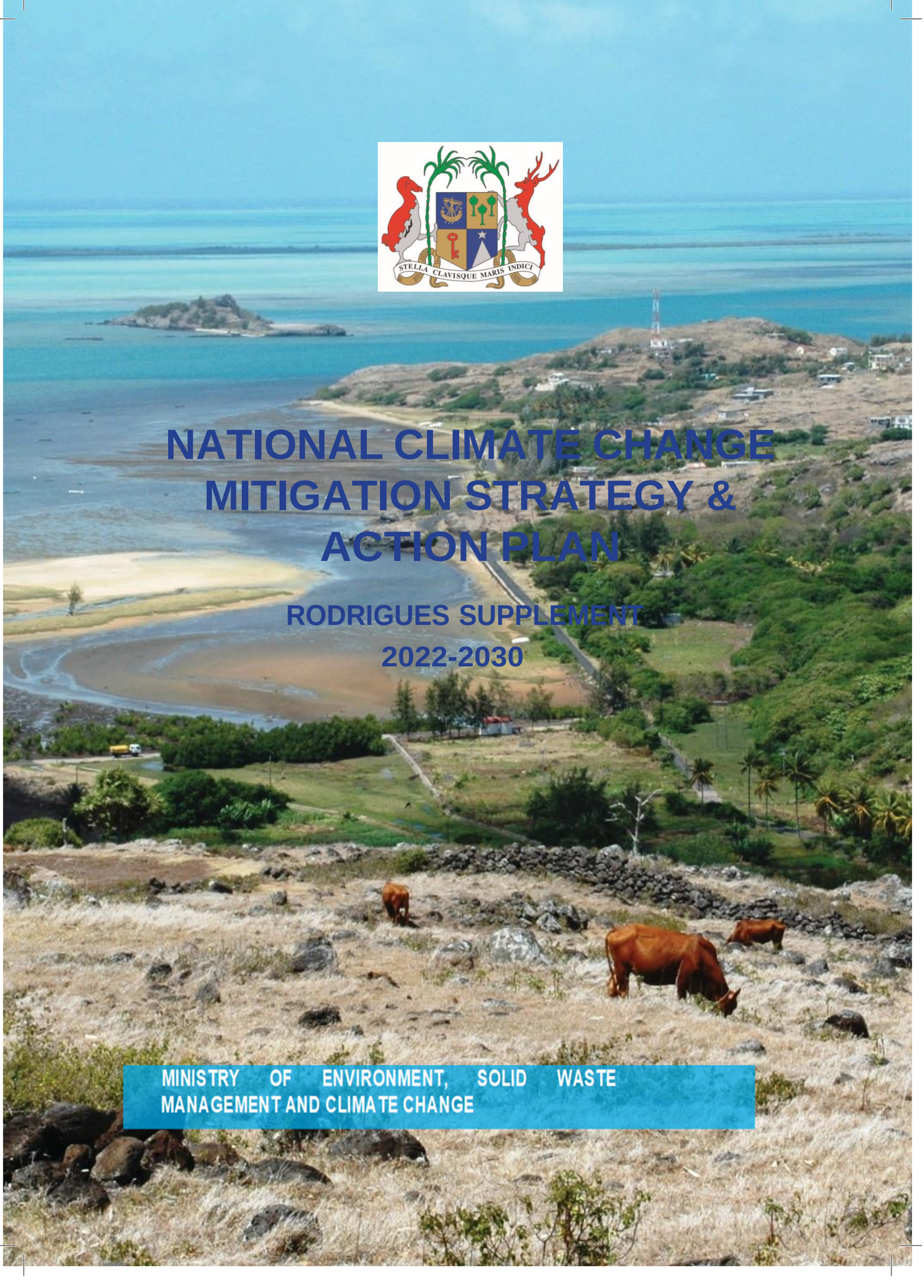

NATIONAL CLIMATE CHANGE MITIGATION STRATEGY & ACTION PLAN

RODRIGUES SUPPLEMENT

2022-2030

MINISTRY OF ENVIRONMENT, SOLID WASTE MANAGEMENT AND CLIMATE CHANGE

NATIONAL CLIMATE CHANGE MITIGATION STRATEGY & ACTION PLAN

RODRIGUES SUPPLEMENT

2022-2030

Developed under the Nationally Appropriate Mitigation Actions (NAMA) for Low Carbon Island Development Strategy for the Republic of Mauritius (NAMA Project)

November 2023

Republic of Mauritius
Mauritius National Climate Change Mitigation Strategy and Action Plan 2022-2030 – Rodrigues Supplement (MSAP-Rod)

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TABLE OF CONTENTS

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SUMMARY OF FIGURES

SUMMARY OF TABLES

LIST OF ACRONYMS

BAU	Business-As-Usual
BESS	Battery Energy Storage System
BUR1	Biennial Update Report (First)
CCA 2020	Climate Change Act 2020
CCC	Climate Change Committee
CCM	Climate Change Mitigation
CEB	Central Electricity Board
CO_2e	Carbon Dioxide Equivalent
DCC	Department of Climate Change
ETF	Enhanced Transparency Framework
FAREI	Food Agricultural Research and Extension Institute
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GWh	Gigawatt hour
HFO	Heavy Fuel Oil
IMCCC	Inter-Ministerial Council on Climate Change
IPCC	Intergovernmental Panel on Climate Change
$ktCO_2$	Kilo tonne of Carbon Dioxide
LMM	Livestock Manure Management
M&E	Monitoring and Evaluation
MEPU	Ministry of Energy and Public Utilities
MESWMCC	Ministry of Environment, Solid Waste Management and Climate Change
MMS	Manure Management System
MW	Megawatt
NAMA	Nationally Appropriate Mitigation Action
NCCMSAP	National Climate Change Mitigation Strategy and Action Plan
NDC	Nationally Determined Contribution
RCCC	Rodrigues Climate Change Committee
RE	Renewable Energy
REHF	Renewable Energy Hybrid Facility
RRA	Rodrigues Regional Assembly
SEP	Stakeholder Engagement Plan
SIDS	Small Island Developing States
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar

FOREWORD

As Minister responsible for the portfolio of climate change, it gives me great pleasure to present the Rodrigues Supplement to the first National Climate Change Mitigation Strategy and Action Plan. As part of the Republic of Mauritius, Rodrigues is also unfortunately witnessing the disproportionate effects of climate change namely through severe droughts, degradation of the coral reefs and coastal erosion. These not only affect its natural environment but also have ripple effects on every sector of the island as well as the vulnerable communities. Taking into consideration this vulnerability, I am ensuring that programmes and projects on climate change are duly integrating a component for Rodrigues to help our brothers and sisters thereat. Healthy ecosystems that are resilient to climate change and stressors are not only critical to securing environmental benefits, but also serve as the foundation for economic and human development as well as ensuring that the population of Rodrigues is benefitting from all enablers to meet objectives under the Sustainable Development Goals and the 2021 updated Nationally Determined Contributions.

Under the Nationally Appropriate Mitigation Action (NAMA) project, a Rodrigues Supplement to the first National Climate Change Mitigation Strategy and Action Plan for the Republic of Mauritius has been developed as a first step towards the formulation of the Climate Change Mitigation Strategy and Action Plan for the island. Due to data and information gaps, the Rodrigues Supplement has covered specific strategies and actions for only two sectors namely energy industries and agriculture (livestock) as well as an elaboration of the climate governance of Rodrigues.

With the implementation of those measures which pertains mainly to enhancing renewable energy sources and improved food security through the adoption of environmentally sound animal excrement management technologies estimated at some USD 6.6 million, it is expected that 4,236 tonnes of carbon dioxide equivalent would be avoided by 2030 in Rodrigues relative to the business as usual scenario. I have no doubt that, in line with the passionate climate ambitions set for Rodrigues in the updated Nationally Determined Contributions and the commitment which the people of Rodrigues have for protecting their natural assets and biodiversity, that those mitigation actions would be duly implemented through public investments. As regards the Monitoring and Evaluation Framework, it is similar to that contained in the First National Climate Change Mitigation Strategy and Action Plan for the Republic of Mauritius and has been designed in compatibility with the requirement of the MauNDC Registry namely in terms of mitigation and support needed and received including the tracking of sustainable development benefits of mitigation actions.

