
# TECHNOLOGY NEEDS ASSESSMENT REPORT-MITIGATION KIRIBATI

TNA TECHNOLOGY NEEDS ASSESSMENT

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**TNA Step 1 Report: Identification and prioritisation of mitigation technologies for Kiribati.**

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# Table of Content

## Abbreviations and Acronyms

| | |
|---|---|
| ALOFU | Agriculture, Forestry, and Other Land Use |
| AUD | Australian Dollar |
| BAU | Business as Usual |
| CCDRM | Climate Change and Disaster Risk Management Unit at OB |
| DBK | Development Bank of Kiribati |
| GEF | Global Environment Fund |
| GHG | Greenhouse Gases |
| GOK | Government of Kiribati |
| KNEG | Kiribati National Expert Group |
| $ktCO_2e$ | metric kilo ton of carbon dioxide (equivalents) or 1,000,000kg equivalent |
| MCA | Multi Criteria Analysis |
| MELAD | Ministry of Environment, Lands and Agricultural Development |
| MISE | Ministry of Infrastructure and Sustainable Energy |
| NDC | Nationally Determined Contribution |
| NSO | National Statistics Office Kiribati |
| OB | Office of the President |
| PICs | Pacific Island Country(s) |
| PUB | Public Utilities Board |
| RE | Renewable Energy |
| SOEs | State Owned Enterprise |
| SUV | Sport Utility Vehicle |
| TFS | Technology Fact Sheet |
| TNA | Technology Need Assessment |
| UCCC | UNEP Copenhagen Climate Centre |
| UNEP DTU | United Nation Environment Program Denmark Technical University |
| UNFCCC | United Nations Framework Convention on Climate Change |
| USD / US$ | United States Dollar |
| USP | University of the South Pacific |

**Forewords**

Kiribati is highly vulnerable to severe climatic changes, with rising sea levels posing an increasing threat. If global efforts to limit warming to 1.5°C fail due to the lack of effective mitigation solutions, the consequences for low-lying atoll nations like Kiribati will be devastating. Despite limited resources and capacity, the Government of Kiribati and its people are working together to enhance resilience by addressing coastal erosion, inundation, saltwater intrusion, and access to potable water.

In the mitigation sector, the Government has developed Kiribati's NDC Implementation Roadmap as part of its commitment to the Paris Agreement, aiming to reduce greenhouse gas (GHG) emissions and contribute to the global effort to limit warming to 1.5°C. Building on this roadmap, the NDC Investment Plan was created to provide critical information on mitigation technologies and their potential financing options, focusing on the transport and energy efficiency sectors.

The NDC Investment Plan has since become a guiding document for the Technology Needs Assessment (TNA) project and process. This country-driven initiative plays a fundamental role in bridging the technology gap and identifying transformative mitigation solutions at the national level.

I firmly believe that implementing both adaptation and mitigation technologies prioritized in the TNA report will strengthen Kiribati's resilience and help mitigate the impacts of climate change. I extend my heartfelt gratitude to the TNA National Team, including representatives from public and private entities, as well as my colleagues at the Climate Change and Disaster Risk Management Department, for their invaluable contributions in completing the first phase of the TNA process.

Additionally, I wish to acknowledge the national consultants and experts from UCCC and USP for their unwavering support and guidance in implementing the TNA project. A special thanks also to Kiribati Kindling for their efforts in organizing events and inspiring participants to contribute their insights and expertise.

**Mr. Tebwaatoki T Taawetia**

Secretary
Office of Te Beretitenti

## Executive Summary

A Technology Needs Assessment (TNA) is a tool through which developing countries can assess and identify the most appropriate technology options required for both key areas under climate change adaptation and mitigation. The TNA is a three-stage process and has three key objectives:

1. To identify and prioritise mitigation and adaptation technologies for selected sectors;
2. To identify, analyse and address barriers hindering the deployment and diffusion of the prioritised technologies, including the enabling framework for these technologies;
3. To conduct, based on the inputs obtained from the previous two steps, a Technology Action Plan, which is a medium/long term plan for increasing the implementation of identified technologies. The Technology Action Plan outlines actions to be undertaken.

This report shows the process of prioritising technology options to achieve Kiribati's greenhouse gas emission target in the Revised NDC 2022 submitted as identified in the Kiribati NDC Investment Plan 2021. The process is country-driven, steered by key stakeholders, coordinated by the Climate Change and Disaster Risk Management unit (CCDRM), and facilitated by the Consultant.

The NDC Investment Plan focus on the Transport and Energy Efficiency sectors. In selecting the sector during the Inception held on 5th November, 2024 as advised by the Director for Climate Change and Disaster Risk Management Department from Office of the Beretitenti (OB) due to the TNA limited coverage agreed that the Transport sector would be considered as the Energy Efficiency sector had completed two funded projects and some under implementation like the Minimum Energy Performance Standard and Appliance Labeling and the Building Code energy efficiency chapter.

In the Transport, the selection of the sector between Land and Sea was guided as requested by the stakeholders on the greenhouse gas (GHG) emission per sector. In reviewing the GHG emissions calculated from the NDC Investment Plan for Land Transport there are six opportunities that have potential to reduce 18.8 $ktCO_2$/year by 2030 as compared to Sea Transport identified opportunities with a total reduction of 6.2 $ktCO_2$/year by 2030. Furthermore, there exist a recent proposal for the Sea transport titled “Transitioning towards a low emission maritime transport sector in the Republic of Kiribati” with a project cost of US$55 million. Therefore, the Land Transport sector was selected to be considered in the TNA project.

After analyzing the Energy Statistic Yearbook and current energy data from 2010 to 2023 from the Energy Department, the road transport GHG emission trend was increasing sporadically jumping by two folds from 12.4 $ktCO_2$/year in 2010 to 32.3 $ktCO_2$/year in 2023. It is notable that the road transport emission had overtaken NDC target of 18.8 $ktCO_2$/year in 2017 in emitting 19.6 $ktCO_2$/year. Therefore, transitioning to electric vehicles is a plausible conditional option to achieve the NDC target by 2030.

The working group further evaluated and reviewed the road transport opportunities or technologies on their GHG emission potentials and viability and agreed to screen down the technologies selecting the most relevant ones that have significant impact in reducing GHG emission. This screening led to the shortlist of 3 technologies all of them on electric vehicles for Motorbike, Bus and SUV/saloon/pickup to be prioritised in the multi criteria analysis (MCA) during the Retreat workshop.

The national consultants prepared technology factsheets (TFS) for the selected technologies with the assistant of NDC Investment Plan concept notes for mitigation opportunities to help stakeholders in the briefing of the respective technology. As the technology will focus on the electric vehicle, stakeholders were concerned about the electric charging station and the current power crisis experienced on the capital island and proposed that solar charging station will be considered to reduce the stress on the electricity grid. In addition, the working group propose that the technology will be implemented from the government ministries and SOEs as there are no existing infrastructures, capacities, institutions, legislation and policies specific for electric vehicles currently and need to be developed and established first before diffusing to the private sector.

The 3 opportunities/technologies selected for the next stage of prioritization as follows:

- T2 – Bicycle/E-Bike Financing Initiative. Stakeholders agreed that the bicycle will be dropped out and the focus will be on electric motorbike.
- T8 – Multi-modal Transit Initiative. Stakeholders agreed that the opportunity will be started with Government ministries and SOEs Electric Bus and later when the infrastructures and charging stations are well developed will be extended to the private sector.
- T11 – Electric Vehicle Network Development. Stakeholders agreed that this will consider Government ministries and SOEs Electric SUVs/saloon/pickup and after maturity electric vehicles infrastructures and capacities will be extended to the private sector as in T8.

The MCA process involved the selection and setting of the Criteria, assigning weight and scores to the Criteria and lastly combining the criteria weight and score to come up with the priority list. The highest score among the technologies will determine the priority. Setting the Criteria and assigning weights and scores became a complicated matter as mitigation stakeholders came with different perspectives from their sector and involved a lot of debates until common grounds were reached and agreed among them.

The result of the prioritization using the MCA tool prioritized T8- Multi modal electric Bus as the top priority. After the final endorsement from high level decision the next stage of the TNA process on the selected technology will be continued.

# Chapter 1 Introduction

This report is the first deliverable in the Technology Needs Assessment (TNA) project for Kiribati. It outlines the process followed to determine the prioritized technologies for mitigation in the transport and energy sectors.

The desktop review includes TNA reports from other countries, scientific literature, market survey and Government existing policies, strategies and plans that facilitated the development of the National Determined Contribution (NDC) Roadmap and Investment Plan 2021. A list of technologies was formulated based on this desktop review which were further screened down based on stakeholders' consultation with the respective sector working groups. Working group sessions were conducted for the mitigation sector in which TNA fact sheets were discussed, and multi-criteria analysis (MCA) was conducted to prioritize the technologies.

The TNA process for Kiribati utilized the NDC Investment Plan 2021 developed by Kiribati National Experts Group (KNEG) facilitated from the Office of the President's Climate Change Unit and endorsed by Cabinet. The NDC Investment Plan 2021 focus the mitigation on Transport and Energy Efficiency sectors.

Nevertheless, to compete with the limited time and the relevance of the Kiribati NDC Investment Plan it was agreed by key stakeholders to use the NDC Investment Plan to guide the TNA project development. Similarly, as reported by the UNEP review on TNA projects submitted from countries, more than 70 percent referred to the needs assessment in their Nationally Determined Contributions (NDCs).

## 1.1 About the TNA project

The Technology Needs Assessment (TNA) process was founded from the Poznan Strategic Programme on Technology Transfer established during the Fourteenth Conference of the Parties (COP 14) to the United Nations Framework Convention on Climate Change (UNFCCC). The overarching aim is to scale up investment technology thus enabling developing countries like Kiribati to develop mitigation technology solutions that could lower greenhouse gas emission and improve our resilient to climate changes impacts.

A TNA is a country-driven process, grounded in national sustainable development plans, building national capacity and facilitating the analysis and prioritisation of climate technologies to support the implementation of the UNFCCC Paris Agreement. TNA's are central to the work of Parties to the Convention on technology transfer and present an opportunity to track on evolving needs for new equipment, techniques, and practical knowledge and skills, which are necessary to mitigate greenhouse gas emissions and reduce the vulnerability of sectors and livelihoods to the adverse impacts of climate change. The enhancement of technology development, its transfer, deployment and dissemination is a key pillar of the international response to climate change.

Kiribati is one of the last countries to develop its TNA project starting in early November 2024 and to be completed by May 2025 due to the TNA project closure date from GEF. The TNA Consultants recruitment was severely delayed and started the first orientation with the TNA Coordinator in November 2024 followed by the Inception meeting first session on the 5$^{th}$ December 2024 with stakeholders at the CCRDM Boardroom. During the meeting, the stakeholders agreed to focus on the Transport sector for the TNA project and after reviewing

the greenhouse gas emission for the Land and Sea transport sectors, selected the Land transport sector and screened down the technologies for electric vehicles for the technology prioritisation.

The second session of the Inception meeting was carried out in a two days retreat workshop from 11th to 13th December 2024 at Midland Resort in North Tarawa for the multi criteria analysis (MCA) on the selected technologies from the first session. Technology fact sheets for each of the technologies was shared and explained with the working group prior the MCA exercise. The prioritization exercise was completed on the second day of the retreat.

The TNA is a three-stage process and has three key objectives:

1. To identify and prioritise mitigation and adaptation technologies for selected sectors;
2. To identify, analyse and address barriers hindering the deployment and diffusion of the prioritised technologies, including the enabling framework for these technologies;
3. To conduct, based on the inputs obtained from the previous two steps, a Technology Action Plan, which is a medium/long term plan for increasing the implementation of identified technologies. The Technology Action Plan outlines actions to be undertaken.

## 1.2 Existing national policies related to climate change and development priorities

### 1.2.1 Country profiles

Kiribati is made up of three main island groups known as the Gilbert group where the capital Tarawa is located, the Phoenix group where Kanton is located and only inhabited and the Line group where Kiritimati is situated and administering the Line and Phoenix groups of islands. The country is located astride both the equator and the international date line but was politically moved to the east due to the day differences between the groups of islands. The three main island groups stretch over 800 kilometers (km) from north to south and over 3,240 km from east to west. The groups of islands comprised of 33 scattered atoll islands dispersed over 3.5 million square kilometers. Kiribati's coral atolls are very low-lying, with a maximum elevation of 3 to 4 meters (m) above sea level except Banaba a raised coral island with a highest point of 81m.

