



Republic of Seychelles

Intended Nationally Determined Contribution (INDC) Under The United Nations Framework Convention On Climate Change (UNFCCC)

September 2015

1. Introduction

1. The Republic of Seychelles is committed to the successful conclusion of negotiations under the Ad-Hoc Working Group on the Durban Platform for Enhanced Action (ADP) in order to adopt, at COP21, a new legally-binding agreement under the United Nations Framework Convention on Climate Change (UNFCCC) applicable to all Parties, which will come into effect and be implemented from 2020.
2. In accordance with decisions 1/CP.19 and 1/CP.20, the Republic of Seychelles hereby communicates its Intended Nationally Determined Contribution (INDC) towards achieving the objective of the UNFCCC as set out in its Article 2, as well as accompanying information to facilitate clarity, transparency, and understanding of its INDC. The information is provided in tabular form that is accompanied by supporting documentation.
3. As a Small Island Developing State (SIDS), the republic of Seychelles is vulnerable to the impacts of climate change and climate variability, and it gives priority concern for adaptation to climate change as communicated in this INDC. Given that the Republic of Seychelles is a net sink, its contributions to climate change mitigation to contribute towards the objectives of the UNFCCC will be the co-benefit of enhancing its energy security and reducing its energy bill.

The Republic of Seychelles will reduce its economy-wide absolute GHG emissions by 122.5 ktCO_{2e} (**21.4%**) in 2025 and estimated 188 ktCO_{2e} in 2030 (**29.0%**) relative to baseline emissions.

2. Mitigation contribution

Time frame and /or period for implementation	Start year: 2020	Mid-term year: 2025	End year: 2030
Type of commitment	Absolute economy-wide emission reductions covering public electricity, land transport and solid waste management (LULUCF is excluded)		
Estimated quantified emission reductions	122.5 ktCO _{2e} in 2025 and 188 ktCO _{2e} in 2030 relative to baseline emissions		
Financial requirements	The cost of achieving the reduction objective (2030) has been estimated to be at least USD 309 million . Including the cost of energy efficiency measures such as building codes, standards and labels, and energy audits will increase the total cost of implementation, which is expected to be met partly through domestic funding and conditional on international climate financing including through the Green Climate Fund among others.		
Type of reference	Emissions reduction relative to Business-As-Usual baselines		
Coverage	% national emissions	~95%	
	Sector	Energy <ul style="list-style-type: none"> • Public electricity (generation and demand side management) • Land transport Waste <ul style="list-style-type: none"> • Solid waste management [sectors not listed do not contribute significantly to emissions; opportunities for emission reductions in LULUCF are limited]	
	Baseline description	Business As Usual scenario of emission projections based on economic growth in the absence of climate change policies, starting from 2010 in the case of public electricity and land transport sub-sectors (to which non-GHG outcomes have been applied), and 2012 for emission from solid waste management (to which a project-based approach is used).	
	Gases	CO ₂ CH ₄ [emissions from other gases are insignificant]	
	Geographical boundaries	Republic of Seychelles	

Intention to use market-based mechanisms to meet target	No
Land sector accounting approach	Not Applicable
Metric applied	GWP of CH ₄ = 21
Methodological approaches	Consistent with methodologies used in the Second National Communication 2011 (1996 IPCC Guidelines); Used combined margin grid emission factor (2014) to calculate emission reductions from public electricity sub-sector
Planning process	<ul style="list-style-type: none"> • <u>Planning processes for preparation of the INDC:</u> The INDC was developed using a multi-stakeholder consultative process by engaging relevant stakeholders in and outside government. The INDC process involved several bilateral meetings and two rounds of national consultations, and it has highlighted synergies with other UNFCCC-related processes, including the Third National Communication (TNC), Biennial Update Reports (BURs), National Adaptation Planning (NAP), and Nationally Appropriate Mitigation Actions (NAMAs), and technology Needs Assessment (TNA). The INDC process was coordinated by the Department of Energy and Climate Change (DECC), Ministry of Environment and Energy and Climate Change. The Cabinet of Ministers has been apprised of the validated INDC and they endorsed the INDC on 23rd September 2015, • <u>Planning processes for implementation and monitoring of the INDC:</u> The overall implementation, and monitoring and evaluation of the INDC will be carried out by the Department Energy and Climate Change (DECC) of the Ministry of Environment, Energy and Climate Change, under the Chair of the National Focal Point for Climate Change who is also the Head of the DECC.
Fair and ambitious	The emissions of Seychelles are less than 0.003% of global emissions. Further, Seychelles are currently a net sink and under the Business-As-Usual scenario it is expected to become a net emitter between 2024 and 2025. In this context, the contribution of Seychelles is considered fair and ambitious. With our contribution, Seychelles will remain a net sink in 2030. The fairness of our contribution also relates to the fact that as a SIDS, adaptation is a higher priority for Seychelles.

3. Adaptation Contribution

4. The Government of Seychelles considers adaptation to climate change as a high priority to reduce the country's vulnerability. The cost of achieving the implementing the adaptation contributions (2030) has been estimated to be at least USD 295 million.