On behalf of the Government of the Republic of Mauritius, I take this opportunity to extend our gratitude to the Global Environment Facility, the United Nations Environment Programme and the UNEP Copenhagen Climate Centre for the support extended for the preparation of this Rodrigues Supplement. I would also like to convey my deep thanks to all the relevant authorities in Rodrigues for their collaboration and active participation in the development of that document.

Honourable Rajesh Anand BHAGWAN
Minister of Environment, Solid Waste Management and Climate Change

EXECUTIVE SUMMARY

In 2021, the Climate Change Act (CCA) 2020 was proclaimed with the overarching objective to enhance the national climate governance'*with a view to making Mauritius a climate change-resilient and low emission country*'. The CCA 2020 will also support Mauritius to implement the provisions of the Paris Agreement (PA) up to 2030 and beyond. In 2021, Mauritius also submitted its updated Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) according to the requirementsof the PA. The updated NDC expresses an increase in the level of ambition to reduce atmospheric emissions of greenhouse gases (GHGs), while taking into account the country context and the common-but-differentiated responsibilities and respective capabilities to address climate change.

A National Climate Change Mitigation Strategy and Action Plan (NCCMSAP) has been developed for the period 2022-2030 to support implementation of the NDC, and same has been validated and approved by the Cabinet of Ministers. The NCCMSAP supports the long-term objective 'to contribute towards achieving a net-zero carbon society by 2070 while achieving the Sustainable Development Goals. The focus is on delivering sustainable development co-benefits while at the same time reducing GHG emissions across all sectors.

The CCA 2020 also requires the formulation of a Climate Change Mitigation Strategy and Action Plan (CCMSAP) for Rodrigues as provisionedin its Section 20. The Rodrigues Supplement to the NCCMSAP contained in this report seeks to support the formulation of the CCMSAP for Rodrigues. Except for the sector-specific strategies and actions, all other sections of the NCCMSAP are equally applicable to the Rodrigues Supplement. Whenever there are actions related to the Climate Change Committee (CCC) in the NCCMSAP, the same actions are to beapplied to the Rodrigues Climate Change Committee (RCCC). Because of data and information gaps, the Rodrigues Supplement to theNCCMSAP covers only two sectors, namely: (i) Rodrigues Energy Industries, and (ii) Agriculture (livestock).

The Rodrigues Supplement to the NCCMSAP at a glance

The Rodrigues Supplement to the NCCMSAP comprises 2 Mitigation Strategies and 4 mitigation actions across two sectors, namely Rodrigues Energy Industries and Rodrigues Livestock. The total capital investment has been estimated to at least **USD 6.6 million** for atotal emission reduction of **4,236 tCO_2e** by 2030. The emission reductions are measured relative to the business as usual (BAU) scenario.The below table summarises the number of mitigation strategies and actions for the two sectors, including the estimated investment costsand the percentage allocation between public, and private and other sources.

SECTOR	NUMBER OF STRATEGIES & ACTIONS	EMISSION REDUCTIONS 2030 (tCO_2e)	ESTIMATED COST (USD MILLION)	PUBLIC / PRIVATE ALLOCATION (%)
	Strategies = 1 Actions = 3	3,460.5	5.2	Public – 100%
Agriculture (Livestock)	Strategies = 1 Actions = 1	775.5	1.4	Public – 100%
Both Sectors	Strategies = 2 Actions = 4	4,236.0	6.6	Public – 100%

Sectoral Mitigation Strategies and Actions

Rodrigues Energy Industries

OUTCOME: DECARBONISATION OF THE ELECTRICITY SYSTEM USING RENEWABLE ENERGIES AND DEMAND SIDE ENERGY EFFICIENCY
TARGET: REDUCE EMISSIONS RELATIVE TO BAU BY 3.46 $ktCO_2e$ IN 2030INVESTMENT: USD 5.2 MILLION

REI1	Enhancing renewable energy sources in the electricity [16.3% RE in 2030]	REI1.1. Installation of 1 MW solar PV farm at Grenade REI1.2. Addition of a 1 MW / 1 MWh BESS to firm up the upcoming 1 MW PV Farm at Grenade and provide peak shaving functions REI1.3. Installation of a 1 MW/1 MWh REHF at Grenade inclusive of peak shaving functions

Rodrigues Agriculture (Livestock)

OUTCOME: IMPROVED FOOD SECURITY WITH APPLICATION OF MITIGATION TECHNOLOGIES FOR LIVESTOCK WASTE MANAGEMENT
TARGET: LIMITING INCREASED EMISSIONS RELATIVE TO BAU TO 0.78 $ktCO_2e$ IN 2030
INVESTMENT: USD 1.4 MILLION

RL1	Improved food security with adoption of environmentally-sound animal excrement management technologies	L1.1. Increase in livestock heads for increased food security with low-carbon excrement management technologies

M&E Framework

The M&E Framework for the Rodrigues supplement is the same as that contained in the NCCMSAP. It is designed for compatibility with the requirement of the Mauritius NDC Registry, including tracking of sustainable development benefits of mitigation. An example for the Energy Industries is illustrated below for energy supply side that is the main component of mitigation for Rodrigues.

ISSUE	AGENDA SETTING	FORMULATION	EVALUATION
Rising energy costs due to heavy reliance on imported fossil fuels (supply side)	1. Per capita energy bill (US$/ person/year) 2. Fossil fuel use (% of total final energy and electricity consumption) 3. Fossil fuel subsidies (US$/year) 4. Share of floor area of green buildings in total Park of buildings (%)	1. Share of renewables in electricity production (%) 2. Economic and financial incentives (US$/year) to invest in renewable energy sources and energy storage technologies 3. Investments in grid strengthening (US$/year) 4. Installed capacity of different types of renewables (MW) 5. Number of persons trained in renewables value chains (sex disaggregated)	1. Reduced costs of energy imports (US$/year) 2. National and household energy savings (US$/year) 3. Emissions from electricity generation and consumption (tCO_2/ year) 4. Grid emission factor (tCO_2/MWh) 5. Number of green jobs created in the electricity supply and demand value chains

Financing Mitigation Measures

In the case of Rodrigues, it is expected that the mitigation actions will be financed wholly using public investments.

1 INTRODUCTION

The scientific consensus is clear that unabated emissions of greenhouse gases (GHGs) in the atmosphere will have irreversible detrimental effects on the global climate system.[1] The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) [2] is to achieve stabilisation of atmospheric greenhouse gases (GHGs) at a level that would prevent dangerous anthropogenic interference with the climate system. The post-2020 legal instrument for achieving the objective of the UNFCCC is the Paris Agreement. Its objective is to constrain the temperature increase to well below 2°, and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.[3] Each Party to the Paris Agreement is expected to communicate ambitious efforts in Nationally Determined Contributions (NDCs) reflecting the common-but-differentiated responsibilities and respective capabilities, in the light of its national circumstances. Mauritius submitted its initial NDC in 2015[4] and an updated and enhanced NDC in 2021.[5] The increased mitigation ambition is reflected by an increase in economy-wide emissions reductions from 30% to 40% in 2030 relative to the business-as-usual (BAU). According to the updated NDC, the business-as-usual (BAU) emissions would reach 6.9 $MtCO_2e$ in 2030.

Connected to the NDCs is the preparation and communication of mid-century strategies, plans and actions[6] for low GHG emissions development that is the object of the Rodrigues supplement to the National Climate Change Mitigation Strategy and Action Plan (NCCMSAP) that was endorsed in 2022. The Rodrigues supplement to the NCCMSAP contributes to the requirement of Section 20 of the Climate Change Act (CCA) 2020,[7] which purports to formulate a Climate Change Mitigation Strategy and Action Plan for Rodrigues.

