHG emissions significantly increased from energy sector (108%), due to increase in petroleum fuel consumption. The methodologies adopted to calculate GHG emissions from the waste sector and agriculture sector; hence these sectors specific comparison not presented here. Further, the 2007-2014 GHG emission shows the increase in emissions from waste sector (due to population increment, change in lifestyle, unscientific and unmanaged waste management practice and emissions accumulated over period of time) and emissions from agriculture sector i.e. only livestock fluctuates and heavily dependent on livestock population (high level of data uncertainty involved GHG emissions from livestock), other agricultural activity on Nauru is very limited due to the small amount of land available and also, more importantly, the scarcity of water. Following table and figure presents the Nauru's total GHG emissions trend since 1994 to 2014.

Figure 3. 15: Nauru Total GHG Emissions in Gg: 1994-2014

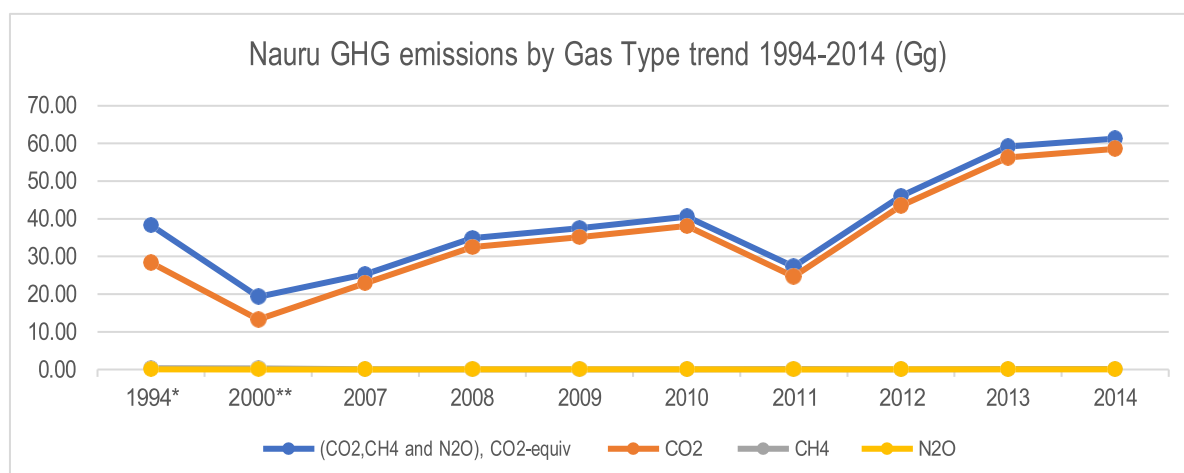


Note: \*First National Communication, \*\* Second National Communication

Table 3. 9: Nauru Total GHG emissions in Gg, 1994-2014

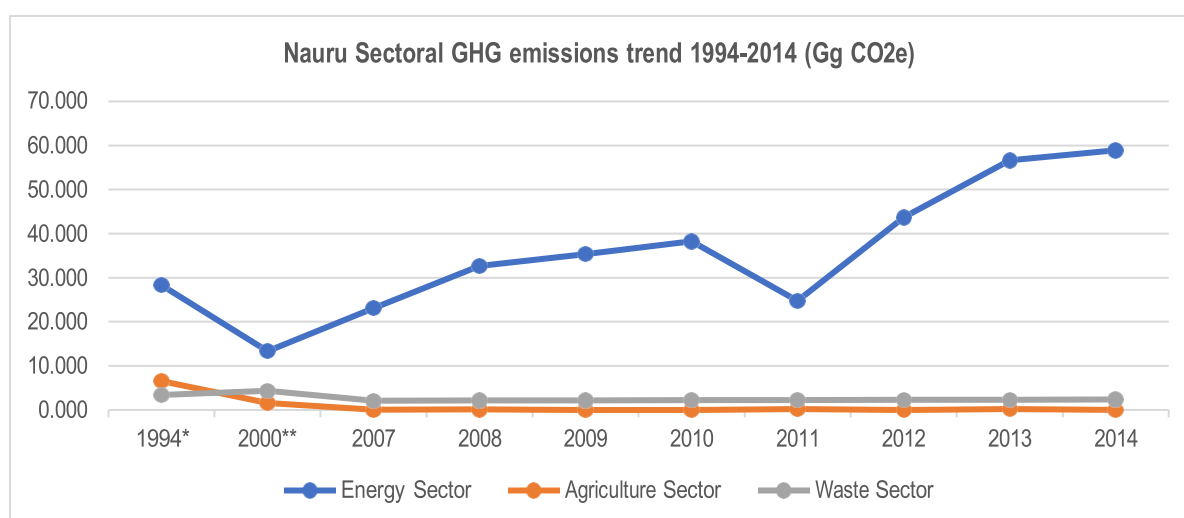
Year	Total GHG emissions in Gg (excl. Removals)			
	CO <sub>2</sub> -equiv (CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O)	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
1994*	38.28	28.318	0.346	0.001
2000**	19.29	13.289	0.257	0.002
2007	25.25	22.93	0.08	0.0006
2008	34.90	32.46	0.08	0.0007
2009	37.55	35.14	0.08	0.0008
2010	40.54	38.09	0.08	0.0008
2011	27.28	24.68	0.09	0.0006
2012	45.98	43.46	0.08	0.0008
2013	59.21	56.34	0.09	0.0010
2014	61.29	58.57	0.09	0.0011
Average	38.96	35.33	0.1268	0.0009

Figure 3. 16: Nauru GHG emissions by Gas Type trend 1994-2014 (Gg)



The gas wise GHG emissions trend 1994-2014 (Gg CO<sub>2</sub> eq.) in Nauru, shows the trend of major gas emissions; CO<sub>2</sub> dominated and contribute the highest share of emission during the period, followed by CH<sub>4</sub> and N<sub>2</sub>O. The trend is expected to follow in future as well considering the increase in fossil fuel consumption in Nauru. However, methane emissions may also increase significantly, if no waste management activities are implemented in near future.

Figure 3. 17: Nauru Sectoral GHG emissions trend 1994-2014 (Gg CO<sub>2</sub>e)



The sectoral GHG emissions trend 1994-2014 (Gg CO<sub>2</sub> eq.) in Nauru, shows the trend of major GHG emissions' fluctuations was in waste and energy sector since 1994 to 2014 (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 increase in waste sector emissions is due to unmanaged waste practices and emissions from accumulated waste over the period. The detailed sectoral and sub-sectoral analysis will be discussed in the following section of the report.

### 3.9.1 Memo Items

In accordance with 2006 IPCC guidelines, CO<sub>2</sub> 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.

### 3.9.2 International Bunkers

International bunkers include aviation and navigation. Emissions from marine transportation are not estimated due to lack of data. CO<sub>2</sub> emissions from international aviation for the year 2007-2014 were estimated and presented in the following table, while emissions from other gases were insignificant. These emissions are not counted under national total GHG emissions.

Figure 3. 18: Nauru Aviation Sector GHG emissions Gg CO<sub>2</sub>e: 2007-2014

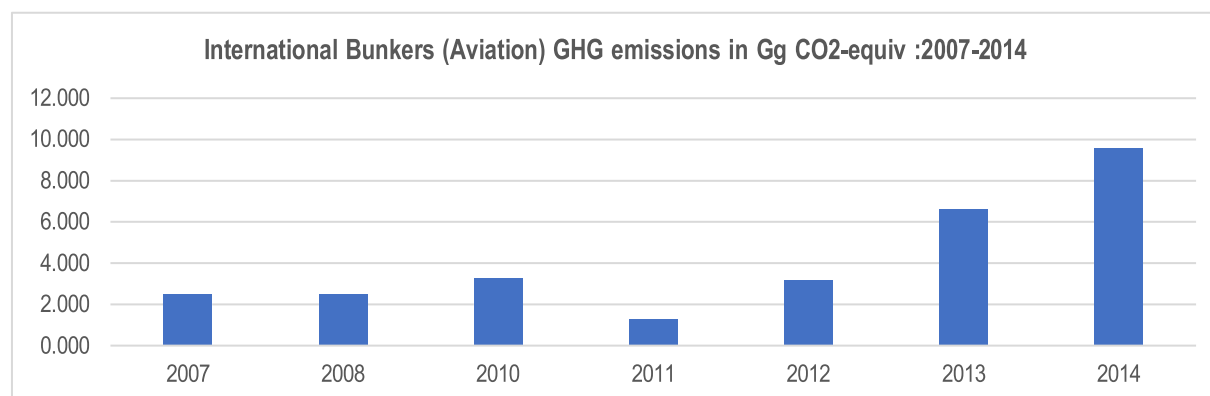


Table 3. 10: International Bunkers (Aviation) GHG emissions Gg CO<sub>2</sub>e trend, 1994-2014

International Bunkers	Total GHG emissions in Gg CO <sub>2</sub> -equiv (CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O)									
	1994*	2000**	2007	2008	2009	2010	2011	2012	2013	2014
Aviation	13.098	NE	2.475	2.479	NE	3.291	1.283	3.170	6.634	9.595

NE: Not Estimated

### 3.9.3 Biomass

The land and biomass availability in Nauru is very limited; CO<sub>2</sub> 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<sup>2</sup> 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.

## 3.10 Nauru: Sectoral GHG Emissions: 2007-2014

The above section presents the Nauru's GHG Inventory for year 2007-2014 and GHG emission trends from 1994-2014. The emission data suggest three major sectors contributing Nauru's 100% GHG emissions i.e. Energy, Waste and Agriculture-Livestock. The follow section of this report presents these sector and sub-sector analysis and GHG emission sources.

### 3.10.1 Energy Sector

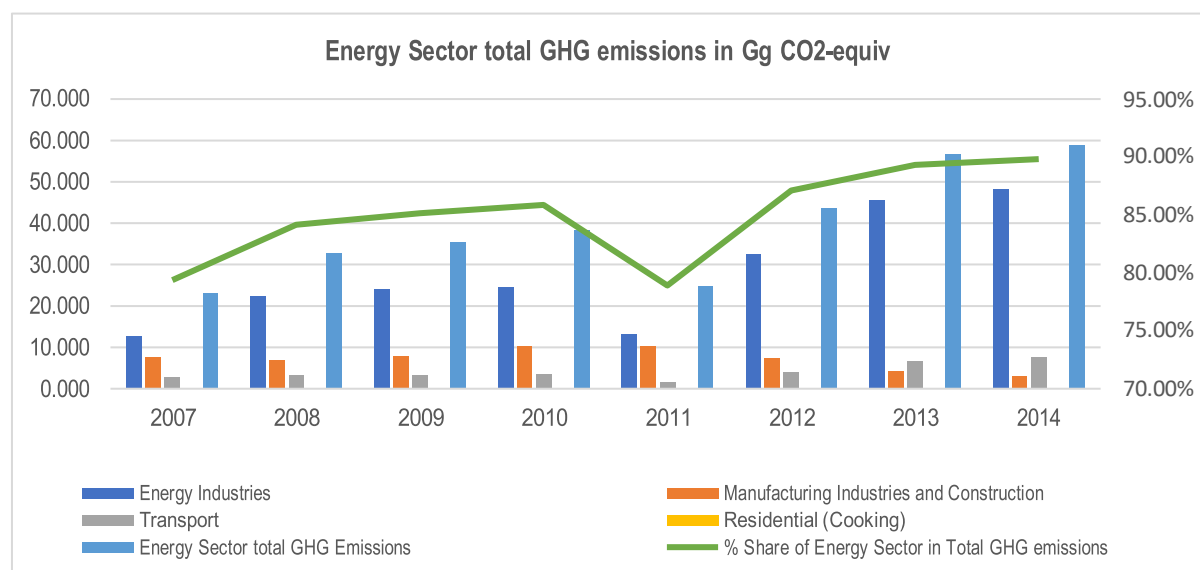
As discussed in the previous section of the report, the energy sector is the predominant emitter of GHGs in Nauru. The calculation of overall emissions in this sector was relatively straightforward once the imported quantity of fossil fuel was known (activity data). The difficulty for Nauru has been in terms of the sectoral breakdown of emissions, given that there were no energy balances for the country available; further the sectoral fuel sales forthcoming from the fuel suppliers/retailers are not available. An attempt was made using some available data from stakeholders and proxy data to estimate the sectoral emissions.

The sectoral data was entered into IPCC Inventory Software (Version 2.54- June 2017) as per the requirement of standard IPCC sectoral model, the IPCC tool was customized for specific requirement of GHG emissions calculation for Nauru i.e. by using the default emission factors for energy conversion and IPCC AR5 GHG emission factors. The result gives a sectoral breakdown of Nauru's energy sector CO<sub>2</sub> emissions for the period 2007 to 2014. The IPCC inventory software calculates direct CO<sub>2</sub> emissions and nonCO<sub>2</sub> emissions (CH<sub>4</sub> and N<sub>2</sub>O) for this sector; further other gases like SO<sub>x</sub>, NO<sub>x</sub> and NMVOC were negligible and outside the estimated accuracy of the main CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions.

**Table 3. 11: Energy Sector Emissions (in Gg CO<sub>2</sub>-equiv): 2007-2014**

GHG Sources	Energy Sector total GHG emissions in Gg CO <sub>2</sub> -equiv (CO <sub>2</sub> , CH <sub>4</sub> and N <sub>2</sub> O)								
	2007	2008	2009	2010	2011	2012	2013	2014	Average
Energy Industries	12.643	22.457	24.118	24.592	13.073	32.399	45.677	48.175	27.892
Manufacturing Industries & Construction	7.696	6.897	7.863	10.278	10.224	7.421	4.321	2.928	7.203
Transport	2.725	3.284	3.373	3.420	1.495	3.862	6.580	7.625	4.045
Residential (Cooking)	0.000	0.000	0.000	0.000	0.000	0.000	0.085	0.198	0.035
Energy Sector total GHG Emissions	23.063	32.639	35.353	38.289	24.792	43.682	56.663	58.925	39.176
% Share of Energy Sector in Total GHG emissions	79.36%	84.14%	85.15%	85.87%	78.90%	87.12%	89.31%	89.82%	86.68%

**Figure 3. 19: Energy Sector GHG Emissions: 2007-2014**



The energy sector in Nauru is highly depended on the imported fossil fuels mainly (Diesel, Petrol, LPG). The imported petroleum fuels 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, Nauru Phosphate Corporation (RONPHOS) and Rehab Centre. 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, LPG for cooking and Petrol for Transportation. Fuel oil was also imported by Government in the 1990s for the phosphate industry; presently import of fuel oil continue today but are handled by RONPHOS directly. 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, however the fuel consumption in Nauru is heavily dependent on the RONPHOS operation and demand. Nauru's tank farm has a capacity of 17,300 kilolitres and average consumption is about 9-10 thousand kilolitres with average consumption per day at 26 litres; However, the tank farm is never at full capacity.

There is a very limited data on the segregation of fuel use between different sectors and sub-sectors. Below table presents the approximate segregation of imported fuel oil. Nauru is 99% dependent on diesel fuel for electricity generation. 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 3. 12: Estimated Average Petroleum Fuel Demand in Nauru**

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

Based on the petroleum fuel demand in Nauru; 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 2007-2014. Percentage distribution of fuel consumption in energy sector presented in Table.

**Table 3. 13: Percentage distribution of fuel consumption in energy sector**

Fossil Fuel Consumption			
Diesel	Petrol	LPG	Jet Fuel (DPK)
100%	100%	100%	100%
Energy Sector Electricity Generation, Mining Sector- <i>RONPHOS</i>	Road Transport	Residential/Cooking	International Aviation

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 (Electricity Generation)
- Manufacturing Industries and Construction (Mining Sector-*RONPHOS*)
- Road Transport
- Residential (Cooking)

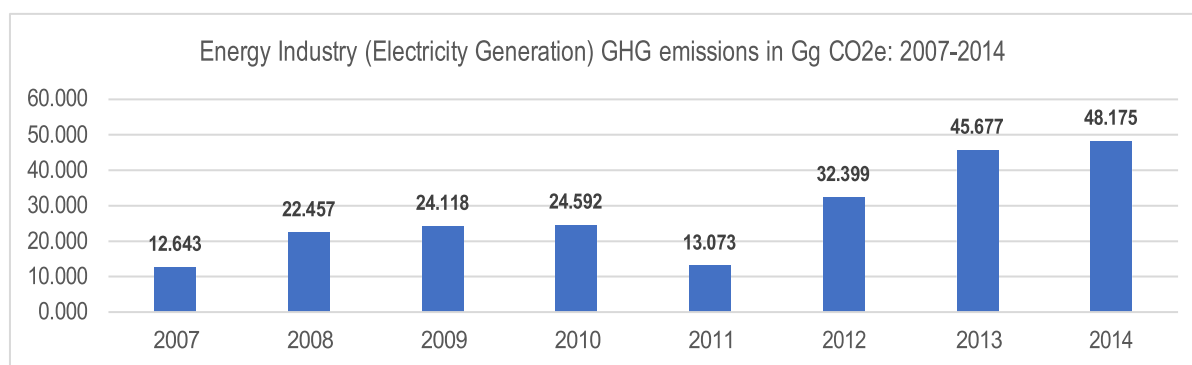
The GHG inventory of Nauru for year 2007-2014 presents that, the energy sector was the major dominant source of GHG emissions. GHG estimation from energy sector is based on data from Department of Commerce, Industry and Environment, Planning and Aid Division (PAD), Nauru Utilities Corporation (NUC), 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. Small amounts of Kerosene and LPG are mainly used for cooking. The following figure presents the total GHG emissions in Gg CO<sub>2e</sub> from energy sector and different sub sectors like Energy Industry (Electricity Generation), Manufacturing (*RONPHOS*), Road Transport and Residential sub-sector of energy sector.

The data represents that, the total GHG emissions from energy sector has increase from 2007-2014; however, the percentage share of energy sector emissions has decreased in total GHG emissions from Nauru. This clearly indicates increased contribution of other GHG sector in Nauru i.e. Waste Sector.

### **3.10.2 Energy Industry (Electricity Generation)**

Energy industries is the first bigger emitter under energy sector and remains 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. Almost all households in Nauru relied on the Government for supplying electricity (99%). A very small minority of households in Ijuw and Denigomodu used their own generator as the main source of electricity (Nauru Energy Road Map 2014 – 2020). Nauru is 99% dependent on diesel fuel for electricity generation (SPC, 2012).

**Figure 3. 20: Energy Industry (Electricity Generation) subsector GHG Emissions: 2007-2014**



Electricity is supplied by a single power station operated by Nauru Utilities Corporation (NUC). The phosphate company, RONPHOS generates its own industrial power, further The Australian Government’s Regional Processing Centres and the new jail generate their own power with their own Diesel generation sets and utilize them in addition to the grid power. On an average, 99.95% of total energy consumed in Nauru was supplied from imported petroleum products, with the remaining 0.05% met by solar power from 40kW grid-connected solar photo voltaic (PV) system at Nauru College. By 2017 solar contribution was increased to 3.35% by adding new solar PV plant at Buda (500kWp), Noddy building (138 kWp) and NUC office solar unit.

NUC’s main powerhouse is in Aiwo. There is a theoretical total of 12.6 MW of generating power available. This is within demand forecasts and allows for operation at 80% capacity and allowances for extended maintenance if necessary. However due to generator breakdowns and lack of spare parts, actual generation is closer to 4 MW peak, and an annual average of 58 MWh per day. Further, poor generation efficiency about 3.5 kWh/litre, higher distribution losses approximately 34% and lack of demand side energy efficiency increase the economic burden and leads to higher GHG emissions in Nauru.