Kiribati population in 2020 Census is 119,940 where 50.7% are females and 49.3% males, this is an increase of 9% (9,804 persons) as compared to the 2015 Census. The median age of the I-Kiribati population is 22 years and over a third of the population is younger than 15 years of age. South Tarawa the capital is where the majority 52.9% of the population resides of Kiribati.

Kiribati is considered a Least Developed Country among Pacific Small Island States. As an atoll nation with an expansive ocean area the country is endowed with extensive marine resources. Despite the systemic challenges and constrain economic development encountered as an LDC, the Kiribati Vision for 20 Years Plan (KV20) commits the government to work with development partners to improve national capacity, improve connectivity to international markets and upgrade national infrastructure. This demonstrated the country's commitment to enhance the capacity for resilience to cope with severe climatic events.

According to IMF after the pandemic Kiribati's economy recovered strongly and strengthened by the supportive fiscal policies. The economy has recovered well after the pandemic recession and getting stronger estimated to be around 17% larger in 2023 compared to 2019. This recovery is attributed to a substantial increase in the government's recurrent spending from

2019 to 2023, mainly on subsidies and grants. The government introduced new benefits as expressed in their manifesto like unemployment benefits for citizens aged 18 to 59 years and senior citizens in 2020, leave grants for the private sector in 2023 and increased copra subsidy. Notably, Kiribati has one of the highest recurrent spending to GDP ratios in the world at 64% on average over 2019–23. Nevertheless, this spending is largely financed by fishing revenue, budget support from development partners, and tax revenues.

### 1.2.2 National policies related to climate change mitigation

The Kiribati Climate Change Policy (KCCP) provides the mandate and policy framework for enhanced coordination and scaled-up implementation of climate change adaptation, mitigation and disaster risk reduction (KNEG) comprised by all Ministerial sectors, Non-Governmental Organization in Kiribati. The Kiribati Joint Implementation Plan (KJIP) operationalizes the KCCP developed from the Kiribati National Expert Group.

The KJIP identifies the following 12 major strategies. The TNA development is related to "Strategy 9 - Promoting the use of sustainable, renewable sources of energy and energy efficiency", where valuable efforts in developing plans have been undertaken by key stakeholders facilitated by international and regional agencies in developing

Mitigation sectors reported in the Kiribati Integrated Energy Roadmap and more specified in the Kiribati NDC Roadmap were considered to align with Government policies. The former outlines key strategies for the transition of the electricity generation sector to integrate more renewables into the grid system and transport internal combustion engines transition to electric vehicles to decrease imported fossil fuels. The latter consider key strategies for the transport sector consumption on fossil fuel reduction and energy efficiency sectors. The NDC Investment Plan detailed the opportunities or technologies identified in the transport and energy efficiency sectors which are used for the initial selection by key stakeholders.

Therefore, this TNA project was very well informed and developed in alignment to the national level policies and plans:

- Kiribati revised National Determined Contribution 2022
- Kiribati 20-year Vision 2016-2036,
- Kiribati Climate Change Policy (KCCP) 2018,
- Kiribati Joint Implementation Plan for Climate Change and Disaster Risk Management (KJIP) 2019 - 2028,
- Kiribati National Development Plan (KDP) 2020 - 2023,
- Kiribati Integrated Environmental Policy (KIEP) 2013,
- Kiribati Integrated Energy Roadmap 2020 -—2025,
- Intended Nationally Determined Contribution (INDC),

### 1.3 Vulnerability assessments in the country

The vulnerability assessment sub-chapter was extracted from the Kiribati Climate Change Policy report, Kiribati remains one of the most vulnerable countries globally to the effects of climate change and climate-related disasters. Its ability to respond to climate risks is hampered by its highly vulnerable socio-economic and environmental conditions and geographical situation. Low atolls, isolation, small land areas separated by a vast expanse of ocean, a highly concentrated population, and the costs of providing basic services make Kiribati, like all Least Developed Countries and Small Island Developing States, especially vulnerable to external shocks including the adverse impacts of CC and disasters. Sea-level rise and exacerbated natural disasters, such as drought and extreme weather fluctuations, pose significant and direct additional threats to sectors and resources central to the provision of basic services and national development.

The following factors contribute to the nation's vulnerability to climate change and disaster risks and apply across the various sectors outlined in this policy

- The already high population density and growth rate on South Tarawa in the Gilbert Group continue to increase.
- Sea-level rise poses the greatest threat to the people of Kiribati, given that the atolls are low lying and the majority of people live on the coast.
- Kiribati's atoll islands provide only a small area of land for people to reside on. Where coastal areas have been highly affected by sea-level rise in association with other factors, people have relocated within the atoll itself, which is problematic given the scarcity of land in general and certain land tenure issues.
- Available underground water sources are vulnerable and can be easily contaminated by saltwater intrusion, which will diminish water security and cause health and food security problems for the population.
- Kiribati is highly dependent on revenue from fisheries; 64% of actual revenue in 2023 (2024 Budget Book), or approximately AUD 212 million, was derived from fishing licenses and other fishing revenue. Any changes in climate will have a direct negative impact on the marine ecosystem and fisheries stocks, which will result in reduced revenue for Kiribati.
- Production and consumption of traditional staples are declining in favour of imported food, and the number of people who preserve and apply traditional knowledge is decreasing, affecting food security.
- In rural areas, people have very limited access to employment opportunities, transport, communication and community services such as education and health. This lack of access, combined with a high dependency on imported food, makes rural communities more vulnerable.
- Emergency response capacities and capability in Kiribati are very limited and often ineffective in responding to large-scale events.
- Kiribati has low terrestrial biodiversity, particularly of the resources that people depend on for economic, social and environmental benefits, including food and water and cultural and heritage values.

The factors outlined above add to the barriers to building effective resilience and affect all aspects of sustainable development in Kiribati.

The most recent vulnerability assessment for the country is reflected in the Kiribati revised NDC submitted in 2022. Climate change vulnerability was explored under two categories: key climate trends and climate related natural hazard summaries as following:

Key Climate Trends

- Temperatures — on Kiribati's islands are generally stable throughout the year, although there are some variations between and within island groups. As reported in Kiribati's NDC, an average increase in maximum temperatures of 0.18°C per decade has been observed during the period 1950 to 2009. For the capital, Tarawa, maximum temperatures rose by 0.13°C per decade from 1950 to 2013.From 1970 to 2009 there have been rises in the sea surface temperature of 0.15°C in the Gilbert group, 0.12°C in the Phoenix group and 0.10°C in the Line group."
- Precipitation — between 1946 and 2023, annual rainfall has increased significantly in Kiritimati Island (in the northern part of the Line islands) whilst in the capital—Tarawa—there has been no significant change in annual precipitation over the same period." The country has been affected by severe droughts at sporadic intervals, with annual rainfall falling below 750mm in 1974, 1985, 1998 and 1999. El Nino Southern Oscillation (ENSO) has a strong influence over interannual precipitation variation over Kiribati's islands.

**Climate related Natural Hazards**

- Heatwaves — with a typically stable temperature regime, further research is required to better understand the implications of climate change, and its interaction with the ENSO phenomenon, for Kiribati's future temperature regime and potential heatwaves, though statistically, the probability of heatwaves is likely to grow significantly, as the average temperature moves away from the historical baseline. Another key concern is marine heatwaves that are projected to extend their spatial footprint and to grow in duration and intensity especially with the identification of Western Tropical Pacific as a global hotspot for climate change impacts on marine heatwaves. The consequences of this trend may be serious for marine ecosystems in the region (and the livelihoods dependent on them), and specifically on Kiribati's productive tuna fishery.
- Drought — meteorological drought, associated with a precipitation deficit is the primary type of drought affecting Kiribati. While some studies "suggest that the time spent in drought is projected to decrease slightly or remain the same for most PICs, prolonged droughts, particularly during La Nina, can cause extreme water shortage, affecting agriculture and peoples' general wellbeing.
- Floods, cyclones and storm surge — climatic patterns currently tend to shelter Kiribati's islands from the direct impact of cyclones however, impacts can still be felt when cyclones pass within a few hundred kilometres. Known risks include sea-level rise, which has risen by 4 - 4mm per year as measured by satellite altimeters thus enhancing the damage caused by cyclone-induced storm surges, and the possibility of increased wind speed and precipitation intensity." Modelling of climate change impacts on cyclone intensity and frequency conducted across the globe points to a general trend of reduced cyclone frequency but increased intensity and frequency of the most extreme events."
- Ocean acidification — according to the climate projections presented in Kiribati's initial NDC, there is very high confidence that the acidification of the ocean will continue to increase. The annual maximum aragonite saturation state will reach values below 3.5 by about 2045 in the Gilbert Islands, by about 2030 in the Line Islands, and by about 2055 in the Phoenix Islands. The aragonite saturation will continue to decline thereafter (moderate confidence). Ocean pH will decrease by -0.4 units by 2035 and by -0.2 to -0.3 units by 2100." Coral reefs

are projected to degrade progressively with losses of live coral of > 25% by 2035 and > 50% by 2050 due to rising sea-surface temperatures and more acidic oceans."

### 1.4 Sector selection

The priority sectors for mitigation chosen for analysis under the TNA is guided from Kiribati NDC Implementation Roadmap 2021. This selection was based on the mitigation opportunities outlined in the Kiribati NDC Investment Plan 2021 as agreed by the key mitigation stakeholders from the government ministries, state owned enterprises and non-government organizations of the country.

The NDC Investment Plan identifies Transport and Energy Efficiency sectors. In selecting the sectors due to the TNA to only focus on one technology, the meeting agreed that the Transport sector will be considered as the Energy Efficiency sector had been completed and some under implementation like the Minimum Energy Performance Standard and Appliance Labelling and the Building Code energy efficient chapter.

In the Transport, the selection of the sector between Land and Sea was guided as requested by the stakeholders on the greenhouse gas (GHG) emission per sector. In reviewing the GHG emissions calculated from the NDC Investment Plan for Land Transport totaling 111 $ktCO_2e$ /year as compared to Sea Transport totaling 34 $ktCO_2e$ /year. Furthermore, their exist a recent proposal for the Sea transport titled "Transitioning towards a low emission maritime transport sector in the Republic of Kiribati" with a project cost of US$55 million and estimated mitigation impact 6.3 $ktCO_2e$ /year. Therefore, the Land Transport sector was selected to be considered in the TNA.

#### 1.4.1 An Overview of Expected Climate Change and its Impacts in Sectors Vulnerable to Climate Change

The Kiribati's Second National Communications (SNC) on Climate Change indicated total national GHG emissions of 64 $ktCO_2e$ equivalent in 2008. Similarly, the approximate GHG emissions of 96.5 $ktCO_2e$ in 2019 was reported in the Kiribati's Revised NDC in 2022 which represents approximately 0.0002% of global emissions. Kiribati's revised NDC submitted in 2022 has an unconditional commitment to reduce 25% and a conditional commitment to reduce 75% GHG emission in 2030 based on a Business-as-Usual (BAU) scenario. With the BAU GHG emissions estimated to be 138.1 $ktCO_2e$ in 2030.

Kiribati's Revised NDC commit to reduce GHG emission by the following sectors:

- Energy: power generation, transport, energy efficiency
- Waste: solid waste and wastewater
- Hydrofluorocarbon: substitutes for ozone depleting substances
- Agriculture, Forestry and Other Land Use (AFOLU): planting new mangroves.

The following table detailed further the emission reduction from identified sectors:

*Table 1.1: Possible Unconditional and Conditional Commitment for the Revised NDC*

| **Unconditional ($ktCO_2e$ in year)** | **2020** | **2025** | **2030** |
|---|---|---|---|
| Operating & financed solar systems (from 2015) | 2.44 | 2.38 | 2.32 |
| Hydrofluorocarbon reduced | 0 | 0.12 | 0.12 |
| Carbon sequestered | 0.07 | 0.16 | 0.15 |
| On-going solar systems | 0 | 8.66 | 8.44 |
| ***Total Unconditional*** | **2.63** | **11.32** | **11.03** |
| | | | |
| **Conditional ($ktCO_2e$ in year)** | **2020** | **2025** | **2030** |
| Planned solar & ocean thermal system | - | 1.72 | 1.68 |
| Hydrofluorocarbon reduced | - | 0.4 | 1.09 |
| Carbon sequestered | - | - | - |
| Waste | - | 0.05 | 0.88 |
| Transport | - | 14.08 | 18.06 |
| Energy Efficiency (adjusted) | - | 3.97 | 11.28 |
| ***Total Conditional*** | **-** | **20.00** | **33.00** |
| | | | |
| **Total Mitigation (unconditional + conditional** | **2.63** | **31.32** | **44.03** |

According to the Table above the GHG reduction in 2030 from the Transport sector was the highest to achieve a target of 18.06 $ktCO_2e$/yr followed the Energy Efficiency sector 11.28 $ktCO_2e$/yr conditionally.