The long-term objective of the Rodrigues supplement is squarely aligned with that of the NCCMSAP which is "*to contribute towards achieving a net-zero carbon society by 2070 while achieving the Sustainable Development Goals and securing a high quality of life for all*". It is underpinned by several Rio Principles, including: sovereignty (Principle 2), common-but-differentiated responsibilities and respective capabilities (Principle 7), inclusiveness and subsidiarity (Principle 10), women and youth participation (Principle 20 and Principle 21), intergenerational equity (Principle 3), poverty elimination (Principle 5), precautionary approach (Principle 15), and partnerships (Principle 27).

1.1 Scope of the Rodrigues Supplement to the NCCMSAP

Article 4 of the Paris Agreement states that Parties[8] should aim to reach global peaking of GHGs as soon as possible, and to undertake rapid reductions thereafter based on the best available science in order to achieve balance between anthropogenic emissions and removals by sinks of GHGs – i.e. net zero carbon emissions – in the second half of this century. Reductions in GHGs are to be carried out on the basis of equity and based on national circumstances[9] so as to support sustainable development and eradication of poverty. Article 4 of the Paris Agreement is reflected in Section 20 of the CCA 2020.

In order to quantify GHG emission reductions, scenario analysis is carried out by first establishing a baseline scenario or the business-as-usual (BAU) scenario representing the emissions trajectory in the absence of mitigation actions (please see below for more details). A mitigation scenario that contains one or a bundle of mitigation actions is then modelled, and the difference between the mitigation scenario and the BAU gives the relative GHG emission reductions. To be able to establish the BAU scenario at either the regional or sectoral level, there is need for historical data that allows modelling to be carried out. In the case of Rodrigues, there are limited sector level data sets that allow emissions baselines to be developed. For instance, in the First Biennial Update Report (FBUR) [10] for the Republic of Mauritius, disaggregated GHG emissions for Rodrigues are calculated for the livestock sub-sector only. The Digest of Statistics on Rodrigues[11] provides activity data, including fossil fuel consumption, for electricity generation that can be used for calculating GHG emissions. However, data for other emissions sectors are not available. Consequently, the Rodrigues supplement to the NCCMSAP is limited to these two sectors. This shows that there is dire need to enhance the capacity of institutions in Rodrigues to develop comprehensive inventory data.

Except for the sector-specific strategies and actions, all other sections of the NCCMSAP are equally applicable to the Rodrigues Supplement. Whenever there are actions related to the Climate Change Committee (CCC) in the NCCMSAP, the same actions are to be applied to the RCCC. Consequently, the Rodrigues supplement covers only the sector specific strategies and actions (section 3 - electricity generation and section 4 - agriculture (livestock)), as well as an elaboration of the climate governance of Rodrigues (section 2) as stipulated in the CCA 2020.

1.2 Approach used for Mitigation Assessments

Mitigation assessments can be made based on a combination of three alternatives namely (i) a project- or activity-based approach, (ii) an outcome-based approach, or (iii) a combination of the two. These types of mitigation actions known as 'contribution type' are depicted in **Figure 1**.

1 IPCC (2021) Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson- Delmotte, V., et al. (eds.)]. Cambridge University Press.
2 UNFCCC (1992) United Nations Framework Convention on Climate Change. https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf. Accessed 15 Apr 2022.
3 UNFCCC (2015) Decision 1/CP.21: Adoption of the Paris Agreement. Paris Climate Change Conference, Paris, France.
4 Republic of Mauritius (2015) Intended Nationally Determined Contribution for the Republic of Mauritius, Ministry of Environment, Solid Waste Management and Climate Change, Port Louis.
5 Republic of Mauritius (2021) Update of the Nationally Determined Contribution of the Republic of Mauritius, Ministry of Environment, Solid Waste Management and Climate Change, Port Louis.
6 The long-term, low-carbon strategies that have been communicated to the UNFCCC are found at: https://unfccc.int/process/the-paris-agreement/long-term-strategies - accessed 19 October 2021.
7 Republic of Mauritius (2020) The Climate Change Act 2020, Government Gazette of Mauritius No. 145 of 28 November 2020.
8 Article 4(6) states that 'The least developed countries and small island developing States may prepare and communicate strategies, plans and actions for low greenhouse gas emissions development reflecting their special circumstances'.
9 Parties should strive to formulate and communicate their long-term low GHG emission development strategies, mindful of Article 2 – i.e. pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels – using the principle of common but differentiated responsibilities and respective capabilities; PNK Deenapanray (2021) Increasing the ambition of mitigation action in small emitters: the case of Mauritius, Climate Policy 21(4):514-528.
10 Republic of Mauritius (2021) National Inventory Report (NIR) to the United Nations Framework Convention on Climate Change, Ministry of Environment, Solid Waste Management and Climate Change, Port Louis.
11 Statistics Mauritius (2022) Digest of Statistics on Rodrigues; https://statsmauritius.govmu.org/Pages/Statistics/By_Subject/Rodrigues/SB_Rodrigues.aspx - accessed 30 August 2022.

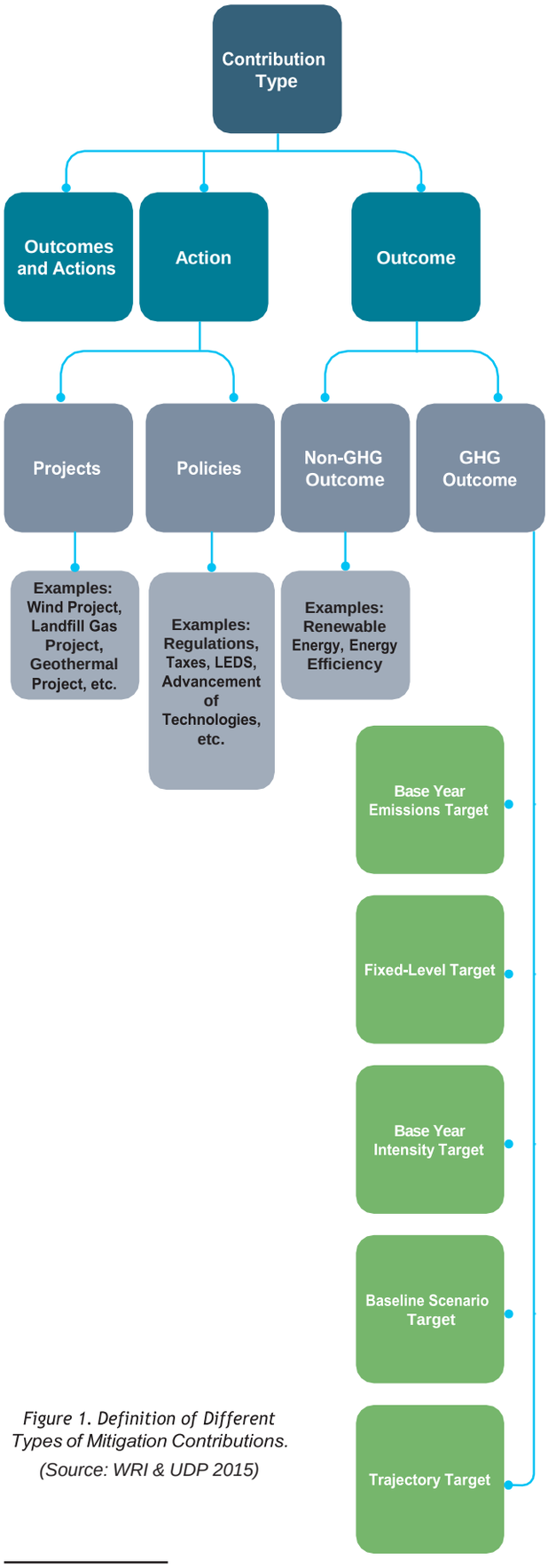

Figure 1. Definition of Different Types of Mitigation Contributions. (Source: WRI & UDP 2015)

The activity-based (bottom-up) approach has been adopted in developing the Rodrigues supplement to the NCCMSAP. The overall level of GHG emission reductions has been calculated by developing BAU sectoral baseline scenarios or the casewhen policies would be hindered due to prevailing barriers. For consistency, the same approach has been applied to develop the Rodrigues supplement to the NCCMSAP. The strategy and action planning has hinged on two interrelated activities, namely: (i) engagement with stakeholders in the two above-mentioned sectors in order to identification and prioritisation of mitigation actions; and (ii) policy and mitigation scenario analyses. The estimation of investment costs has been carried out based on data used in the NCCMSAP.