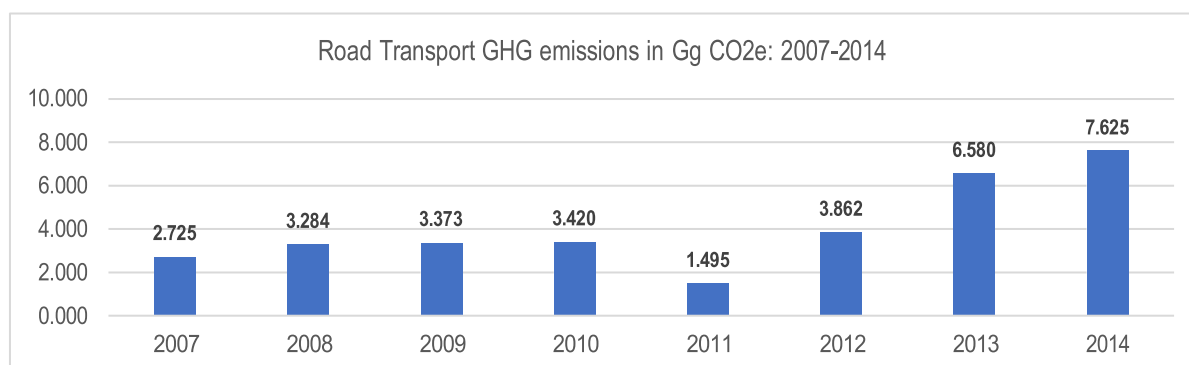
Maximum electricity demand in Nauru was once more than 7 MW but has dropped, largely due to the loss of industrial demand, to around 3.6 MW dominated by domestic usage. An additional 2.5 MW demand is expected by addition of new consumers like Ronphos phosphate drier, The Rehabilitation Corporation crusher, the Regional Processing Centres 1, 2 and 3, the Refugees camps the Anibare Workers village, and new demand. The weekday baseload is around 2 MW. 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 of electricity.

### **3.10.3 Road Transport**

It is observed that the share of GHG emission from transport sub-sector (under energy sector) is the second largest source of GHG emissions. Most of emissions from this sector is CO<sub>2</sub> emissions resulting from the combustion of gasoline (petrol) 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.). The 2011 census counted 573 motor cars 1066 motor bikes, 98 trucks, vans or minibuses and 736 bicycles on the island. Given that the island is only 20 km in circumference and 21 km<sup>2</sup> in area.

However, the use of bicycles is low due to the danger of attacks from the large number of roving dogs in the country.

**Figure 3. 21: Road Transport subsector GHG Emissions: 2007-2014**



The mitigation options for the transport sector may include, modern public transport system may be investigated (there is none at present) but with such low population numbers public transport is difficult in terms of cost effectiveness. In terms of transport the National Road Map report suggests electric vehicles, but this technology may not be attractive in the short term due to the additional maintenance and servicing constraints that this relatively new technology would present for such a low volume of vehicles.

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

### 3.10.4 Manufacturing Industries and Construction and Other Sub -Sectors

Manufacturing Industries and Construction sub sector accounts for remaining GHG emissions from Diesel consumption under the energy sector. The Nauru Phosphate Corporation became the Republic of Nauru Phosphate Corporation (RONPHOS) is the only industry categorized under this subsector. RONPHOS is one of the bigger petroleum fuel private importers (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 average Phosphate production by RONPHOS during 2007-2014 was 250,000-300,000 Tonnes per year and average fuel consumption (Diesel/Waste Oil) litre per ton of Phosphate production.

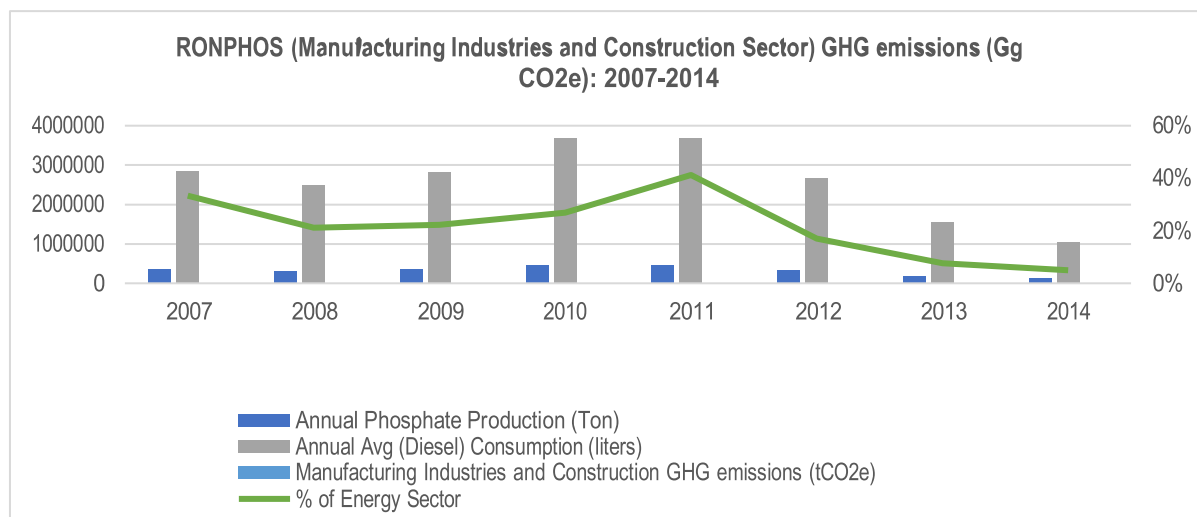
The annual production of Phosphate and average Diesel consumption by RONPHOS is presented in the table below. The GHG emissions are calculated using the tier-1 approach multiplying the activity data with GHG emission factor.

**Table 3. 14: Annual Phosphate Production and Diesel Consumption by RONPHOS: 2007-2014**

RONPHOS	Operational Data							
	2007	2008	2009	2010	2011	2012	2013	2014
Phosphate Production (Ton)	354,927	309,981	352,347	461,932	459,525	333,547	194,213	131,581
Annual Avg Fuel Consumption (Litres)	2,839,412	2,479,848	2,818,772	3,695,456	3,676,200	2,668,376	1,553,704	1,052,644

The fuel consumption and GHG emissions from RONPHOS (Manufacturing Industries and Construction Sector of Nauru) depends on the Phosphate mining and export and fluctuation in operation evident in the data for year 2007-2014. No major change in this sector expected in the future emission scenario as well.

Figure 3. 22: RONPHOS (Mfg, INd & Cont subsector) GHG emissions: 2007-2014



### 3.10.5 Residential

Residential sub-sector in Nauru is the fourth source of GHG emissions and constitutes small but important segment of energy sector emissions. As per Nauru Census Report 2006 and 2011, the number of household (average household size 6 person/HH) are as follows:

Table 3. 15: Population and Households: 2007-2014

Nauru Population	2006 *	2007	2008	2009	2010	2011**	2012	2013	2014
Total Population	9233	9426	9623	9825	10031	10,084	10263	10445	10630
Households	1538	1597	1631	1665	1700	1,647	1710	1740	1771

Note: 2006\* and 2007\*\* Census year

The residential sector energy requirement is mainly for Illuminating/lighting, cooking, refrigeration, and electric/electronic appliances (Illuminating bulbs and tubes, refrigerators, freezers, Air conditioners, Small electrical appliances, Computers including printers, Microwave Ovens, Mobile phones, Water heaters, Fans, others.).

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.

However detailed data on residential sector demand profile is not available. The fuel (LPG) used for the cooking purposes in households and small commercial establishment (hotels, restaurants etc.) are covered under the GHG assessment for this sector; further LPG

consumption data was available for year 2013 and 2014; hence GHG is accounted for those years only.

**Table 3. 16: Residential Sector -Cooking Fuel (LPG) Consumption and GHG emissions Gg CO2e : 2013-2014**

LPG (Lava Gas Import)	2013	2014
LPG -Consumption (Litres)	54,000	1,26,000
GHG emissions in Gg CO2e	0.0847	0.1976

Further there is no biofuel development project has been implemented or proposed in Nauru. Hence CO<sub>2</sub> emission from biomass is not estimated.

### 3.10.6 Carbon Dioxide Emissions from the Energy Sector Using the Reference 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<sub>2</sub> emissions for the year 2014 using reference approach were 57.95 Gg which is close to the 58.56 Gg of CO<sub>2</sub> emissions estimated using sectoral approach. The difference between the outputs from the two approaches is -1%, which is very close. The table below presents the calculation results using reference and sectoral approach.

**Table 3. 17: Energy Sector CO2 Emissions using Reference and Sectoral Approach, 2014**

Reference Approach				Sectoral Approach		Difference	
Apparent Consumption (TJ)	Excluded Consumption (TJ)	Apparent Consumption - Excluding Non-energy uses (TJ)	CO2 Emission (Gg)	Energy Consumption (TJ)	CO2 emission (Gg)	Energy Consumption (%)	CO2 emission %
797.79549	0	797.79549	57.95986	797.79551	58.567	0%	-1%

## 3.11 Industrial Processes

This sector covers GHG emissions from industrial processes as an output of non-energy related activities. In Nauru this sector is not present except phosphate mining process. Further, the GHG emissions from this sector are not estimated, only the direct energy consumption for 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 under the manufacturing industries & construction sector. Considering the unique national circumstances and economic structure of Nauru, GHG emissions from this sector is not expected in near future.

### 3.11.1 Solvents and Other Products Use

This sector comprises emissions (primarily Non-Methane Volatile Organic Compounds) from solvents and other products containing volatile compounds. There are no calculations and emissions factors in the 2006 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.

### 3.12 Agriculture, Forestry and Other Land Use

As discussed in previous section, there is very limited land area available in Nauru for Agriculture and Forestry. Further sufficient data was not available from agriculture, forestry and land use sector; hence this GHG inventory does not include emission from these subsectors (N<sub>2</sub>O Emissions from Agricultural Soil: Not estimated due to lack of data; further the 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).

The emission from Livestock farming is only sub-sector covered under this GHG inventory; livestock sector is one of the contributors of methane emissions in Nauru, GHG emissions in this sector are estimated for following categories: (i) Livestock-Enteric Fermentation, and (ii) Livestock-Manure Management.

The total share of GHG emissions from livestock was 0.377% (0.0952 Gg CO<sub>2</sub>e) in 2007 and reduced to 0.019% (0.0114 Gg CO<sub>2</sub>e) in 2014. This is mainly because the higher emissions from the energy sector and uneven distribution of the livestock in Nauru. Further, considering the limited capacity and are available for livestock farming, the emission from this sector will remain the minor emission source in future as well. However, there is further opportunity for mitigation by better manure management and improving the livestock farming practice in Nauru. Options for small scale bio-gas plant may be explored to utilize the unmanaged manure from pig farms.

Figure 3. 23: Livestock Emissions in total GHG Gg CO<sub>2</sub>e: 2007-2014

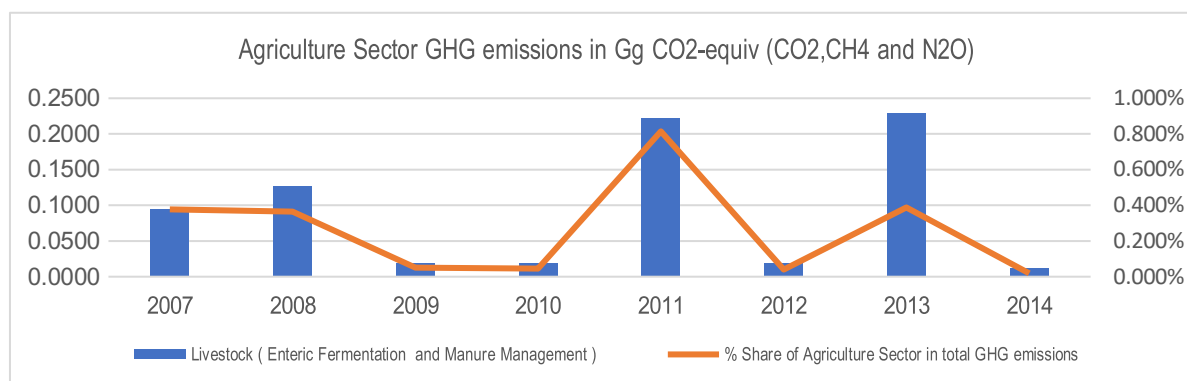
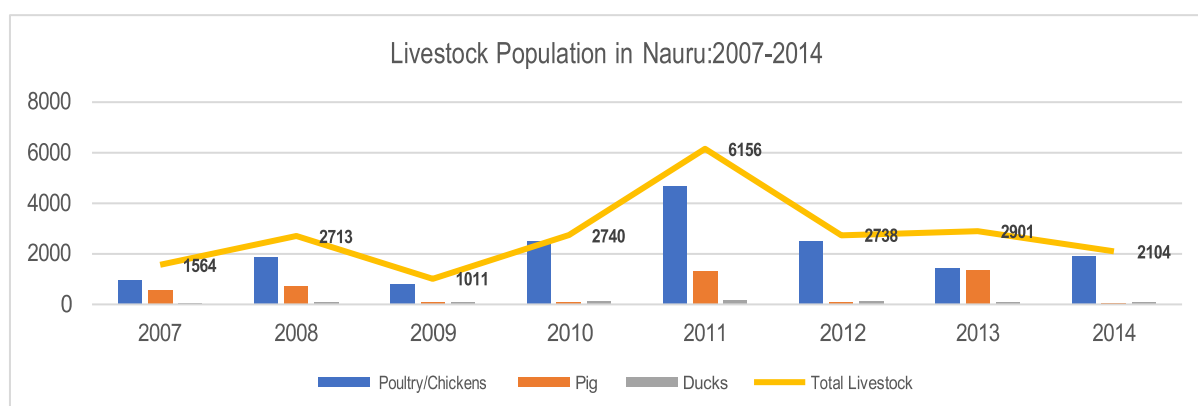


Figure 3. 24: Livestock Emissions Gg CO<sub>2</sub>e: 2007-2014



The total share of GHG emissions from livestock was 0.327% (0.0952 Gg CO<sub>2</sub>e) in 2007 and reduced to 0.017% (0.0114 Gg CO<sub>2</sub>e) in 2014. This is mainly because the higher emissions from the energy sector and uneven distribution of the livestock in Nauru. Further, considering

the limited capacity and are available for livestock farming, the emission from this sector will remain the minor emission source in future as well. However, there is further opportunity for mitigation by better manure management and improving the livestock farming practice in Nauru. Options for small scale bio-gas plants may be explored to utilize the unmanaged manure from pig farms.

Data used for estimating GHG emissions from Livestock sector was sourced from Nauru Livestock Census 2007 and Census 2011, Agriculture 2012/2013 HIES, the data for the rest of the years extrapolated using the livestock population growth rate. High level of data uncertainty observed in the different report, but in the absence of the any further reference the available data used for calculation from livestock emissions. The data related uncertainty shall be addressed during the upcoming reporting years. The livestock population in Nauru presented in the table below:

**Table 3. 18: Livestock Population in Nauru: 2007-2014**

Livestock - Number of animals (head)									
Sl. No.	Species / Livestock category	2007	2008	2009	2010	2011	2012	2013	2014
1	Poultry/chickens	948	1,882	800	2,500	4,683	2,500	1,453	1,926
2	Pig	563	749	100	100	1,306	100	1,360	61
3	Ducks	53	82	111	140	167	138	88	117
Total		1,564	2,713	1,011	2,740	6,156	2,738	2,901	2,104

The two sources of GHG emission from Livestock farming in Nauru, are as follows:

**Enteric Fermentation:** Enteric Fermentation is the fermentation that takes place in the digestive system of animals. 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. 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 and hence is last source of GHG emissions in the country.

**Manure Management:** Systematic management of manure from livestock is not practiced 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 IPCC guidelines. This can be reduced by introducing animal waste management systems.

**Table 3. 19: Livestock Emissions in Nauru: 2007-2014**

Livestock Emissions	Livestock Subsector GHG emissions in Gg							
	2007	2008	2009	2010	2011	2012	2013	2014
Livestock (Gg CO <sub>2</sub> e)	0.0952	0.1270	0.0192	0.0183	0.2222	0.0183	0.2294	0.0114
Enteric Fermentation (Gg CH <sub>4</sub> )	0.0006	0.0007	0.0001	0.0001	0.0013	0.0001	0.0014	0.0001
Manure Management (Gg CH <sub>4</sub> )	0.0028	0.0038	0.0006	0.0006	0.0066	0.0006	0.0068	0.0003

### 3.13 Waste Sector

This section reports estimated emissions of methane from the waste sector for the national Greenhouse Gas Inventory. This sector contains mostly methane (CH<sub>4</sub>) emission estimate from the following key sources or key categories:

- Solid Waste Management and Disposal (excluding biological waste)
- Domestic and Commercial wastewater handling (there is no industrial wastewater generation)

A very small amount of (N<sub>2</sub>O) emitted from wastewater disposal. No data was available on municipal solid waste incineration; further incineration of waste is not a very common practice therefore the emissions will be insignificant. Methane emissions from waste sector for 2007 – 2014, presented following graph and table below. The total GHG emissions increased from 2.091 Gg CO<sub>2</sub>e in 2007 to 2.357 Gg CO<sub>2</sub>e in 2014, showing a net increase of 12.7% during the reporting period (2007-2014). However, share of waste sector in total GHG emissions from Nauru was reduced from 8.3% in 2007 to 3.8% in 2014. This was mainly due to higher GHG emissions from the energy sector. The emissions from MSW subsector increased from 1.877 Gg CO<sub>2</sub>e in 2007 to 2.124 Gg CO<sub>2</sub>e in 2014; however, the wastewater emission remains almost similar during the period i.e., 0.214 Gg CO<sub>2</sub>e in 2007 to 0.233 Gg CO<sub>2</sub>e in 2014.

Figure 3. 25: Waste Sector Emissions Gg CO<sub>2</sub>e: 2007-2014

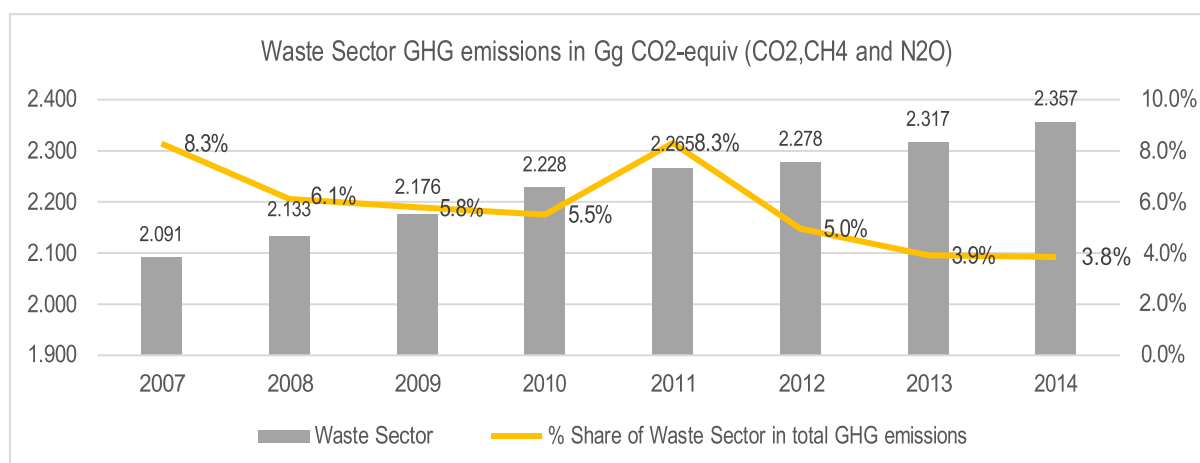


Table 3. 20: Waste Sector Emissions in Nauru: 2007-2014

Waste Sector	Waste Sector GHG emissions in Gg CO <sub>2</sub> -equiv							
	2007	2008	2009	2010	2011	2012	2013	2014
Waste - Municipal Solid Waste (MSW)	1.877	1.917	1.957	1.998	2.040	2.050	2.087	2.124
Waste - Waste Water	0.214	0.217	0.219	0.231	0.226	0.228	0.230	0.233
Waste Sector	2.091	2.133	2.176	2.228	2.265	2.278	2.317	2.357

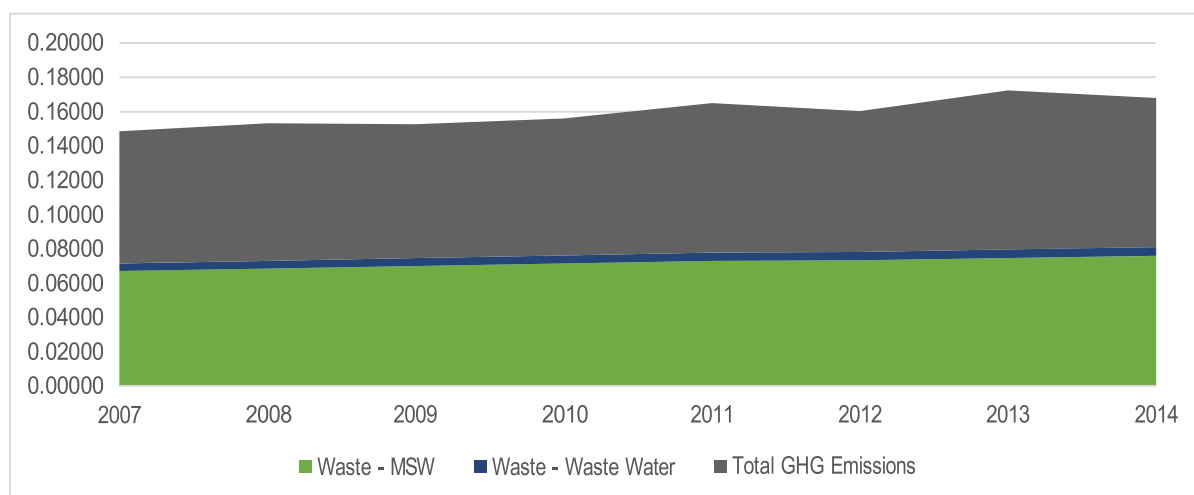
The figure below is the graphical representation of GHG emissions from different key categories within the waste sector i.e. MSW and WW. It is apparent that GHG emissions from MSW and WW sub-sector is increasing in Nauru, but overall emissions contribution is very similar from 2007 and 2014. The linear increase in GHG emissions from the solid waste is due to the use of a First Order Decay (FOD) model, which assumes that not all methane is

generated the year the waste is deposited but it degrades slowly using first order and releases methane in first few years.