3.1 Climate Change Trends, Impacts and Vulnerabilities

5. Seychelles is about to embark on its *Third National Communication* to the UNFCCC, which will eventually produce updated findings with respect to climate change trends and projected impacts. For now, existing data from the *Second National Communication* must be used to guide planning for climate change. The main climate change threats facing Seychelles are similar to those threatening other small island developing states: changes in rainfall patterns leading to flooding, landslides on one hand and extended periods of drought on the other, increases in sea temperature, changes in acidity and damage to marine ecosystems, increases in storms and storm surges, and sea level rise during the longer term. **Research is needed to better understand changes** in cyclone patterns, ocean and air currents, and the interplay between climate change and other climate phenomena such as El Niño.
6. The threats caused by climate change will have significant impacts on Seychelles in the short, medium and longer term on infrastructure, agriculture, fisheries, tourism, energy and water security, biodiversity, waste management and on human health and well-being. Although the exact impacts are not known, and more research is needed to better understand the implications of a change global climate on the islands, **it is critical that Seychelles take measures to better understand** the threats and begin longer-term planning for adaptation. All national plans and strategies that address climate change adaptation consistently mention Seychelles' shortfalls in terms of capacity building and research. The *National Climate Change Strategy (2009)* addresses this specifically and, although some progress has been made, it was highlighted at the stakeholder workshop that improved gender-sensitive capacity building, research and education was needed to underpin all climate change adaptation efforts in order to make them effective and resilient.
7. Recent studies conducted in Seychelles, by research partners from Cuba and Japan, highlighted that much of the human activity is concentrated around the low-lying, coastal areas which are at the highest risk of flooding from heavy rainfall, storm surges, and sea level rise during the longer term. A recent UNISDR report has revealed that most disasters occurring in Seychelles were related to storms, floods, rain and landslides, and recommended that future planning should focus on losses from flooding and landslides which also caused the greatest economic losses. The report also noted concern about **lack of clear policy on the protection of critical infrastructure** in the country, such as roads, ports, government buildings, energy generation, water distribution and sewerage systems.
8. A Vulnerability/Resilience Profile exercise undertaken in Seychelles revealed that Seychelles was most vulnerable and least resilient in terms of biodiversity resources and sustainable consumption and production (both with significant implications for climate change adaptation) the tourism industry (the country's crucial economic sector) and food security, Other areas of concern were sea level rise, coastal and marine resources, water security and energy security.
9. Seychelles vulnerabilities with respect to climate change are:
 - Critical Infrastructure (roads, ports, government buildings, electricity, water and sewerage management systems);
 - Tourism (in proximity to the coast or in areas vulnerable to flooding and landslide);
 - Food Security (currently reliant on food imports, and need support for local sustainable and climate-smart agriculture and fisheries efforts);
 - Coastal and Marine Resources (considering the aims of the *Blue Economy and Seychelles Strategic Plan 2015*);
 - Water Security (particularly considering issues of storage and distribution);
 - Energy Security (particularly considering the reliance on fossil fuels);
 - Health (particularly addressing the burden placed on high-density populations in the coastal areas and general vulnerability to climate-sensitive diseases);

- Waste (particularly for landfill sites in high risk, coastal locations); and
- Disaster preparedness (particularly addressing the need for more research to understand climate change impacts, and resources to predict, prevent and respond to disasters).

3.2 Statement of Long Term Vision

10. Seychelles' long-term vision is to minimise the impacts of climate change through concerted and proactive action at all levels of society. This vision is nested in the country's broader aspiration of sustainable development: finding strategies to realise the nation's economic, social and cultural potential through an innovative, knowledge-led and gender-sensitive approach. Seychelles' approach to climate change adaptation is guided by a collective understanding of the need to ensure that all actions taken must conserve the integrity of the Seychelles natural environment and heritage for present and future generations.
11. During the longer term, Seychelles' aims to:
 - Advance understanding of climate change, its impacts and appropriate responses;
 - Build gender-sensitive capacity and social empowerment at all levels to adequately respond to climate change;
 - Put in place measures to adapt, build resilience and minimise vulnerability to the impacts of climate change, especially in critical sectors such as water, food and energy security, and disaster management;
 - Develop policy direction and strategies to encourage and enhance action on technology development and transfer of cleaner technologies; and
 - Scale-up financial resources and investment to support action on adaptation.

3.3 Statement of Current and Near-Term Planning and Action

12. Seychelles *National Climate Change Strategy* provides an overarching framework and direction for climate change adaptation in Seychelles. This plan was incorporated into, and updated, in the *Seychelles Sustainable Development Strategy, 2012-2020*, Chapter 12, which provides strategic goals and objectives to guide adaptation until 2020. These plans called for the mainstreaming of climate change adaptation into all sectoral plans and this has progressed in several sectors including tourism, health, finance, agriculture, biodiversity, fisheries, disaster management, and land-use planning.
13. More recently, climate change adaptation has been mainstreamed in the *Seychelles Strategic Plan (2015)* which is the definitive document intended to guide land-use management during the next 25 years (to 2040). The plan has been developed with reference to sectoral plans by various ministries and is intended to provide an integrated framework for the development of new plans, particularly regarding land use.
14. Also recently, the *Seychelles Biodiversity Strategy and Action Plan (2015-2020)* has been launched, and includes many cross-sectoral projects with climate change adaptation implications. Projects address issues such as sustainable tourism, watershed management, sustainable agriculture and fisheries, disaster planning, research and a shift toward ecosystem-based adaptation approaches to biodiversity conservation.
15. The Ministry of Environment, Energy and Climate Change has recently restructured and created the new Climate Change Division which will serve as the national focal point for climate change adaptation planning and implementation of projects. The University of Seychelles has recently established the *Blue Economy Research Institute* which should be strengthened and fully funded and function as a hub for climate change related research. Other government ministries, agencies and civil society organisations will continue to contribute to adaptation efforts guided by their own sectoral plans but in collaboration with the Ministry.
16. Moving towards the longer-term adaptation goal, the **main actions** up to and beyond 2030 are to increase resilience and reduce vulnerability of livelihoods and island life with respect to critical infrastructure, tourism, food security coastal and marine resources, water scarcity, energy security and health.

Vulnerabilities	Increased Resilience from
Critical Infrastructure	Climate change adaptation to be mainstreamed in all sectors with critical infrastructure Planning process for all new developments, with associated improvements in the building codes and their rigorous enforcement
Tourism	Greater co-management of the sector by the Ministry of Tourism and Department of Risk and Disaster Management as well as with the Ministry of Environment, Energy and Climate Change
Food Security	A sustainable modern agriculture supported by new and innovative technologies across all food production supply and value chains, and by skilled and qualified human resources and integrated with the <i>Blue Economy and Seychelles Strategic Plan 2015</i>
Biodiversity	Fully implemented <i>Seychelles Biodiversity Strategy and Action Plan</i> Fully implemented and enforced <i>Biodiversity Law</i> Fully bio-secure border
Water Security	Fully integrated approach to water security that addresses issues such as ecosystem health, waste management, water treatment and supply, sewage, agriculture, etc
Energy Security	More resilient energy base with greater innovation of renewable energy where practicable Efficient fuel-based land transport and more use of electric vehicles charged with renewable energy technology Strengthened cooperation between Government entities
Health	Health sector able to respond to population increase and its additional climate-related health burden Exploration of relevant potential science and technology innovations
Waste	Waste managed according to strict hierarchy and waste policy fully implemented Exploration of relevant potential science and technology innovations