Stakeholder engagement is a cornerstone of the CCA 2020 both through Section 8(2)(l) and Section 19 on public consultation where public institutions should carry out public consultations for the purpose of developing strategies and policies. As per Section 19 of the CCA 2020, the process of formulating the Mitigation Strategy and Action Plan requires broad stakeholder consultations, including cross-sectoral coordination between public institutions. A Stakeholder Engagement Plan (SEP)[12] has been developed to guide facilitation of multi-stakeholder processes in order to achieve inclusiveness in participation.

In the case of Rodrigues, there are virtually no policy documents[13] that contain strategic orientations regarding future climate actions. Consequently, discussions were held with the competent authorities and institutions that are responsible for electricity generation and agriculture in Rodrigues, namely the Central Electricity Board (CEB) and the Commission for Agriculture, respectively. For the purpose of the NCCMSAP (and the Rodrigues supplement), the definition of sectors has been aligned with the nomenclature of the Intergovernmental Panel on Climate Change (IPCC). A BAU GHG emission scenario was modelled for each sector (or sub-sector) reflecting the absence of mitigation strategy and action plan. Similarly, alternative lower-emission scenarios were modelled for the identified mitigation policies and actions. The modelling approaches and customised tools for carrying out mitigation scenario analyses[14] are listed in **Table 1**.

SECTOR / SUB-	APPROACHES AND TOOLS
Energy industries (electricity generation and use)	Econometric model developed for Rodrigues electricity demand, and using structure used in the system dynamics model customized for Mauritius.[15] The results of the model were validated based on historical data and projected demand[16] by the CEB to 2030.
Agriculture (livestock waste management)	Excel-based tool customized for Rodrigues using the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.17

Table 1. Approaches and Tools used to carry out Mitigation Scenario Analyses in NAMA project.

12 *Ministry of Environment, Solid Waste Management and Climate Change (2022) Stakeholder Engagement Plan, MESWMCC, Mauritius.*
13 *At the time of developing the Rodrigues supplement to the NCCMSAP, Rodrigues was in the process of developing a long-term strategy for renewable energies. However, the results were not yet available for modeling purposes.*
14 *PNK Deenapanray and AM Bassi (2022) Mitigation Scenarios Modelling for Strategic Planning in Mauritius; The tools have been developed as open source products, and have been shared with institutional stakeholders.*
15 *More details of the structure of the model can be found in: Bassi A.M., and Deenapanray, P.N.K. (2012). A green investment analysis using system dynamics modeling – The case study of Mauritius. Small States: Economic Review and Basic Statistics, 16(12):256-265; Deenapanray, P.N K., and Bassi, A.M. (2015). System dynamics modelling of the power sector in Mauritius. Environmental and Climate Technologies, 16(1):20-35.*
16 *Discussions with Mr Iqbal Dreepaul in September 2022.*
17 *https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_05_Ch5_Cropland.pdf; https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_10_Ch10_Livestock.pdf - accessed 18 February 2022;*

2 CLIMATE GOVERNANCE IN RODRIGUES

The CCA 2020 sketches the institutional arrangements for climate governance in the Republic of Mauritius. A schematic representation of the institutional mechanism proposed in the CCA 2020 is shown in **Figure 2**, which also covers organs in Rodrigues. The mains organs of this institutional structure, namely the **Inter-Ministerial Council on Climate Change** (IMCCC) and the **Department of Climate Change (DCC)** are discussed in the NCCMSAP. The salient features and provisions that are pertinent to Rodrigues are given in Part VI of the CCA 2020, and they are:

- The **Chief Commissioner of Rodrigues** can be invited to attend IMCCC meetings on a needs basis;
  - The **Environment Commission** is expected to play the equivalent role of the DCC in that:

® the Commissioner for Environment shall be responsible for the formulation of a Climate Change Adaptation Strategy and Action Plan for Rodrigues and a Climate Change Mitigation Strategy and Action Plan for Rodrigues, as well as ensuring effective implementation and monitoring

® any public officers designated by the Island Chief Executive to assist the Rodrigues Climate Change Committee (RCCC) in the proper discharge of its function shall be under the administrative control of the Departmental Head of the Environment Commission

® the Departmental Head of the Environment Commission has an analogous function to the Director of the DCC as far as data and information related to climate change are concerned. As stipulated under Section 23 of the CCA 2020, the Departmental Head of the Commission may request any relevant public or private institution to submit, at a predetermined schedule, data and information on climate change

Reporting on progress made on the formulation and implementation of climate change strategies and action plans in order to achieve the goals and objectives set by the Council flows from the DCC to the Minister to the Council. Section 9(3) is explicit that the Director of the DCC shall report to the Minister: (i) on an annual basis regarding the compliance with Section 16 of the CCA 2020 relating to the duties of public and private institutions (discussed in the next section), and (ii) on any such matters as may be required under the CCA 2020. Hence, it is expected that all reporting related to Rodrigues will flow from the Environment Commission to the DCC.

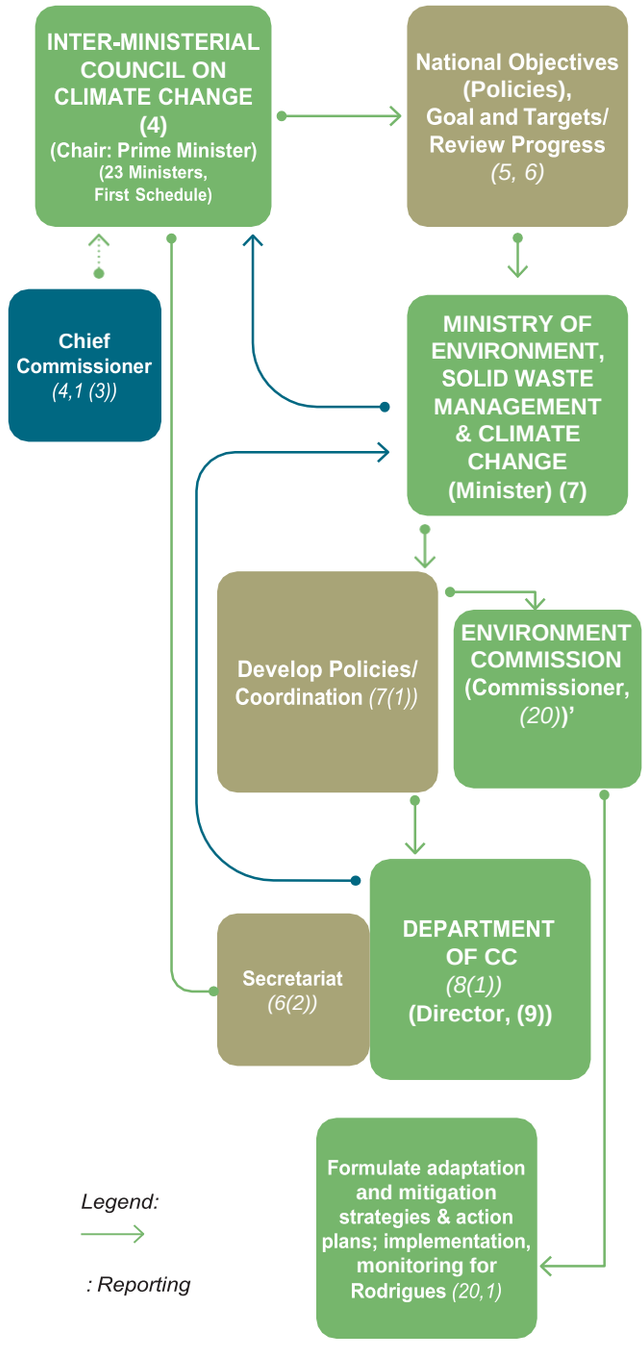

Figure 2. Schematic of Institutional Arrangements Proposed in the Climate Change Act 2020.