Figure 3. 26: Waste sub-sectoral GHG Emissions Gg CO2e: 2007-2014



Figure 3. 27: Waste sub-sectoral Methane Emissions Gg: 2007-2014



The total methane emissions from the waste sector (both MSW and WW) increased from 0.0715 Gg in 2007 to 0.0810 Gg in 2014. The increase was almost linear across the reporting period, the percentage change with respect to 2007 emission was approximately 13% for years 2007 – 2014. Similarly, the total N2O emissions from wastewater sub-sector increased from 0.00063 Gg in 2007 to 0.00110 Gg in 2014. The increase was not linear across the reporting period, the percentage change with respect to 2007 emission was approximately 75% for years 2007 – 2014.

Table 3. 21: Waste Sector CH4 and N2O Emissions Gg: 2007 – 2014

Waste Sector Methane Emissions (Gg)	CH <sub>4</sub>	N <sub>2</sub> O
2007	0.0770	0.00063
2008	0.0802	0.00072
2009	0.0780	0.00084

Waste Sector Methane Emissions (Gg)	CH <sub>4</sub>	N <sub>2</sub> O
2010	0.0798	0.00080
2011	0.0873	0.00059
2012	0.0822	0.00083
2013	0.0928	0.00104
2014	0.0870	0.00110
Average (2007-2014)	0.0830	0.0008

The increase in the cumulative amount of waste deposited in the landfill and solid waste disposal sites and increase in BOD values in recent years could contribute to this trend. It is apparent that methane emissions from the SWD is increasing quite rapidly in recent years and will continue to increase rapidly (see discussion below), if the landfill gas is not recovered.

### **3.13.1 Municipal Solid Waste (MSW) Sub-Sector**

The key source of methane emissions under solid waste management and disposal includes 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 continues 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 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.

In the absence of actual monitored data, the MSW generation in Nauru estimated from the population of Nauru and using average 0.66 kg/person/day and waste composition was considered as the regional Weight of waste component (wt%) in Pacific island countries. The MSW generation and waste composition considered for the current inventory calculation is provided in Figure 3.28.

Figure 3. 28: Population and MSW Generation in Nauru: 2007-2014

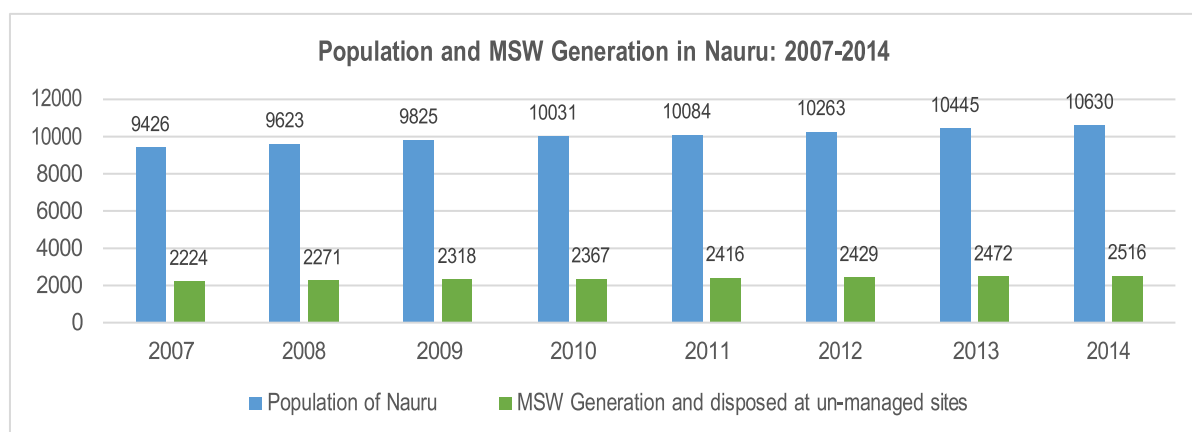
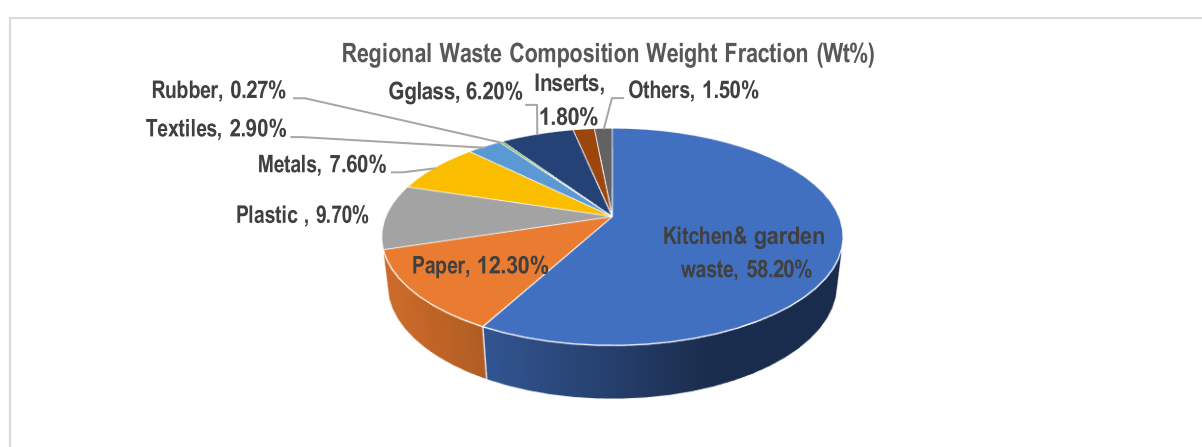


Figure 3. 29: MSW Composition - Weight of waste component (wt%)



The uncertainty of the data can be removed by conducting the sector specific study in Nauru and improving the data management practices in Nauru for future GHG inventory.

### 3.13.2 Wastewater (WW) Sub-Sector

There is not appropriate information available for wastewater generation, sewerage treatment and 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 wastewater and sludge as by-products. The wastewater is generally discharged into the sea. The direct discharge of wastewater and sewerage to sea, negatively impacting the coastal fisheries (productivity of coral reef fish), degrading the coral reef fish habitats, coastal fisheries, and aquaculture. Fish is an important of Nauru's food chain and economic activity; the gradual degradation may pose serious risk to the future of Nauru.

The GHG emissions from wastewater includes Methane and N<sub>2</sub>O emissions, in the absence of the monitored data; wastewater generation estimated from the population and IPCC default parameter for Oceania region. The per capita wastewater generation was calculated as per the freshwater consumption i.e., 60% of freshwater consumption (Per capita freshwater consumption in Nauru was 130 Liters Per Day). The parameter used for estimation of GHG emissions is presented in the following table.

**Table 3. 22: Wastewater generation in Nauru: 2007 – 2014**

Data/Parameters	2007	2008	2009	2010	2011	2012	2013	2014
Total Wastewater generated (MLD)	0.74	0.75	0.77	0.78	0.79	0.80	0.81	0.83
Wastewater and sewage treatment (Septic System) (MLD)	0.32	0.33	0.33	0.34	0.34	0.35	0.35	0.36
Wastewater Source	Domestic	Domestic	Domestic	Domestic	Domestic	Domestic	Domestic	Domestic
Wastewater's organic content (Domestic Effluent) - mg/litre	52	52	52	52	52	52	52	52
Wastewater's organic content (Septic System) -mg/litre	150	150	150	150	150	150	150	150
Wastewater treated (MLD)	0	0	0	0	0	0	0	0

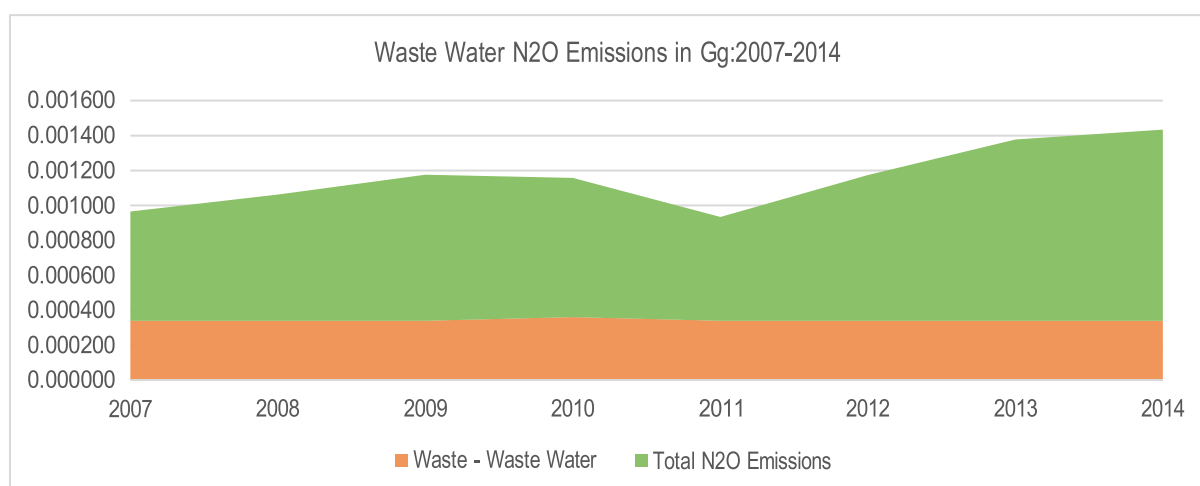
The wastewater emissions CH<sub>4</sub> and N<sub>2</sub>O are estimated using the IPCC methodology and default value for Oceania region. The methane and N<sub>2</sub>O emissions from the wastewater during the period 2007-2014 presented in the table below:

**Table 3. 23: Wastewater GHG emissions in Nauru: 2007 – 2014**

Wastewater Emissions	2007	2008	2009	2010	2011	2012	2013	2014	Avg.
CH <sub>4</sub> Emissions (Gg)	0.00444	0.00453	0.00462	0.00482	0.00485	0.00493	0.00502	0.00511	0.0048
N <sub>2</sub> O Emissions (Gg)	0.000339	0.000339	0.000339	0.000361	0.000339	0.000339	0.000339	0.000339	0.000342
Total CO <sub>2</sub> eq	0.214	0.217	0.219	0.231	0.226	0.228	0.230	0.233	0.225

Wastewater sector is one of the major contributors in total N<sub>2</sub>O emissions in Nauru depicted in the following graph:

**Figure 3. 30: Wastewater N<sub>2</sub>O Emissions in Nauru: 2007-2014**



The data uncertainty and default values used for the waste sector emission shall be overcome by the proper data monitoring and reporting, though the wastewater GHG emission are not significant in Nauru but this poses threat to Nauru. Government of Nauru shall look in to mitigating emissions from this sector by deploying appropriate wastewater disposal and treatment process.

### **3.13.3 Conclusion - Observations and Recommendations**

The 2007 to 2014 GHG emissions results revealed a reasonably constant trend over the reporting period with the annual variation dominated by fuel consumption in energy sector (mostly the mining operation and related electricity and fuel consumption). The compilation of the GHG inventory continues to be a challenge, especially in the availability of activity data for computation of GHG emissions. The fossil fuel consumption in Nauru continued to be the main contributor of GHG emissions, to the electricity generation and transportation and was found to be a key category; therefore, it is important that activity data from this sector is always available to ensure that the results are accurate. It is thus recommended in the longer term, a fuel database to be maintained in conjunction with the tank farm database (that records import and offtake by the major consumers).

In terms of sectoral data approach for future GHGIs, it is recommended that the Bureau of Statistics directly obtain fuel import/consumption data from NUC, RONPHOS, Rehab and Lava Gas etc. Moreover, cross verify the data with tank farm data.

The waste sector (MSW and WW) was also highlighted as an important sector and thus it is recommended that the assessment of waste (MSW and WW) generation and disposal to be monitored. Further, disposal of waste can pose serious health risk in Nauru, hence attempt shall be made to implement scientific treatment method for MSW and WW.

In the agriculture and forestry sector there is lack of data and detailed information, hence the agriculture and forestry sector data shall be monitored, and database shall be used in future GHG inventory. Further, huge data uncertainty observed in livestock numbers and manure management information; the database shall be updated for future GHG inventory.

## Executive Summary: Mitigation Assessment

Nauru's Energy Roadmap, endorsed by the government in 2014, outlines a comprehensive strategy across six key thematic areas: power, petroleum, renewable energy, demand-side energy efficiency, transport, and institutional strengthening and capacity building. The roadmap's implementation progress is instrumental in helping Nauru adapt to climate change impacts and reduce disaster risks. Institutional strengthening activities are highlighted as a crucial component of this roadmap.

The Energy sector in Nauru is heavily reliant on imported fossil fuels and is a significant contributor to the nation's greenhouse gas emissions. The government has directed its focus on this sector to enhance resilience and reduce dependence on imported fuel. Key areas of improvement include addressing the energy supply and demand landscape, optimizing institutional arrangements, harnessing the potential of renewable energy and energy efficiency, and ensuring comprehensive data management for effective energy planning.

The Nauru Energy Road Map (NERM) of 2014 builds upon the energy development objectives outlined in the National Sustainable Development Strategy and the National Energy Policy Framework. It aims to align with long-term development goals, including governance stability, improved public services, revenue diversification, land rehabilitation, and domestic food production. By 2020, the NERM targets include achieving 24/7 grid electricity supply with minimal interruptions, sourcing 50% of grid electricity from renewable sources, and achieving a 30% improvement in energy efficiency in residential, commercial, and government sectors.

*Table ES-4.1: Nauru Energy Road Map Summary Strategies*

Sector	Strategy	Estimated million A\$	Budget
Power	Improve power sector operation management and efficiency. Recover full costs	9.645	
Petroleum	Upgrade the tank farm	0.425	
Renewable Energy	Put in place 8.5MW Solar PV. Build capacity to operate system	51.375	
Demand side energy efficiency	Plan and implement demand side energy efficiency measures introduce energy labelling and MEPS	0.705	
Transport	Improve transport efficiency and investigate transport fuel substitutes	0.33	
Institutional strengthening and capacity building		0.82	
Total Cost NERM		63.3	

Nauru has developed comprehensive Mitigation Action Plans within the framework of the Energy Road Map, each aligned with one of the six thematic areas of the Road Map. These action plans are instrumental in guiding various stakeholders toward achieving the roadmap's ambitious targets. While all stakeholders in the energy sector play a role, the Nauru Utilities Corporation (NUC) and the Commerce, Industry, and Environment Department (CIE) primarily lead most of these actions.

The six action plans encompass the following themes: 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 (RE)
- Demand Side Management (DSM) and Energy Efficiency (EE)
- 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 activity 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.

Each action plan includes essential components such as policy statements (drawn from the National Energy Policy Framework), detailed strategies, specific activities under each strategy, responsible organizations, activity importance classification, estimated timeframes, expected results, and indicative budgets. These action plans are subject to regular revisions to adapt to changing circumstances and progress.

### **Climate Change Mitigation Sectors in Nauru**

The Nauru Energy Roadmap (NERM) and various strategies have been implemented to address climate change mitigation in several sectors. Here is an overview of the key sectors and actions taken:

**Energy Sector:** Nauru's energy sector is heavily reliant on imported fossil fuels and is a significant contributor to the country's greenhouse gas (GHG) emissions.

The NERM was designed to contribute to long-term development goals, including stable governance, improved social services, a diverse economy, land rehabilitation, and domestic food production.

Targets of the NERM by 2020 include 24/7 grid electricity supply with minimal interruptions, 50% of grid electricity supplied from renewable sources, and a 30% improvement in energy efficiency in residential, commercial, and government sectors.

Strategies include reducing power outages, improving customer service, and enhancing supply chain management.

The development of renewable energy sources, particularly solar PV, is a focal point for achieving energy sustainability and reducing reliance on imported fuels.

### **Renewable Energy Goals:**

- Nauru aims to meet 50% of its electricity needs from renewable energy sources by 2020.
- Solar PV installations have increased to 3.3% of total energy produced in 2017, up from 0.7% in 2016.
- Proposed projects include rooftop solar installations, ground-mounted solar panels, and the expansion of solar PV capacity through funding from various sources, including the Green Climate Fund (GCF).

The NERM report acknowledges that achieving these renewable energy targets requires addressing storage solutions due to intermittent energy production.

**Energy Efficiency Initiatives:** Energy efficiency is a crucial aspect of Nauru's mitigation efforts, particularly in the residential and commercial sectors. Challenges include artificially low residential electricity tariffs and a high ownership of electrical devices.

- Proposals involve energy-efficient home designs, energy labelling, penalties for power theft, discouraging energy-inefficient appliances, and public awareness programs.
- Energy audits are suggested for commercial and industrial sectors to identify energy-saving opportunities.

### **Transport Sector:**

- The transport sector is a focus for examining energy efficiency and renewable energy options.
- Proposals include vehicle import regulations, reducing import duties on efficient vehicles, promoting bicycles, motorcycles, and electric bicycles, and exploring electric vehicles.
- Efforts are made to improve land transport efficiency, reduce the import of vehicles with large engine displacements, and incentivize energy-efficient vehicle use.

### **Waste and Wastewater:**

- Nauru faces water scarcity issues and seeks to mitigate environmental impacts in waste and wastewater management.
- Proposed measures include the installation of effluent and sewerage treatment plants to manage wastewater effectively, potentially restoring a defunct sewerage treatment plant.

### **Nauru Energy Roadmap 2018-2020:**

The NERM for 2018-2020 aims to reconfirm Nauru's commitment to sustainable energy use through renewable energy and energy efficiency. The NERM outlines strategies, activities, and lead agencies for each sector, building on previous plans and policies.

These climate change mitigation efforts in Nauru reflect the nation's commitment to reducing its greenhouse gas emissions, transitioning to renewable energy sources, and improving overall energy efficiency to create a more sustainable and resilient future.