17. Further details of the actions to be taken are contained in the monitoring plan in *Supplementary Information*.

3.4 Statement of Gaps, Barriers and Needs

18. **Capacity Building, Education and Awareness** - Much has been accomplished during the past ten years to educate the public about the causes and impacts of climate change, and mitigation and efforts. While civil society is generally aware of the problem of climate change, much more work is needed to educate different stakeholder groups about climate change adaptation measures and to help them develop capacity to research, develop and implement these and other appropriate strategies. There is a need to accelerate efforts to integrate climate change education into the school curriculum at all levels, including primary, secondary and professional centres and ensure that adequate attention is given to adaptation measures. On a more fundamental level, there is a need for Seychelles to reinforce and enhance the quality of STEM (science, technology, engineering and mathematics) education at all levels to develop a new generation more capable of climate change adaptation leadership. The University of Seychelles has already integrated climate change into the Environmental Science BSc programme, though needs more support to offer climate change specialist training at diploma, undergraduate and graduate level to build on the, currently, very limited group of climate change specialists in the country. In-service training is also needed for teachers and other professionals working in diverse sectors (government, private sector and civil society) to help them integrate climate change adaptation measures into their work.
19. **Research and Monitoring** - Seychelles limited research and monitoring capacity for climate change reflects a challenge common to many islands with a small population. The establishment of the *Blue Economy Research Institute* based at the University of Seychelles offers new opportunities for research into and monitoring of climate change adaptation efforts, though requires greater input of financial and human resources to meet this potential. Many government sectoral plans and strategies also call for research and monitoring related to climate change adaptation but they lack the human and financial resources to fully undertake this task. The way forward will include innovative approaches in partnerships between the University, local agencies and overseas research institutions.
20. **Technology** - In many cases, Seychelles lacks the technological capacity to undertake effective research on climate change modelling and risks, monitoring of climate change impacts and

implementation of adaptation measures. In some cases, the knowledge may be there but the technology is prohibitively expensive, e.g. in terms of diversifying away from fossil fuels for renewable energy, or protecting critical infrastructure. The way forward for these challenges will also include alliances with overseas partners including donors, a trend that has already been initiated by several government agencies including Seychelles Meteorological Service, the Department of Risk and Disaster Management, and the Ministry of Environment, Energy and Climate Change. The National Institute for Science, Technology and Innovation will reinforce the technological capacity to undertake effective research on climate change-related issues.

21. **Legislation** – Seychelles is already in the process of revising some of its legislation to reflect emerging sustainable development issues, including climate change. There is a need to finalise amendments to the *Town and Country Planning Act*, and to enforce and provide resources as well as for the new *Disaster Risk Management Act*. Other legislation may also need to be reviewed and amended in light of climate change adaptation needs.

3.5 Summary of Existing Support

22. General support includes EUR 2 M of budgetary support from the *Global Climate Change Support Fund* which was awarded to the Government of Seychelles to implement aspects of the *National Climate Change Strategy*, granted in 2010. More specific support includes:

- **Ecosystem-Based Adaptation** – Seychelles is currently implementing three ecosystem-based adaptation projects funded by the GEF Climate Change Adaptation Fund, UNEP and the Government of China. The projects focus on management of coastal ecosystems, protection of mangroves, and sustainable watershed management collectively;
- **Water Security** – Public Utilities Corporation is implementing a project to address deficiencies in water security, funded by a loan from the European Investment Bank and a loan from the Agence Française de Développement and designed to address deficiencies in water security. A further loan and grant of about EUR 20 M from the African Development Bank will help the Government to finance part of the Mahé Sustainable Water Augmentation Project and meet targets as set out in the 2008-2030 *Water Development Plan* supported by the African Water Facility. The project will address water supply to the residential, commercial and tourism sectors;
- **Food Security** – The Ministry of Agriculture and Fisheries and its associated parastatals (Seychelles Agriculture Agency and the Seychelles Fishing Authority) have been receiving support from donors including the African Development Bank, the International Fund for Agriculture Development, the Japanese Government and others to help work towards more sustainable agriculture and fisheries and contribute to improving food and nutrition security;
- **Energy Security** – Seychelles is currently implementing two GEF-funded projects focused on solar photovoltaic energy and energy efficiency, both of which address energy security issues in terms of electricity. The European Union funded the development of a new *Energy Act* which has paved the way for the integration of renewable energy sources into the electricity grid. The United Arab Emirates donated a wind farm to Seychelles in 2013 to help diversify the electricity supply;
- **Disaster and Risk Management** – Seychelles has received assistance from the regional European Union funded Islands Project and other sources to support an improvement in disaster preparedness and communication with the public and the private sector. A Cuban research team and Japan-funded study have assisted Seychelles with disaster and risk modelling related to climate change; and
- **Education and Capacity Building** – Many government and civil society partners have contributed to an ongoing climate change education programme targeting schools, the general public, artists, and professions from diverse sectors. For instance, the University of Seychelles has partnered with local and overseas institutions to develop its Environmental Science degree programme.

3.6 Description of Monitoring and Implementation Plans

23. The process of implementing the Vision to build gender-sensitive capacity, education and awareness, research and monitoring across critical sectors will be nationally monitored, reviewed, updated, and reported by the Ministry of Environment, Energy and Climate Change and will be focused on short-term monitoring of activities and processes, and outputs rather than on longer-term outcomes.

24. The *National Climate Change Committee* is a multi-stakeholder group chaired by the Ministry and about to embark on the *Third National Communication*. The committee will function as the main body to coordinate and monitor implementation of climate change adaptation projects, and identify emerging gaps and opportunities for further action.
25. An indicative monitoring plan is elaborated in the *Supplementary Information* which will be monitored by the Climate Change Division of the Ministry of Environment, Energy and Climate Change. This will be aligned with the Department of Public Administration initiative (Monitoring and Evaluation and Administrative Governance) which is being introduced across all ministries to facilitate ministry-wide monitoring.

4. Supplementary information on the INDC for the Republic of Seychelles

MITIGATION

The Voluntary Initiatives of Seychelles

The Republic of Seychelles has developed strategic tools for the sustainability of its development and economic reforms, such as *Seychelles National Climate Change Strategy*, 2009. The Strategy has five priority objectives to:

- Advance understanding of climate change, its impacts and appropriate responses;
- Put in place measures to adapt, build resilience and minimise the country's vulnerability;
- *Achieve sustainable energy security and to reduce greenhouse gas emissions*;
- Mainstream climate change considerations into national policies, strategies and plans; and
- Build capacity and social empowerment at all levels.

The *Energy Policy* that was proposed in 2010 has set a target for 15% of energy supply to be met from renewable energy sources in 2030. The expected target in 2020 is 5%. In the long term, the Policy envisages that 100% of energy supply will be from renewable energy sources. Discussions with the Seychelles Energy Commission (SEC) have revealed that these targets are now being applied primarily to the power sector rather than being applied to primary energy supply. The Policy has also proposed the adoption of demand side energy efficiency practices that would decrease the energy intensity by at least 10% in 2020.