Since climate change is a developmental issue that cuts across all socioeconomic systems, the CCA 2020 also makes provision for carrying out multi-stakeholder coordination. For this, a **Rodrigues Climate Change Committee** (RCCC) is established under Section 21(1) of the CCA 2020, and its main functions shall be (Section 21(3)):

a to collaborate with the DCC in producing the National Inventory Report (NIR) and all other reports as required under the UNFCCC and its related instruments
b to coordinate the implementation of measures, in Rodrigues, related to greenhouse gas inventories, greenhouse gas emission reduction, the assessment of risks associated to, and vulnerability to, climate change, adaptation to climate change and compliance with the relevant laws
c to coordinate strategic planning and policies in the field of climate change in Rodrigues
d to coordinate any other activities related to climate change in Rodrigues

The RCCC is chaired by the Commissioner for Environment with the Departmental Head of the Environment Commission serving as Vice-Chairperson. The RCCC has the discretion **(Section 22(3))** to regulate its proceedings and establish subcommittees as may be necessary. The frequency of meetings must be at least once every month. The institutional arrangement including the RCCC and subsidiary bodies that may be established are shown in **Figure 3**.

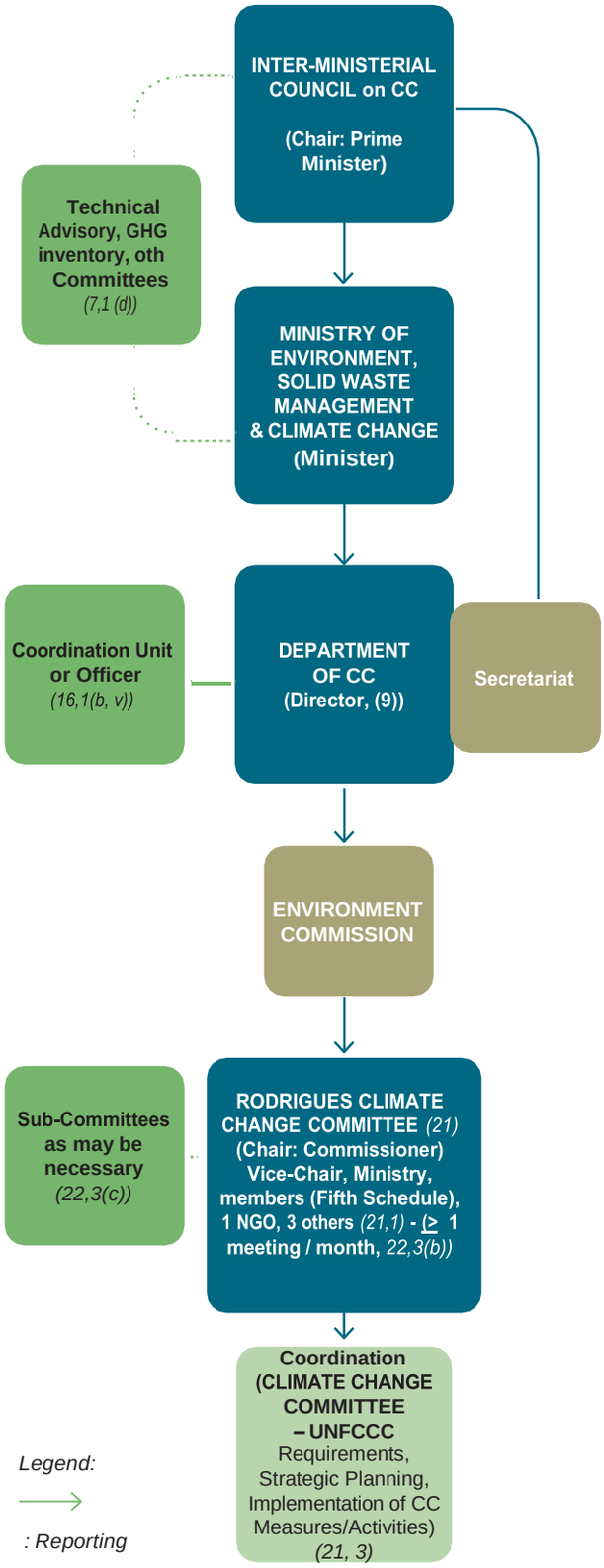

Figure 3. Additional Structures Proposed in the CCA 2020.

3 RODRIGUES ENERGY INDUSTRIES

31 Sectoral Emission Profile

In Rodrigues, electricity is generated from fossil fuels and renewable energies. Thermal generation is from diesel and heavy fuel oil (HFO), while renewable electricity generation is from both wind and solar energy resources. In 2021, a total of 46.5 GWh of electricity was generated, of which 42.9 GWh (or 92.3%) was from non-renewable energy sources **(Figure 4)**.

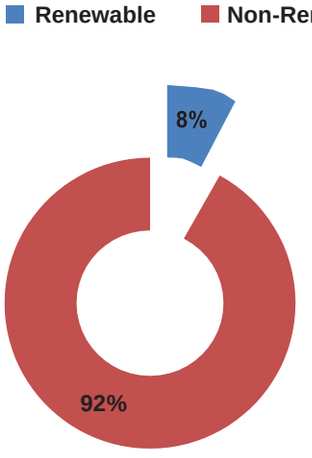

Figure 4. Share of Renewable and Non-Renewable Electricity: 2021.
(Source: Digest of Statistics on Rodrigues, 2022)

The changes in electricity generated from non-renewable and renewable energy sources are shown in **Figure 5**. The following observations can be made between 2010 and 2021:

- The share of renewable electricity generation from wind and solar energy sources has varied between 6.5% (2018) and 10.7% (2012). Between 2010 and 2021, the generation of renewable electricity has increased at a compound annual growth rate (CAGR) of 3.11%. In the latest 5 years (i.e. 2017 to 2021), the contribution of renewable electricity in total electricity generated has been between 6.5% and 7.6% with a CAGR of 3.93% per annum;
- Solar PV generation started in 2014 (100 MWh) and reached 700 MWh in 2021. Although the contribution of solar PV in the electricity mix is currently very small (1.51%), it has exhibited a strong CAGR of 32.05% per annum;
- Total electricity generation has grown from 32.1 GWh (2010) to 46.4 GWh (2021) - i.e. CAGR = 3.41% per annum. Between 2017 and 2021, the CAGR for total electricity generated is 2.52%. The bulk of this electricity is generated from thermal or non-renewable energy sources; 29.6 GWh in 2010 and 42.9 GWh in 2021 (CAGR = 3.43% per annum). The annual growth of thermal production is 2.41% per annum between 2017 and 2021;
- Although non-renewable electricity dominates generation in Rodrigues, the recent trend (2017-2021) shows that the annual growth of renewable electricity generation exceeds the growth of both total electricity generated and thermal electricity generated.

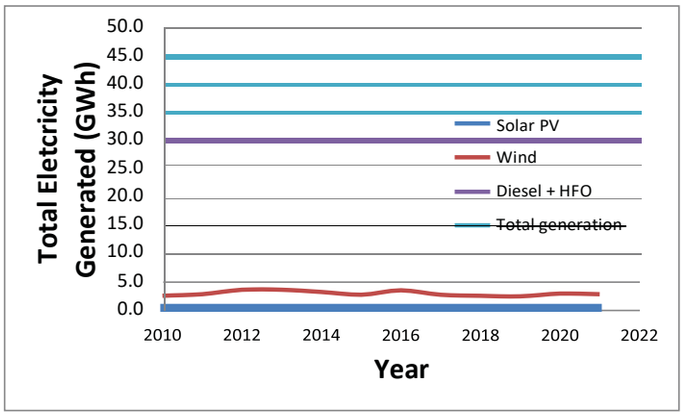

Figure 5. Renewable and Non-Renewable Electricity Generation: 2010-2021.
(Source: Digest of Statistics on Rodrigues, 2022)

GHG emissions accrue from the combustion of fossil fuels. In 2010 and 2021, 6,896 tonne HFO and 9,786 tonne were used,[18] respectively. These correspond to 20,924 tCO_2 in 2010 and 29,694 tCO_2 in 2021. Details of calculations are given in Annex 1.