**Table ES-4.2: NERM:2018-2020 –Action Plan, Activities and Outcome**

Action Plan	Activities
<p><b>Capacity (C):</b> Efficient, robust and well-resourced institutions for energy planning and implementation.</p>	<ol style="list-style-type: none"> <li>1. Establish appropriate policies, regulations and legislation for the energy sector.</li> <li>2. Facilitate development of appropriate local skill base to meet ongoing demand in energy sector.</li> <li>3. Improve governance and accountability in the energy sector.</li> <li>4. Foster a culture of partnerships between public and private sectors including the community.</li> </ol>
<p><b>Power (P):</b> A reliable, affordable and safe electrical power supply and services.</p>	<ol style="list-style-type: none"> <li>1. Upgrade assets.</li> <li>2. Improve planning and management.</li> <li>3. Improve supply-side energy efficiency.</li> <li>4. Move toward full recovery of operating and maintenance costs.</li> <li>5. Develop and safeguard NUC staff.</li> </ol>
<p><b>Renewables (R):</b> 50% of electricity used in Nauru comes from renewable energy sources by 2020.</p>	<ol style="list-style-type: none"> <li>1. Phased implementation of large-scale solar.</li> <li>2. Investigation and implementation of other renewable energy sources.</li> <li>3. Build in-country capacity to operate and maintain solar PV systems.</li> </ol>
<p><b>Efficiency (E):</b> An efficient supply and use of energy.</p>	<ol style="list-style-type: none"> <li>1. Data collection and analysis for preparation for Demand Side Management implementation.</li> <li>2. Implementation of demand side energy efficiency.</li> <li>3. Introduction of energy labelling and Minimum Energy Performance Standards.</li> </ol>
<p><b>Fuels (F):</b> A reliable and safe supply of fossil fuels.</p>	<ol style="list-style-type: none"> <li>1. Establish an economically efficient, secure and safe National Fuel Terminal and fuel supply.</li> <li>2. Investigate ways to reduce use or find alternatives to liquid fuels.</li> </ol>
<p><b>Transport (T):</b> Policy to be developed as part of road map implementation.</p>	<ol style="list-style-type: none"> <li>1. Implementation of energy efficiency in transport.</li> <li>2. Investigate substitutes to diesel and petrol for transport.</li> </ol>

## 4 Mitigation Assessment

### 4.1 Background

Nauru is continuously raising concerns over the damage to the environment and ecosystem caused by anthropogenic Greenhouse gas (GHG) emissions and increase in temperature. Nauru has prioritised mitigation action and recognised that the rehabilitation must aim at a sustainable, steady-state economy based on renewable energy. Nauru's GHG emissions and energy sector is heavily dependent on imported petroleum products (Diesel or heavy fuel oil for electricity generation, Petrol for transport sector, Avgas/jet Kerosene for international aviation). Nauru recognises the significant GHG mitigation opportunities by reducing the fossil fuels consumption especially in the power sector through tariff reforms, efficiently using the Diesel Generator sets, reducing electricity distribution losses, inducting renewable energy technology (Solar PV systems), demand side energy management and using energy efficient products, use of alternate fuels such as LPG for cooking and solar thermal for water heating will assist in reducing the relatively high levels of domestic power consumption.

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. The policies and action of Nauru is focused with the national commitment *to improving the sustainability of energy use through renewable energy and energy efficiency to contribute to a sustainable quality of life for all Nauruans.*

**Table 4. 1: Nauru – Key Policies and Actions**

Year	Key Action/Policy/Act/Regulation
1992	Signs Climate Change Convention
1993	Ratification Climate Change Convention
1994	Rehabilitation and Development Feasibility Study (NACRDFS)
1996	National Environmental Management Strategy and National Environment Action Plan
1997	Nauru Rehabilitation Corporation Act
1998	National Economic Development Reforms
1998	Atmospheric Radiation Measurement Programme – Climate Research Station (ARM – ARCS II)
1998	National Meteorological and Hydrological Service, National Weather Service (NWS)
1999	First National Communication to UNFCCC
2001	Ratification of Kyoto Protocol
2005	Nauru National Sustainable Development Strategy (NSDS) 2005 – 2025
2008	National Energy Policy Framework (NEPF)
2008	Energy Efficiency Action Plan (EEAP) 2008-2015
2008	Price Regulation Act
2009	National Sustainable Development Strategy (NSDS) 2005 – 2025 (Revised)
2011	Nauru Economic Infrastructure Strategy and Investment Plan (NEISIP)
2011	Nauru Utilities Corporation Act

2013	Solid Waste Strategy and Solid Waste Action Plan - Draft
2014	First Nauru Energy Road Map
2015	Framework for Climate Change and Disaster Risk Reduction (RONadapt)
2015	Second National Communication to UNFCCC
2015	Nauru's Intended Nationally Determined Contribution (iNDC)
2017	Roadmap for Implementation of the Nationally Determined Contribution (NDC)
2018	Review of the Nauru Energy Road Map 2014 – 2020
2018	Nauru Energy Road Map 2018 to 2020

## 4.2 Mitigation Related Key National/Regional Policies and Programs

The Republic of Nauru (RoN) 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 Second National Communication (SNC) of Nauru was submitted to the UNFCCC in 2015. In terms of mitigation related policies and programs there are two major developments; firstly, the Nauru Energy Road Map 2014 – 2020 has been reviewed and updated with the Nauru Energy Road Map 2018 to 2020 and further a roadmap has been prepared for the implementation of the Nationally Determined Contribution (NDC). Key existing policies and new relevant updates towards the climate change mitigation present here:

### 4.2.1 National Sustainable Development Strategy (NSDS), 2005-2025

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 includes following:

- 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

**Table 4. 2: NSDS:2005-2025 – Strategies and Milestones**

Focus Area	Strategies and Milestones
<b>Environment</b>	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.
<b>Gender</b>	The NSDS update expands the coverage of gender issues in various sectors.

Focus Area	Strategies and Milestones
<b>Community Development</b>	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.
<b>Youth</b>	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.
<b>Law and Justice</b>	This is a major issue, especially regarding 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.
<b>Land</b>	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.
<b>Fisheries</b>	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.

*Table 4. 3: NSDS:2005-2025 – Sector Goals*

Sector	Sector Objectives	Sectoral Goals
<b>Economic</b>	<ol style="list-style-type: none"> <li>1. Fully rehabilitate topside with a greater area of rehabilitated land utilised for livelihood sustainability including environment conservation and protection.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>5. Improve labour market access for Nauruans leading to a higher flow of remittances.</li> </ol>	<p>Macroeconomic management: A stable macroeconomic environment conducive to private investment established.</p> <p>Agriculture: Increased level of domestic agricultural production aimed at addressing food security and healthy livelihoods</p> <p>Fisheries: Enhance development and sustainable management of marine and fisheries resources to provide sustainable economic returns</p> <p>Mining &amp; Quarrying: Efficient and effective use of mining and quarrying resources</p> <p>Commerce, Industry &amp; Business Development: Promote development of small and micro enterprises, foreign investment and economic integration into the global economy</p>

		<p>Tourism: Promote development of small-scale sustainable eco-tourism</p> <p>Financial Services: An effective, competitive and stable financial system that will enhance economic growth and development.</p>
<b>Social</b>	<ol style="list-style-type: none"> <li>1. Improve the educational system, focusing on the quality (to regional standards), scope (primary, secondary, vocational and life &amp; trade skills) and reach (new audiences such as the mature age).</li> <li>2. Provision of effective preventative health services reducing lifestyle related illness.</li> <li>3. An efficient and effective judicial system with strong, functioning law and order.</li> <li>4. Increase the use of traditional values, knowledge, skills and practices to strengthen cultural and national identity.</li> </ol>	<p>Education: Improve the quality and broaden the scope and reach of education</p> <p>Health: A healthy and productive population</p> <p>Sports: Enhanced quality of life through Sports for All</p> <p>Traditional Leadership &amp; Culture: A healthy, socio-cultural, inclusive, cohesive and self-reliant community with sustainable livelihoods</p> <p>Women &amp; Development: A just society that recognizes and respects the rights of women and promotes equal opportunities</p> <p>Youth Development: Investing in Youth – A sustained future for Nauru</p> <p>Civil Society: A robust, vibrant and effective civil society for a just and peaceful Nauru</p>
<b>Infrastructure</b>	<p>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.</p>	<p>Energy: Provide a reliable, affordable, secure and sustainable energy supply to meet socio-economic development needs</p> <p>Water &amp; Sanitation: Provide a reliable, safe, affordable, secure and sustainable water supply to meet socio-economic development needs</p> <p>Waste &amp; Sewerage: Effective management of waste and pollution that minimizes negative impacts on public health and environment</p> <p>Transport: Improve transport infrastructure and provide reliable</p>

		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
<b>Cross-cutting</b>	<ol style="list-style-type: none"> <li>1. Develop the human resources in technical, organisational and financial management capacities.</li> <li>2. A stable, trustworthy, fiscally responsible government with transparent and accountable Parliamentarians, cabinet and public service.</li> <li>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.</li> <li>4. Maintain good bilateral, region-wide and international relations and comply with international standards.</li> </ol>	<p>Public Administration: Strengthen and develop the institutional capacity of the Nauru Public Service</p> <p>Governance Institutions: Strengthen Parliament, Audit, Justice, Law, Order and Border Control</p> <p>Land: A transparent and fair land management system that supports social, economic and private sector development</p> <p>Environment: Sustainable use and management of the environment and natural resources for present and future generations</p>

#### **4.2.2 National Energy Policy Framework (NEPF)**

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. The medium-term targets for the energy sector were: *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.

#### **4.2.3 Energy Efficiency Action Plan (EEAP) 2008-2015**

EEAP 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. 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, a medium to long-term plan for 2010-2020. The latter includes strategies to establish a Demand Side Management (DSM) Team within the Power Utility (NUC), conduct loss-analysis of the electricity transmission and distribution, build capacity of local personnel, promote and demonstrate energy efficiency (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.

About Renewable Energy (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 Litre per month at the power station. As for EE, over 1,800 pre-payment 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 NUC 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 structure.

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 to provide geotechnical services, the SOPCA, and of the Secretariat of the Pacific Regional Environment Programme (SPREP).

#### **4.2.4 Nauru Energy Road Map 2018 to 2020 (Updated)**

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 first Nauru Energy Road Map was endorsed in 2014 for the period till 2020 and since its adoption, implementation has been particularly good in electricity supply. The Nauru Energy Road Map (NERM) 2014 - 2020<sup>1</sup> was developed during 2013 and built upon the energy sector development agenda outlined in the:

- National Sustainable Development Strategy 2005 - 2025 (revised 2009), and
- National Energy Policy Framework of 2009.

The purpose of the Development Strategy and Energy Policy Framework as well as the NERM is to enable the achievement of Nauru's overall vision of: "*A future where individual, community, business and government partnerships contribute to a sustainable quality of life for all Nauruans*". Through the National Sustainable Development Strategy (NSDS) consultative process, the Government of Nauru has set three ambitious targets to achieve by 2020. They are:

- 24/7 grid electricity supply with minimal interruptions
- 50% of grid electricity supply from renewable energy sources, and
- 30% improvement in energy efficiency in the residential, commercial and government sectors.

However, challenges posed by capacity issues, has limited progress in other areas. Institutional strengthening is being implemented across the board at the Nauru Utilities Corporation to address gaps, inadequacies, and the various other challenges. The purpose of the NERM:2018-2020 is to reconfirm commitments of Nauru to improving the sustainability of

energy use through renewable energy and energy efficiency to contribute to a sustainable quality of life for all Nauruans. The updated NERM<sup>35</sup> 2018 to 2020 was developed in 2017/18 after a review of the NERM 2014 - 2020, consultations in Nauru on implementation progress to 2017 and is based on the original document. The key changes include renaming the Action Plans, reducing the number of Activities to be implemented, ordering the Activities by Lead Agency and Time Frame, as well as revising wording for some of the Activities and Expected Results.

#### **4.2.5 Intended Nationally Determined Contribution (INDC)**

As per the INDC, key mitigation intervention is to replace a substantial part of the existing costly and high GHG intensive diesel generation with a large-scale grid connected renewable energy sources i.e. solar photovoltaic (PV) system which would assist in reducing the GHG emissions from fossil fuels combustion. Notably no target was given in the INDC, but the present report will investigate what might be achieved in terms of percentages RE. The National Energy Roadmap (NERM) had a target of 50% by 2020. Concurrent to the above there needs to be put in place extensive demand side energy management improvements (as NERM suggested a target of 30% savings) will complement the PV installation.

The power sector intervention given in the INDC for reducing emissions is by replacing a portion of imported diesel generated electricity with solar PV. It was calculated that 8.5 MW of installed solar PV would reduce annual emissions by around 13,000 tonnes CO<sub>2</sub> or 23% of total 2014 CO<sub>2</sub> emissions from fossil fuels. Further reductions were thought possible from energy efficiency and improved control and generation of existing supply but here options are limited, and levels of uncertainty are very high, meaning any realistic calculations of gains would be problematic. It was calculated that 15% across the board energy efficiency savings would reduce emissions by around 8,000 tonnes CO<sub>2</sub> giving a total estimated annual GHG reduction of around 21,000 tonnes CO<sub>2</sub>. The cost of the recommended mitigation measures in the INDC was thought likely to be around US\$50 million (US\$ 42 million for Solar PV and US\$ 8 million for demand side energy efficiency measures) with some uncertainty depending on the storage of energy either as electrical (Battery) or thermal (Chilled Water) to account for the high nighttime electrical load on the island.

#### **4.2.6 Pacific Island Regional Policies and Programs**

Nauru is an active participant in Pacific Island regional affairs and has signed on to several 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.

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<sup>35</sup> The development of the updated NERM 2018 to 2020 was facilitated by ITP Renewables and supported by the UNDP via the EU-GIZ Adapting to Climate Change and Sustainable Energy (EU-GIZ ACSE) project.

- Introduction of cost-effective renewable energy technologies.
- Promotion of local sources and knowledge and
- Development and implementation of Clean Development Mechanisms.

**Pacific Islands Energy Policy:** Adopted in November 2004, the policy includes several 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.

### 4.3 Climate Change Mitigation Sectors

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.

#### Energy Sector

As discussed in above sections, Energy sector of Nauru is heavily dependent on imported fossil fuel and large-scale consumers' demand. The Energy sector also a leading GHG emitter and largest contributor in Nauru's total GHG emissions. Energy sector was in focus of Government policies and programmes to achieve the resilience and reduce dependency on imported fuel; this has been reflected in the recent government policies and review of Nauru Energy Road Map (NERM). The prime area of improvement in this sector are:

- Energy sector landscape covering supply and demand and institutional arrangements.
- Experience, potential and challenges in the use of renewable energy and energy efficiency; and data needs for the energy road map and beyond.

**Nauru Energy Road Map (NERM) Overview:** The Nauru Energy Road Map 2014 – 2020 builds upon the energy sector development agenda laid out in the National Sustainable Development Strategy 2005 -2025 (revised 2009) and the National Energy Policy Framework (NEPF) of 2009. The Nauru Energy Road Map was designed to contribute to the long-term development goals of a stable, trustworthy, fiscally responsible government; provision of enhanced social, infrastructure and utilities services; development of an economy based on multiple sources of revenue; rehabilitation of mined out lands for livelihood sustainability; and development of domestic food production. The targets of the Energy Road Map by 2020 were for:

- 24/7 grid electricity supply with minimal interruptions
- 50% of grid electricity supplied from renewable energy sources.
- 30% improvement in energy efficiency in the residential, commercial and government sectors.

A summary of the 2014 NERM strategies for the future is given below together with estimated costing. Of these all are pertinent to Nauru's mitigation objectives.

**Table 4. 4: Nauru Energy Road Map Summary Strategies**

Sector	Strategy	Estimated Budget million A\$
Power	Improve power sector operation management and efficiency. Recover full costs	9.645
Petroleum	Upgrade the tank farm	0.425
Renewable Energy	Put in place 8.5MW Solar PV. Build capacity to operate system	51.375
Demand side energy efficiency	Plan and implement demand side energy efficiency measures introduce energy labelling and MEPS	0.705
Transport	Improve transport efficiency and investigate transport fuel substitutes	0.33
Institutional strengthening and capacity building		0.82
Total Cost NERM		63.3

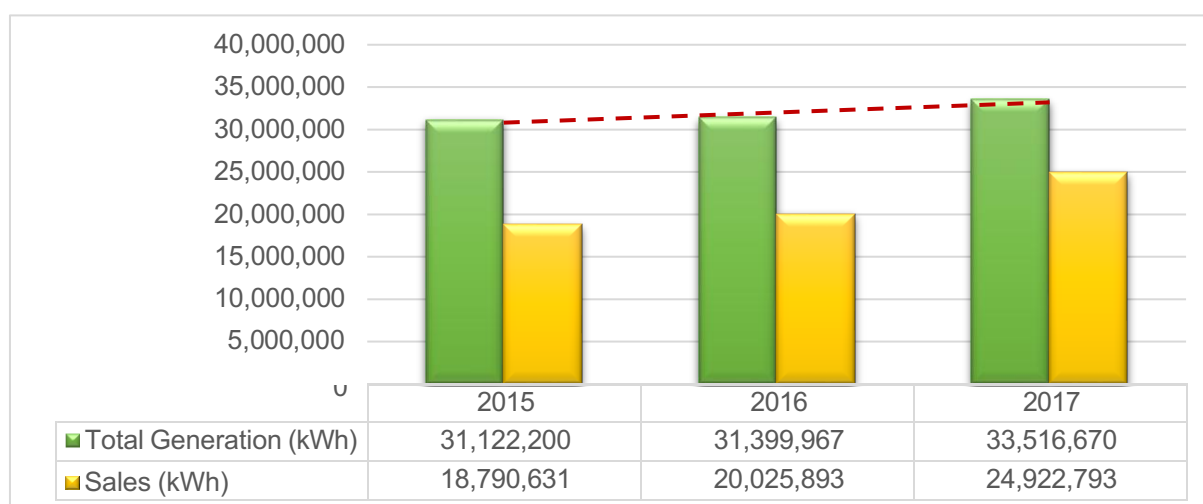
**Electricity Sector:** The total operational capacity in Nauru is about 5.6MW with a maximum demand of 5.03 MW, with an off-grid demand of 4.5 MW (around 2.5MW of demand is expected to be connected to grid). The electricity sector of Nauru has faced various challenges in the past mainly due to reactive approach, unreliable supply and frequent interruptions, Inefficient operations lower generation efficiencies, insufficient generating capacity, poor state of the power network, poor customer service, poor supply chain/ inventory management and low worker skill & knowledge levels; however, the recent reforms and improvement aimed to achieve the reliable & safe power supply, best efficiencies and production capacities, low frequency and duration of power outages, customer service and supply chain and inventory management system and high skills and knowledge level by adopting the proactive approach. The status of the diesel generators as at 2017 is as follows:

**Table 4. 5: Nauru N-2 Security Levels for Production of Electricity**

Generator	Installed Capacity (MW)	Rated Capacity (MW)
G1 – Ruston	2.4	2.0
G2A Cummins	1.0	0.8
G2B Cummins	1.0	0.8
G3 Cummins	1.0	0.8
G4 Cummins	1.0	0.8
G5 Caterpillar	1.0	0.8
G6 Ruston	2.4	2.0
G7 MTU	1.0	0.8
G8 Ruston	1.0	0.8
Ruston	2.8	2.5

Generator	Installed Capacity (MW)	Rated Capacity (MW)
Man Gen	2.8	2.5
Man Gen	2.8	2.5
Total Operational Capacity (MW)	5.6	

Figure 4.1: Electricity Generation and Supply (in kWh): 2015-2017



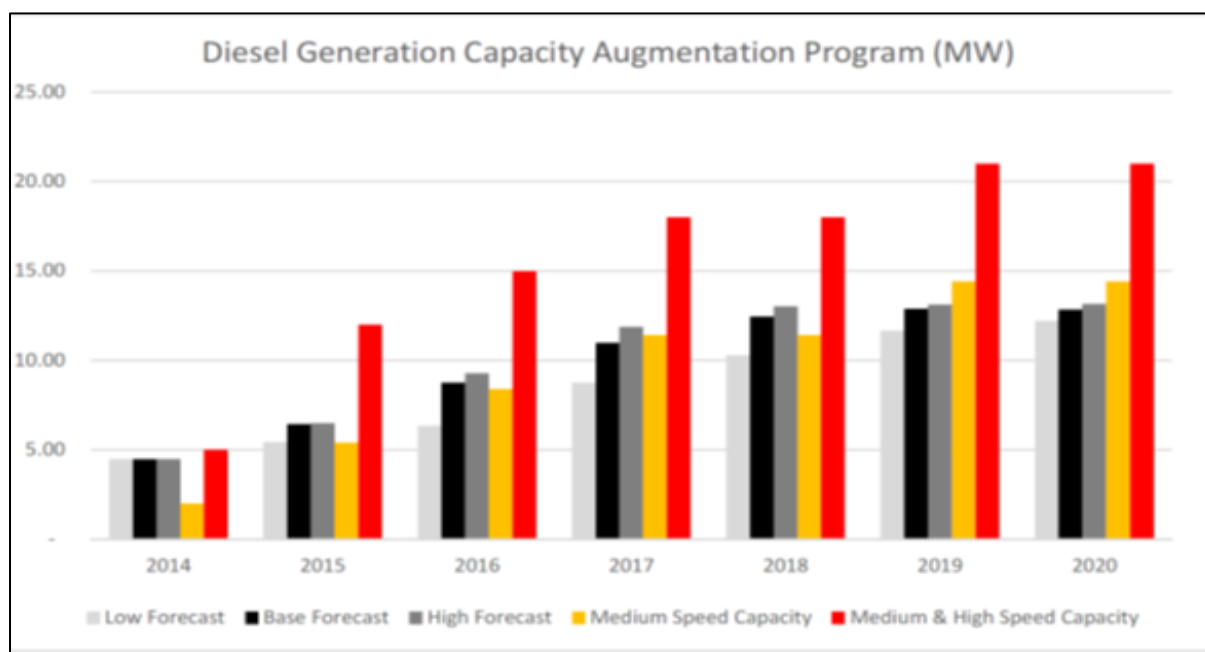
The electricity sector in recent years have shown significant improvements, power outages have been reduced by around 50% compared to the previous period and electricity System losses (Technical and Non-Technical) continue to fall from 36% to 26%. There have been several reports detailing possible action plans in the energy sector for Nauru mostly concentrating on the electricity sector. In November 2014, the Nauru Utilities Corporation, the government body which is responsible for electricity generation in Nauru, produced a strategic plan 2015 to 2020. This detailed document covered upgrading the existing grid, demand forecasting, renewable power generation, energy efficiency, fuel tank management, water production and delivery, financial procurement and human resources strategies. This report is particularly pertinent to Nauru’s GHG mitigation possibilities. The report noted that to achieve the 50% NERM target “The only renewable source of energy at this point in time that appears to be viable is PV solar panel.”