The Mitigation Context of Seychelles

The mitigation assessments have been guided by the fact that Seychelles is an insignificant emitter of GHGs by world standard as it accounted for only 0.001% of the global emissions of GHGs in 2000, and less than 0.003% of world emissions in 2011. Further, excluding the offsetting capacity of ocean biomass and marine ecosystems (or blue carbon), Seychelles was a net sink of GHGs in 2000 at -564,232 tCO_{2e} according to the Second National Communication (SNC), 2011. Accordingly, Seychelles is not expected to become a net emitter of GHGs before 2025. Voluntary emission reductions will only postpone the time when Seychelles will become a net emitter.

According to the SNC, ~95% of all national emissions took place in the energy sector in 2000. The remaining 5% of national emissions was accounted by forestry. The generation of public electricity and transport accounted for 82.0% and 82.8% of all emissions in 2000 and 2007, respectively. Public electricity and transport are therefore priority sectors for emissions reductions. In 2000, emissions related to fuel combustion in cooking represented 6% of national emissions. These values show that the priority sector for mitigation is the energy sector, of which public electricity and transport are significant potential sub-sectors for GHG emission reductions.

Emissions from industrial processes and agriculture are insignificant in Seychelles. The emissions from agriculture were deemed to be so insignificant that the SNC mentions that it might not be necessary to calculate emissions from agriculture in the future. Concerning forestry, it was estimated that 8,000 m³ of biomass was harvested annually amounting to an annual emission of 12,540 tCO₂. In contrast, the sink capacity of forests was 837,380 tCO₂ with an expected loss in sink capacity of 1% every 5 years. Solid waste generated some 2,510 tCH₄ in 2000 (SNC, 2011).

In Seychelles, climate change mitigation to stabilize the climate system is not a primary objective. Mitigation is rather seen as an important outcome or by-product of decreasing the country's dependence on imported fossil fuels (i.e. increase in energy security), and to enhance its balance of trade profile (through a reduction in its energy bill) (Seychelles National Climate Change Strategy, 2009). The energy bill of Seychelles represented 25.15% of its total import bill in 2014. Except for the generation of 2.15% of renewable electricity in 2014, all the other energy needs of the Seychelles were met from imported fossil fuels.

GHG Emissions Scenarios

Non-GHG Outcomes in Public Electricity and Transport

The *Energy Policy 2010* has provided guidance regarding energy use scenarios in the power sector (electricity production and consumption) and transport to 2030.

Electricity Generation

It is estimated, that the renewable energy sources described above, together with the necessary legislation, can contribute with 15% - 20% renewable energy in the supply matrix in 2030. Wind power and, in the longer term, PV, are expected to contribute substantially.

Electricity Consumption

It is estimated that implementation of the policies outlined here has the potential to save 15% - 30% of electricity consumption towards 2030 compared to the baseline.

Transport

Keeping a high penetration of public transport, targeting fuel efficiency and biofuels in import regulation, and moving towards electric vehicles and two-wheelers, have the potential to reduce oil imports for transport purposes by 15% to 30% (or perhaps more) by 2030 compared to the baseline.

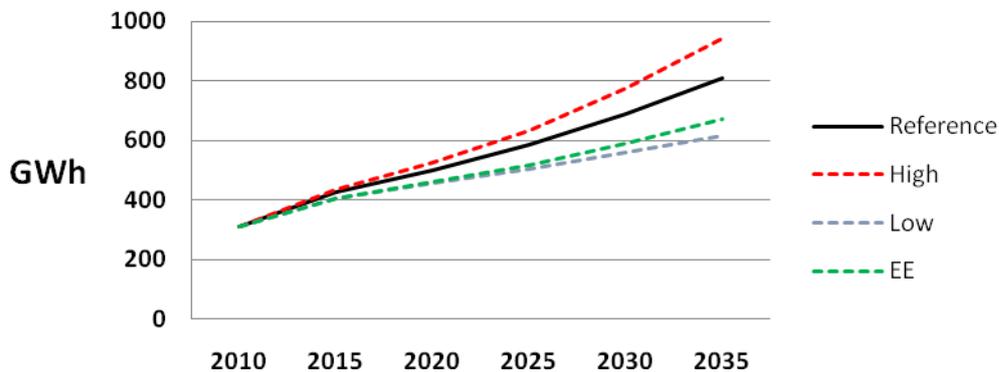
Public Electricity

Concerning electricity demand, the SEC has carried out projections of electricity to 2035 under different GDP growth rate and energy efficiency scenarios using Model for Analysis of Energy Demand (MAED). These are summarised in the schematic below. The Reference (Ref), Low and High scenarios refer to annual GDP growth rates of 5%, 3% and 6%, respectively. The Energy Efficiency (EE) scenario is one where the annual energy intensity drops by 20% compared to 10% in the Reference scenario. This scenario is based on the Reference scenario (scenario 1) with a GDP growth rate of 5% per year, except that in Industry the *energy intensity will decrease by 20% per year* in all the sub-sectors of industry for motor fuel uses, electricity specific uses and thermal uses except in Agriculture and Others in Manufacturing. This is due to energy efficiency improvement and technology innovation which are likely to occur in the next 25 years.

- The implementation of a National Energy Efficiency Programme includes the following activities:
- Promotion of energy-efficient appliances: target of 10% energy savings in 2035
- Promotion of solar water heating: target of 80% of needs in Households, and 80% in Services by 2035,
- New Regulations on the use of air-conditioning, target of 20% energy savings in the service sector,
- New Building Code for Household dwellings (features natural ventilation, roof insulation,..), target of 50% energy savings on fans & AC in households by 2035,
- Promotion of cogeneration (production of hot water from waste heat from electricity generation) in hotels, target to cover 20% of hot water needs by 2035.

It is assumed that for the period of the study 2010-2035, the population will grow at a constant rate of 1% per year, corresponding to the annual average growth rate (AAGR) for the preceding 10 years. It is assumed that the structure of the GDP is the same as for 2010 throughout the study period 2010-2035.

Seychelles Electricity Demand to 2035 MAED projections

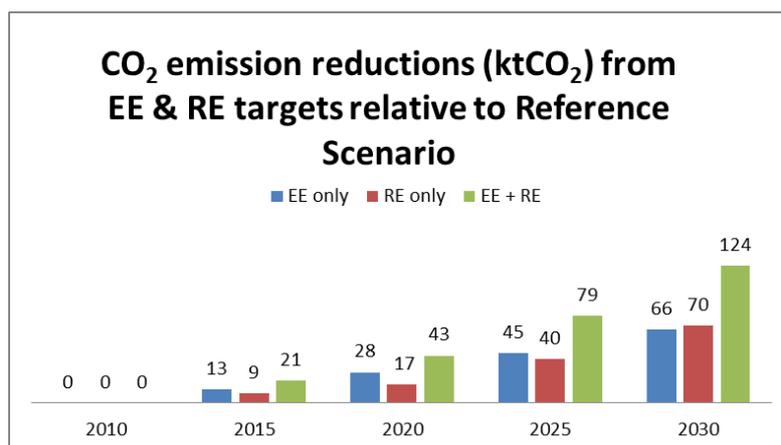


The SEC has revealed that the realistic non-GHG targets that have been proposed in the Energy Policy 2010 should be 15% for diversification of electricity generation using renewables by 2030, and to achieve the energy efficiency scenario given in the figure above.