### 1.4.2 Process and results of sector selection

During the Inception meeting on 5th December 2024, in reference to NDC Investment Plan for Transport and Energy Efficiency, the advice provided from the Climate Change and Disaster Risk Management Department (CCDRM) of the Office of Te Beretitenti was to focus on Transport sector. The reason was based on the completed and ongoing funded projects identified for Energy Efficiency opportunities. Therefore, the Transport would be considered in the TNA project.

Furthermore, the CCDRM recommended that Land Transport will be a priority as another funding proposal for the Sea Transport project had been developed and seeking donor funding. The Stakeholders also seconded the advice from the CCDRM and agreed to focus the TNA on Land Transport as per opportunities identified in the NDC Investment Plan.

## Chapter 2 Institutional arrangement for the TNA arrangement

The Climate Change and Disaster Risk Management division (CCDRM) of the Office of the President acts as the coordinating agency for the implementation of the Kiribati Climate Change Policy and its implementation plans in the NDC Investment Plan and this TNA project. Respective government ministries will lead technical implementation/investment plans like the Ministry of Infrastructure and Sustainable Energy for mitigation projects in energy efficiency, Ministry of Transport for mitigation project in the transport sector and so forth.

CCDRM is responsible to report on NDC Investment Plan for mitigation and National Adaptation Plan and liaising with and reporting to the United Nations Framework Convention on Climate Change (UNFCCC) matters and ensuring transparency, integrity, and consistency of reporting.

As the Coordinating Agency for this TNA, CCDRM coordinate with key stakeholders for the technical contribution and participation in developing the TNA project document and facilitate the Consultants work program and consultations with key stakeholders.

### 2.1 National TNA team

The structure of the TNA Project in Kiribati followed the structure recommended by the TNA Process (Figure 2.1). The TNA National Coordinator is supported by a National Project Steering Committee comprising of Kiribati National Expert Group members from government agencies and non-government organization, and provides the consulting team with overall vision, leadership support, communication, and guidance.

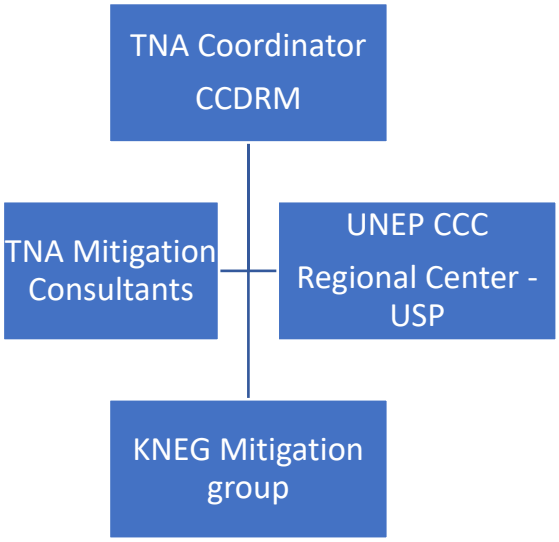



*Figure 2.1 of the TNA Mitigation Team in Kiribati*

**TNA Coordinator**

The National TNA Coordinator was appointed from CCDRM Division. The TNA coordinator has the responsibility to manage overall TNA process, including the recruitment of national consultants (adaptation and mitigation) and ensure the consultations and workshops held to identify the priority sectors for the TNA process. The role of the coordinator also includes presentation of report findings to the NSC for endorsement.

**TNA Consultant**
National expert consultants are responsible for finalising the TNA Report after thoroughly identifying and prioritising technologies for the two sectors identified under climate change adaptation and mitigation after exhaustive consultation with the relevant stakeholders and experts. The National consultants lead the process of multiple-criteria analysis, along with the national stakeholder groups, and facilitate the process of technology prioritisation, addressing the barriers and developing an enabling framework.

**TNA Sectoral Working Group**
There is already a KNEG Mitigation group established by the CCRDM to deal with mitigation projects comprising of key stakeholders from government ministry departments, state owned enterprises and non-government organisations.

The primary role of each the mitigation working group is to review and analyse each fact sheet and corresponding Multi-Criteria Analysis (MCA) rankings before presenting it at the wrap up meeting.

## 2.2 Stakeholder Engagement Process followed in the TNA

The TNA utilised the Kiribati National Expert Group (KNEG) coordinated from the Climate Change and Disaster Risk Management division. KNEG are technical experts in the ministry divisions, state owned enterprises and non-government organisations. All of these entities were informed by the CCDRM to send their participants every time the KNEG meet and the selection of the participant is done by the respective entity.

In this TNA process, the CCDRM division organize and coordinate all members of the KNEG who have also been assigned to Mitigation and Adaptation groups for the planned meetings and workshops. This existing arrangement is very useful providing up to date information and status continuity for the respective entities on climate change implementation planned activities. Moreover, the decision of the planned activities is guided by key stakeholders at the national level supporting the TNA project objective to be country driven.

## 2.3 Consideration of Gender Aspects in the TNA process

Gender aspect's consideration in the TNA process is important as the climate change affects all members of society and its impacts can be different for men, women, disabled and old citizens. The Constitution of Kiribati states that every individual is entitled to fundamental rights and freedoms regardless of race, place of origin, political opinion, colour, creed or sex.

Kiribati is committed to mainstreaming gender equality across its development and climate change polices and plans. It recognizes the critical need to actively pursue greater involvement of women, youth, persons with disability and other marginalised groups in the development and implementation of the public infrastructures such as the building codes and in public service employment recruitments for government ministries and state owned enterprises and non-government organisations.

The proportion of male and female during the TNA stakeholder workshop confirms that women lead:

Inception meeting - Male 25% and Female 75%
MCA Retreat workshop – Male 14% and Female 86%

Notably during the work group exercise, gender and person with disability consideration was also part of the discussion for each technology.

# Chapter 3 Technology prioritisation for Land Transport

Kiribati is among the most vulnerable countries to the impacts of climate change yet continue to be increasingly dependent on imported fossil fuels that dominates its Greenhouse Gas (GHG) emissions. According the NDC Implementation Roadmap, the BAU baseline scenario as defined in the (Intended) NDC leads to GHG emissions of approximately 73.5 $ktCO_2e$/year in 2025, and 78.3 73.5 $ktCO_2e$/year in 2030. The goal of the NDC Roadmap is to provide a temporal pathway with concrete mitigation actions, and indicate approximate investment needs, to achieve the transformational change called for to contribute to unconditionally reduce 12.8% of BAU GHG emissions and conditionally reduce 49% of BAU GHG emissions by 2030.

Currently as the year 2025 will be in the TNA process, the group consider the mitigation actions lead to the Revised NDC in 2030 total GHG emission of 44 $ktCO_2e$ comprising of reduction targeted on Unconditional 8.0 % (11 $ktCO_2e$) and Conditional 23.8% (33 $ktCO_2e$) of BAU GHG emission and Unconditional carbon sequestration/sink of 0.15 $ktCO_2e$.

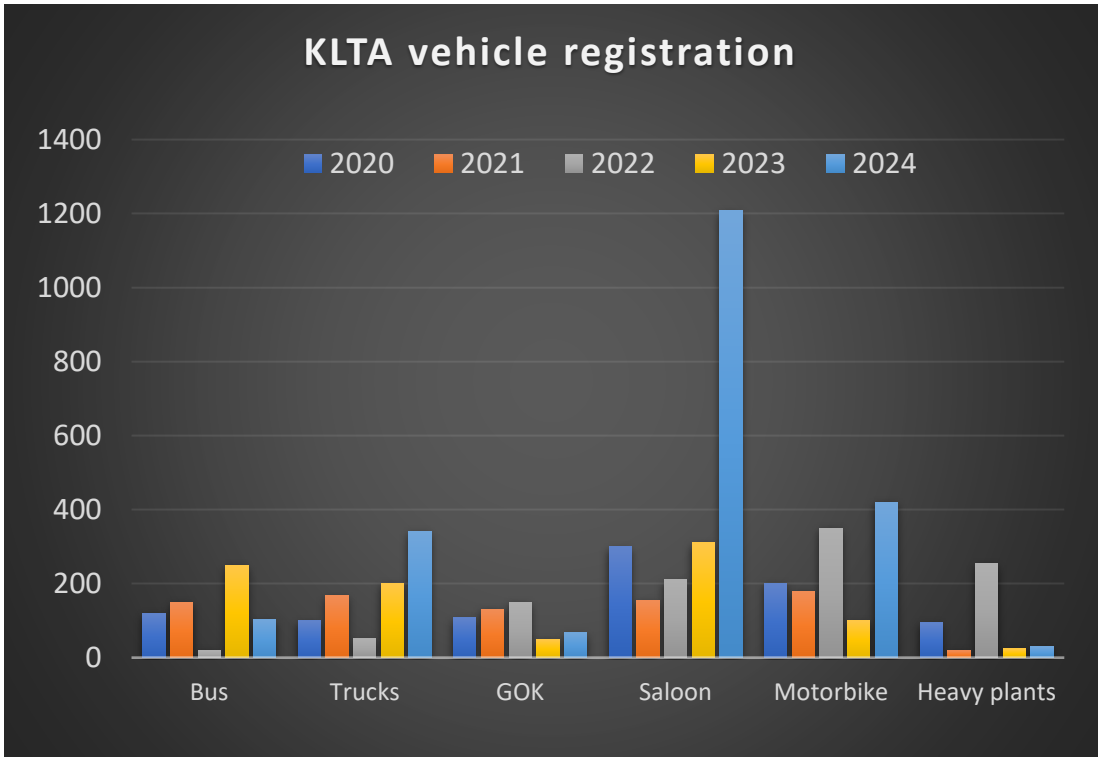
In the Revised NDC Investment Plan 2021the mitigation actions are divided between the two sectors of transportation 18.06 $ktCO_2e$ and energy efficiency 11.28 $ktCO_2e$, and are closely aligned to existing national policies, strategies, and plans. The implementation of the identified mitigation action is expected to start and be implemented during period 2026 -2030.

The Government plays a predominant role in the transport sector in Kiribati, in terms of regulation, enforcement of safety standards, and through its SOEs responsible for aviation and maritime transport services (including infrastructure. The establishment of the Kiribati Land Transport Authority (KLTA) now provide regulation and enforcement of safety standard on the main island where land transport is highly utilized.

The affordable second-hand vehicles imported conforming to KLTA regulation from Japan and other countries sold to individuals and communities on South Tarawa had seen an abrupt increase despite the regulation of the to a level where road traffic and parking congestion is of a concern now to KLTA and the public. It is noteworthy that more private cars are now used by individuals to commute to work, shopping and other events creating traffic and parking congestion on a two lanes main road also because of fuel price in Kiribati is one of lowest in the region since 2018. This concern has also aided the focus by the majority of Stakeholders during the Inception meeting for the TNA project to address the road transport congestive issue and to achieve the more GHG emission reduction from the land transport as compared to energy efficiency.