And to achieve that target by 2020 using their forecasts for future demand would require PV generation contribution to the grid of 45.87 GWh per annum. Here it might be noted that while the 2016 maximum demand on the NUC grid was only a little over 3 MW this did not include the generation for RONPHOS, NRC (REHAB) and the capacity for the Nauru Regional Processing Centre (NRPC) for refugees. If added together the 2016 total comes to around 6 MW and with growth, NUC estimates a maximum demand of around 12-13 MW by 2020 necessitating an installed diesel capacity of around 20 MW for N2 security.

The figure below shows the diesel capacity needed to 2020 in the NUC strategic plan. Using modelling the NUC strategic plan suggested that the 50% PV contribution would require around 32 MW of solar PV and the report also notes that this level of penetration would require several hours of storage to account for dips in production due to clouds and up to several days’ storage, if diesel generation capacity is reduced from that being able to cover 100 % of

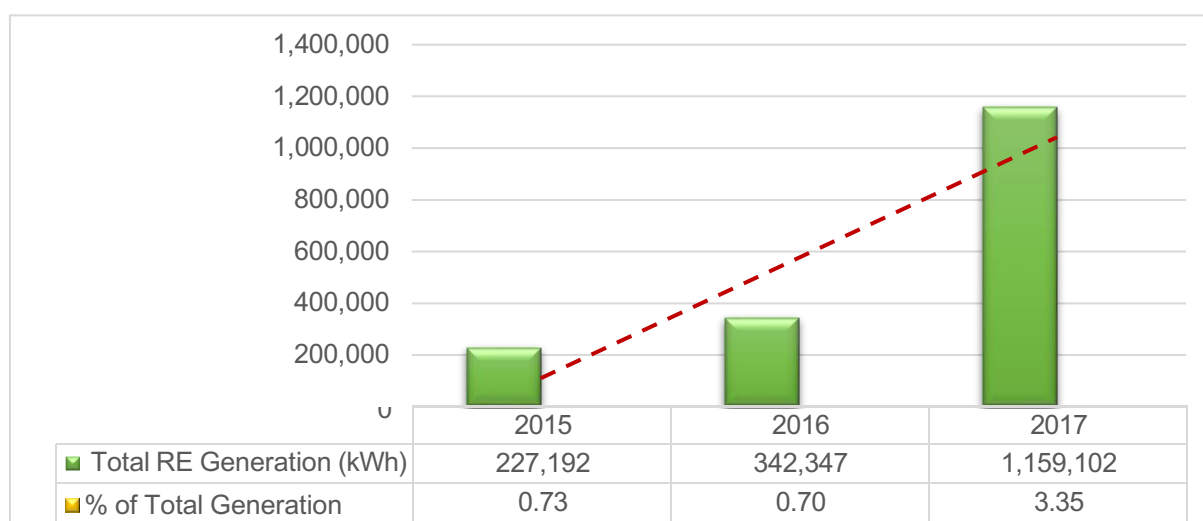
the load. The cost of such an intervention was estimated at around A\$111 million with annual savings in imported fuel of around A\$20 million per annum for a diesel price of A\$2/litre.

Figure 4.2: Diesel Generation Augmentation till 2020 (NUC strategic plan)



**Renewable Energy:** A key driver in initiating and implementing the NERM was Nauru’s ambitious goal of reducing the country’s high reliance on imported fossil fuel by meeting 50% of its electricity needs from renewable energy sources by 2020. The renewable energy generation from solar PV increased to 3.3% of the total energy produced in 2017, up from 0.7% the year 2016. The renewable energy installations and generation in Nauru during 2015-2017 as follows:

Figure 4.3: Renewable Energy (Solar) Generation (in kWh): 2015-2017



To meet the 50% of energy from renewable sources by 2020 target, NUC needs to aggressively pursue the commissioning of solar panel projects. The bulk of the proposed cost of the NERM was for the planned 8 MW PV system. The proposal to achieve 50% Energy from Renewable Sources by 2020 includes following:

- 200 KW of roof top solar panel installations
- 500 KW Ground Mounted Solar Panel Installation commissioned in April 2016 (Funded by UAE)
- 300 KW solar panel installation planned under the EU EDF 11 Program.
- 8MW planned for GCF funding coordinated by ADB.

The NERM plan for a more modest 8 MW PV system was investigated in terms of implementation in a report prepared by the ADB which detailed proposal to the Green Climate Fund in October 2016 for an 8 MW PV system. This was budgeted at US\$ 30 million of which the ADB would finance US\$4 million, US\$ 20 million from the Green Climate Fund, US\$ 4 million from other co-financers (to be determined) and US\$ 2 million from the Nauru Government. If the funding is approved the proposed schedule was for construction to start in November 2018.

### **Renewable Energy Capacity Addition Proposals**

**Generation- Physical systems: 8 MW Solar PV:** The existing 500-kW solar system as part of an aid package from the United Arab Emirates commissioned in 2016 is planned to be upgraded by a further 8MW. A funding proposal has been developed to obtain ADB support.

**20 MW Solar PV:** A further upgrade has been proposed as part of NUC load forecasts to upgrade the PV capacity to 20 MW by 2023. Grid stability study: Associated with the two upgrades mentioned above, the NUC has secured funding for a grid stability study to be undertaken using NZ funds to ensure that the grid is capable of safely absorbing the increased intermittent PV capacity.

**Wind energy assessment:** The DCIE has proposed that IUCN funding be sought to carry out a wind resource assessment and feasibility study for Nauru. It might be noted here that such a wind resources assessment study has been completed as part of the ARM study referenced elsewhere in the report. The only missing piece of information is a short study to correlate wind speed at meteorological heights (10m) with wind turbine heights (50m). In any event, it is highly likely that the economics of solar PV would surpass that of wind energy in Nauru.

**Rooftop solar PV:** Roof top solar PV system have been proposed by the NUC for placement on public and commercial building (USP Building, Menen & Od N Aiwo hotels, super markets etc.). In addition, the DCIE together with the NUC have suggested that an assessment be completed of a framework for private sector (IPPs, businesses and residences) net metering for Solar PV projects.

**PV capacity building:** The NUC, in association with the DCIE, has proposed to relevant donor agencies including the GCF to develop and implement training programmes to build in-country capacity to operate and maintain the above solar PV systems.

**Energy Efficiency:** The NERM noted “A major driver of demand side energy efficiency is the price of electricity. So long as residential electricity tariffs remain artificially low, as has long been the case in Nauru, programmes to improve demand side efficiency will tend to have only a short-term effect with energy usage soon rising back to pre-programme levels after the programme concludes”.

The report suggested that the residential sector used around 75% of NUC generated electricity (61% per 2015/16 NUC data) or around 1100 kWh per person per annum, which is high by Pacific country standards (Fiji was around 220 kWh per person per annum for 2014, FEA annual report). This high usage is a legacy of the high incomes that prevailed in Nauru at the

peak of the phosphate mining era and is occasioned by a high ownership of electrical devices in domestic homes including air conditioning.

The NERM report gave a list of options to reduce domestic usage including establishing guidelines for energy efficient home design, energy efficiency labelling, making power theft a crime, discouraging electric hot water heaters, replacing energy inefficient appliances with energy efficient ones and implementing public awareness programs.

The same problem exists here as for the domestic sector when a low electricity tariff exists in that energy efficiency measures are not a high priority for commercial and industrial users as they are not generally seen as economic. The NERM report recommended that energy audits should be provided only to businesses that specifically state their intent to follow through with actual investments that are determined to have a payback that is less than a pre-agreed upon time. The report recommended that the Nauru Government should be the driver of energy efficiency programmes and to take the lead in improving its own efficiency of energy use. A target was set of 30% savings overall in terms of energy efficiency in the NERM.

#### **Energy conservation mitigation actions proposals:**

**Energy Efficient Appliances:** A proposal has been written for Nauru to be part of the SPC Pacific wide project for the promotion of energy efficient appliances, lighting and equipment. Potential sources of funding are the GCF. The NUC is proposing a scheme to replace old household and commercial AC units with energy efficient models with funding again to come from the GCF and bilateral donors. In addition, the NUC is leading a program to obtain funding for providing energy efficient lighting for households, commercial buildings and for streetlighting.

**Energy Auditing:** The NUC has proposed that private sector funding be sought for carrying out appropriate energy audits for the commercial and industrial sector with a follow up program of implementing energy efficiency recommendations.

**Transport Sector:** In terms of transport the NERM noted that there has been almost no investigation or action into energy efficiency and renewable energy options for the transport sector in the past and the road map was the first substantial effort to examine this sector. There are several transport sector proposals in the pipeline including one by the DCIE for a comprehensive transport sector assessment and development of appropriate policies. These could include policies on and/or regulations on: restricting the import of vehicles having larger engine displacement; reducing import duty on more efficient vehicles (including motorcycles, bicycles and electric bicycles). The DCIE is also proposing an analysis of potential options (including electric vehicles) to implement an around the island ring route public transport system and an assessment of incentives to increase the use of bicycles and motorcycles for personal transport, as well as carpooling and other behavioral changes to encourage energy efficiency and implement as appropriate. Options to improve land transport efficiency reported in the NERM included:

- Restricting the import of vehicles that have a larger engine displacement than is considered appropriate for the Nauru transport requirements.
- 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.

- Programmes to provide incentives and facilities to improve the quality of maintenance of vehicles.
- Implementation of a privately-operated public transport system in Nauru following a study of public transport systems in Pacific Islands, with similar traffic patterns. One option could be two buses going around the island, one going clockwise and one counterclockwise. If waiting times are too long, the number of buses could be increased (or smaller mini vans used instead of buses which would be more cost-effective to run in greater numbers).
- 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.
- LPG cars and hybrid electric-diesel vehicles may also be options to investigate for the future. As renewable energy for power generation is developed in Nauru, it may also be worth examining the feasibility of fully electric vehicles with solar (or wind) charging.

**Waste and Wastewater:** Republic of Nauru National Water, Sanitation and Hygiene Policy 2011. This report noted that “Nauru has no potable surface water resources, very limited fresh groundwater resources, no household piped freshwater and is highly vulnerable to frequent ENSO-related droughts when most rainwater tanks fail within a month of no rain.” The waste and wastewater sector mitigation options include the installation of effluent treatment plant (ETP) and sewerage treatment Plant (STP) along with solid waste management facility. The existing defunct STP may be restored to avoid direct dumping of wastewater into sea.

#### 4.4 Key Mitigation Actions under the Nauru Energy Road Map 2018 to 2020 (Updated)

As discussed earlier, the NERM:2018-2020 is to reconfirm commitments of Nauru to improving the sustainability of energy use through renewable energy and energy efficiency to contribute to a sustainable quality of life for all Nauruans. The outcomes the NERM aimed to achieve are listed in the table below, further the updated NERM:2018-2020 renames the six actions plans and each action plan has a range of Strategies; each strategy has multiple activities with a variety of lead agencies.

*Table 4. 6: NERM:2018-2020 –Action Plan, Activities and Outcome*

Action Plan	Activities
<b>Capacity (C):</b> Efficient, robust and well-resourced institutions for energy planning and implementation.	<ol style="list-style-type: none"> <li>1. Establish appropriate policies, regulations and legislation for the energy sector.</li> <li>2. Facilitate development of appropriate local skill base to meet ongoing demand in energy sector.</li> <li>3. Improve governance and accountability in the energy sector.</li> <li>4. Foster a culture of partnerships between public and private sectors including the community.</li> </ol>
<b>Power (P):</b> A reliable, affordable and safe electrical power supply and services.	<ol style="list-style-type: none"> <li>1. Upgrade assets.</li> <li>2. Improve planning and management.</li> <li>3. Improve supply-side energy efficiency.</li> <li>4. Move toward full recovery of operating and maintenance costs.</li> <li>5. Develop and safeguard NUC staff.</li> </ol>

<b>Renewables (R):</b> 50% of electricity used in Nauru comes from renewable energy sources by 2020.	<ol style="list-style-type: none"> <li>1. Phased implementation of large-scale solar.</li> <li>2. Investigation and implementation of other renewable energy sources.</li> <li>3. Build in-country capacity to operate and maintain solar PV systems.</li> </ol>
<b>Efficiency (E):</b> An efficient supply and use of energy.	<ol style="list-style-type: none"> <li>1. Data collection and analysis for preparation for Demand Side Management implementation.</li> <li>2. Implementation of demand side energy efficiency.</li> <li>3. Introduction of energy labelling and Minimum Energy Performance Standards.</li> </ol>
<b>Fuels (F):</b> A reliable and safe supply of fossil fuels.	<ol style="list-style-type: none"> <li>1. Establish an economically efficient, secure and safe National Fuel Terminal and fuel supply.</li> <li>2. Investigate ways to reduce use or find alternatives to liquid fuels.</li> </ol>
<b>Transport (T):</b> Policy to be developed as part of road map implementation.	<ol style="list-style-type: none"> <li>1. Implementation of energy efficiency in transport.</li> <li>2. Investigate substitutes to diesel and petrol for transport.</li> </ol>

*Table 4. 7: NERM:2014-2020 –Activities Completed (as on 2017)*

<b>Capacity (C): Efficient, robust and well-resourced institutions for energy planning and implementation.</b>
<b>Activities (Completed, as on 2017)</b>
<p>C3.1 Establish an Energy Unit within the Department of CIE</p> <p>C3.2 Establish position of Energy Coordinator within public service</p>
<b>Activities (Work in Progress)</b>
<p>C3.6 Develop detailed Monitoring and Evaluation plan for the NERM.</p> <p>C3.5 Carry out an assessment of the institutional arrangements for the implementation of the NERM including recommendations for long term implementation.</p> <p>C3.4 Support and facilitate the activities of the NERM Coordinating Committee.</p> <p>C3.3 Recruit new staff to support the function of the CIE Energy Unit including NERM implementation.</p> <p>C1.6 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).</p> <p>C2.1 Assess training needs and develop appropriate training strategy for secondary and primary school teachers, managers, small businesses, technicians, tradespeople, etc.</p> <p>C2.4 Develop energy curriculum for schools focusing on energy efficiency and renewable energy.</p> <p>C1.1 Develop a legislative and governance framework for the energy sector.</p> <p>C1.5 Review of regulatory or policy barriers (e.g. import duties) to efficiency and renewable investments.</p> <p>C2.2 Carry out training in technical skills for efficiency and renewable as identified in Activity C2.1. Establish train the trainer's programs in efficiency and renewable for local teachers, equipment operators, managers and technicians.</p>

C4.2 Disseminate information on efficiency measures, PV buyback tariffs plus metering and other information regarding changes in the power sector as and when appropriate.

**Power (P): A reliable, affordable and safe electrical power supply and services.**

**Activities (Completed, as on 2017)**

P1.2 Carry out structural repairs to the NUC powerhouse, including removal of the asbestos roofing and replacement.

P1.4 Purchase and install of a new generator.

P1.5 Carry out major overhaul of the newest existing generator

P2.1 Review the corporate governance of NUC.

P2.2 Carry out capacity planning exercise for 2014 to 2020 including projected demand and generation.

P2.3 Establish process for long-term financial planning and develop first long term financial plan.

P2.4 Develop annual procurement plan and maintenance plan.

P2.5 Undertake comprehensive technical assessment of generation, transmission and distribution, including thermo-graphic analysis.

P2.6 Undertake comprehensive mapping, data compilation, inventory, storage planning and maintenance planning for all assets.

P2.7 Develop manuals for operation, safety, maintenance and service for all key equipment.

P2.8 Develop asset security, disposal and revaluation policy.

P2.9 Collect baseline information and establish collection, storage, management and back-up processes for all financial and sales data.

P2.10 Develop procedures for handling and monitoring customer complaints and train staff.

P3.1 Establish a clear process for reconciling the fuel supplied by the tank farm and the fuel used by generating units.

P3.2 Analyse fuel use data, identify opportunities to reduce losses and implement.

P3.3 Develop new project proposals for improvement of transmission and distribution line losses as more information from metering becomes available.

P3.4 Implement further T&D loss reduction projects.

P5.4 Develop and implement improved administrative procedures including payroll, job descriptions, workload planning and employee leave and related entitlements.

P4.1 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).

P4.2 Carry out willingness-to-pay and affordability studies (carried out in conjunction with the cost-of-service and tariff studies).

P4.3 Establish separate business unit financial information for water, electricity and fuel services.

P4.4 Improve accounting systems through integration of the asset registry and the financial management information system.

P4.5 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.

P4.6 Develop and implement process to move fuel purchasing responsibility from government to NUC.

P5.1 Identify training needs across all units and at all levels, develop a training plan and implement training programs.

P5.2 Develop and implement talent identification, apprenticeship and scholarship scheme for power sector.  
P5.3 Design and implement a Performance Management System for lower level NUC staff.  
P5.5 Provide additional health and safety (H&S) training and enforce all H&S policies and practices.  
P5.6 Purchase sufficient personal protection equipment for all staff.

**Renewables (R): 50% of electricity used in Nauru comes from renewable energy sources by 2020.**

**Activities (Completed, as on 2017)**

R1.1 Prepare Solar Feasibility Study and technical standards and specifications for all phases of solar installations.  
R1.3 Develop regulations, standards and payment methods for private generation using solar energy sources.  
R1.4 Prepare tender documents and carry out tender for first 600 to 1000 kW of grid connected solar without storage.  
R2.1 Carry out a wind resource assessment and feasibility study.