In order to calculate the emission reduction potentials of these non-GHG targets applied to the MAED scenario projections, the grid emission factor of Seychelles has been calculated using the Clean Development Mechanism (CDM) Methodological Tool 07 – i.e. “Tool to calculate the emission factor for an electricity system (Version 04.0)”. For electricity supply diversification from renewable energy sources that are intermittent such as wind and solar PV, the combined margin emission factor has been calculated as 0.67887 tCO₂/MWh. For all other renewable energy sources and end use energy efficiency, the combined margin emission factor has been calculated as 0.65936 tCO₂/MWh.

GHG Emission Reductions from Supply Side Diversification and Energy Efficiency

Since the supply side diversification in Seychelles is expected to be primarily from solar PV and wind energy (as per the proposal made in the Energy Policy 2010), the combined margin emission factor = 0.67887 has been applied to convert the non-GHG target of 15% renewables in the electricity mix in 2030 into the equivalent amount of GHG emissions. Similarly, the emission factor = 0.65936 tCO₂/MWh has been applied to obtain the emission reductions associated with demand side energy efficiency gains. The GHG emission scenarios were calculated using a combination of the Reference scenario and the non-GHG targets of 15% RE and 15.5% EE in 2030.



Transport

Projections have been made in the SNC regarding the increase in baseline emissions from road transport sector from 66, 525 tCO₂ in 2005 to 167,087 tCO₂ in 2030. The projections correspond to an increase in the number of vehicles from 10,622 in 2005 to 20,000 in 2030. Fossil fuel consumption is expected to increase from 21,324 t (2005) to 53,620 t in 2030. Using a target of 30% reduction in fuel use, which is expected to produce a proportional decrease in GHG emissions, the total emissions arising

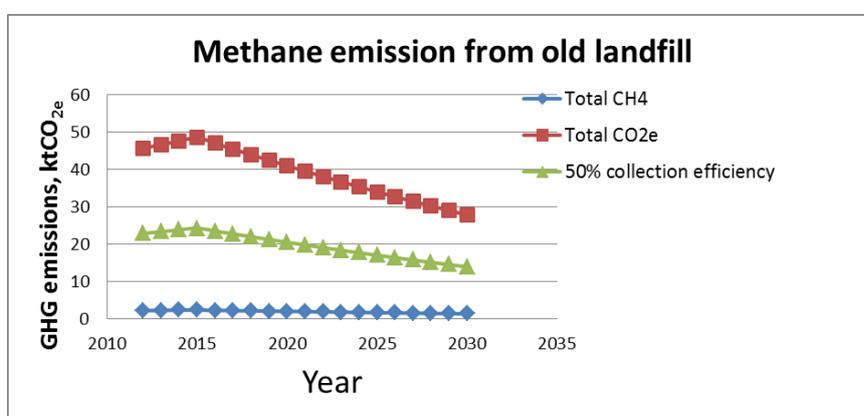
from road transport is expected to be 116.96 ktCO₂ in 2030. This target corresponds to a reduction in emission of 50.13 ktCO₂ in 2030. Assuming a target of 18% for 2025, the corresponding emission reduction is expected to be 26.5 ktCO₂.

Project-based Approach

The climate change mitigation contribution of Seychelles has been calculated using a combination of outcome- and project-based approaches, while avoiding double accounting. There are projects that are not captured in the outcome targets discussed above, and which might be implemented after 2020. Examples of such projects are solid waste management and end-use energy efficiency in the water sector that is not captured in the EE scenario that is discussed above. The EE in the water sector are not included in the INDC because most measures are expected to be implemented before 2020.

Solid Waste Management

Data regarding methane (CH₄) emissions from the old landfill in Mahe was provided by the SEC. Currently, the emissions are not captured neither for flaring nor for electricity generation. The projected emissions profile of CH₄ is shown in the figure below for the period covering 2012 and 2030. The INDC has included a conservative scenario where only 50% of the emissions are captured for flaring. There is currently no provision for power generation using the captured emissions.



Seychelles as a Net Sink

According to the SNC (2011), Seychelles is currently a net sink. With GHG emissions projected to increase from 310,816 tCO₂ in 2005 to 911,985 tCO₂ in 2030, and its removal capacity decrease from 813,780 tCO₂ in 2005 to 773,896 tCO₂ in 2030, Seychelles is not expected to become a net emitter until 2024-2025. The reduction in sink capacity is projected to take place by 1% every 5 years, and it is assumed that this cannot be avoided since reclaiming land for built-up areas (to protect forests) has proved to be too costly (SNC, 2011).

By taking into account the emission reductions arising from (1) RE and EE (i.e. 124 ktCO_{2e} in 2030), (2) land transport (i.e. 50.13 ktCO_{2e} by 2030), and (3) methane capture and flaring from the old landfill (i.e. 13.91 ktCO_{2e} by 2030), the total emissions in 2030 can be reduced by 188 ktCO_{2e} – i.e. the contribution of Seychelles. With this contribution, Seychelles will be a net sink of GHGs by about 50 ktCO₂ in 2030, and it will become a net emitter only after 2033. These calculations do not take into account the potential for additional sinks in the form of marine ecosystems – i.e. blue carbon (Seychelles Strategic Plan 2040, 2015).

In 2025, the emission reductions against the baseline scenarios have been calculated at 122.5 ktCO₂ – RE and EE = 79 ktCO₂, land transport = 26.5 ktCO₂, and methane capture = 17 ktCO₂.

ADAPTATION

To support the Statement of Long-Term Vision

Another essential component of overall country resilience to climate change is recognising and planning for **Critical Infrastructure**, particularly roads, ports, government buildings, energy generation, and water and sewerage management systems. Building capacity in managing the country's critical infrastructure requires clear linkages between responsible Government entities, a responsive education and awareness programme targeting infrastructure users, supported by appropriate research, and followed by reflexive monitoring.