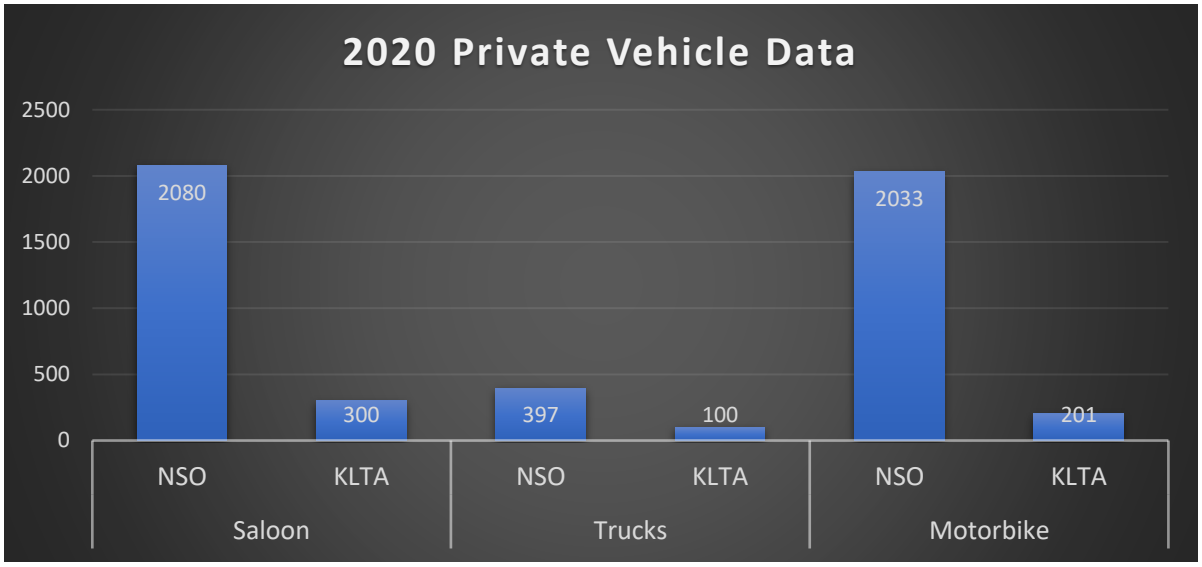
## 3.1 GHG emissions and existing technologies

The transportation modes in Kiribati are land vehicles, marine vessels and aviation services. The only fuel used is petroleum products in particular gasoline and diesel in the transport sector. As depicted from the Energy Statistics Yearbook, the Road transport consumed around 52%, followed by Sea transport with 40% and Aviation fuels accounts for 8% in 2021. According to KLTA, the internal combustion vehicle annual registration in South Tarawa was as shown in Graph 3.1.




*Graph 3.1: South Tarawa vehicles registration (Source: Kiribati Land Transport Authority)*

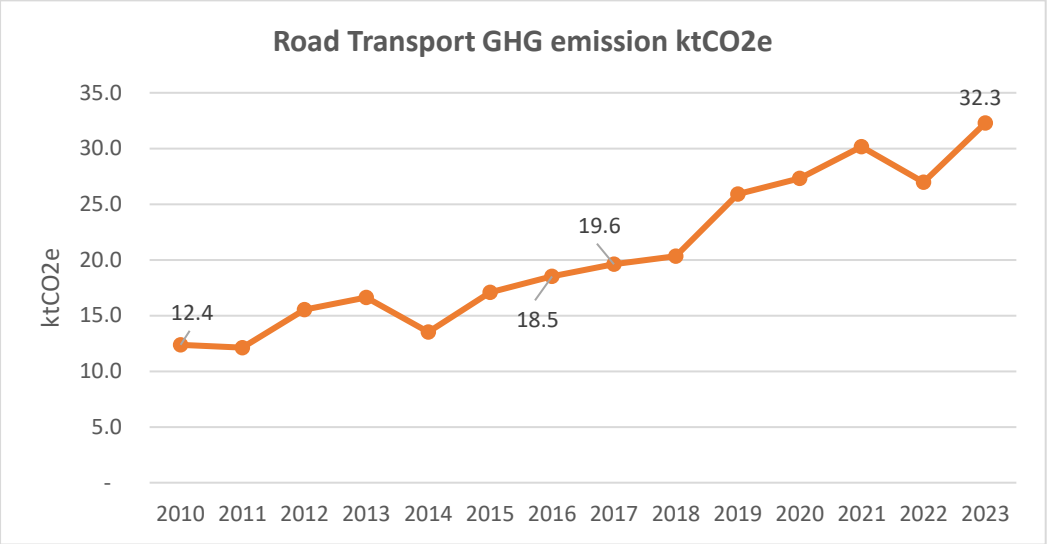
However, when the National Statistics Office (NSO) data for the latest Census in 2020 for South Tarawa household vehicles depicted in Graph 3.2 for South Tarawa is compared to KLTA registration, this showed an enormous difference. For instance, in 2020 the NSO data indicated that South Tarawa total private saloon car recorded was 2080 as compared to KLTA registered private vehicles of 300 excluding government vehicles.




*Graph 3.2: Comparing the vehicles quantities with National Statistics Office (Source: NSO and KLTA)*

Thus, it could be assumed that there were a significant number of private vehicles not registered and used on the main road avoiding capture from the regulators, and the data from KLTA may be around three folds lower than the actual vehicles running the road on South Tarawa.

Conferring the Energy Statistic Yearbook and current energy data from 2010 to 2023 from the Energy Department, the road transport GHG emission trend was increasing sporadically jumping by two folds from 12.4 $ktCO_2e$ /year in 2010 to 32.3 $ktCO_2e$ /year in 2023 as shown in the following Graph 3.3 this also concurred the increasing number of vehicles used overtime.




*Graph 3.3: Road transport GHG emission trend (Source: Energy Planning Unit)*

The NDC Investment Plan target for the road transport GHG emission was 18.8 $ktCO_2e$ /year by 2030. However, with the recent data depicted in the above graph, the road transport emission overtook this target in 2017 with 19.6 $ktCO_2e$ /year and reached 32.3 $ktCO_2e$ /year in 2023. Therefore, transitioning to electric vehicles is a plausible conditional option to achieve the NDC target.

## 3.2 Decision context

Based on the stakeholder's agreement the selection of the Land transport sector will be considered for the TNA project as reflected in the Kiribati NDC Investment Plan. There are six mitigation opportunities which focus on Land Transport shown in Table 3.1 below. Together, these have the potential to reduce 111.2 $ktCO_2e$ in emissions from 2020 to 2030, with an annual mitigation potential of 18.8 $ktCO_2e$ /yr in 2030. This annual mitigation potential is approximately equal to 24% of the projected BAU emission in 2030. The estimated capital investment costs needed to reach the mitigation potential is US$ 792.7M between 2020 and 2030, along with an estimated cost for project/ programme development, capacity building & technical assistance of US$ 29.8M.

*Table 3.1:* ***Aggregated Information for Land Transport Mitigation Opportunities***

| Opportunities | Indicative Development, CB and TA 2020-2030 (US$M)* | Indicative Investment Needs to 2020-2030 (US$M) | Cost of Mitigation US$/ $tCO_2$ | Annual Mitigation 2030 (tCO2/yr.) | Total Mitigation 2020-2030 ($tCO_2$/yr.) |
|---|---|---|---|---|---|
| T2 – Bicycle/E-Bike Financing Initiative*** | 0.8 | 20.3 | 2,700 | 1,400 | 7,900 |
| T7 – Biofuel blends in Land and Maritime Transport | 1.2 | 7.0 | 400 | 3,100 | 18,600 |
| T8 – Multi-modal Transit Initiative*** | 3.9 | 89.4 | 1,800 | 7,000 | 51,800 |
| T11 – Electric Vehicle Network Development*** | 3.1 | 102.5 | 3,500 | 6,500 | 29,800 |
| T13 – Whole-of-Lifecycle Vehicle Programme**** | 0.8 | 1.5 | 5,000 | 100 | 500 |
| T15 – Land Transport Infrastructure Upgrade for Non-motorized Transport** | 20.0 | 572 | 227,000 | 700 | 2,600 |
| Total Mitigation Potential of all[38] | 29.8 | 792.7.4 | | 18,800 | 111,200 |

*Source: Kiribati NDC Investment Plan 2021 – Table 3.*

T2 – Bicycle/E-Bike Financing Initiative: This mitigation opportunity enhances the access and use of bicycles and/or e-bicycles in Kiribati, which continue to be more popular in Kiribati compared to other PICs. This opportunity involves the inclusion of 7,000 standard bicycles and 7,000 e-bicycles imported into Kiribati and replacing 60% of the motorbikes expected to enter the market in Kiribati under BAU conditions. Ensuring bicycle use as a primary source of transport for people of all ages (reducing reliance on motor vehicle use and associated fuel consumption) can strengthen household cost savings, GHG emission reductions, and provide potential health benefits for the population of Kiribati. This opportunity also includes capacity building for the maintenance of standard bicycles and e-bicycles, and the provision of initial spare parts, as a means to encourage sustainability of this type of transport.

T7 – Biofuel Blends in Land and Maritime Transport: A range of sustainable fuels are in use globally, which can be suitable alternatives for vehicles in Kiribati. This opportunity involves the import and use of biofuel blends for diesel and petrol, and the construction of necessary infrastructure to enable the use of these fuels. The applicability, appropriateness, and financial viability of this option is likely dependent on the scale of use of biofuel blends in other PICs, such as Fiji and Samoa. Biofuel blends would need to be shipped from Singapore to fuel transfer hubs in Fiji or directly to Kiribati. Technology piloting in the maritime sector is ongoing, but biofuel blends in land transport, especially biodiesel and ethanol blending, are already used and mandated extensively in Brazil, Europe, North America and Indonesia.

T8 – Multi-modal Transit Initiative: Public transport in Kiribati is not organized under a formal state-structured system or a robust licensed commercial operator system found in other PICs. Congestion and increases in singleoccupancy travel are placing a strain on the road network, which is comprised of a single two-lane road through most of South and North Tarawa while other roads are largely unpaved roads elsewhere in Kiribati. This mitigation opportunity would provide technical assistance, capacity building, and investment in motorised, transit services (e.g. buses), which will offer more passenger capacity per vehicle for transit between

communities. This opportunity includes establishing Public Private Partnerships (PPPs) to operate up to 132 buses in Kiribati and the operational infrastructure. In addition to reducing GHG emissions, this pportunity will increase mobility and equity for those in society without driver's licenses, improving options for women, youth, elderly, disabled persons, low-income travellers, and other vulnerable groups.

T11 – Electric Vehicle Network Development: Technical assistance and financial support for the development and introduction of up to 2,800 Electric Vehicles (EV) and a network of Level-2 chargers in Kiribati. This will include both market instruments to facilitate the introduction of EV technology and the planning for the allocation of infrastructure to create a sufficient charging network across first the public, and then the private sector locations. Unlike the existing paradigm, in which individuals and households primarily purchase second-hand vehicles, the lack of maturity in the EV market means a robust second-hand EV market (including battery warranty / life-cycle concerns) is not readily available to replace the second-hand internal combustion engines vehicle imports. Thus, new EVs will be required until the global second-hand market matures. This option does not include the costs of additional power generation and distribution, which will be necessary to facilitate a large-scale introduction of EVs.

T13 – Whole-of-Lifecycle Vehicle Programme: Derelict vehicles are a common sight around Tarawa. The current preponderance of second-hand vehicles in Kiribati means that the vehicles are being imported at nearer the end of their operational lifespans, and disposal is not addressed in Kiribati. It is estimated that there are 10,000 derelict vehicles across the nation, as no mechanism for disassembling, consolidating, and exporting scrapped vehicles currently exists (a previous scrap mechanism ended years ago). The opportunity for government intervention, as well as potential private sector operators, in the collection and export of scrap materials from recovered vehicles can be addressed through technical assistance and investment to develop and establish publicprivate partnerships or service contract/licensing arrangements. This would not only create economic opportunity (and employment), but also address the underlying environmental problem of past and future derelict vehicles. Mitigation under this option is achieved via carbon sequestration gained from the planting of vegetation in areas where there are previous derelict vehicles.

T15 – Land Transport Infrastructure Upgrade for Non-motorized Transport: The design and implementation of enhanced land transport infrastructure will support decarbonisation based on the availability of infrastructure designed to prioritize use of non-motorized transport (e.g. - cycling and walking). To encourage decarbonisation, by reinforcing non-motorized transport through deliberate inclusion of separated green space between vehicle lanes and protected infrastructure for foot and bicycle traffic along 370 km of dedicated roadways yet to undergo paving/upgrading. Technical assistance and the financing of both the design and infrastructure will guide how carriageway and bridges are partitioned, and the allocation of space between motorized and non-motorized transport will encourage GHG mitigation via non-motorised transport. Mitigation under this option is achieved via carbon sequestration gained from the planting of vegetation in separation areas.

### 3.3 An overview of possible mitigation technology potential and other co-benefits

In reviewing all the six technologies as shown in Table 3.1, the group noticed that some of the technologies T13 and T15 have minimal impact in reducing the GHG emission and one T7 is not viable as the price of blended biofuel will be more expensive than diesel retailed. The following Table 3.2 shows the technologies that have impactful contribution to reduce GHG .