**Activities (Work in Progress)**

R3.1 Develop and implement installation, operating and maintenance training programs for the solar photovoltaic (PV) installations.  
R3.2 Establish regular training in solar energy and other relevant renewables as well as energy efficiency in a local training institution.  
R2.3 Undertake pre-feasibility studies for other renewable energy sources, such as waste-to-energy and OTEC.  
R1.6 Commission Meneng 1.0 MW solar PV system.  
R1.2 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.  
R1.5 Install 600 to 1000 kW of grid connected solar PV without storage Bottom-side on government owned buildings, parking lots, etc.  
R1.7 Install 7 to 10 MW solar PV system including associated enabling equipment to maintain grid stability. Associated enabling equipment includes batteries, advanced inverters and control systems, cloud camera, frequency resistors, capacitors and/or low-load diesel gensets to allow integration of high shares of PV.  
R1.8 Install further large solar PV farm(s) to meet the 2020 renewable energy electricity supply target.  
Size of additional solar PV farm(s) will depend on load growth to 2020.

**Efficiency (E): An efficient supply and use of energy.**

**Activities (Completed, as on 2017)**

E1.1 Carry out household energy use survey.  
E1.2 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 energy efficiency programs.  
E2.6 Replace street lights to EE technologies combined with solar power.

**Activities (Work in Progress)**

E3.1 Prepare feasibility study to determine the best approach to MEPS and labelling.  
E3.4 Prepare and enact appropriate legislation for MEPS and labelling.  
E3.2 Introduce Minimum Energy Performance Standards (MEPS) and labelling of high electricity consumption appliances such as air conditioners, freezers, refrigerators, etc.

E3.5 Training to customs and other government departments on MEPS and labelling, including enforcement.

E1.3 Undertake energy surveys/audits of hotels and commercial buildings.

E1.4 Undertake industrial energy audits of RONPHOS and NRC facilities.

E2.5 Undertake energy efficiency actions in Government Buildings.

E3.3 Carry out awareness raising on MEPS and labelling to communities, businesses and government.

E1.5 Assess feasibility of efficiency technologies, including cost benefit analysis and develop relevant financing options for end users to make efficiency investments which are compatible with local institutional and financing structures.

E2.4 Establish guidelines and financial incentives for energy efficiency measures in construction or retrofitting of buildings.

E2.1 Prepare and implement energy efficiency campaign to residential customers including financial incentives for people to exchange less energy efficient appliances for new, more efficient ones.

E2.3 Review draft NUC Power System Rules and Regulations, update these (including making electricity theft a crime and covering embedded generation from renewable energy sources) and enact final NUC Power System Rules and Regulations.

E1.7 Carry out safe and environmentally sound disposal of retired generators and other old equipment that is replaced.

E1.1 Purchase and install new Transmission and Distribution (T&D) equipment.

E3.5 Review opportunities for:

- savings of electricity from water pumping and reverse osmosis units,
- back-up solar powered reverse osmosis units in alternative locations,
- additional water storage with reticulated water distribution, and
- reducing leakages in the reticulation, delivery and storage systems /tanks.

Carry out feasibility study for most promising water sector opportunity and, if favourable, implement.

#### **Fuels (F): A reliable and safe supply of fossil fuels.**

##### **Activities (Completed, as on 2017)**

F1.1 Establish a technical service agreement with a fuel testing laboratory to sample, test and certify jet fuel existing stocks and new deliveries.

F1.2 Prepare fuel pricing template and provide training to NUC and DoF staff.

F1.3 Carry out training and recertification of staff at the fuel terminal including for shore officers, testing officers, terminal managers and aviation refuelers and fitters.

F1.4 Carry out a feasibility study for the tender of the fuel terminal operation and bulk fuel supply to a private sector operator.

F1.5 If feasibility study is favourable, prepare documents for tender for private fuel terminal operator and bulk fuel supplier.

F1.6 Undertake tender for a terminal operator and defined term (3-5 years) bulk fuel supplier.

F1.7 Establish a fuel industry levy to support government administration and regulation of fuel operator.

#### **Transport (T): Policy to be developed as part of road map implementation.**

##### **Activities (Completed, as on 2017)**

T1.5 Using results of Activity T1.3, design and implement a public transport system for Nauru.

#### Activities (Work in Progress)

T1.9 Establish a data collection system for energy and transport data (related to other databases as appropriate).

T1.8 Design and implement awareness campaign to communities on energy efficiency in transport.

T1.3 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. This study could also assess options to discourage the importation of vehicles that have larger engines (e.g. through increased import duties, etc).

T1.7 Implement appropriate options to discourage the importation of vehicles with large engines.

T2.1 Study the feasibility of LPG, hybrid and electric (powered by renewable electricity) vehicles, including buses.

## 4.5 Nauru Mitigation Action Plans

The Energy Road Map sets out the key activities 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 (RE)
- Demand Side Management (DSM) and Energy Efficiency (EE)
- 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 activity 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.

## Executive Summary: Other Information considered relevant to the achievement of the objectives of the Convention.

This chapter provides an overview of Nauru's capacity to respond to climate change, highlighting various aspects, challenges, and initiatives. Key points from the paragraphs include:

**Research and Systematic Observation:** Nauru recognizes the importance of strengthening its capabilities in research and systematic observation related to climate change. This involves data collection, processing, analysis, and dissemination.

**Meteorological Service:** Nauru established its meteorological service with support from Fiji and international agencies. It is a member of the Pacific Meteorological Council and benefits from the Climate Risk and Early Warning Systems (CREWS) initiative, which aids in predicting climate-related hazards.

**Climate Change Education and Training:** Nauru is integrating climate change education at all levels of its education system, preparing its citizens, particularly the youth, to address climate challenges effectively. The Department of Education plays a pivotal role in this regard.

**Training and Public Awareness:** Nauru is actively involved in training and public awareness programs related to climate change. It utilizes various materials and information sources to disseminate climate-related information to its citizens. Efforts are underway to establish a local website dedicated to climate change.

**Gender and Climate Change:** Nauru recognizes that the effects of climate change are not gender-neutral and is committed to achieving gender equality and social inclusiveness. This aligns with its national sustainable development goals.

**Constraints and Gaps:** Nauru faces several challenges in its climate change initiatives, including limited institutional and technical capacity, coordination issues, low awareness, and data gaps. Addressing these constraints is essential for effective climate adaptation and mitigation planning.

**Mitigation:** Nauru faces barriers to implementing greenhouse gas (GHG) mitigation projects, such as limited capacity, logistical challenges, and dependence on imports. Ongoing efforts include transforming utility services, collaboration with Annex-1 countries, and sustainable master planning.

**Adaptation:** Adaptation planning in Nauru is hindered by limited institutional and technical capacity, coordination challenges, low awareness, and information gaps. Opportunities include regional projects, groundwater utilization, renewable energy goals, environmental rehabilitation, education enhancement, waste reduction, resource diversification, and community resilience.

**Finance Needs and Gaps:** Nauru acknowledges its proactive steps in raising funds from international development partners for climate change projects but emphasizes the continued need for international support. Both technical and financial assistance are essential to enhance resilience, social protection, and climate-resilient infrastructure. Nauru seeks to expand investments in these areas and relies on international cooperation to achieve its climate goals.

**Technology:** Nauru conducted a Technical Needs Assessment (TNA) in 2018 to align potential technologies with national development priorities. This TNA identified vulnerable sectors for adaptation and mitigation, highlighting key technologies for each:

*Adaptation:*

- Water Sector: Technologies include rooftop rainwater harvesting, efficient water management, and enhanced manual water distribution.
- Coastal Area Management: Technologies involve beach and vegetation replenishment, marine area management, and sea wall construction.

*Mitigation:*

- Energy Sector: Nauru aims to reduce emissions and expand renewable energy with technologies like ocean thermal energy conversion (OTEC) and rooftop solar PV.
- Waste Management: Technologies prioritize composting and waste segregation at the household level. The TNA process is vital for Nauru, given its climate vulnerability and limited technological capacity.

## 5 Other Information considered relevant to the achievement of the objectives of the Convention.

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.

### 5.1 Research and systematic observation

Strengthening of the capabilities and expertise of Nauru to contribute to and participate in research and systematic observation, data collection and processing, archiving, analysis and dissemination is crucial in dealing with climate change issues. Therefore, there is a need to enhance the capacity of the institutions and personnel responsible for Nauru's contribution to and participation in the global climate observing system and other global observation systems.

### 5.2 Nauru's meteorological service

Nauru's meteorological service, established in May 2015 and operates under the Ministry for National Emergency Services. In December 2018, Nauru began conducting its own weather observations and reporting, Fiji's meteorological service played a crucial role in training and providing expert support, with funding from the Japan International Cooperation Agency and the UN Development Programme. Nauru is a member of the Pacific Meteorological Council and a beneficiary of the WMO-spearheaded Climate Risk and Early Warning Systems (CREWS) initiative project Strengthening Hydro-meteorological and Early Warning Services in the Pacific.

The CREWS project seeks to strengthen resilience and more effective, people-centred early warnings particularly in the Pacific, by providing predictions from global and regional centers that cater to the specific forecasting needs of individual countries. Thus, the Regional Specialized Meteorological Center (RSMC) in Nadi, Fiji, is working to provide high-resolution predictions of flash floods and other hazards<sup>36</sup>.

### 5.3 Information on climate change education, training and public awareness

The nation is strengthening climate change education at the primary and secondary levels. Climate change issues are also being integrated into non-formal education and various levels of formal education curricula. This holistic approach ensures that Nauru's citizens, from a young age and throughout their lives, are equipped with the knowledge and awareness needed to address climate challenges effectively.

The Department of Education is responsible for training and educating the people of Nauru, and it holds a top priority for the Government of Nauru. Their primary aim is to prepare and equip Nauru's future generations to meet the challenges ahead. These goals are clearly outlined under the National Sustainable Development Strategy (2005-2025) or the NSDS which states<sup>37</sup>: "The Framework for learning and environmental development in the Education Sector through the Footpath for Education and Training Strategic Plan for 2008-

<sup>36</sup> World Meteorological Organization 2019, [Nauru becomes 193rd WMO Member | World Meteorological Organization](#)

<sup>37</sup> The Government of the republic of Nauru 2023, [Department of Education - The Government of the Republic of Nauru](#)

2013, will lead students from Secondary School to leave school as a confident citizen to live and contribute to the Country's complex and global networked society."

This plan envisions guiding students from Secondary School to leave with confidence, fully prepared to participate and contribute effectively to the complexities of Nauru's global and interconnected society.

Recognizing the pivotal role of education in climate action, Nauru acknowledges that a well-educated population is a prerequisite for the effective implementation of nationally relevant climate initiatives. Addressing these educational challenges is not only essential for improving human capacity across various policy areas and economic sectors but is also critical for building a skilled and capable workforce capable of taking ownership of climate planning and implementation. Nauru's long-term resilience and capacity to respond effectively to climate challenges depend significantly on its ability to provide quality education to its citizens. As part of its Nationally Determined Contributions (NDC), Nauru has outlined two specific actions aimed at enhancing its education system to meet these pressing needs<sup>38</sup>.

**Conduct national assessment of public education system** The Government of Nauru is undertaking a rigorous, formal assessment of the education system to address the systemic challenges mentioned above. This process will also deliver a revised primary school curriculum, developed by Nauruan teachers and appropriate for Nauruan students. The assessment will integrate, as appropriate, recommendations from the regional education assessment currently being conducted by The Pacific Community (SPC).

**Integrate climate change into primary school curriculum** as part of the Government's effort to prepare students with the knowledge and skills necessary to prosper as a small islander in the global economy, Nauru is working with Germany's GIZ to integrate climate change into the school curriculum so that our youth understand the challenges facing their country and are prepared to implement effective climate actions.

There is a need to continue and improve the efforts in training and awareness-raising on climate change issues at the community and national level. Existing networking and information exchange between the various levels of society should be strengthened and where relevant new networks and information exchange mechanisms should be explored.

## 5.4 Training and Public Awareness and information and networking

Nauru is taking proactive steps to address the urgent issue of climate change through comprehensive training and public awareness initiatives. To disseminate crucial information to its citizens, the government is preparing a wide array of outreach materials, including leaflets, booklets, calendars, posters, quarterly newsletters, videos, and CDs. These materials draw upon reputable sources such as SPREP, IPCC, WMO, IUC/UNEP, UNITAR, and the UNFCCC Secretariat, ensuring that the information presented is grounded in scientific consensus<sup>39</sup>.

Building on existing education, training, and awareness efforts, Nauru is establishing a local website dedicated to climate change. This digital platform will serve as a hub for sharing experiences and lessons learned among communities. Ensuring the sustainability of this website beyond the project's completion will involve capacity-building for its maintenance and updates.

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<sup>38</sup> Updated Nationally Determined Contribution [Final Nauru Revised NDC \(unfccc.int\)](https://unfccc.int)

Nauru is making various efforts and prioritizing both climate change mitigation and an 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 specialized English terminology is used during consultation and awareness programs. 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 and 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.

Furthermore, this initiative is conducting a thorough assessment to identify constraints, gaps, and specific financial, technical, and institutional requirements for capacity-building in public awareness, education, and training. By highlighting these needs, Nauru aims to secure the necessary resources and support to continue and expand its climate change initiatives, ultimately fostering a more resilient and informed population ready to tackle the global climate crisis.

## **5.5 Gender and Climate Change**

Climate-related disasters have impacted human populations in many areas including agricultural production, food security, water management and public health. The level of impacts and coping strategies of populations depends heavily on their socio-economic status, socio-cultural norms, access to resources, poverty as well as gender. Research has also provided more evidence that the effects are not gender neutral, as women and children are among the highest risk groups. Key factors that account for the differences between women's and men's vulnerability to climate change risks include gender-based differences in time use; access to assets and credit, treatment by formal institutions, which can constrain women's opportunities, limited access to policy discussions and decision making, and a lack of sex-disaggregated data for policy change.

Achieving gender equality and empowering all women and girls is a key outcome of the NSDS, as doing so improves the overall quality of life for all Nauruans. Nauru thus remains committed to advancing gender equality and social inclusiveness through efforts to implement the Paris Agreement, the SAMOA (SIDS Accelerated Modalities of Action Pathway) Pathway and the 2030 Agenda. Nauru hereby reaffirms its commitment to the implementation of SDG 5 and to raising capacity for effective climate change action in accordance with SDG 13 and target 13(b)<sup>40</sup>.

## **5.6 Constraints and gaps, and related financial, technical and capacity needs**

As per decision 17/CP.8 on the preparation of national communications, this section presents an assessment of challenges and related financial, technical and capacity needs associated with the preparation and improvement of national communications and with the implementation of activities, measures and programmes envisaged under the Convention. It also describes proposed and/or implemented activities for overcoming the gaps and constraints. In addition, this section provides information on financial resources and technical support received by Nauru for the implementation and reporting of climate activities and identifies barriers to further accessing financial support.

## **5.7 Constraints, Gaps and Needs**

Nauru, as a small island developing state, relies on international cooperation and support to address the challenges posed by climate change. This includes financial assistance, technology transfer, capacity building, and knowledge sharing. International agreements such as the Paris Agreement provide a framework for global action on climate change and aim to mobilize resources for adaptation and mitigation efforts in vulnerable countries like Nauru.

Efforts to address climate change in Nauru also require collaboration with regional and international organizations, such as the Pacific Islands Forum, the United Nations Development Programme (UNDP), and the Green Climate Fund (GCF), to access funding and technical assistance for climate resilience projects.

### ***GHG Inventory***

The country needs technical and financial resources and capacity building to improve its inventory compilation system. Financial resources are required improving the data collection and compilation system. Currently the most limiting of these is the lack of capacity. Data providers and inventory compilers need training on various aspects of the GHG inventory update process for efficient and accurate data collection and inventory management. This includes the development of data collection template, 2006 IPCC guideline methodologies for all four sectors, use of 2006 IPCC software, estimation of uncertainties in the data collected, Key category analysis (KCA), QA/QC process and methods, uncertainty analysis. The constraints, gaps, and requirements identified for the national greenhouse gas (GHG) inventory, which are integral to the national inventory improvement plan (NIIP), are outlined below.

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<sup>40</sup> Updated Nationally Determined Contribution [Final Nauru Revised NDC \(unfccc.int\)](https://unfccc.int)

In the preparation of its National Communication (TNC), Nauru faced several significant problems and constraints that need to be addressed effectively. These issues can be summarized as follows:

a) **Difficulty in Accessing Accurate Data and Lack of GHG Database Management System:** Nauru encounters challenges in obtaining precise and up-to-date data related to greenhouse gas (GHG) emissions. Additionally, there is a notable absence of a comprehensive GHG database management system, making data organization and retrieval a complex task.

b) **Data Collection and Collation Challenges:** The process of collecting and collating data on GHG emissions poses difficulties. These challenges could include data fragmentation, inconsistency, and reliability issues, which can hinder the creation of a reliable inventory.

c) **Lack of Knowledge or Expertise and Limited Studies in Specific GHG Emission Categories:** Nauru faces a shortage of knowledge and expertise in certain GHG emission categories. This gap is exacerbated by the absence of comprehensive studies in these areas, making it challenging to accurately assess emissions.

d) **Quality Data Deficiency and Poor Data Management:** Among the constraints, the lack of quality data and inadequate data management systems stand out as particularly pressing issues. Without reliable data and efficient data management, the accuracy of the GHG inventory is compromised.

e) **Inadequate Hardware and Software for Data Management:** Nauru lacks the appropriate hardware and software necessary to develop and enhance data management systems required. This technological deficiency can hinder the efficient compilation of emissions data.

f) **Weak Coordination of SNC Preparation Activities:** Effective collaboration and coordination are essential for a streamlined and comprehensive approach.

### **5.7.1 Energy sector Gaps and Uncertainty**

For the energy sector reference approach, there were uncertainties in the data from the Tank Farm that need to be addressed in future reports as well as instituting some level of quality control and independent assurance of data integrity. No national energy balance available, further energy datasets available are fragmented with irregular data reporting.

For the sectoral approach, it is recognised that there are considerable gaps in information regarding sectoral usage in the energy sector that need to be addressed by obtaining data directly from the fuel supply companies. In addition, having two independent data sources would then lead to better data quality assurance and the ability to cross check quantities.

In general uncertainties of around  $\pm 1\%$  would not be unreasonable for the energy sector.

*Agriculture Gaps and Uncertainty:* Uncertainties in the agricultural sector are inherent due to the lack of detailed census data in animal numbers and manure management practices. The uncertainties are suggested to be higher than the energy sector and amount to around  $\pm 30\%$ .

*Waste gaps and Uncertainties:* Although there were a number of limitations in the data quality for the waste sector, the overall relatively low emissions from this sector made the final uncertainties not a large problem in terms of the total emissions profile for Nauru.

Given these challenges, it may be imperative to prioritize emissions estimation for categories where data are accessible and reliable. Focusing on these categories that significantly contribute to Nauru's total GHG emissions can ensure a more accurate and feasible inventory.

In response to these problems and constraints, capacity-building and training programs will be conducted to equip individuals with the knowledge and skills required to carry out the inventory work effectively. These efforts are crucial in addressing the challenges and improving the quality and accuracy of Nauru's Second National Communication regarding GHG emissions.

In light of this, it will be useful to establish data management systems closely aligning to the NIIP developed under the TNC. It also envisages providing training for local staff is expected to provide training to local staff on how to collect data, populate the data repository and training on how to extract relevant data for reporting obligations.

A key consideration will be to develop and implement a monitoring/measuring, reporting and verification (MRV) system to identify the implementation and progress of climate change strategies and policies.

### ***Mitigation***

Nauru, faces numerous challenges and barriers in implementing greenhouse gas (GHG) mitigation projects. These issues encompass various sectors, including land transport, maritime transport, energy efficiency, and waste management. In this section, we will explore the main issues and constraints in planning and implementing mitigation measures in Nauru, as well as proposed solutions and ongoing efforts to address these barriers.