18 *Statistics Mauritius (2022) Digest of Statistics on Rodrigues.*

32 Sectoral Strategies and Targets

At the time of developing the mitigation scenarios, Rodrigues did not have a strategy for the electricity sector.[19] The CEB provided information of prospective installation of additional renewable energy sources up to 2030 as given in **Table 2**.

RENEWABLE ENERGY TECHNOLOGY	INCREMENTAL CAPACITY (MW)	TIME SCHEDULE
Solar PV farm at Grenade	1	2023
Solar PV addition at Grenade with 1 MWh battery energy storage system (BESS)	1	2026
Solar PV addition at Grenade with 1 MWH renewable energy hybrid facility (REHF)	1	2029
TOTAL	**3**	

Table 2. New Renewable Energy Capacity Additions for Electricity Generation: 2023-2030.
Source: Central Electricity Board (through the Environment Commission)

33 Mitigation Actions, Enabling Measures and Finance Needs

The mitigation actions are detailed in **Table 3** following the information given in **Table 2**. The enabling measures and capital investment needs are given in **Table 4** using information contained in the NCCMSAP and in the Renewable Energy Roadmap 2030 for the Electricity Sector – Review 2022.[20] The modelled total GHG emission reductions expected by 2030 are 3.46 $ktCO_2e$ relative to the BAU. The total investment cost for mitigation actions for the Rodrigues Energy Industries is estimated at USD 5.2 million.

RODRIGUES ENERGY INDUSTRIES, REI OUTCOME: DECARBONISATION OF THE ELECTRICITY SYSTEM USING RENEWABLE ENERGIES (SOLAR PV) TARGET: REDUCE EMISSIONS RELATIVE TO BAU BY 3.4605 $ktCO_2e$ IN 2030				
ID	**STRATEGY**	**ACTION**	**TIME FRAME**	**MAIN STAKEHOLDERS**
REI1	Enhancing solar PV generation in the electricity mix of Rodrigues [3.46 $ktCO_2e$ ER]	REI1.1. Installation of 1 MW solar PV farm at Grenade	2023	Ministry of Energy and Public Utilities (MEPU); CEB; Rodrigues Regional Assembly (RRA)
		REI1.2. Addition of a 1 MW / 1 MWh BESS to firm up the upcoming 1 MW PV Farm at Grenade and provide peak shaving functions	2026	MEPU; CEB; RRA
		REI1.3. Installation of a 1 MW/1 MWh REHF at Grenade inclusive of peak shaving functions	2029	MEPU; CEB; RRA

Table 3. Mitigation Strategies and Actions for Rodrigues Energy Industries.

RODRIGUES ENERGY INDUSTRIES, REI	
REI1.1. Installation of additional 1 MW utility scale PV	**USD 1.1 million**
Measure 1.1.1. Implementation of CEB's Green Field RE Scheme	
REI1.2. Installation of 1 MW solar PV + battery storage	**USD 1.5 million**
Measure 1.2.1. Implement Request for Proposal for solar PV with BESS	
REI1.3. Installation of 1 MW new RE Hybrid Facility (solar PV + battery)	**USD 2.6 million**
Measure 1.3.1. Implement Request for Proposal for RE Hybrid Facility	
Cross-cutting measures supporting EI2 (CcME) *CcME 1: Grid reinforcement using Battery Energy Storage System, Automatic Generation Control, Advanced Distribution Management System and Advanced Metering Infrastructure* *CcME 2: Full operationalisation of the Utility Regulatory Authority* *CcME 3: Continued application of existing fiscal incentives to promote renewables* *CcME 4: Carry out feasibility studies of power generation using locally available woody biomass (e.g. invasive species)* *CcME 5: Cost benefit analysis of increased penetration of variable REs with alternative storage technologies*	

Table 4. Enabling Measures and Financing Needs, Rodrigues Energy Industries.

19 An initiative to formulate a renewable energy strategy for Rodrigues was ongoing, but the results were not yet available.
20 MEPU, MARENA, CEB and EEMO (2022) Renewable Energy Roadmap 2030 for the Electricity Sector – Review 2022, Ministry of Energy and Public Utilities, Port Louis.

34 Mitigation Scenarios

The impact of the mitigation strategies and actions **(Table 3)** on emissions reductions in the Rodrigues Energy Industries is shown in **Figure 6**. The mitigation actions are implemented sequentially relative to a business-as-usual (BAU) scenario. The share of renewables in the electricity mix increases from 7.7% in 2021 (BAU) to 16.3% in 2030. In 2030, the BAU emissions are 36.00 $ktCO_2$, and they decrease to 32.54 $ktCO_2$ with additional solar PV capacity additions – i.e. giving a total reduction of 3.46 $ktCO_2$.

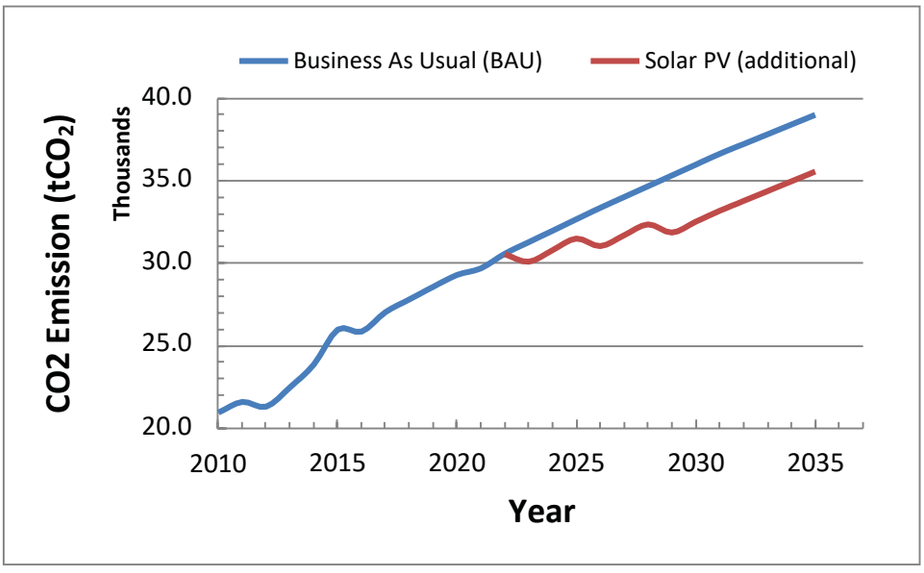

Figure 6. GHG Emissions Scenarios for Rodrigues Energy Industries.

4 RODRIGUES LIVESTOCK

41 Sectoral Emission Profile

In Rodrigues, emissions from animal husbandry are lower than from electricity generation. Nevertheless, GHG emissions from livestock in Rodrigues are in the same order magnitude as in Mauritius. In Rodrigues, livestock-related emissions increased from 13.49 $ktCO_2e$ in 2000 to 15.06 $ktCO_2e$ in 2016,[21] representing a compound annual growth rate (CAGR)[22] of 0.74% per annum. For comparison, livestock-related emissions for Mauritius were 22.48 $ktCO_2e$ in 2016.[23] The relatively large share of emissions from livestock indicates the strong significance of animal husbandry in the agricultural and food security strategy of Rodrigues. As in the case of Mauritius, most of the mitigation actions being developed and promoted in the agricultural sector involve and rely heavily on farmers' behavioural change.