*Table 3.2: Selected road transport technologies for the MCA*

| NDC Investment Opportunities | TNA Technology definition | Indicative Development CB and TA 2020-2030 (US$M) | Indicative Investment Needs to 2030 | Cost of Mitigation US/tCO2 | Annual Mitigation 2030 (ktCO2/yr) | Total Mitigation 2020-2030 (ktCO2/yr) |
|---|---|---|---|---|---|---|
| T2- E-Bike Financng Initiative | Electric bike with charging station and capacity building | 0.8 | 20.3 | 2,700 | 1.4 | 7.9 |
| T8- Multi modal Transit Initiative | Public bus with charging station and capacity building | 3.9 | 89.4 | 1800 | 7 | 51.8 |
| T11_ Electric Vehicle Network development | SUVs with charging station and capacity building | 3.1 | 102.5 | 2500 | 6.5 | 29.8 |
| Total Mitigation Potential of all | | 7.8 | 212.2 | 7000 | 14.9 | 89.5 |

The total annual mitigation potential in 2030 for the selected three technologies listed above is around 80% of the total identified land transport of six opportunities or technologies shown in Table 3.1 earlier.

After evaluation, Stakeholders agreed that the identified technologies or opportunities in the NDC Investment Plan will be selected for the next stage on MCA as follows:

- T2 – Bicycle/E-Bike Financing Initiative. Stakeholders agreed that the bicycle will be dropped out and the focus will be on electric motorbike with charging station.
- T7 - Biofuel Blends in Land and Maritime Transport. This action focuses on importing the high-quality blended biofuels as a replacement for diesel for fuelling vehicles and marine vessels.
- T8 – Multi-modal Transit Initiative. Stakeholders agreed that the opportunity will be started with Government ministries and state-owned enterprises Electric Bus and later when the infrastructures, institution, policy and legislation and charging stations are well established will be diffused to the private sector.
- T11 – Electric Vehicle Network Development. Stakeholders agreed that the opportunity will be started with Government ministries and state-owned enterprises Electric SUV/saloon/pickup and later when the infrastructures, institution, policy and legislation and charging stations are well established will be diffused to the private sector.
- T13 -Whole-of-Lifecycle Vehicle Programme. Derelict vehicles are a common sight around Tarawa. The opportunity for government intervention to be accompanied by private sector operators in the collection and export of scrap materials from recovered vehicles may be addressed through public-private partnerships or service contract/licensing arrangements.
- T15 - Active Transport Road Infrastructure Upgrade (non-motorised). To encourage decarbonisation in the market, reinforcing non-motorized transport (cycling, walking, etc.).

through inclusion of separated, protected active transport lanes. The mitigation option will upgrade 370km of these roads by the end of 2030.

Among the technologies identified in particular on electric vehicles, as agreed by the working group, since Kiribati is far behind in the electric vehicle transition with no existing infrastructures, legislation, institutional arrangement and capacity to support the utilization of electric vehicles, the TNA project will start from government transport first. This is more possible as all ministries and SOEs are controlled and monitored from the central government administration.

The suggestion is to develop enabling framework and address barriers for the utilization from government entities by establishing recharging station at respective ministries and reviewing the existing Plant and Vehicle Unit roles or setup a similar public vehicle unit from the specific for electric vehicles with a responsibility for procuring and maintenance of government electric vehicles including capacity building for engineers and technicians. Charging stations was suggested to utilize the abundant solar energy for charging vehicles during the day while parking at respective office site and may assign the Kiribati Green Energy Solution for the development and maintenance of solar charging stations at office sites or dedicated sites. This is to avoid overloading the current limited electricity grid in the urban centers. Furthermore, enabling policies for the electric vehicles can be easily implemented across government ministries with effective monitoring and evaluation from respective administration.

Transitioning the government fleet to electric vehicles will be beneficial for the country as this could also means an added energy fuel security for the private sectors and addition of new employments for solar and vehicle engineers and technicians. In addition, this will be the only viable option to achieve Kiribati NDC target from the road transport. When the electric vehicle project is successful from the government side after commissioning the electric vehicles could be diffused to the private sectors while the needed infrastructures, institution, technical capacity, policy and legislation to support electric vehicles are already established.

### 3.4 Criteria and process of technology prioritisation

During the MCA retreat, the three (3) technologies for land transport were presented and detailed in the Technology Fact Sheet (TFS) to working group for further evaluation and agreement. Issues on charging stations was raised due to the current unstable and electricity crisis now experienced. the issue had already been included in the TFS but again reemphasized that Kiribati has a rich and abundance solar resource located under equator with the highest sun-hours and therefore solar charging station using office roof or parking will be very beneficial. After all the working group members were comprehended, the next task was to set up criteria for comparing the technologies and to be used in the MCA prioritisation tool.

In facilitating the stakeholders, there was a long debate on the selection of the best criteria since the technology is the same to utilise the electric vehicles but on the different modes of land transport. Some of the criteria on political and climate change alignment were considered not applicable in this context until it was decided that ten (10) criterions such as: (1) Investment cost, (2) Reliability; (3) Improve economic performance; (4) Trigger private investment; (5) Energy security; (6) Accessibility/Porvety reduction, (7) Safety; (8) Congestive road traffic/parking; (9) End of life issues (land space for recycling) and (10) Ease of implementation would provide a meaningful comparison for the technologies.

*Table 3.3: Criteria selected for the technologies*

| Category | Criteria | |
|---|---|---|
| Cost | Investment Cost | |
| Technology | Reliability | |
| Benefits | Economic | Improve economic performance |
| | | Trigger private investment |
| | | Energy security |
| | Social | Accessibility/Poverty reduction |
| | | Safety |
| | Environmental | Congestive road traffic/parking |
| | | End of life issues (land space) |
| Institutional | Ease of Implementation | |

In assigning the weight for the criteria by dividing the budget of 100 between the criterion, again this was another heavy debate among the working group and in particular when considering their angle from the respective departments they worked in. Nevertheless, a level of consensus among the group came about after agreeing on selecting the priority list per criterion.

*Table 3.4: Assigning weight to criteria*

| Order | Criteria | Weight |
|---|---|---|
| 1 | Energy security | 15 |
| 2 | Investment cost | 14 |
| 3 | Reliability | 13 |
| 4 | Congestive road traffic/ parking | 12 |
| 5 | Safety | 11 |
| 6 | Ease of implementation | 10 |
| 7 | Trigger private investment | 8 |
| 8 | Accesibility/Poverty reduction | 7 |
| 9 | Improve economic performance | 6 |
| 10 | End of life issues | 4 |
| | **Total** | **100** |

The next task on assigning the score between 0 and 100 was more faster by the working group and agreed on the following scoring scale.

*Table 3.5: Assigning score for criteria*

| Criteria | | | Scoring scale | |
|---|---|---|---|---|
| Cost | Investment cost | | 0 = high cost | 100 = low cost |
| Techology | Reliability | | 0 = low | 100 = high |
| Benefits | Economic | Improve economic performance | 0 = low | 100 = high |
| | | Trigger private investment | 0 = low | 100 = high |
| | | Energy security | 0 = low | 100 = high |
| | Social | Accessibility/Poverty Reduction | 0 = few | 100 = many |
| | | Safety | 0 = low | 100 = high |
| | Environmental | Congestive road traffic/parking | 0 = few | 100 = many |
| | | End of Life issues (e.g land space etc) | 0 = high | 100 = low |
| Institutional | Ease of implementation | | 0 = low | 100 = high |

After the weighing and scoring had been confirmed from the working group, the MCA excel sheet was populated and the group assigned scoring scale for each criterion on the selected technologies.

The MCA scoring sheet is annexed in Annex I on the selected technologies by priority ranking

## 3.5 Results of technology prioritisation

From the final score for prioritisation the following Table 3.6 shows the ranking of priority for the selected technologies identified in the land transport sector inputted and agreed by the working group without further sensitivity analysis requested by the group.

*Table 3.6: MCA scoring prioritization*

| Priority | Technology | General Name |
|---|---|---|
| 1 | T8 – Multi-modal Transit Initiative | Electric Bus |
| 2 | T2 – Bicycle/E-Bike Financing Initiative | Electric motorbike |
| 3 | T11 – Electric Vehicle Network Development | Electric SUV/Saloon/Pickup |
| 4 | T13 – Whole-of-Lifecycle Vehicle Programme | Recycling unused vehicle waste |
| 5 | T15 – Land Transport Infrastructure Upgrade for Non-motorized Transport | Walkways |
| 6 | T7 – Biofuel blends in Land and Maritime Transport | Biofuel blend for Diesel replacement |

This mitigation opportunity would provide technical assistance, capacity building, and investment in the selected and first prioritized technology like Electric Bus starting with GOK ministries and SOEs, which will offer more passenger capacity per vehicle for transit between communities and daily commuting to and back from work.

The second priority was T-2 for electric motorbike for the public and private sectors. Lastly, the third priority was T-11 for electric SUV/saloon/pickup targeting GOK and SOEs to transition the internal combustion engine SUV/saloon/pickup used currently by Secretaries, CEOs, Directors and department utility vehicles.

# Chapter 4 Summary and Conclusions

During the desktop review study, the valuable report for the NDC Investment Plan 2021 for Transport and Energy Efficiency was considered as the most relevant guide for the TNA project as a lot of efforts and review from the mitigation sectors had been invested in it and aligns with the government policies and strategies. Also, two projects listed in the NDC Investment Plan had been implemented since 2022 for the Energy Efficiency sector.

During the Inception meeting with key stakeholders, the selection of the NDC Investment 2021 was confirmed to be the most suitable guide for TNA project due to the limited time left available before the project closed in mid 2025 as well as to consider the tireless efforts of the same stakeholders invested for developing the document. Highlighted during the introduction of the Inception meeting, it was explained that only one (1) technology will be submitted for the TNA project and therefore will require the fine selection from the working group to identify the most relevant technology from the NDC Investment Plan on Transport and Energy Efficiency sectors. In the sector selection, the group agreed to consider the Transport sector as Energy Efficiency sectors few projects have been completed and while some are underway.

Within the Transport sector, Land and Sea were considered as more applicable and the GHG emission reduction actions could be implemented. The working group find it complicated to select which sector to select between Land and Sea and requested that the GHG emission contribution would be presented. According to the NDC Investment Plan, the Land transport GHG emission as reported for 2020-2030 was around 111 $ktCO_2e$ and Sea Transport was 34 $ktCO_2e$ for the same period. Furthermore, there was also a pipeline project proposal recently developed tilted "Transitioning towards a low emission maritime transport sector in the Republic of Kiribati" with a project cost US$55 million and estimated mitigation impact of 6.3 $ktCO_2e$ per year. Hence, the selection of the Land transport for the TNA project.

According the NDC Investment Plan for Transport, the Land transport identified six (6) opportunities or technologies, and after evaluating and reviewing their GHG emission potentials and viability, the working group agreed to screen down the technologies selecting the most relevant ones that can have significant impact in reducing GHG emission. This screening led to the shortlist of 3 technologies to be prioritised in the MCA during the Retreat workshop.

As a result of the MCA workshop, the three top technology be taken up for barrier analysis stage of the TNA are:

1. T8- Multi modal transit initiative defined as Electric Public Bus
2. T-2 - Bicycle/E-Bike Financing Initiative defined as Electric Motorcycle
3. T11 - Electric Vehicle Network Development

. These priorities will be further reviewed at the uppermost level of Government decision making for confirmation or revisit before moving on to the next step of TNA process.