Climate change adaptation needs to be mainstreamed into planning process for all new developments, with associated improvements in the building codes and their rigorous enforcement. A critical role is that of the Department of Risk and Disaster Management which needs upgrading in capacity with enhanced mapping underpinned with commensurate internet bandwidth. The Department should be linked in real time to Seychelles Meteorological Service to assist in understanding risks and hazards, improving emergency response system, whilst engaging directly with, and empowering, communities and islands to plan, mitigate risks and respond.

The key economic sector is **Tourism** and this sector requires nimble, adaptive responses, particularly where its success is predicated on proximity to the coastal or island areas. Tourism tends naturally to adapt to market forces and the suitability of the tourism offering for the future will need not only to recognise market pressures but also those driven by climate change. Consequently, it will be essential that the Blue Economy Research Institute in conjunction with the National Institute of Science, Technology and Innovation produces relevant products that enable the tourism sector to respond in a timely fashion.

Adaptive responses may include expanding marine tourism (yachts, ocean-based experiences) and mountain tourism (away from the coast). Greater co-management of the sector by the Ministry of Tourism and Department of Risk and Disaster Management as well as with the Ministry of Environment, Energy and Climate Change.

Food Security has been recognised by the Government as a crucial issue and it is widely understood within Government and agreed that there are clear linkages between water, food, ecosystem health and well-being of the people. Seychelles is in the process of implementing an ecosystem-based approach to watershed management and its implications for foods supply as well as water security. The Ministry of Agriculture and Fisheries is currently working on a feasibility study for a project to improve food and nutrition security and this project also addresses issues of water and soil management with reference to climate change.

The Ministry recognises that sustainable modern agriculture requires new and innovative technologies, and investment supported by skilled and qualified human resources. The Ministry anticipates additional resources being committed to enhance human capacity development at the Seychelles Agricultural Agency, revitalising the extension services and also providing opportunities for young Seychellois to study climate-smart and ecosystem-based approaches to agriculture, put in place programmes for sustainable industrial and artisanal fisheries, sustainable mariculture, promote home gardening, improve port infrastructure for artisanal and industrial fisheries, reduce illegal, unreported and unregulated activities; and continue to support the insurance scheme for farmers and fishers.

With so much territory protected from human land use and with a remarkably narrow coastal strip, Seychelles has real challenges in designing a future to take into account climate change which has jurisdiction over the entire coastal strip through, storm surge, high winds and salty air. Much has been made of the "blue economy" and for islands that would seem to be a logical consideration. Seychelles needs to fast-track its blue-economy ambition into action so that it can develop innovative and additive links with the *Seychelles Strategic Plan 2015* which is in its closing formulation. For island states, it is too short-sighted in terms of climate change and island development to orchestrate land use plans without due consideration of the primary engine ~ the blue economy.

A current Marine Spatial Planning project underway also has potential to coordinate connections between different interests in the blue economy, **biodiversity**, whether they be conservationist or exploitative in nature.

The issue remains that little research has been done regarding the impacts of climate change on Seychelles' fisheries, both industrial and artisanal, and more research will provide valuable insights to guide adaptation strategies for the fishing sector.

With 50% of Seychelles under protection, that is an enviable basis for the future. The newly-launched *Seychelles Biodiversity Strategy and Action Plan* addresses climate change as a cross-cutting theme and identifies a series of projects to improve biodiversity conservation through cross-referencing issues such as water and food security. A new Biodiversity law is currently being drafted which will update the existing laws related to the protection of biodiversity and strengthening of the capacity of those charged with their protection. There is a need to balance protected areas and room for development whilst developing a strong capacity for biosecurity. Such requirements offer ideal scope to inform a strengthened Blue Economy Research Institute.

Water Security, particularly considering issues of storage and distribution, requires urgent attention and needs to take into account projected population growth, whilst reducing demand for treated water, using more rainwater, improving efficiency of the distribution system, and improving water storage capacity. Increasing water demand from the residential, commercial, agriculture, and tourism sectors is exacerbated by changes in rainfall patterns and a limited water storage capacity. The ecosystem-based watershed project mentioned previously is currently being implemented to address water supply from an ecosystem perspective. Another demonstration project is being implemented on La Digue focused on integrated water resource management. Both of these projects represent an integrated approach to water security that address issues such as ecosystem health, waste management, water treatment and supply, sewage, agriculture, etc. It is advocated that this approach is mainstreamed throughout island water resource management. In addition, the Public Utilities Corporation is currently implementing a project to improve water security by increasing efficiency of the system and reducing demand from consumers. This project also addresses the linkages between the treated water system and energy efficiency. It is essential that these endeavours are linked to the Blue Economy Research Institute to optimise knowledge-sharing and research throughout Government.

Energy Security, particularly considering the reliance on fossil fuels is vital to the longer-term sustainability of Seychelles. There is a need to keep the options for diversifying electricity sources under continual review, whilst exploring more opportunities for the application of renewable energy technologies and strategies for using waste as an energy form. Commensurate with this, the distribution grid needs to maintain flexibility, and plans engaged to move critical infrastructure out of flooding/storm surge risk areas. Whilst the introduction of renewables is a usual early thought that has to be cautioned with detailed feasibility studies, innovations are possible, though require well-programmed research.

Mechanised transport is essential given the terrain of Seychelles. This currently relies on fossil-fuelled vehicles and infrastructure that is degraded. Both require upgrading as these are critical and underpin all other sectors ~ moving people to school, work and shops. The departments responsible for road maintenance and repair in case of flooding, erosion and landslides collaborate to some degree to deal with crises, but a strengthening of cooperation between them in terms of troubleshooting and planning would be desirable (e.g. Seychelles Land Transport Agency, the Department of Transport, Department of Risk and Disaster Management and the Ministry of Environment, Energy and Climate Change).

The **Health** burden due to high-density populations in the coastal areas needs to be managed through improved research, response and planning. There are known challenges within the coastal zone related to chemical and solid waste.

The conventional **waste** hierarchy (reduce, re-use, recycle) should be implemented fully and the use of organic waste for soil improvement promoted. Traditionally, on Seychelles, waste management has been mostly about disposal rather than looking at waste as an opportunity (especially through the circular economy). Seychelles has a relatively new waste policy (2013) which highlights the waste hierarchy with landfill being the last option, though for most forms of waste this may be the only option.

Waste management sites are located in the limited coastal area on all three main islands; the new landfill on Mahé has been designed to collect leachate though this is only expected to last five to six years and thus far there is no plan or location identified for the next landfill. There is growing interest in business opportunities presented by recycling by the private sector, and this movement is being supported by the Government as well as by civil society organisations. The Government is conducting feasibility studies to look at the potential of a waste to energy facility, which would probably take the form of a biogas plant.