Figure 7 shows that the enteric fermentation contributes the most significant part of total livestock emissions. It also suggests that changes in the Livestock Manure Management (LMM) system may not have a significant impact on livestock emissions reductions.

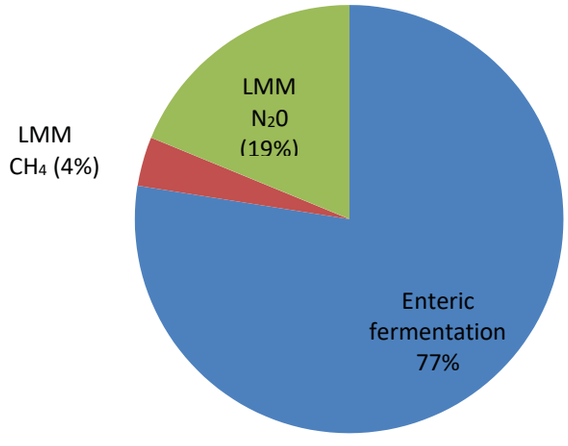

Figure 7. Relative Contributions of Enteric Fermentation and Livestock Manure Management (LMM) in Livestock Emissions: 2016.

42 Sectoral Policies and Targets

Rodrigues does not have an agricultural policy that gives prospective targets for the number and type of animals, as well as the technologies that can be deployed for more sustainable animal waste management. For instance, the NIR showed that information regarding the livestock sector in Rodrigues was derived from local experts, and data gaps regarding number of heads of animals by type were missing.[24] Similarly, there were data gaps in information on manure management system (MMS), and the NIR relied on expert judgement.[25]

The Rodrigues Supplement to the NCCMSAP has relied on information provided by the Commission for Agriculture. A strong emphasis is placed on food security as reflected in the targets given in Annex 2. **Table 5** summarises the description of mitigation actions for animal husbandry in Rodrigues. Both the BAU and mitigation scenario use the same data for animal heads that represent the current planned policy of enhanced food security.

21 Republic of Mauritius (2021) National Inventory Report (NIR) to the United Nations Framework Convention on Climate Change, Ministry of Environment, Solid Waste Management and Climate Change, Port Louis, pg. 121.
22 In the NIR (2021), the emissions from livestock are constant at 13.49 $ktCO_2e$ between 2000 and 2005. For the period 2005 to 2016, the CAGR is 1.01% per annum.
23 Republic of Mauritius (2021) National Inventory Report (NIR) to the United Nations Framework Convention on Climate Change, Ministry of Environment, Solid Waste Management and Climate Change, Port Louis, pg. 121.
24 Ibid., pg. 114.
25 Ibid., pg. 141.

STRATEGIES	DESCRIPTION OF ACTIONS
Baseline situation (or policy scenario with unchanged MMS)	The planned action to increase the number of goat, sheep and swine heads is used as shown in Annex 2. This represents the objective for increasing local food security and increase livelihoods. The model assumes that the technological options used for livestock manure management remains unchanged from that used in 2016.[26]
Mitigation scenario (enhanced food security with low-carbon manure management technologies)	

	2015	2020	2025	2030
Solid storage	0.27 (0.96)	0.27 (0.96)	0.2 (0.9)	0.1 (0.75)
Pasture	0.73 (0.04)	0.73 (0.04)	0.73 (0.04)	0.73 (0.04)
Anaerobic digestion	0 (0)	0 (0)	0.07 (0.06)	0.17 (0.21)

Table 5. Mitigation Strategies and Targets, Rodrigues Livestock.

43 Mitigation Actions, Enabling Measures and Finance Needs

The actions related to the mitigation strategies for Agriculture are given in **Table 6**, and the enabling measures and finance needs[27] are shown in **Table 7**. Finance estimated at USD 1.4 million is needed to implement the mitigation actions. This is a lower limit that excludes capital investments in scaling up low-carbon manure treatment systems.

RODRIGUES LIVESTOCK (RL) OUTCOME: IMPROVED FOOD SECURITY WITH APPLICATION OF MITIGATION TECHNOLOGIES FOR LIVESTOCK WASTE MANAGEMENT TARGET: LIMITING INCREASED EMISSIONS RELATIVE TO BAU TO 0.78 $ktCO_2e$ IN 2030				
ID	STRATEGY	ACTION	TIME FRAME	MAIN STAKEHOLDERS
RL1	Improved food security with adoption of environmentally-sound animal excrement management technologies	RL1.1. Increase in livestock heads for increased food security with low-carbon excrement management technologies	2022 - 2030	Commission for Agriculture FAREI; farmers

Table 6. Mitigation Strategy and Actions for Rodrigues Livestock.

RODRIGUES LIVESTOCK (RL)	
RL1.1. Increase in livestock heads for increased food security with low-carbon excrement management technologies	**USD 1.40 million**
Measure 1.1.1. Technology transfer of anaerobic (with biogas production) treatment of waste at the expense of solid storage Measure 1.1.2. Capacity building of farmers on the use of anaerobic animal waste technologies Measure 1.1.3. Economic and financial incentives provided to farmers for the adoption of low-carbon technologies	

Table 7. Enabling Measures and Financing Needs, Agriculture.

44 Mitigation Scenarios

In the BAU scenario, the MMS has been kept unchanged from its 2016 configuration, whereas it has been improved through the gradual uptake of anaerobic digestion at the expense of solid storage in the mitigation scenario. The technology utilisation factors are given for 2015 to 2030 in **Table 5** for cattle/dairy cows and swine (brackets). It is pointed out here that the Commission for Agriculture did not provide any information regarding prospective MMS for Rodrigues. Hence, the MMS technology utilisation fractions shown in **Table 5** are indicative based on the approach contained in the NCCMSAP.

The results of mitigation analyses are given in **Figure 9**. As mentioned earlier, the largest contributing factor to total livestock emissions is enteric fermentation. Hence, the prospective adoption of improved MMS does not result in substantial emissions reductions, which are found to be 0.78 $ktCO_2e$ in 2030 for the MMS technology options given in **Table 5**.

26 *Ibid., Table 93, pg. 118.*
27 *Since the action is similar to the case of Mauritius, the financing requirement has also been kept the same.*

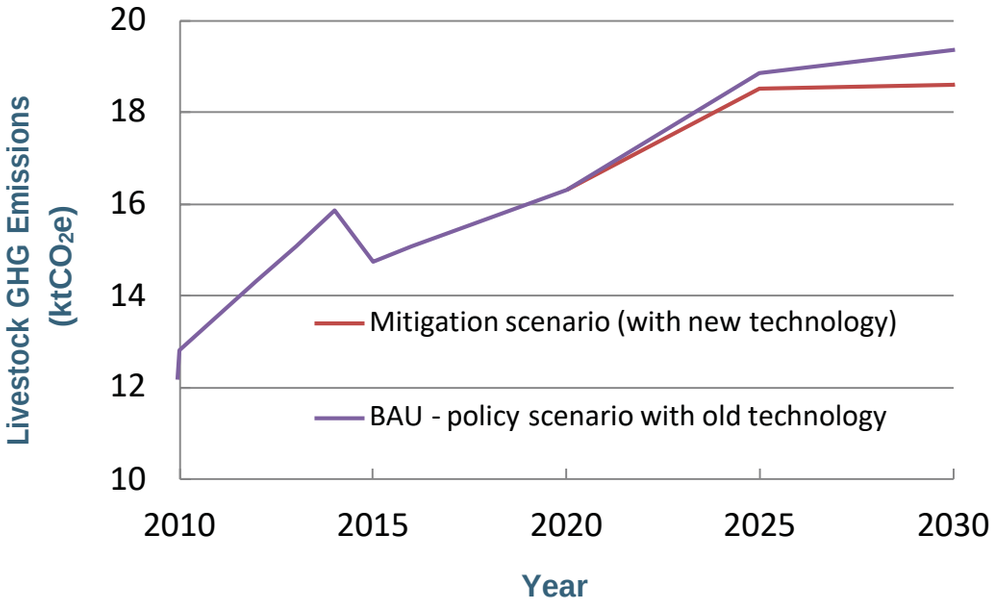

Figure 8. Mitigation Scenarios for Rodrigues Livestock Manure Management.