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# Annex I: MCA Decision Matrix

**Performance Matrix**

| Technology | Costs | Technology | Economic | | | Social | | Environmental | | Institutional |
|---|---|---|---|---|---|---|---|---|---|---|
| | Investment cost | Reliability | Improve economic performance | Trigger private investment | Energy security | Accesibility/ Poverty reduction | Safety | Congestive road traffic/ parking | End of life issues | Ease of implementation |
| | US$/scale | LMH | LMH | LMH | LMH | LMH | LMH | LMH | LMH | LMH |
| T2 Electric motorbike | 12,718,000 | H | L | L | L | M | L | H | L | H |
| T7 – Biofuel blends in Land and Maritime Transport | 7,450,000 | L | L | L | L | L | L | L | L | H |
| T8 – Multi-modal Transit Initiative | 39,900,000 | M | H | H | H | H | H | L | L | M |
| T11 – Electric Vehicle Network Development | 52,710,000 | L | M | M | M | L | M | M | L | M |
| T13 – Whole-of-Lifecycle Vehicle Programme | 1,800,000 | M | M | H | L | M | M | M | H | M |
| T15 – Land Transport Infrastructure Upgrade for Non-motorized Transport | 10,908,000 | H | L | L | L | M | H | M | H | M |

**Scoring Table**

| Technology | Costs | Technology | Economic | | | Social | | Environmental | | Institutional | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Investment cost | Reliability | Improve economic performance | Trigger private investment | Energy security | Accesibility/ Poverty reduction | Safety | Congestive road traffic/ parking | End of life issues | Ease of implementation | |
| T2 Electric motorbike | 50 | 100 | 20 | 20 | 30 | 50 | 15 | 100 | 10 | 100 | |
| T7 – Biofuel blends in Land and Maritime Transport | 70 | 5 | 10 | 5 | 5 | 5 | 10 | 5 | 10 | 20 | |
| T8 - Electric Public bus | 40 | 50 | 100 | 100 | 100 | 100 | 80 | 20 | 30 | 40 | |
| T11 Electirc SUVs | 20 | 25 | 50 | 56 | 60 | 20 | 60 | 40 | 20 | 50 | |
| T13 – Whole-of-Lifecycle Vehicle Programme | 100 | 10 | 10 | 20 | 5 | 5 | 5 | 10 | 20 | 15 | |
| T15 – Land Transport Infrastructure Upgrade for Non-motorized Transport | 60 | 40 | 20 | 2 | 20 | 50 | 80 | 30 | 50 | 40 | |
| *Criterion weight* | 14 | 13 | 6 | 8 | 15 | 7 | 11 | 12 | 4 | 10 | 100 |

**Decision Matrix: Weighted Scores**

| Technology | Costs | Technology | Economic | | | Social | | Environmental | | Institutional | Total score | Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Investment cost | Reliability | Improve economic performance | Trigger private investment | Energy security | Accesibility/ Poverty reduction | Safety | Congestive road traffic/ parking | End of life issues | Ease of implementation | | |
| T2 Electric motorbike | 700 | 1,400 | 280 | 280 | 420 | 700 | 210 | 1,400 | 140 | 1,400 | 6930 | 2 |
| T7 – Biofuel blends in Land and Maritime Transport | 980 | 70 | 140 | 70 | 70 | 70 | 140 | 70 | 140 | 280 | 2030 | 6 |
| T8 - Electric Public bus | 560 | 700 | 1,400 | 1,400 | 1,400 | 1,400 | 1,120 | 280 | 420 | 560 | 9240 | 1 |
| T11 Electirc SUVs | 280 | 350 | 700 | 784 | 840 | 280 | 840 | 560 | 280 | 700 | 5614 | 3 |
| T13 – Whole-of-Lifecycle Vehicle Programme | 1,400 | 140 | 140 | 280 | 70 | 70 | 70 | 140 | 280 | 210 | 2800 | 5 |
| T15 – Land Transport Infrastructure Upgrade for Non-motorized Transport | 840 | 560 | 280 | 28 | 280 | 700 | 1,120 | 420 | 700 | 560 | 5488 | 4 |
| *Criterion weight* | 14 | 13 | 6 | 8 | 15 | 7 | 11 | 12 | 4 | 10 | 100 | |

## Annex II: Technology Factsheets for selected technologies

| Technology Name | T2 E-bike financing initiatives |
|---|---|
| Subsector GHG emission | up to 1.36 $ktCO_2$/yr in 2030 and a total of up to 7.94 $ktCO_2$ for 2020 - 2030 |
| Background/Notes, Short description of the technology option. | In 2019, the motorbike imported is 2,600 ICE motorbikes. As agreed by the Stakeholders in the first inception meeting, this NDC Investment plan will omit bicycles and focus on electric motorbikes.<br><br>This initiative should secure cost savings, emission reductions by encouraging the import and use of 22,600 standard and e-bikes between 2025 and 2030. This action should take place alongside the integration with emerging, cost-competitive e-bike technology, with infrastructure requirements for charging. |
| Implementation assumptions, How the technology will be implemented and diffused across the subsector? Explain if the technology could have some improvements in the country environment. | This mitigation opportunity enhances the access and use of e-motorbike in Kiribati, which continue to be more popular in Kiribati compared to other PICs. This opportunity involves the inclusion 7,000 e-motorbike imported into Kiribati and replacing 60% of the ICE motorbikes expected to enter the market in Kiribati under BAU conditions.<br><br>This opportunity also includes capacity building for the maintenance of standard e-motorbikes and the provision of initial spare parts, as a means to encourage sustainability of this type of transport.<br><br>This would also include Level 1 charging stations for public and private users which can be installed at home or office or private owned public charging station. Kiribati has an abundant solar energy resource and the use of solar energy for charging will be considered to avoid stress on the PUB grid.<br><br>A. Secure technical assistance and capacity building support for items B, C, and D below.<br>B. Prepare a new policy (or regulation) for inclusion of e-motorbike financing and infrastructure projects.C<br>C. Pilot items B in one or more feasibility study(s) for the e-bike initiative in all municipal-cities/areas.<br>D. Enter into discussions with supporting agencies for primary investment financing and state budget allocations. |
| Implementation barriers | ● The establishment of a more robust maintenance and parts & service environment will be necessary to ensure purchases stay in operable and in good repair through at least a 3-year lifespan (high quality standard and e-bicycles can last to 5+ years). |

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| | • Disseminating information around the lending mechanisms to encourage participation will be a significant challenge for success.<br>• As duty and excise designations for standard and e-bicycles are not properly grouped alongside VAT exemptions issued for bicycles and bicycle parts, political will and effort on the part of government to amend this tax policy and forego future revenue from motorbike taxation must be aligned.<br>• Importers and retailers may need to collaborate (where otherwise functioning competitively) to reduce purchase costs for standard and e-bicycles through a government/DBK-aligned bulk purchasing system. |
| Reduction in GHG emissions | 5.98 $ktCO_2/yr$ |
| Country social development priorities | Increase number of employees. Will create about 100 new jobs (Operations & maintenance & other direct employment). |
| Country economic development priorities – economic benefits | **Increased energy security.** Lack of own natural fossil fuel reserves is obliging the country to import 95 % of energy resources needed. 90 % of electricity demand is covered by import. |
| Country environmental development priorities | Increased energy security. Lack of own natural fossil fuel reserves is obliging the country to import 95 % of energy resources needed. 90 % of electricity demand is covered by import.<br>Wind energy has a net positive impact on climate change mitigation (see Reduction in GHG emissions above). I |
| **Other** considerations and priorities such as market potential | Less air pollution. Work conditions improvement, less costs for transportation and stock of liquefied fuel. |
| Capital costs | Estimated capital investment needed for the physical implementation: US$20,314,000.107<br>Estimated development costs: US$110,000 to design, establish, and administer a revolving commercial and micro-finance mechanism prior to mainstreaming it within existing financial institutions (such as DBK and ANZ), and preparation of and instrument for taxation changes.<br>Estimated Enabling, Capacity Building and Technical Assistance Needs: US$790,000 to promote access to the financing mechanism across the outer islands and organize bulk purchasing to reduce shipment costs on a per unit basis, as well as training for bicycle/e-bike mechanics for each island to provide continued service.<br><br>NDC Investment costs 2026-2030<br>Estimated CB & TA Costs US$ 350,000<br>Estimated Capital Investment US$ 12,718,000 |

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| | Made in China<br>E-motorbike USD500 - 2,000 FOB<br>Level 1 charging station - USD300 FOB |
| Cost of GHG reduction | Cost of GHG reduction is 69.2 USD/tCO2 |

Source: Kiribati NDC Investment Plan 2021, https://www.made-in-china.com/

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| Technology Name | T7 Biofuel blends in land and marine transport |
| Subsector GHG emission | 18,400t$CO_2$ for 2025 – 2030. |
| Background/Notes, Short description of the technology option. | There are a range of alternative fuels that are already in use or are undergoing R&D globally, including biofuels, biofuel blends, methanol, ammonia, and hydrogen. The applicability, appropriateness, and financial viability of some of these fuels needs to be considered carefully via technical assistance, as the cost and practicality of using some of these is likely to be prohibitive in the PICs at this time. Technology piloting in the maritime sector is ongoing, but biofuels in land transport, especially biodiesel (<B10) and ethanol (<E10) blending, are already used and mandated extensively in Brazil, Europe, North America, Indonesia, and already blended and shipped from Singapore.<br>This action focuses on importing the high-quality blended biofuels. Two actions can be taken: 1) a requirement that all imported biofuels include a blend such as B7 and E5 to start with which is medium amount as in the EU and compatible for EURO-3 vehicles are higher, this can raise up to 10% blending in 2030 when EURO-5 vehicles or higher are on the road. 2) allow for the availability of dual fuel types, e.g. bio-blends and regular fuels and later phase to only biofuels after 2030. Note that biodiesel blending will also affect the power generation sector, and this option influences emissions in that sectors as well, and all imported fuels will be blended. This option will require infrastructure investments. Action 1 only requires new terminal storage facilities. Action 2 requires more investment in terminal storage facilities, as well as pumps/mini-storage to petrol stations. Both actions will require a minimum standard for vehicle (e.g. EURO-3). The price of blended fuels will likely be higher than standard fuels, and this will depend on the global oil prices. Tax policy can level out the price parity of the fuel types and potentially make biofuels cheaper to the consumer. |

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| | There are also efforts in PIC to develop biodiesel industry via. Coconut production. These efforts have mainly focused on power generation, and not transport, and have face several bottle necks. Some of these are technical such as quality of fuel, but also economic where low diesel prices do not incentivise farmers to sell coconut oil / copra for biofuels when they get better prices from other markets. This regional & national production of biofuel is not considered in this action. |
| Implementation assumptions, How the technology will be implemented and diffused across the subsector? Explain if the technology could have some improvements in the country environment. | A range of sustainable fuels are in use globally, which<br>can be suitable alternatives for vehicles in Kiribati. This opportunity involves the import and use of biofuel blends for diesel and petrol, and the construction of necessary infrastructure to enable the use of these fuels. The applicability, appropriateness, and financial viability of this option is likely dependent on the scale of use of biofuel blends in other PICs, such as Fiji and Samoa. Biofuel blends would need to be shipped from Singapore to fuel transfer hubs in Fiji or directly to Kiribati. Technology piloting in the maritime sector is ongoing, but biofuel blends in land transport,<br>especially biodiesel and ethanol blending, are already used and mandated extensively in Brazil, Europe, North<br>America and Indonesia. |
| Implementation barriers | ● The availability of biofuel blends in the Pacific region, including the likelihood of availability for shipping from Fiji, or directly from Singapore or Taiwan. Sourcing and contractual assistance will be needed.<br>● Public knowhow on blended biofuels will need to be strengthened (to reduce fears), where a public dissemination programme is needed.<br>● Euro-3 vehicle or higher will be needed, therefore a restriction on the import of any vehicles less than Euro-3 will be required. |
| Reduction in GHG emissions | Up to 3,100 $tCO_2$/yr in 2030<br>Nominal BAU ER calculation is: |

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| | Diesel fuel: 14,350,000 L per year (2019) * 2.66 kg $CO_2$/L * 7% bio-blend / 1000 kg/t * 80% = 2,137 $tCO_2$/yr<br>Petrol fuel: 10,130,000 l per year (2019) * 2.29 kg $CO_2$ / l * 5% bio-blend / 1000 kg/t * 80% = 927 $tCO_2$/yr |
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| Country social development priorities | The business model focuses on the same as existing supply of diesel and petrol fuels, but requires infrastructure upgrades at the terminals and petrol stations to allow for blended and non-blended fuels in the first years of implementation. The business model is highly dependent on changes in taxation which encourages the consumer price to be at least in parity to blended and non-blended fuels, or blended fuels being slightly cheaper. A grant is needed for the estimated Enabling, Capacity Building and Technical Assistance Needs<br>There are two financing models for development and implementation:<br>Model 1 – Includes a 100% grant for project development costs and implementation. Under this model only the imported fuel price parity will affect the GOK revenues and/or consumer prices.<br>Model 2 – Includes a concessional or other low interest loan taken out by Government or KOIL to provide debt, and a development loan guarantee for this amount will be needed. Equity will be gained from KOIL or GOK. This model will affect the GOK revenues and/or consumers prices. |
| Country economic development priorities – economic benefits | The business model is highly dependent on changes in taxation which encourages the consumer price to be at least in parity to blended and non-blended fuels, or blended fuels being slightly cheaper.<br>If the infrastructure upgrades at the terminals and petrol stations are financed under a favourable model then the nominal cost increase to the consumer would be a minimum of US$ 0.08 per l for all fuels. In addition, biofuel blends have a volatile price due to swings in both oil prices and pure-biofuel price, but blends are typically 10-15% higher per litre than non-blends. |