To support the Statement of Current and Near-Term Planning and Action

The Department of Risk and Disaster Management has mainstreamed climate change concerns into its work and is guided by a new policy and law (*Disaster Risk Management Act, 2015*) that provide clear guidance. The Department is receiving some support under various funding programmes but requires more input in terms of human and financial resources to fulfil the mandate as guided by the *National Progress Report on The Implementation of the Hyogo Framework For Action (2013-2015)* which details many actions focusing on building capacity in communities and districts to prepare for and respond to disaster (climate change mediated) events. In addition, the *Seychelles National Disaster Risk Policy (2014)* provides several areas for near-term action: Establishing sound, integrated and functional legal and institutional capacity for total disaster risk management in Seychelles; Improving risk identification, assessment and monitoring mechanisms in Seychelles; Reducing the underlying risk and vulnerability factors by improving disaster risk management applications at all levels; Strengthening disaster preparedness for effective response and recovery practices at all levels; and Enhancing information and knowledge management for disaster risk management.

The Ministry of Agriculture and Fisheries is looking at food security issues, including nutritional issues, and has developed a *Food and Nutrition Security Policy* as well as an investment plan. The Ministry recognises that sustainable modern agriculture requires new and innovative technologies, and investment supported by skilled and qualified human resources. The Ministry anticipates additional resources being committed to enhance human capacity development at Seychelles Agricultural Agency, revitalising the extension services and also providing opportunities for young Seychellois to study climate-smart agriculture technologies.

The Ministry of Education has recently integrated climate change into the secondary geography curriculum, and climate change issues are often addressed in extra-curricular school activities in primary (wildlife clubs) and secondary schools. Climate change has also been addressed in the programmes of many of the professional centres. The Ministry has the opportunity to identify opportunities for building on the work already being done, particular with respect to adaptation strategies related to the different sectors.

The Ministry of Environment, Energy and Climate Change, through its *Seychelles Energy Policy (2010-2030)* outlines key strategies for energy security and has a ten-year outlook and action plans for energy security, efficiency, renewable energy (as documented in the *Seychelles Sustainable Development Strategy, Volume 2, Chapter 11 – Energy and Transport*). Many of the planned projects are underway, the *Energy Act* is in force and has paved the way for the introduction of power supplied to the grid from diverse sources. Two GEF projects are being implemented, focused on energy efficiency and solar photovoltaic, both of which will also contribute significantly to an improvement in the energy security of Seychelles.

The Ministry of Tourism has a master plan (2012 -2020) which indicates its focus on climate change where appropriate. The priorities for sustainable tourism are documented in the *Seychelles Sustainable Development Strategy, Volume 2, Chapter 8 – Tourism* and include: Minimising negative impacts of tourism on environment (and society) generally; and addressing climate change through training of tourism environmental representatives, training of the Seychelles Tourism Board in sustainable tourism development and training of environmental conservationists.

The Ministry of Land Use and Habitat is largely guided by the *Seychelles Strategic Plan (2015)* which is the definitive document intended to guide land use management during the next 25 years to 2040. Climate change adaptation is a cross-cutting theme with maps/plans for areas for growth showing intense areas of development along east coast of Mahé including the Victoria area. There is little mention of risks due to sea level rise and storm surges and the plans contradict predictions from the Cuban Study projections (map chapter 3) which could be addressed through further research as indicated previously.

The Ministry of Health recently developed a *Seychelles National Climate Change and Health Adaptation Plan of Action (2014-2018)* in collaboration with the Ministry of Environment, Energy and Climate Change. This plan will foster closer ties between the two ministries and guide adaptation efforts related to public health.

The National Institute of Science, Technology and Innovation (NISTI) is a newly-enacted body under the Ministry of Investment, Entrepreneurial Development and Business Innovation. It has an oversight and

leadership mandate with regards to the growth and development of science, technology and innovation across all sectors and programmes, and has potential to contribute to climate change mitigation and adaptation action. Also of interest, is that it has been mandated to assist the transition to a Seychelles knowledge-based economy between now and 2026.

To support the Description of Monitoring Plan

VISION: Minimise impacts of climate change through sustained action at all levels of society		
Components	Activities/Processes	Outputs
Blue Economy Research Institute	<ul style="list-style-type: none"> • Scope out strengthening Institute needs • Feasibility Study to cost climate change research activities by the Institute • High speed networks to sectors • Appropriate training • Establishment of a national data hub • Collaboration with local (e.g. the National Institute for Science, Technology and Innovation, Seychelles Meteorological Office), and overseas research partners • Support innovative and research-based approaches to climate change education for both informal and formal education sectors and their staff • Support enhancement of Science, Technology, Engineering and Mathematics education in schools at all levels 	<p>Functional research Institute based at the University of Seychelles capable of attracting, retaining and funding postgraduate programmes in climate research with proactive links to all sectors including education sector and their professional centres</p>
Critical Infrastructure	<ul style="list-style-type: none"> • Scope critical infrastructure needs • Appropriate training • Create clear linkages between responsible Government entities • Develop a responsive education and awareness programme targeting infrastructure users • Link to Blue Economy Research Institute and the National Institute for Science, Technology and Innovation • Instil reflexive monitoring • Department of Risk and Disaster Management upgraded and linked in real time to the Seychelles Meteorological Service • Improved road maintenance and repair • Need to re-think basic philosophy to incorporate climate-smart designs • Ensure prioritised with near, mid- and long term aims 	<p>Climate change adaptation needs mainstreamed into all sectors with critical infrastructure</p> <p>Planning process for all new developments, with associated improvements in the building codes and their rigorous enforcement</p> <p>All new builds to incorporate rainwater harvesting, solar PV and other sustainable building features</p>
Tourism	<ul style="list-style-type: none"> • Link to the Blue Economy Research Institute • Receives and acts upon relevant products • Reviews and acts upon potential adaptive responses • Training in climate change for hoteliers and tourism students at the Seychelles Tourism Academy 	<p>Greater co-management of the sector by the Ministry of Tourism and Department of Risk and Disaster Management as well as with the Ministry of Environment, Energy and Climate Change</p>
Food Security	<ul style="list-style-type: none"> • Complete feasibility study for a project to improve food and nutrition security • Enhance human capacity development at Seychelles Agricultural Agency and Seychelles Fishing Authority • Revitalise extension services and provide opportunities to study climate-smart and ecosystem-based approaches to agriculture and fisheries • Programmes for sustainable industrial and artisanal fisheries, sustainable mariculture • Promote home gardening, improve port infrastructure for artisanal and industrial fisheries, reduce illegal, unreported and unregulated activities; and support the insurance scheme for farmers and fishers • More research needed regarding the impacts of climate change on Seychelles' fisheries, both industrial and artisanal, and more research will provide valuable 	<p>A sustainable modern agriculture and fisheries supported by new and innovative technologies, investment, and by skilled and qualified human resources</p> <p><i>Integrated Blue Economy and Seychelles Strategic Plan 2015</i></p>