#### **Key Challenges in Mitigation Planning and Implementation**

- **Limited Capacity:** Nauru encounters difficulties in developing and executing intricate project proposals, especially in renewable energy initiatives. There is a need for enhanced project management skills and technical expertise.
- **Absence of a Designated Government Agency:** The absence of a designated government agency responsible for overseeing renewable energy initiatives hinders effective coordination and implementation of mitigation projects.
- **Logistical Challenges and High Expenses:** High logistical expenses associated with accessing the island can deter investment in mitigation projects, making it economically challenging to bring in necessary resources and expertise.
- **Land Tenure Issues:** Land tenure issues can complicate large-scale installations, requiring a comprehensive sustainable master plan to address potential conflicts.
- **Challenging Environmental Conditions:** Nauru's challenging environmental conditions pose difficulties for maintaining electrical and mechanical equipment, demanding ongoing maintenance and repair efforts.
- **Limited Technical Expertise:** Inadequate technical expertise for equipment maintenance and repair further complicates the sustainability of renewable energy initiatives.
- **Economies of Scale:** The small population of Nauru results in limited opportunities for economies of scale, making projects less cost-effective.
- **Institutional and Financial Constraints:** Deficiencies in institutional and financial capabilities, including insufficient resources for comprehensive mitigation measures, impede progress.
- **Lack of Awareness Among Decision-Makers:** Decision-makers within the government may have limited awareness and understanding of renewable energy, affecting policy support and project approval.

- **Lack of a Clear Strategy for Fuel Imports Reduction:** The absence of a practical and clearly defined strategy to reduce fuel imports hinders progress in achieving energy efficiency.
- **Data Gaps and Documentation:** While Nauru has extensive documentation on energy and environmental matters, data gaps exist, including accounting for fuel usage and electricity generation.
- **Funding and Capacity Limitations:** Lack of funding and capacity limitations are significant barriers, with insufficient local capacity for all necessary technologies.

### **Proposed Solutions and Ongoing Efforts**

- **Transformation of Nauru Utilities Corporation (NUC):** NUC has initiated a transformational program to improve its operations, aiming to become proactive, provide reliable power supply, operate efficiently, and enhance customer service. This transformation model could be replicated in other sectors of the economy.
- **Collaborative Efforts with Annex-1 Countries:** Collaborative efforts with Annex-1 countries are essential to acquire high-quality data and imagery for forestry and land use sector initiatives.
- **Sustainable Master Plan:** A comprehensive sustainable master plan is needed to address land tenure issues and facilitate large-scale projects.
- **Land Rehabilitation Opportunities:** Land rehabilitation efforts may offer opportunities for biofuel plantations and domestic-scale piggery biogas projects, but quantitative assessments are required.
- **Capacity Building and Knowledge Networking:** Capacity building and knowledge networking among peer groups and international forums should be prioritized to overcome capacity and resource limitations.
- **Waste and Wastewater Management:** To address challenges in waste and wastewater management, Nauru should finalize its waste management strategy, review waste collection systems, and develop plans for landfill rehabilitation or establishment.

In summary, Nauru faces multiple barriers to implementing GHG mitigation projects, but ongoing efforts and proposed solutions indicate a commitment to overcoming these challenges and advancing sustainability and environmental protection. Collaboration, capacity building, and strategic planning are vital components of Nauru's journey towards a more sustainable future.

### ***Adaptation***

Nauru faces various gaps and barriers that hinder its efforts to enhance climate resilience. Addressing these gaps and barriers is crucial to effectively manage climate change risks and ensure the long-term sustainability and well-being of Nauru's population. Below are some of the constraints, gaps and needs identified for implementation of adaptation measures within the country and require be addressed.

### **Barriers to Adaptation Action in Nauru:**

Adaptation planning in Nauru faces several barriers and gaps, as identified through key documents such as the RONAdapt, Nauru 1NDC, NSDS, and national communications. Following are the barriers and gaps, highlighting the challenges in adaptation planning in Nauru through cause-and-effect logic:

Limited institutional and technical capacity: Nauru faces constraints in terms of institutional and technical capabilities to effectively carry out adaptation planning. This includes a lack of skilled personnel, inadequate resources, and limited expertise in climate change adaptation strategies.

- **Restricted coordination on climate change:** There is a need for improved coordination and collaboration among government agencies and stakeholders involved in climate change adaptation. Currently, coordination efforts are limited, which hinders the development and implementation of comprehensive adaptation plans.
- **Low awareness of climate change impacts:** A significant barrier to adaptation planning is the low awareness among key stakeholders and the general public regarding the potential impacts of climate change on Nauru. This lack of awareness undermines the sense of urgency and the prioritization of adaptation measures.
- **Information gaps for adaptation planning:** Insufficient and fragmented information on climate change impacts, vulnerabilities, and available adaptation options pose a challenge to effective planning. There is a need for improved data collection, research, and knowledge sharing to support evidence-based decision-making in adaptation planning.
- **Limited Resources:** Nauru has a constrained resource base, with its main exports being fish and phosphate soil, which is a finite resource. The mining of phosphate has degraded a significant portion of the island's surface area.
- **Dependency on Imports:** Nauru heavily depends on imports for food and energy security, making it vulnerable to external forces such as global food and energy price changes and financial crises.
- **Vulnerability to Climate Change:** Nauru is highly vulnerable to climate change, sea-level rise, ocean acidification, and natural disasters due to its proximity to the coast and dependence on coastal and marine resources for livelihood and food security.
- **Water Scarcity:** Freshwater resources are limited, with water scarcity exacerbated by frequent droughts, inadequate rainwater storage facilities, and contamination of groundwater due to phosphate mining and other pollutants. Climate change further threatens water security.
- **Waste Management Challenges:** Limited land for landfills and the distance from markets pose challenges for waste management in Nauru. Accumulation of imported waste threatens the fragile ecosystem and public health.
- **Education Deficiency:** Education is crucial for sustainable development, but Nauru faces challenges in education outcomes, with low completion rates for secondary and tertiary education. Poor educational outcomes contribute to high unemployment rates and dependence on expatriate workers.
- **Energy Dependency:** Nauru depends on imported fossil fuels for energy, especially in the transport sector. The lack of economies of scale and limited space for solar panels hinder progress towards renewable energy targets.
- **Environmental Damage:** Phosphate mining has damaged a significant portion of Nauru's terrestrial ecosystem habitat, rendering it unsuitable for habitation or agriculture. This has led to challenges in ensuring food security and biodiversity loss.

These barriers and gaps must be addressed to enhance the effectiveness of adaptation planning in Nauru. By overcoming these challenges, Nauru can develop robust adaptation

strategies that align with its national priorities and ensure the resilience of its communities and ecosystems in the face of climate change.

### **Opportunities for Adaptation Action in Nauru:**

- **Regional Projects:** Nauru is participating in multi-country regional projects addressing priority areas for adaptation, including gender, forestry, and tourism. Collaboration with neighboring countries can provide opportunities for shared solutions.
- **Groundwater Utilization:** Despite contamination issues, fully utilizing groundwater can improve water security, and addressing water quality problems can reduce waterborne illnesses.
- **Renewable Energy Goals:** While progress has been limited, Nauru's target of achieving 50% renewable energy by 2015 provides an opportunity to reduce dependency on imported fuel and mitigate the impact of global fuel price fluctuations.
- **Environmental Rehabilitation:** Rehabilitating mined areas and restoring natural vegetation can improve water quality, reduce erosion, and enhance the overall resilience of the natural environment.
- **Education Enhancement:** Improving education outcomes, providing career counseling, and developing technical and scientific capacity can help reduce dependence on expatriate workers and enhance human capacity for sustainable development.
- **Waste Reduction:** Minimizing waste, especially from imports, can alleviate waste management challenges and reduce threats to the environment and public health.
- **Diversification of Resources:** Exploring opportunities for diversifying the resource base beyond fish and phosphate can reduce economic vulnerability.
- **Water Security Measures:** Implementing measures to address water scarcity, including improved rainwater harvesting and water purification methods, can enhance water security.
- **Tourism Development:** Rehabilitating the environment and promoting Nauru as a tourist destination can diversify the economy and generate revenue.
- **Community Resilience:** Building community resilience through education, awareness, and disaster preparedness can help mitigate the impacts of climate change and natural disasters.

### **5.7.2 Finance needs and gaps**

The Government of Nauru is continuously taking proactive steps and has been successful in raising funds from international development partners for projects aimed at climate change mitigation and adaptation. However, continued international support is crucial to enable Nauru to implement further actions outlined in its policies and plans, including at sector level. Increased international assistance both technical and financial are required to continue building the resilience and improve vulnerability of people of Nauru, social protection activities for all and expand investment in climate resilient infrastructure.

### **5.7.3 Technology<sup>41</sup>**

TNA (Technical need assessment) was conducted in March 2018, to identify and align potential technologies (adaptation and mitigation) to the national development priorities of the

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<sup>41</sup> Nauru- Technology Needs Assessment for Climate Change Adaptation And Mitigation [nauru-final-tna-report-2020.pdf](http://nauru-final-tna-report-2020.pdf) ([unepccc.org](http://unepccc.org))

country. The government could then use those identified technologies to seek funding from potential investors or financial institutions such as Green Climate Fund (GCF), Global Environment Facility (GEF).

The TNA study in Nauru has identified four vulnerable sectors for adaptation and mitigation efforts:

#### **5.7.3.1 Adaptation**

For adaptation, two sectors were identified as most vulnerable to climate change (CC) in Nauru:

##### **Water Sector**

The water sector in Nauru is highly vulnerable to the impacts of climate change. Stakeholder participation played a crucial role in identifying and prioritizing technologies for this sector.

- Roof top rainwater harvest for better water management and uses at household level
- Efficient water uses and management through reticulation distribution system on the island.
- Efficient water uses and management through non-potable water distribution system on the island.
- Enhanced manual water distribution throughout the Island

##### **Coastal Area Management**

Coastal areas and beaches in Nauru are under threat from beach and soil erosion, exacerbated by climate change and sea-level rise. Similar to the water sector, the coastal area management sector also underwent the TNA process. The selected technologies for this sector include:

- Coastal beaches and vegetation replenishment for community resilience against soil erosion.
- Integrated locally managed marine areas, coastal area revegetation and beach nourishment resilience for food security and adaptation against soil erosion.
- Establishment of National Policy and guideline on coastal area development
- Construction of sea wall structures at selective sites around the Island

#### **5.7.3.2 Mitigation**

For mitigation, two sectors were identified as most vulnerable to climate change in Nauru:

##### **Energy Sector**

Nauru is committed to reducing greenhouse gas (GHG) emissions and expanding its use of renewable energy sources. Given its heavy reliance on imported petroleum fuel, Nauru seeks to explore technology opportunities for a more sustainable energy future. The outcome in this sector is shown below: Technology Rank Ocean thermal energy conversion (OTEC)

- Grid-connect rooftop solar PV.
- Biogas
- Pumped hydroelectric storage (PHES) system.

## ***Waste Management***

Nauru faces significant challenges in solid waste management, primarily relying on uncontrolled open dumping. Despite the existence of a National Solid Waste Management Strategy, its implementation has been lacking. The MCA ranking of prioritized technologies for waste management reveals that composting and segregation at the household level are favored based on relevant criteria. These technologies offer not only waste reduction benefits but also socioeconomic advantages.

- Composting at household level
- Waste segregation at household level
- Semi-aerobic landfill – Fukuoka system
- Baling or compacting at commercial level

### ***5.7.4 Importance of TNA in Nauru***

Both climate change adaptation and mitigation are critical considerations for small island developing states (SIDS) like Nauru. Nauru, lacking adequate technological capacity, is included in the third phase of the TNA process to address this shortfall.

## 5.8 Conclusion

The Government is already taking proactive steps to address climate change in their development planning and some degree of budgeting, both on national and subnational levels. However, there are still many barriers and gaps (policy, regulatory, institutional, technical, financial, business, social and cultural in nature) that need to be addressed in order to be able to shift the pattern to transform the development and address climate change into tangible solutions, pragmatic actions, investments and inclusive business opportunities on the ground in driving towards a resilient and low carbon economy, community, and nation.

**Financial Needs** The constrained financial resources of the country and limited absorptive capacity in and coordination between government agencies and with the private sectors create additional challenges to successfully mainstream climate change and align development aspirations with climate change response strategies.

**Capacity needs** Nauru continues to face a multitude of barriers for the scaling up of effective climate responsive actions for achieving the climate and development goals and for meeting its UNFCCC obligations.

The various obstacles include insufficient institutional and financial resources; lack of research data; information management problems and inadequate human resources and infrastructure. More needs to be done to build awareness both within the Government and the community about Nauru vulnerability to climate change. There is also an apparent need to feed information, knowledge, and technologies to enable improved decision making and environmental management.

Overall, the impacts of climate change on Nauru's natural resources, ecosystems, communities, and infrastructure is significant. Building resilience, implementing adaptation measures, and receiving international support are essential for Nauru to address these challenges and secure a sustainable and climate-resilient future.

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## 6 Annexures

### Annexure 1: List of Adaptation Projects

S.No.	Project Name	Funded By
1.	Ecosystem Restoration and Sustainable Land Management to improve livelihoods and protect biodiversity in Nauru	GEF
2.	Supporting Mainstreamed Achievement of Roadmap Targets on Energy in Nauru (SMARTEN)	GEF
3.	R2R: Implementing a "Ridge to Reef" Approach to Protecting Biodiversity and Ecosystem Functions in Nauru (R2R Nauru)	GEF
4.	LDC/SIDS Portfolio Project: Capacity Building for Sustainable Land Management for Nauru	GEF
5.	National Biodiversity Conservation Strategy and Action Plan and Report to the COP including Clearing House Mechanism	GEF
6.	Enabling Activities for the Stockholm Convention on Persistent Organic Pollutants (POPs): National Implementation Plan for Nauru	GEF
7.	Creating Knowledge Solutions for the Pacific	ADB
8.	Promoting Climate-Resilient and Sustainable Blue Economies	ADB
9.	Operations, Knowledge, and Analytics Support in Fragile and Conflict-Affected Situations and Small Island Developing States	ADB
10.	Development of Pacific Power Utilities Reform Network	ADB
11.	Preparing Projects to Enhance Transport Connectivity and Resilience in the Pacific, Phase 2	ADB
12.	Pacific Financial Technical Assistance Centre, 2023-2028	ADB
13.	Advancing the 2030 Agenda for Sustainable Development - Subproject 2	ADB
14.	Sustainable and Climate-Resilient Connectivity Project - Additional Financing	ADB
15.	Sovereign Debt Analytics and Management Support	ADB
16.	Green and Resilient Rural Recovery through Agri-Food System Transformation in the Asia and Pacific Region	ADB
17.	Development of the Pacific Energy Regulators Alliance	ADB
18.	Supporting Quality Infrastructure and Effective Project Implementation in the Pacific	ADB
19.	Preparing the Nauru Sustainable Urban Development Project	ADB
20.	Advancing the 2030 Agenda for Sustainable Development, 2021-2024	ADB
21.	Support to Climate Resilient Investment Pathways in the Pacific	ADB

22.	Preparing Floating Solar Plus Projects under the Pacific Renewable Energy Investment Facility	ADB
23.	Strengthening Digital Information of the National Statistical Data Systems	ADB
24.	Sustainable Capacity Development for Safeguards in the Pacific – Phase 1	ADB
25.	COVID-19 Emergency Response	ADB
26.	Improving Public Investment Management Program	ADB
27.	Digital Twin Capabilities in Project Management	ADB
28.	Pacific Urban Development Investment Project Enhancement and Capacity Development Facility	ADB
29.	Strengthening Social Protection in the Pacific	ADB
30.	COVID-19 Emergency Response	ADB
31.	Pacific Private Sector Development Initiative, Phase IV	ADB
32.	Pacific Region Infrastructure Facility Coordination Office-Leveraging Infrastructure for Sustainable Development	ADB
33.	Solar Power Development Project	ADB
34.	Preparing the Pacific Renewable Energy Investment Facility (Phase 2)	ADB
35.	Improving Pacific Public Financial Management Facility	ADB
36.	Pacific Renewable Energy Program	ADB
37.	Implementing a Differentiated Approach to Urban Development in the Pacific	ADB
38.	Strengthening Education in the Pacific Region	ADB
39.	Towards Effective and Sustainable Delivery of Development Results in Fragile Situations in the Pacific	ADB
40.	Asian Development Outlook 2019–2021	ADB
41.	Enhancing ADB's Support for Social Protection to Achieve the Sustainable Development Goals	ADB
42.	Improving Internet Connectivity for Micronesia Project (formerly Improving Internet Connectivity for FSM, Kiribati, and Nauru)	ADB
43.	Capacity Building and Sector Reform for Renewable Energy Investments in the Pacific	ADB
44.	Key Indicators for Asia and the Pacific 2018-2020 – Key Indicators for Asia and the Pacific 2019 (Subproject 2)	ADB
45.	Asian Development Outlook 2016-2018 - Asian Development Outlook 2018 (Subproject 3)	ADB

46.	Pacific Information and Communication Technology Investment Planning and Capacity Development Facility- Phase 2	ADB
47.	Pacific Renewable Energy Investment Facility (formerly Pacific Renewable Energy and Energy Efficiency Investment Facility)	ADB
48.	Asian Development Outlook 2016-2018 - Asian Development Outlook 2017 (Subproject 2)	ADB
49.	Strengthening Financial Inclusion and Financial Sector Development	ADB
50.	Fiscal Sustainability Reform Program	ADB
51.	Sustainable and Climate-Resilient Connectivity Project (formerly Port Development Project)	ADB
52.	Port Development Project	ADB
53.	Asian Development Outlook 2016-2018 - Asian Development Outlook 2016 (Subproject 1)	ADB
54.	Asian Development Outlook 2016-2018 (Cluster TA)	ADB
55.	Mapping Resilience to Fragility and Conflict in Asia and the Pacific	ADB
56.	Electricity Supply Security and Sustainability	ADB
57.	Asian Development Outlook 2015	ADB
58.	Institutional Strengthening of the Nauru Utilities Corporation	ADB
59.	Electricity Supply Security and Sustainability	ADB
60.	Implementation of the Strategic Program for Climate Resilience: Pacific Region	ADB
61.	Supporting Participation in the Pacific Energy Summit	ADB
62.	Results-Based Strategy and Sector Planning in the Pacific	ADB
63.	Public Financial Management Reform Program	ADB
64.	Enhancing ADB's Engagement in Fragile and Conflict-Affected Situations	ADB
65.	Solid Waste Management in the Pacific	ADB
66.	Regulatory and Governance Reform for Improving Water and Electricity Supply in Nauru	ADB
67.	Pacific Renewable Energy Investment Facility (formerly Pacific Renewable Energy and Energy Efficiency Investment Facility)	ADB
68.	Asian Development Outlook 2016-2018 - Asian Development Outlook 2017 (Subproject 2)	ADB
69.	Strengthening Financial Inclusion and Financial Sector Development	ADB

70.	Fiscal Sustainability Reform Program	ADB
71.	Sustainable and Climate-Resilient Connectivity Project (formerly Port Development Project)	ADB
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73.	Asian Development Outlook 2016-2018 - Asian Development Outlook 2016 (Subproject 1)	ADB
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84.	Enhancing ADB's Engagement in Fragile and Conflict-Affected Situations	ADB
85.	Solid Waste Management in the Pacific	ADB
86.	Regulatory and Governance Reform for Improving Water and Electricity Supply in Nauru	ADB
87.	Nauru Trust Fund	ADB
88.	National Reform Program	ADB
89.	Preparing Nonsovereign Operations in the Pacific	ADB
90.	Developing and Implementing Private Sector Projects in Fragile and Conflict-Affected Situations and Small Island Developing States	ADB
91.	Developing Inclusive and Resilient Social Protection Systems in Asia and the Pacific	ADB