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| **Other** considerations and priorities such as market potential | Grant for Estimated Enabling, Capacity Building and Technical Assistance Needs: US$450,000<br>There are two financing models for development and implementation:<br>Model 1 – 100% grant for US$ 7,750,000 for development costs and implementation.<br>Model 2 – A concessional or low interest loan taken out by Government or KOIL to provide debt of US$<br>6,200,000 (80%), and a development loan guarantee for this amount will be needed. Equity will likely need<br>to be gained from KOIL or GOK for<br>US$ 1,550,000 (20%) |
| **Cost** | |
| Capital costs | Estimated capital investment needed for the physical implementation: Up to US$7m.<br>US$4m for Action 1 – which would require only 2 new terminal storage tanks in South Tarawa and likely 10 medium new standard storage tanks in the outer islands. Action 2 will have an estimate additional cost of US$3m for 30 new petrol tanks and pumps for both diesel and petrol, and two new tanker trucks.<br>Estimated development costs: US$750,000 – for funding of development, engineering design and ESIAs.<br>Estimated Enabling, Capacity Building and Technical Assistance Needs: US$450,000 – for fuel, market, taxation options, and feasibility studies. Including training for KOIL and petrol stations, and information dissemination programmes on the use of fuels blends.<br><br>Investment costs 2023-2025<br>Estimated CB & TA Costs US$ 450,000<br>Estimated Capital Investment US$ 7,000,000 |
| Cost of GHG reduction | US$387/t$CO_2$ |
| Lifetime | 20 years |

Source: Kiribati NDC Investment Plan 2021.

| Technology Name | T8 – Multi-modal Transit Initiative |
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| Subsector GHG emission | Up to 6.98 $ktCO_2$/yr in 2030 and a total of 51.79 $ktCO_2$ for 2020 – 2030. |
| Background/Notes, Short description of the technology option. | During the project inception workshop, congestion and increasing single-occupancy travel were cited as an issue by stakeholders, exacerbated by the limits of the road network to a single two-lane road throughout most of Tarawa. This mitigation option provides an improved and structured transit services to reduce distance (and associated emissions) of single occupant motorized transport between communities. This system will also increase mobility and equity for those in society without drivers licenses, improving options for youth, elderly, disabled persons, low-income travelers, and other vulnerable or disadvantaged demographics.<br><br>The NDC Investment Plan identified the National bus services with up to 132 buses in 2030 will be operated under Public Private Partnership (PPP) model, and include the installation of bus stops and maintenance terminals. |
| Implementation assumptions, How the technology will be implemented and diffused across the subsector? Explain if the technology could have some improvements in the country environment. | The assumption is for electric bus will start first with Government ministries/agencies and SOEs as a compulsory transport for all employees to commute to the office and return during working days.<br><br>Charging stations for individual buses will be setup at the respective ministry, agency and SOE for charging during the day when the bus is at bay. Kiribati has an abundant solar energy resource and the use of solar energy for charging will be considered to avoid stress on the PUB grid.<br><br>Part of the mitigation opportunity is to consider establishment of the public vehicle department like PVU and the private sector for providing technical assistance and capacity building for maintenance and repair of public electric buses. |

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| | The private sector will be assisted if the opportunity are realized and successful from the public transport. |
| Implementation barriers | ● absence of a robust legislative/regulatory structure for the establishment and operation of a national public transport system.<br>● The school bus system can be examined and lessons may be learned as to the operational and financial management of this service<br>● fostering behaviour change and inducing a shift from private vehicle use.<br>● private ICE vehicle import duty and registration rates may be increased to prohibitive levels to disincentivize the import and registration of second hand vehicles<br>● establishment of the electric vehicle infrastructure which is extraordinarily costly. The transit system can be established without requiring additional infrastructure and realize >87% emissions reductions in the land transport sub-sector if fully implemented. |
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| Capital costs | Estimated capital investment needed for the physical implementation: up to US$ 40m for buses, bus stops and maintenance terminals.<br>Estimated development costs: US$ 750,000 for detailed feasibility studies and financing support applications.<br>Estimated Enabling, Capacity Building and Technical Assistance Needs: US$ 3.1m for driver and technician training programmes, setting up a PPP franchise scheme, setting up a PPP lending programme, and annual planning and regulation by government.<br><br>NDC Investment costs 2026-2030<br>Estimated CB & TA Costs US$ 1,025,000<br>Estimated Capital Investment US$ 39,900,000<br><br>Made in China<br>Electric bus 24 seats - USD70,000<br>Level 3 EV charging station - USD10,000 |

Source: Kiribati NDC Investment Plan 2021, https://www.made-in-china.com/

| Technology Name | T11 – Electric Vehicle Network Development |
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| Subsector GHG emission | 6,500 tCO2/yr in 2030 and a total of 29,800 tCO2 for 2020 – 2030. |
| Background/Notes, Short description of the technology option. | Development of an EV network in Kiribati will require both market instruments to facilitate introduction of electric vehicle technology and planning around allocation of infrastructure to create a sufficient support network for a burgeoning EV market. Introducing EV technology creates both a shift in energy storage and distribution requirements, as well as the current market access and profile of vehicles.<br>Unlike the existing paradigm, in which individuals and households primarily purchase second-hand vehicles, the lack of maturity in the EV market means a robust second-hand vehicle market is not readily available to replace the second-hand ICE imports.<br>● The infrastructure requirements include electric vehicle service equipment (EVSE), as well as designated carport space.<br>● The rationale for the transition to electric vehicles for motorized land transport relies upon recognizing the opportunity for decarbonisation of the sub-sector alongside increased installation of renewable energy infrastructure. Vehicle-based energy storage provides the opportunity for variable tariff rates contingent upon supply/demand electricity load curves.<br>● It is estimated that there are 3,300 actively operated SUVs (sport utility vehicles) in Kiribati in 2020. In addition, there is an estimated average fuels increase in land transport of 6.7% annually between 2014 and 2019. Given this growth rate it is expected that up to 11,200 SUVs will be imported between 2022 and 2030, and there will be up to 7,000 actively operated SUVs on the roads in Kiribati in 2030. This mitigation option proposes that up to 2,800 new EVs will be on the road in 2030 which is equal to 38% of the total for such |

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| | vehicles. This mitigation options includes the EVs and one Level 2 charger per vehicle.<br>● This mitigation option does not include additional (RE) power generation or power distribution system upgrades. Offset for public SUVs alone will consider RE Solar charging stations. |
| Implementation assumptions, How the technology will be implemented and diffused across the subsector? Explain if the technology could have some improvements in the country environment. | The assumption will start first with Government ministries/agencies and SOEs for SUVs to be used by Secretaries, Directors, SOE CEOs and office normal run.<br><br>Charging stations for SUVs will be setup at the respective ministry, agency and SOE for charging during the day when parked at bay. Kiribati has an abundant solar energy resource and the use of solar energy for charging will be considered to avoid stress on the PUB grid.<br><br>Technical assistance and financial support for the development and introduction of up to 2,800 Electric Vehicles (EV) and a network of charging stations in Kiribati. This will include both market instruments to facilitate the introduction of EV technology and the planning for the allocation of infrastructure to create a sufficient charging network across first the public, and then the private sector locations.<br><br>EV market is growing rapidly and observed to be skyrocketing in China, EU and US and start to grow in developing countries. |
| Implementation barriers | ● Prior to entry of EVs to the market, the absence of charging and RE infrastructure must be resolved to allow uptake of new technology.<br>● The disparity in price points between second-hand ICE automobiles and new EVs will be a significant barrier to market acceptance. The price disparity between EV two-wheelers and ICE motorbikes is less pronounced, which may serve as the most appropriate point upon which incentives may be introduced (see T3. Bicycle/E-Bike Financing initiative below). |

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| | ● As duty and excise designations for electric vehicles (and charging stations) are not properly encompassed in the existing tariff schedule, nor are VAT exemptions issued for EV network development.<br>● Rebates/tax credits may be provided to importers/retailers who shift their inventory to EVs and cease trading in ICE vehicles.<br>● Government facilities across all ministries may be encouraged to integrate EVSE sites into parking lot/carport locations, and PVU and government vehicle purchases can facilitate entrance of new EVs to the market as the leading avenue for new vehicles entering the national fleet. |
| **Cost** | |
| Capital costs | Estimated capital investment needed for the physical implementation: US$ 18,250,000 for Level 2 chargers accommodating all expected growth of the vehicle fleet over the 2022-2030 period. The total investment cost of imported EVs is US$84,210,000 can be assumed.<br>Estimated development costs: US$ 120,000 – for full feasibility study, concept development and preparation of applications for support.<br>Estimated Enabling, Capacity Building and Technical Assistance Needs: US$3,090,000 – for market scoping and feasibility study(s), and annual planning and administrative facilitation of charging network development incl. training (2023-2030), direct training for technicians in installation and maintenance<br>EVs & chargers in the private sector across the country, and developing a financial instrument to support public and private sector procurement.<br><br>NDC Investment costs 2026-2030<br>Estimated CB & TA Costs US$ 1,075,000<br>Estimated Capital Investment US$ 52,710,000<br>Made in China<br>SUVs price USD 9,000 - 30,000 FOB<br>Charging station plug-in USD900 FOB |

Source: Kiribati NDC Investment Plan 2021, https://www.made-in-china.com/

| Technology Name | T13 – Whole-of-Lifecycle Vehicle Programme: |
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| Subsector GHG emission | Up to 70 tCO2/yr in 2030 and a total of 465 tCO2 for 2020 – 2030.<br>• Given the sequestration potential, land reclamation may account for 8,593m2 from motorbikes, 19,804m2 from automobiles for a total of 33.2tCO2 from legacy vehicles59, and at least 2.9tCO2/yr additional sequestration from 2022 onward in avoided land degradation. |
| Background/Notes, Short description of the technology option. | Derelict vehicles are a common sight around Tarawa. The current dominance in the Kiribati market of second-hand vehicles largely represents the importing of end-of-life vehicle issues from the exporting countries. Given the 5-year lifespan estimated for vehicles in the KIER, it is expected the 9,175 vehicles from 2004-2013 are largely deregistered and no longer functioning. Given the vehicles brought in prior to this period, the assumption over 10,000 derelict vehicles are present across the nation remains a conservative estimate, as no mechanism for disassembling, consolidating, and exporting scrapped vehicles currently exists. Building upon the existing requirements for the deposit of an old battery to purchase/obtain a new battery should serve as an appropriate model to build upon, extending beyond lead acid battery collection to include lithium ion, nickel cadmium, and other types of batteries to prevent exacerbating environmental contamination. The opportunity for government intervention to be accompanied by private sector operators in the collection and export of scrap materials from recovered vehicles may be addressed through public-private partnerships or service contract/licensing arrangements.<br>• The scrapping process will necessary involve breaking down vehicles either on-site or at a designated scrapyard serving as a repository for whole vehicle chassis. Vehicle life-cycle management generally involves cutting chasses into transportable sections or compacting vehicles for loading onto vessels for export. Logistics and supply chain management of the removal of |

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| | derelict vehicles is crucial to ensure the emissions associated with removal are offset with the environmental benefits of waste management (which may include remediation and greening of newly cleared land footprint.)<br>• The distinction between scrapping older vehicles and derelict vehicles must be reinforced, with prioritization upon maintenance and upkeep of older operational vehicles to extend beyond the expected 5-year lifespan outlined in the KIER. For older vehicles, establishment of a machining capacity for engine remanufacturing is an option with additional emission reduction potential (at the expense of adding significant capital costs and capacity building requirements domestically). |
| Implementation assumptions, How the technology will be implemented and diffused across the subsector? Explain if the technology could have some improvements in the country environment. | Derelict vehicles are a common sight around Tarawa. The current preponderance of second-hand vehicles in Kiribati means that the vehicles are being imported at nearer the end of their operational lifespans, and disposal is not addressed in Kiribati. It is estimated that there are 10,000 derelict vehicles across the nation, as no mechanism for disassembling, consolidating, and exporting scrapped vehicles currently exists (a previous scrap mechanism ended years ago). The opportunity for government intervention, as well as potential private sector operators, in the collection and export of scrap materials from recovered vehicles can be addressed through technical assistance and investment to develop and establish public private partnerships or service contract/licensing arrangements. This would not only create economic opportunity (and employment), but also address the underlying environmental problem of past and future derelict vehicles. Mitigation under this option is achieved via carbon sequestration gained from the planting of vegetation in areas where there are previous derelict vehicles. |
| Implementation barriers | • The establishment of a scrapyard and facility for storage of derelict vehicles will require significant allocation of land (up to 28,400m2 to accommodate the >9,175 vehicles estimated to be due for |