VISION: Minimise impacts of climate change through sustained action at all levels of society		
Components	Activities/Processes	Outputs
	insights to guide adaptation strategies for the fishing sector <ul style="list-style-type: none"> Fast-track the blue-economy ambition and develop innovative and additive links with the <i>Seychelles Strategic Plan 2015</i> 	
Biodiversity	<ul style="list-style-type: none"> Fast-track full implementation of <i>Seychelles Biodiversity Strategy and Action Plan</i> and the new Biodiversity law Fully developed capacity for biosecurity including emphasis on invasive alien species 	Fully implemented Action Plan Fully implemented and enforced Biodiversity and Biosecurity Laws Fully bio-secure country borders
Water Security	<ul style="list-style-type: none"> Undertake a Water Security Review Fast-track improvements to water security by increasing efficiency of the system and reducing demand from consumers Link to the Blue Economy Research Institute and the National Institute for Science Technology and Innovation to optimise knowledge-sharing and research 	Fully integrated approach to water security that addresses issues such as ecosystem health, waste management, water treatment and supply, sewage, agriculture, etc
Energy Security	<ul style="list-style-type: none"> Keep the options for diversifying electricity sources under continual review Explore more opportunities for the application of renewable energy technologies Plan to move critical infrastructure out of flooding/storm surge risk areas Replacement of fossil-fuelled vehicles where practicable and upgrading of infrastructure Collaboration with the National Institute for Science Technology and Innovation to optimise knowledge-sharing and research 	More resilient energy base Greater use of renewable energy where practicable Optimum fuel-based fleet Strengthened cooperation between Government entities
Health	<ul style="list-style-type: none"> Actively managed health burden through improved research, response and planning 	Health sector able to respond to population increase and its climate-related health burden
Waste	<ul style="list-style-type: none"> Actively managed waste hierarchy Fast-track implementation of new waste policy Decommission landfills in flood risk areas Research and commercialisation of waste-based products Urgent completion of waste-to-energy feasibility studies 	Waste is managed according to strict hierarchy and waste policy fully implemented Decision taken on waste-to-energy

Cost of priority mitigation actions

The cost of achieving the reduction objective in 2030 has been estimated to be at least USD 309 million as detailed in Table 1. Including the cost of energy efficiency measures such as building codes, standards and labels, and energy audits will increase the total cost of implementation. The cost of emission reductions does not include the implementation of a biofuel policy in the transport sector, nor does it include any actions related to the decongestion of Victoria, Mahé.

Table 1: Estimate (lower bound) of the cost of mitigation

Sector/sub-sector	Mitigation action	Cost (million USD)
Public electricity ¹	90 MW of solar PV (capital expenditure, and operation & maintenance cost over lifetime of 20 years) ²	191.7

¹ As per the *Energy Policy 2010*, the target of 15% renewable electricity in 2030 is met predominantly using solar PV

² The capital cost of 1 MW installed of solar PV has been assumed to be USD 1.75 million, while the operation & maintenance cost has been taken as 19,000 USD/MW/yr.

Waste management	Retrofitting the old landfill (Providence 1) with landfill gas capture and flaring equipment ³	20.8
Land transport	30% of private vehicles are electric by 2030 ⁴	66.7
	15.8 MW of solar PV for meeting the energy demand of electric vehicles (capital expenditure, and operation & maintenance costs)	29.8
	TOTAL	309

Cost of priority Adaptation Actions

The threats caused by climate change will have significant impacts on Seychelles in the short, medium and longer term on infrastructure, agriculture, fisheries, tourism, energy and water security, biodiversity, waste management and on human health and well-being. Although the exact impacts are not known, and more research is needed to better understand the implications of a change global climate on the islands, it is that Seychelles take measures to better understand the threats and begin longer-term planning for adaptation as depicted in the table below. Hence, the total cost of implementing the adaptation component of the INDC is estimated to exceed USD 295 million.

Table 2: Estimate (lower bound) of the cost of adaptation

Sector/sub-sector	Adaptation action	Cost (million USD)
Critical Infrastructure	<ul style="list-style-type: none"> Climate change adaptation to be mainstreamed in all sectors with critical infrastructure ; Planning process for all new developments, with associated improvements in the building codes and their rigorous enforcement ; Building the resilience of communities 	70.00
Tourism/ Coastal Management	<ul style="list-style-type: none"> Implement Coastal rehabilitation and protection measures in critical areas due to coastal erosion caused by SLR ; Build Coastal resilience Reduce vulnerability to flooding and landslide in critical areas ; Strengthen the early warning System and capacity building In coastal areas; Greater co-management of the sector by the Ministry of Tourism and Department of Risk and Disaster Management as well as with the Ministry of Environment, Energy and Climate Change 	45.00
Food	<ul style="list-style-type: none"> A sustainable modern agriculture supported by new and 	35.00

³ There is no provision for generating electricity using the landfill gas.

⁴ This target corresponds to 6,667 vehicles. The incremental cost of an electric car compared to a conventional one is taken to be USD 10,000.

Security	<p>innovative technologies across all food production supply and value chains, and by skilled and qualified human resources and integrated with the <i>Blue Economy</i> and <i>Seychelles Strategic Plan 2015</i> ;</p> <ul style="list-style-type: none"> • Integrate of early warning systems in agriculture ; • Invest in research and innovation to strengthen Seychelles' climate resilience 	
Biodiversity	<ul style="list-style-type: none"> • Fully implemented <i>Seychelles Biodiversity Strategy and Action Plan</i> ; • Fully implemented and enforced <i>Biodiversity Law</i> ; • Fully bio-secure border 	15.00
Water Security	<ul style="list-style-type: none"> • Fully integrated approach to water security that addresses issues such as ecosystem health, waste management, water treatment and supply, sewage, agriculture, etc ; • Increase storage capacity by building a dam ; • Improving water resource management: 	85.00
Health	<ul style="list-style-type: none"> • Health sector able to respond to population increase and its additional climate-related health burden e.g dengue fever, leishmaniasis etc... • Exploration of relevant potential science and technology innovation 	30.00
Blue Economy	Set up a proper marine resource management institution	15.00
Total		295.00