## Annexure 2: Summary Report for GHG Emissions Inventory – 2014

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	58.56733671	0.0870	0.0011	0	0	0	0	0	0	0	0	0
1 - Energy	58.56733671	0.0056	0.0008	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	58.56733671	0.0056	0.0008	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	48.017541	0.0019	0.0004						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	2.918014432	0.0001	2E-05						0	0	0	0
1.A.3 - Transport	7.434736003	0.0035	0.0003						0	0	0	0
1.A.4 - Other Sectors	0.197045273	2E-05	3E-07						0	0	0	0
1.A.5 - Non-Specified	0	0	0						0	0	0	0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	0	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	0								0	0	0	0
2.A.2 - Lime production	0								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0							0	0	0	0
2.C.2 - Ferroalloys Production	0	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.D - Non-Energy Products from Fuels and Solvent Use	0	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	0								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0				0	0	0	0
2.E.4 - Heat Transfer Fluid					0				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0					0	0	0	0
2.F.2 - Foam Blowing Agents				0					0	0	0	0
2.F.3 - Fire Protection				0	0				0	0	0	0
2.F.4 - Aerosols				0					0	0	0	0
2.F.5 - Solvents				0	0				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0			0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses					0	0			0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.G.3 - N2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	0	0.0004	0	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	0.0004	0	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		6E-05							0	0	0	0
3.A.2 - Manure Management		0.0003	0						0	0	0	0
3.B - Land	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	0								0	0	0	0
3.B.2 - Cropland	0								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	0								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0	0						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	0								0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.C.5 - Indirect N2O Emissions from managed soils			0						0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0						0	0	0	0
3.C.7 - Rice cultivations		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	0	0.0810	0.0003	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	0.0759	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	0.0051	0.0003	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0	0	0	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												
International Bunkers	9.522260748	7E-05	0.0003	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	9.522260748	7E-05	0.0003						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
1.A.3.d.i - International water-borne navigation (International bunkers)	0	0	0						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

### Annexure 3: Summary Report for GHG Emissions Inventory – 2013

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	56.33520285	0.0928	0.001	0	0	0	0	0	0	0	0	0
1 - Energy	56.33520285	0.0051	0.0007	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	56.33520285	0.0051	0.0007	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	45.52784265	0.0018	0.0004						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	4.306993338	0.0002	3E-05						0	0	0	0
1.A.3 - Transport	6.415913771	0.0031	0.0003						0	0	0	0
1.A.4 - Other Sectors	0.08445309	7E-06	1E-07						0	0	0	0
1.A.5 - Non-Specified	0	0	0						0	0	0	0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	0	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	0								0	0	0	0
2.A.2 - Lime production	0								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0							0	0	0	0
2.C.2 - Ferroalloys Production	0	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.D - Non-Energy Products from Fuels and Solvent Use	0	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	0								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0				0	0	0	0
2.E.4 - Heat Transfer Fluid					0				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0					0	0	0	0
2.F.2 - Foam Blowing Agents				0					0	0	0	0
2.F.3 - Fire Protection				0	0				0	0	0	0
2.F.4 - Aerosols				0					0	0	0	0
2.F.5 - Solvents				0	0				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0			0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses					0	0			0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.G.3 - N2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	0	0.0082	0	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	0.0082	0	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		0.0014							0	0	0	0
3.A.2 - Manure Management		0.0068	0						0	0	0	0
3.B - Land	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	0								0	0	0	0
3.B.2 - Cropland	0								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	0								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0	0						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	0								0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.C.5 - Indirect N2O Emissions from managed soils			0						0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0						0	0	0	0
3.C.7 - Rice cultivations		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	0	0.0795	0.0003	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	0.0745	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	0.005	0.0003	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0	0	0	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												
International Bunkers	6.584038911	5E-05	0.0002	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	6.584038911	5E-05	0.0002						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
1.A.3.d.i - International water-borne navigation (International bunkers)	0	0	0						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

## Annexure 4: Summary Report for GHG Emissions Inventory – 2012

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	43.45577572	0.0822	0.0008	0	0	0	0	0	0	0	0	0
1 - Energy	43.45577572	0.0034	0.0005	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	43.45577572	0.0034	0.0005	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	32.29305491	0.0013	0.0003						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	7.39695441	0.0003	6E-05						0	0	0	0
1.A.3 - Transport	3.765766394	0.0018	0.0002						0	0	0	0
1.A.4 - Other Sectors	0	0	0						0	0	0	0
1.A.5 - Non-Specified	0	0	0						0	0	0	0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	0	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	0								0	0	0	0
2.A.2 - Lime production	0								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0							0	0	0	0
2.C.2 - Ferroalloys Production	0	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOcs	SO2
2.D - Non-Energy Products from Fuels and Solvent Use	0	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	0								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0				0	0	0	0
2.E.4 - Heat Transfer Fluid					0				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0					0	0	0	0
2.F.2 - Foam Blowing Agents				0					0	0	0	0
2.F.3 - Fire Protection				0	0				0	0	0	0
2.F.4 - Aerosols				0					0	0	0	0
2.F.5 - Solvents				0	0				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0			0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses					0	0			0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.G.3 - N2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	0	0.0007	0	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	0.0007	0	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		0.0001							0	0	0	0
3.A.2 - Manure Management		0.0006	0						0	0	0	0
3.B - Land	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	0								0	0	0	0
3.B.2 - Cropland	0								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	0								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0	0						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	0								0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.C.5 - Indirect N2O Emissions from managed soils			0						0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0						0	0	0	0
3.C.7 - Rice cultivations		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	0	0.0782	0.0003	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	0.0732	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	0.0049	0.0003	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0	0	0	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												
International Bunkers	3.145790548	2E-05	9E-05	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	3.145790548	2E-05	9E-05						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOcs	SO2
1.A.3.d.i - International water-borne navigation (International bunkers)	0	0	0						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

## Annexure 5: Summary Report for GHG Emissions Inventory – 2011

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	24.67858922	0.0873	0.0006	0	0	0	0	0	0	0	0	0
1 - Energy	24.67858922	0.0016	0.0003	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	24.67858922	0.0016	0.0003	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	13.03040571	0.0005	0.0001						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	10.19072417	0.0004	8E-05						0	0	0	0
1.A.3 - Transport	1.457459333	0.0007	7E-05						0	0	0	0
1.A.4 - Other Sectors	0	0	0						0	0	0	0
1.A.5 - Non-Specified	0	0	0						0	0	0	0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	0	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	0								0	0	0	0
2.A.2 - Lime production	0								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0							0	0	0	0
2.C.2 - Ferroalloys Production	0	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.D - Non-Energy Products from Fuels and Solvent Use	0	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	0								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0				0	0	0	0
2.E.4 - Heat Transfer Fluid					0				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0					0	0	0	0
2.F.2 - Foam Blowing Agents				0					0	0	0	0
2.F.3 - Fire Protection				0	0				0	0	0	0
2.F.4 - Aerosols				0					0	0	0	0
2.F.5 - Solvents				0	0				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0			0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses					0	0			0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.G.3 - N2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	0	0.0079	0	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	0.0079	0	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		0.0013							0	0	0	0
3.A.2 - Manure Management		0.0066	0						0	0	0	0
3.B - Land	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	0								0	0	0	0
3.B.2 - Cropland	0								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	0								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0	0						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	0								0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.C.5 - Indirect N2O Emissions from managed soils			0						0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0						0	0	0	0
3.C.7 - Rice cultivations		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	0	0.0777	0.0003	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	0.0728	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	0.0048	0.0003	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0	0	0	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												
International Bunkers	1.273475303	9E-06	4E-05	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	1.273475303	9E-06	4E-05						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOcs	SO2
1.A.3.d.i - International water-borne navigation (International bunkers)	0	0	0						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

## Annexure 6: Summary Report for GHG Emissions Inventory – 2010

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	38.08965652	0.0798	0.0008	0	0	0	0	0	0	0	0	0
1 - Energy	38.08965652	0.0030	0.0004	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	38.08965652	0.0030	0.0004	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	24.51112275	0.001	0.0002						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	10.24410336	0.0004	8E-05						0	0	0	0
1.A.3 - Transport	3.334430404	0.0016	0.0002						0	0	0	0
1.A.4 - Other Sectors	0	0	0						0	0	0	0
1.A.5 - Non-Specified	0	0	0						0	0	0	0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	0	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	0								0	0	0	0
2.A.2 - Lime production	0								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0							0	0	0	0
2.C.2 - Ferroalloys Production	0	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.D - Non-Energy Products from Fuels and Solvent Use	0	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	0								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0				0	0	0	0
2.E.4 - Heat Transfer Fluid					0				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0					0	0	0	0
2.F.2 - Foam Blowing Agents				0					0	0	0	0
2.F.3 - Fire Protection				0	0				0	0	0	0
2.F.4 - Aerosols				0					0	0	0	0
2.F.5 - Solvents				0	0				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0			0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses					0	0			0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.G.3 - N2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	0	0.0007	0	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	0.0007	0	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		0.0001							0	0	0	0
3.A.2 - Manure Management		0.0006	0						0	0	0	0
3.B - Land	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	0								0	0	0	0
3.B.2 - Cropland	0								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	0								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0	0						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	0								0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.C.5 - Indirect N2O Emissions from managed soils			0						0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0						0	0	0	0
3.C.7 - Rice cultivations		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	0	0.0762	0.0004	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	0.0713	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	0.0048	0.0004	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0	0	0	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												
International Bunkers	3.266631869	2E-05	9E-05	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	3.266631869	2E-05	9E-05						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOcs	SO2
1.A.3.d.i - International water-borne navigation (International bunkers)	0	0	0						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

## Annexure 7: Summary Report for GHG Emissions Inventory – 2009

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	35.14140942	0.0780	0.0007	0	0	0	0	0	0	0	0	0
1 - Energy	35.14140942	0.0029	0.0004	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	35.14140942	0.0029	0.0004	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	24.03910943	0.001	0.0002						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	7.813864305	0.0003	6E-05						0	0	0	0
1.A.3 - Transport	3.288435691	0.0016	0.0002						0	0	0	0
1.A.4 - Other Sectors	0	0	0						0	0	0	0
1.A.5 - Non-Specified	0	0	0						0	0	0	0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	0	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	0								0	0	0	0
2.A.2 - Lime production	0								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0							0	0	0	0
2.C.2 - Ferroalloys Production	0	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.D - Non-Energy Products from Fuels and Solvent Use	0	0	0	0	0	0	0	0	0	0	0	0
2.D.1 - Lubricant Use	0								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0				0	0	0	0
2.E.4 - Heat Transfer Fluid					0				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0					0	0	0	0
2.F.2 - Foam Blowing Agents				0					0	0	0	0
2.F.3 - Fire Protection				0	0				0	0	0	0
2.F.4 - Aerosols				0					0	0	0	0
2.F.5 - Solvents				0	0				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0			0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses					0	0			0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.G.3 - N2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	0	0.0007	0	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	0.0007	0	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		0.0001							0	0	0	0
3.A.2 - Manure Management		0.0006	0						0	0	0	0
3.B - Land	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	0								0	0	0	0
3.B.2 - Cropland	0								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	0								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0	0						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	0								0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.C.5 - Indirect N2O Emissions from managed soils			0						0	0	0	0
3.C.6 - Indirect N2O Emissions from manure management			0						0	0	0	0
3.C.7 - Rice cultivations		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	0	0.0745	0.0003	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	0.0699	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	0.0046	0.0003	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0	0	0	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												
International Bunkers	0	0	0	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	0	0	0						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOcs	SO2
1.A.3.d.i - International water-borne navigation (International bunkers)	0	0	0						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

## Annexure 8: Summary Report for GHG Emissions Inventory – 2008

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOcs	SO2
Total National Emissions and Removals	32.46087195	0.0802	0.0007	0	0	0	0	0	0	0	0	0
1 - Energy	32.46087195	0.0027	0.0004	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	32.46087195	0.0027	0.0004	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	22.38405701	0.0009	0.0002						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	6.874339524	0.0003	6E-05						0	0	0	0
1.A.3 - Transport	3.202475418	0.0015	0.0001						0	0	0	0
1.A.4 - Other Sectors	0	0	0						0	0	0	0
1.A.5 - Non-Specified	0	0	0						0	0	0	0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	0	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	0								0	0	0	0
2.A.2 - Lime production	0								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0							0	0	0	0
2.C.2 - Ferroalloys Production	0	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.D.1 - Lubricant Use	0								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0				0	0	0	0
2.E.4 - Heat Transfer Fluid					0				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0					0	0	0	0
2.F.2 - Foam Blowing Agents				0					0	0	0	0
2.F.3 - Fire Protection				0	0				0	0	0	0
2.F.4 - Aerosols				0					0	0	0	0
2.F.5 - Solvents				0	0				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0			0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses					0	0			0	0	0	0
2.G.3 - N2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCS	SO2
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	0	0.0045	0	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	0.0045	0	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		0.0007							0	0	0	0
3.A.2 - Manure Management		0.0038	0						0	0	0	0
3.B - Land	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	0								0	0	0	0
3.B.2 - Cropland	0								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	0								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0	0						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	0								0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0						0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			0						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.C.6 - Indirect N2O Emissions from manure management			0						0	0	0	0
3.C.7 - Rice cultivations		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	0	0.0730	0.0003	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	0.0685	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	0.0045	0.0003	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0	0	0	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												
International Bunkers	2.460062405	2E-05	7E-05	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	2.460062405	2E-05	7E-05						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	0	0	0						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

## Annexure 9: Summary Report for GHG Emissions Inventory – 2007

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCS	SO2
Total National Emissions and Removals	22.92861185	0.0770	0.0006	0	0	0	0	0	0	0	0	0
1 - Energy	22.92861185	0.0021	0.0003	0	0	0	0	0	0	0	0	0
1.A - Fuel Combustion Activities	22.92861185	0.0021	0.0003	0	0	0	0	0	0	0	0	0
1.A.1 - Energy Industries	12.60137042	0.0005	0.0001						0	0	0	0
1.A.2 - Manufacturing Industries and Construction	7.67037999	0.0003	6E-05						0	0	0	0
1.A.3 - Transport	2.656861446	0.0013	0.0001						0	0	0	0
1.A.4 - Other Sectors	0	0	0						0	0	0	0
1.A.5 - Non-Specified	0	0	0						0	0	0	0
1.B - Fugitive emissions from fuels	0	0	0	0	0	0	0	0	0	0	0	0
1.B.1 - Solid Fuels	0	0	0						0	0	0	0
1.B.2 - Oil and Natural Gas	0	0	0						0	0	0	0
1.B.3 - Other emissions from Energy Production	0	0	0						0	0	0	0
1.C - Carbon dioxide Transport and Storage	0	0	0	0	0	0	0	0	0	0	0	0
1.C.1 - Transport of CO2	0								0	0	0	0
1.C.2 - Injection and Storage	0								0	0	0	0
1.C.3 - Other	0								0	0	0	0
2 - Industrial Processes and Product Use	0	0	0	0	0	0	0	0	0	0	0	0
2.A - Mineral Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.A.1 - Cement production	0								0	0	0	0
2.A.2 - Lime production	0								0	0	0	0
2.A.3 - Glass Production	0								0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
2.A.4 - Other Process Uses of Carbonates	0								0	0	0	0
2.A.5 - Other (please specify)	0	0	0						0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.B.1 - Ammonia Production	0								0	0	0	0
2.B.2 - Nitric Acid Production			0						0	0	0	0
2.B.3 - Adipic Acid Production			0						0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			0						0	0	0	0
2.B.5 - Carbide Production	0	0							0	0	0	0
2.B.6 - Titanium Dioxide Production	0								0	0	0	0
2.B.7 - Soda Ash Production	0								0	0	0	0
2.B.8 - Petrochemical and Carbon Black Production	0	0							0	0	0	0
2.B.9 - Fluorochemical Production				0	0	0	0	0	0	0	0	0
2.B.10 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	0	0							0	0	0	0
2.C.2 - Ferroalloys Production	0	0							0	0	0	0
2.C.3 - Aluminium production	0				0			0	0	0	0	0
2.C.4 - Magnesium production	0					0		0	0	0	0	0
2.C.5 - Lead Production	0								0	0	0	0
2.C.6 - Zinc Production	0								0	0	0	0
2.C.7 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOcs	SO2
2.D.1 - Lubricant Use	0								0	0	0	0
2.D.2 - Paraffin Wax Use	0								0	0	0	0
2.D.3 - Solvent Use									0	0	0	0
2.D.4 - Other (please specify)	0	0	0						0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	0	0	0
2.E.1 - Integrated Circuit or Semiconductor				0	0	0	0	0	0	0	0	0
2.E.2 - TFT Flat Panel Display					0	0	0	0	0	0	0	0
2.E.3 - Photovoltaics					0				0	0	0	0
2.E.4 - Heat Transfer Fluid					0				0	0	0	0
2.E.5 - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	0	0	0	0	0	0	0	0	0
2.F.1 - Refrigeration and Air Conditioning				0					0	0	0	0
2.F.2 - Foam Blowing Agents				0					0	0	0	0
2.F.3 - Fire Protection				0	0				0	0	0	0
2.F.4 - Aerosols				0					0	0	0	0
2.F.5 - Solvents				0	0				0	0	0	0
2.F.6 - Other Applications (please specify)				0	0				0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0	0	0	0	0
2.G.1 - Electrical Equipment					0	0			0	0	0	0
2.G.2 - SF6 and PFCs from Other Product Uses					0	0			0	0	0	0
2.G.3 - N2O from Product Uses			0						0	0	0	0
2.G.4 - Other (Please specify)	0	0	0	0	0	0	0	0	0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCS	SO2
2.H - Other	0	0	0	0	0	0	0	0	0	0	0	0
2.H.1 - Pulp and Paper Industry	0	0							0	0	0	0
2.H.2 - Food and Beverages Industry	0	0							0	0	0	0
2.H.3 - Other (please specify)	0	0	0						0	0	0	0
3 - Agriculture, Forestry, and Other Land Use	0	0.0034	0	0	0	0	0	0	0	0	0	0
3.A - Livestock	0	0.0034	0	0	0	0	0	0	0	0	0	0
3.A.1 - Enteric Fermentation		0.0006							0	0	0	0
3.A.2 - Manure Management		0.0028	0						0	0	0	0
3.B - Land	0	0	0	0	0	0	0	0	0	0	0	0
3.B.1 - Forest land	0								0	0	0	0
3.B.2 - Cropland	0								0	0	0	0
3.B.3 - Grassland	0								0	0	0	0
3.B.4 - Wetlands	0		0						0	0	0	0
3.B.5 - Settlements	0								0	0	0	0
3.B.6 - Other Land	0								0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land	0	0	0	0	0	0	0	0	0	0	0	0
3.C.1 - Emissions from biomass burning		0	0						0	0	0	0
3.C.2 - Liming	0								0	0	0	0
3.C.3 - Urea application	0								0	0	0	0
3.C.4 - Direct N2O Emissions from managed soils			0						0	0	0	0
3.C.5 - Indirect N2O Emissions from managed soils			0						0	0	0	0

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)				Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
3.C.6 - Indirect N2O Emissions from manure management			0						0	0	0	0
3.C.7 - Rice cultivations		0							0	0	0	0
3.C.8 - Other (please specify)		0	0						0	0	0	0
3.D - Other	0	0	0	0	0	0	0	0	0	0	0	0
3.D.1 - Harvested Wood Products	0								0	0	0	0
3.D.2 - Other (please specify)	0	0	0						0	0	0	0
4 - Waste	0	0.0715	0.0003	0	0	0	0	0	0	0	0	0
4.A - Solid Waste Disposal	0	0.0670	0	0	0	0	0	0	0	0	0	0
4.B - Biological Treatment of Solid Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.C - Incineration and Open Burning of Waste	0	0	0	0	0	0	0	0	0	0	0	0
4.D - Wastewater Treatment and Discharge	0	0.0044	0.0003	0	0	0	0	0	0	0	0	0
4.E - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
5 - Other	0	0	0	0	0	0	0	0	0	0	0	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	0	0	0	0	0	0	0	0	0	0	0	0
5.B - Other (please specify)	0	0	0	0	0	0	0	0	0	0	0	0
Memo Items (5)												
International Bunkers	2.455862409	2E-05	7E-05	0	0	0	0	0	0	0	0	0
1.A.3.a.i - International Aviation (International Bunkers)	2.455862409	2E-05	7E-05						0	0	0	0
1.A.3.d.i - International water-borne navigation (International bunkers)	0	0	0						0	0	0	0
1.A.5.c - Multilateral Operations	0	0	0	0	0	0	0	0	0	0	0	0