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| | removal), and this may prove complicated to delineate based upon existing land use and tenure arrangements.<br>• Data collection on the distribution of derelict vehicles will be a significant logistical undertaking.<br>• The actual logistics of removing derelict vehicles from outer islands will prove complicated given the current capacity limitations in loading cargo onto vessels around various atolls.<br>• Disassembly of chassis and removal will likely need to be coupled with maritime transport project activities to meet the needs of this programme, as high transportation costs inhibit profitability.<br>• The notice period, grace period, and penalties for failing to remove derelict vehicles or failing to properly dispose of a vehicle upon deregistration will require market assessment.<br>• The start-up financing for the infrastructure, training, and initial collection will likely need to be sourced<br>outside of Kiribati, which will require adherence to a range of donor requirements. |
| Reduction in GHG emissions | 70tCO2 per/year |
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| Country economic development priorities – economic benefits | · The National Development Plan Mid-Term Review (issued 2014)<br>➢ The significant waste issue associated with end-of-life vehicles and absence of proper disposal mechanisms. The Kiribati Institute of Technology (KIT) was running a level III certification course in light vehicle mechanical technology, but it ceased in 2016 after 12 students enrolled in 2015, which highlights the need for capacity development for preventative maintenance and proper disposal of vehicles.<br>· The Kiribati Integrated Environment Policy (issued 2013)<br>➢ Goals and objectives include waste management & pollution control. |

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| | · The current MSP (2020-2023) identifies as one of its three core issues (addressed as Strategic Objective<br>2), "The need to improve, air, sea and land transportation and infrastructures." This involves the following strategies;<br>· Commonwealth Clean Oceans Alliance (CCOA) (initiated 2018)<br>· SPREP/EU PacWaste+ Programme (initiated 2018) |
| Country environmental development priorities | Primary Outcomes:<br>· Removal/recovery of waste materials for salvage and/or export.<br>· Opportunity for sequestration of carbon through restored vegetation.<br>Secondary Outcomes:<br>· New industry developed.<br>· Remediation and beautification of currently occupied and degraded land area. |
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| Capital costs | Estimated capital investment needed for the physical implementation: Site-specific costs for establishment of a vehicle scrapyard and processing facility will need to be determined, inclusive of cutting equipment to dismantle vehicles on outer islands for easier transport back to Tarawa (minimum US$1,500,000)<br>Estimated development costs: Full feasibility study for development of the Whole-of-Lifecycle Vehicle Programme. Establishing the financial mechanism to remove derelict vehicles will involve structuring of a penalty system to discourage abandoning vehicles and improper disposal. ($300,000)<br>Estimated Enabling, Capacity Building and Technical Assistance Needs: Course development and Training on disassembling vehicles and occupational health & safety for a range of new dismantling equipment<br>and machinery will be necessary for personnel in the sector. US$60,000 per year during 2022 to 2030. (total US$ 540,000) |

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| | Investment costs 2026-2030<br>Estimated CB & TA Costs US$ 300,000<br>Estimated Capital Investment US$1,500,000 |
| Cost of GHG reduction | US857/tCO2 |
| Other | The Whole-of-Lifecycle Vehicle Programme involves recovering devalued land and rehabilitating both greenspace and otherwise usable land, providing a range of co-benefits beyond the relatively limited potential for mitigation and additional sequestration. Chief among these are resource recovery potential (for steel recycling and other material processing) and beautification or remediation of land to improve aesthetic value for locals and especially tourists. Relevant SDGs include 3, 6, 8, 9, 10, 11, 12, 13, 15, 17. |

Source: Kiribati NDC Investment Plan 2021

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| Technology Name | T15 – Land Transport Infrastructure Upgrade for Non-motorized Transport |
| Subsector GHG emission | 650 tCO2/yr in 2030 and a total of <2,600 tCO2 for 2020 – 2030.<br>· The emission reductions considered under this action are those directly attributable to sequestration, and any mode shift from motorized to non-motorized transport would be in addition to the base sequestration values, but are not included in the presented calculations. The sequestration rates are based upon area-based carbon contained in vegetation biomass estimated by the FAO (>11.7 tCO2 per hectare/yr or 1.17kg CO2 per m2/yr).61 The calculation is based upon the assumption that every kilometre of newly constructed roadway of the 370km requiring rehabilitation include this partitioning with greenspace of 1-2m allocated in the road design, with an average of 1.5m. |
| Background/Notes, Short description of the technology option. | To encourage decarbonisation in the market, reinforcing non-motorized transport (cycling, walking, etc.) through inclusion of separated, protected active transport lanes. As a larger part of roadways should incentivize non-motorized road users to take advantage of the additional allocated space. There are currently 615km of roads in Kiribati requiring rehabilitation/upgrade beyond the recently rehabilitated South Tarawa road. This mitigation option will upgrade 370km of these roads by the end of 2030.<br>The separation of active transport lanes from motorways should ideally be achieved through inclusion of green space between lanes (1-2m width should be allocated in the road design.)<br>Infrastructure design standards around how carriageway and bridges are partitioned, and the allocation of space between partitioning for motorized and non-motorized transport will dictate how the roads are used. |

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| | ➢ Technological options for achieving this partitioning of active transport infrastructure include;<br>o Curbing, bioswales, and green walls, potentially inclusive of a variety of appropriate flora species.<br>o Bio-generated lighting systems may subsequently be integrated into the greenspace to provide street lighting as the technology is commercially deployed.<br>➢ The need for traffic control and safety benefits associated with protected non-motorized paths may be coupled with emission sequestration and particulate matter filtration potential. |
| Implementation assumptions, How the technology will be implemented and diffused across the subsector? Explain if the technology could have some improvements in the country environment. | The design and implementation of enhanced land transport infrastructure will support decarbonisation based on the availability of infrastructure designed to prioritize use of non-motorized transport (e.g. - cycling and walking). To encourage decarbonisation, by reinforcing non-motorized transport through deliberate inclusion of separated green space between vehicle lanes and protected infrastructure for foot and bicycle traffic along 370 km of dedicated roadways yet to undergo paving/upgrading. Technical assistance and the financing of both the design and infrastructure will guide how carriageway and bridges are partitioned, and the allocation of space between motorized and non-motorized transport will encourage GHG mitigation via non-motorised transport. Mitigation under this option is achieved via carbon sequestration gained from the planting of vegetation in separation areas. |
| Implementation barriers | ● The enormity of the financing requirements for nationwide infrastructure upgrades will be a barrier to financing in a single phase, and a staged approach will be needed over the 16-year implementation period.<br>● Formalizing carriageway designs to maximize green space in partitioning lanes is one of the most important aspects to address before this action begins.<br>● Road User levies could be employed to support this initiative through both the specific |

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| | allocation of import taxes on vehicles, vehicle registration and licensing fees, and fuel taxation.<br>● The bulk of financing would need to be sourced outside of Kiribati, which will require adherence to a range of donor requirements. |
| Reduction in GHG emissions | 650 tCO2/yr in 2030 |
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| Country social development priorities | · Partitioning active transport through green space provides the joint benefits of encouraging improved health and fitness (muscular and cardiovascular health), filtration of various air pollutants (respiratory health) and improved safety for road users (reduced threat of injury and death from motorized vehicles)<br>· Once a functional design is approved, the deployment should be replicable and scalable across the full 615km of road network requiring improvement.<br>Relevant SDGs include 3, 5, 6, 8, 9, 10, 11, 13, 15, 17. |
| Country economic development priorities – economic benefits | · Ministry Strategic Plan 2020-2023 (MICTTD & SOE)<br>o Strategic Objective 2: Strengthen air, sea and land transportation and infrastructures to meet social demands and compliment economic enhancing activities.<br>· The Kiribati 20-Year Vision – KV20 (issued 2016)<br>o Pillar 1: Wealth and Health outlines plans to use the Revenue Equalisation Reserve Fund RERF as collateral for a $70 million loan to develop infrastructure (road, runways, ports) to develop 19 tar sealed roads by 2036 in the outer islands.<br>Pillar 3: Infrastructure for development, Improving Access to Utility and Social Infrastructure, Energy as a foundation of the KV20 |
| Country environmental development priorities | Primary Outcomes<br>· GHG mitigation (carbon sequestration through increased green space.) |

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| | · Improved access and safety for non-motorized transport users.<br>Secondary Outcomes<br>· Improved operational efficiency for road users and reduced operational costs associated with maintenance and repair.<br>· Strengthened barriers between motor vehicles and non-motorized transport users. |
| **Cost** | |
| Capital costs | Estimated capital investment needed for the physical implementation: US$ 572m total cost from 2020-2030 (2024-2030 implementation), based upon the per km costs of US$ 1.55m for 370 km of roads.<br>Estimated development costs: US$ 7.4m relative phased planning and management costs based upon the scaling of the action should come in lower than 1.3% of capital investment.<br>Estimated Enabling, Capacity Building and Technical Assistance Needs: US$ 12.6m for phased project oversight support which is determined as 2.2% of capital investment.<br><br>Investment costs 2026-2030<br>Estimated CB & TA Costs US$ 10,500,000<br>Estimated Capital Investment US$ 408,000,000 |
| Lifetime | 50 years |

Source: Kiribati NDC Investment Plan 2021

## Annex III: List of stakeholders involved and their contacts

***Inception meeting 5th December 2024 at Office Of President Boardroom.***

| Name | Post | Organisation | Email |
|---|---|---|---|
| Ms. Okoro Ruka | PM | Child Fund Organisation Kiribati | Okoro@childfund.org.ki |
| Mr. Robwati Tiemti | SHPO | Kiribati Land Transport Authority | kakarobati@gmail.com |
| Ms. Ruiti Uriano | Coordinator | Foundation of South Pacific Kiribati | ruriano@gmail.com |
| Ms. Bwetina Teariki | WSO | Water Department – Ministry of Infrastructure and Sustainable Energy | wso@mise.gov.ki |
| Ms. Kiritaake Teannaki. | NA | Marine Division – Ministry of Information Communication Transport | kiritaake.teannaki@mict.gov.ki |
| Ms. Eretina Benete | Ag. SUMO | Ministry of Culture and Internal Affairs | ebenete@mcia.gov.ki |
| Ms. Tekimwau Otiawa | SCCO | CCRDM - Office of President | tekimwau@ob.gov.ki |
| Ms.Tekena Redfern | Ag. Director | CCRDM - Office of President | takena@ob.gov.ki |
| Ms. Kauanga Rimai | AO | Agriculture Division – Ministry of Environment, Land & Agriculture | k.rimai@melad.gov.ki |
| Mr. Nikora Erene | EIO | ECD - Ministry of Environment, Land & Agriculture | n.erene@melad.gov.ki |
| Ms. Rateiti Vaimalie | FO | CFD - Ministry of Environment, Land & Agriculture | rateitiv@fisheries.gov.ki |
| Mr. Mase Kiraneti | AO | ACD - Ministry of Environment, Land & Agriculture | m.kiraneti@melad.gov |
| Ms.Karamaniti Maereia | Officer | Kindling Kiribati | maereia@gmail.com |
| Ms.Akoia Toromon | Officer | Kindling Kiribati | akoiatoromon@gmail.com |

***Retreat Workshop 11th to 13th December 2024 at Midland Resort, North Tarawa.***

| Name | Post | Organisation | Email |
|---|---|---|---|
| Ms. Arata Tabuaka | Engineer | Kiribati Green Energy Solution | atabtab00@gmail.com |
| Mr. Barekiau Tanentoa | Logistics | Kiribati Green Energy Solution | logistics@kges.com.ki |
| Ms. Eretina Benete | Ag. SUMO | Ministry of Culture and Internal Affairs | ebenete@mcia.gov.ki |
| Ms. Ueaniti Kiritimati | Energy Economist | Energy Department - MISE | energy.economist@mise.gov.ki |
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| Ms.Kiritaake Teannaki. | NA | Marine Division - MICT | kiritaake.teannaki@mict.gov.ki |
| Ms. Kaaroti Henry | SBCO | Environment Conservation Division-MELAD | k.henry@melad.gov.ki |