ANNEX 1 – RODRIGUES ENERGY INDUSTRIES

This annex provides information concerning the approach and assumptions used for mitigation scenario modeling in the Energy Industries of Rodrigues.

A. Estimating Electricity Generation to 2030

An econometric model has been developed based on the approach used for estimating electricity demand in the system dynamics model (SDM) of the Republic of Mauritius.

$$E_{(g}e_n e_{rat} e_{d,i)} = \alpha.\ Pop_i + \beta.\ GDP^{\gamma}_{proxy,i} + \varepsilon$$

Eq(1)

Where: $E_g e_n e_{rat} e_d$ is electricity generated in year *i* (MWh);

Pop is population in year *i*;

GDP_{proxy} is a surrogate for GDP in year *i*, and is the Public Finance for Rodrigues normalised for the year 2010;

α, β are coefficients, and ε is a residual term;

η is the elasticity of GDP.

The Digest of Statistics on Rodrigues[28] provides data for mid-year population between 2010 and 2021, and projections at 5 year intervals starting in 2021 (i.e. for 2026, 2031, 2037 etc…). Linear interpolation was used to estimate inter-annual population for 2022 to 2025; 2027 to 2030; 2032 to 2035. Data for Public Finance was also drawn from the Digest of Statistics on Rodrigues.[29] Projections were made using a constant annual growth rate of 2.66%, which is the annual growth rate between 2020 and 2021.

Regression analysis using historical data (2010-2021) was carried out to estimate the values of coefficients, residual term and the elasticity of GDP as follows: a = 2.42359; b = 42653.46064; e = -107945.93726; g = 0.15. The projected total generation of electricity (red line) to 2035 is shown in **Figure 9**, together with the historical data (blue squares). The maximum error in modelled results was less than 2.1%.

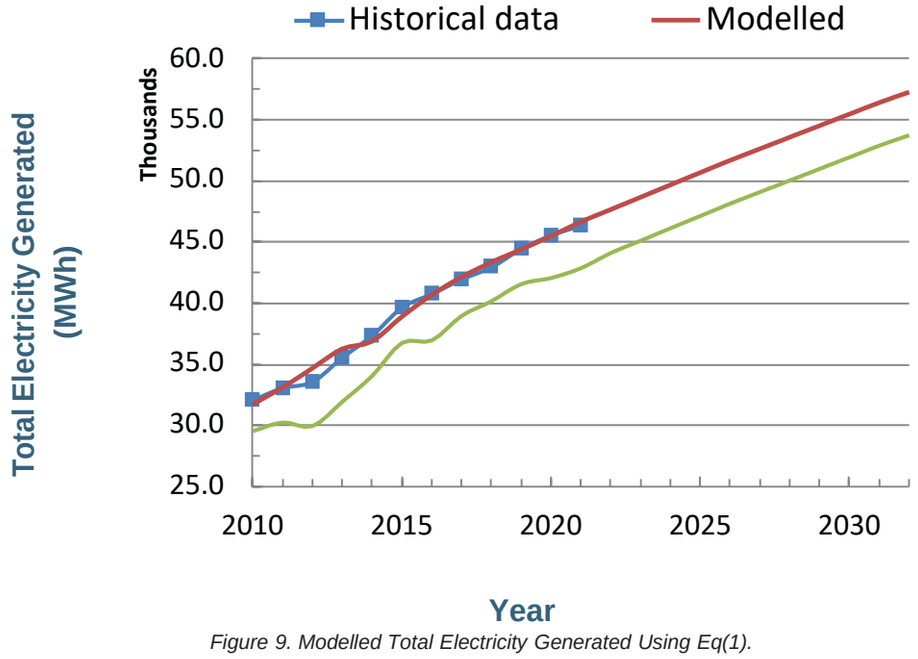

Figure 9. Modelled Total Electricity Generated Using Eq(1).

28 *Statistics Mauritius (2022) Digest of Statistics on Rodrigues – Population and Vital Statistics, Table 6 and Table 17.*
29 *Statistics Mauritius (2022) Digest of Statistics on Rodrigues – Population and Vital Statistics, Table 28.*

B. Estimating Renewable Electricity Generation to 2030

For estimating the generation of solar PV electricity from the data given in **Table 3**, Eq(2) and the assumptions given in **Table 9** were used.

$$^{E}Solar\ PV = Installed_{Solar\ PV} \times CF \times Availability \times Hours\ per\ year)$$

Eq(2)

Where: $E_{Solar\ PV}$ is electricity generated from solar PV (MWh/year);

$Installed_{Solar\ PV}$ is the solar PV installed capacity (MW);

CF is capacity factor (%);

Availability is the effective production time (%);

CAPACITY FACTOR, CF (%)	AVAILABILITY (%)	HOURS PER YEAR, HR/YEAR
*20**	*95*	*8,760*

Table 8. Assumptions Used for Estimating Electricity Generation from Solar PV.

*Note: * https://www.irena.org/Data/View-data-by-topic/Costs/Global-Trends - accessed 6 July 2023*

C. Mitigation Scenario Analysis

In **Figure 9**, the curve shown in green is the projected electricity generated from thermal energy sources that is used to generate the business-as-usual (BAU) emissions scenario. In the BAU, it has been assumed that the generation of renewable electricity will be frozen at its 2021 value of 3.5 GWh in the absence of any policy to increase renewable energy capacity. The following steps are used to construct mitigation scenario analyses.

1. *Estimating Fuel Consumption*: The projected thermal electricity is converted in an equivalent amount of HFO using the factor 4.38 MWh/t(fuel). This is the average value over the period 2010 to 2021 using historical data given in the Digest of Statistics on Rodrigues[30];
2. *Emission Factors for GHG Emissions calculation*: The quantities of HFO derived from the previous step are converted to GHG emissions using the emission factors given in **Table 9**;
3. *Mitigation Scenario*: Renewable electricity generated from additional solar PV generation (Part B above) is subtracted from the BAU electricity generation, and steps 1 and 2 are repeated.

FUEL SOURCE	NET CALORIFIC VALUE (GJ/T)	EMISSION FACTOR (TCO_2/TJ)	EMISSION FACTOR (TCO_2/T(FUEL)
HFO	*40.19*	*75.5*	*3.034*

Table 9. Emission Factors of HFO.

Source: Central Electricity Board (data used for calculating the Standardized Baseline Emission Factor for the Electricity System in Mauritius)

30 *Statistics Mauritius (2022) Digest of Statistics on Rodrigues – Population and Vital Statistics, Table 63.*

ANNEX 2 – RODRIGUES LIVESTOCK

The number of animal heads that were used for modeling the BAU and mitigation scenario to 2030 is given in **Table 10**.

Production (heads)	2010	2011	2012	2013	2014	2015	2016	2020	2025	2030
Dairy Cow	3177	3482.75	3788.5	4094.25	4400	4400	4400	4,550	4,600	4,650
Other cattle	4765	5223.75	5682.5	6141.25	6600	6600	6600	6,855	6,905	6,955
Imported beef (annualised figure)	1268	1435.75	1603.5	1771.25	1939	1939	1939	2,100	2,075	2,050
Goat	19685	19513.75	19342.5	19171.25	19000	14600	15700	19,000	21,000	23,000
sheep	9188	9391	9594	9797	10000	10900	11850	13,450	14,450	14,700
Pig	14719	15039.25	15359.5	15679.75	16000	10430	11000	13,000	15,500	17,000

Table 10. Number of Animal Heads Based on Current Plans: 2010-2030.

Source: FBUR-NIR, 2021 (2010 – 2016); data for 2020, 2025 and 2030 for goat, sheep and pig were provided by the Commission for Agriculture; the values for other animals are constructed to represent a conservative increasing trend.

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