

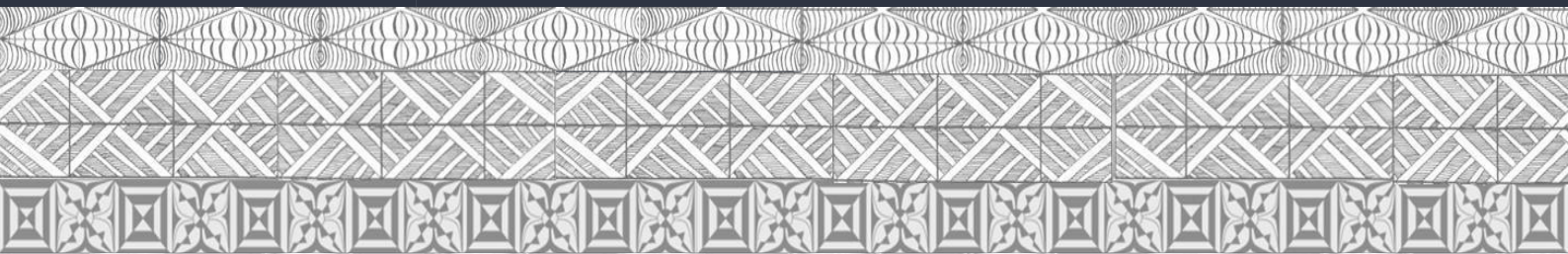


Kingdom of Tonga

Tonga Nationally Determined Contributions Review Report

**Review of the 2015
Intended Nationally
Determined Contributions
and Recommendations for
the 2020 Nationally
Determined Contributions**

**Department of Climate Change
Ministry of Meteorology, Energy,
Information, Disaster Management,
Environment, Climate Change, and
Communications (MEIDECC)**





Kingdom of Tonga

Tonga Nationally Determined Contributions Review Report

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List of Abbreviations

°C	degree Celsius
AFOLU	Agriculture, Forestry and Other Land Use
cm	centimeter
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent
COVID-19	Corona virus disease 2019
CTCN	Climate Technology Centre and Network
DPE	Department of Energy
Gg	Gigagram
GGGI	Global Green Growth Institute
GHG	Greenhouse gas
GWh	Gigawatt per hour
ha	hectare
HFO	high sulphur fuel oil
ICAO	International Civil Aviation Organization
IFAD	International Fund for Agricultural Development
INDC	Intended Nationally Determined Contribution
IOM	International Maritime Organisation
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
JNAP 2	Joint National Action Plan on Climate Change and Disaster Risk Management 2
km	kilometer
km ²	square kilometer
LED	light-emitting diode
LPG	liquefied petroleum gas
LULUCF	Land Use, Land-Use Change and Forestry
MAFF CP	Ministry of Agriculture, Food and Forests corporate plan
MPA	Marine Protected Area
MW	Megawatt
MWh	Megawatt per hour
NDCs	Nationally Determined Contributions
Ω_{ar}	aragonite saturation state
PACCSAP	Pacific Australia Climate Change Science and Adaptation Program
TNC	Third National Communication
TERM	Tonga Energy Road Map
TPL	Tonga Power Limited
UNDP	United Nations Development Programme
UNEP-WCMC	United Nations Environment Programme World Conservation Monitoring Centre
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WRI	World Resources Institute

1. Background

Paris Agreement and Nationally Determined Contributions

The Paris Agreement aims to strengthen the global response to the threat of climate change, mentioning three specific means to achieve that aim:

1. Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels,
2. Increasing the ability to adapt to the adverse impacts of climate change, and
3. Making finance flows consistent with a pathway towards low greenhouse gas (GHG) emissions and climate-resilient development.

To achieve its ambitious long-term goals, the Paris Agreement introduced the Nationally Determined Contributions (NDCs). In the lead-up to the Paris Agreement, governments initially developed Intended Nationally Determined Contributions (INDCs) and submitted these to the secretariat of United Nations Framework Convention on Climate Change (UNFCCC) in Bonn, Germany. With the ratification of the Paris Agreement, those INDCs became Nationally Determined Contributions (Fransen et al., 2017). These NDCs represent a five-year cycle of pledges and reviews of governments' actions to mitigate their countries' contribution to climate change. Each party¹ to the Paris Agreement is required to prepare and submit a successive NDC every five years to the UNFCCC secretariat (UNFCCC, 2015).

This NDC review process was designed to provide a formal framework within which governments would increase the ambition of their actions against climate change and reduce its GHG emission over time, with the intention that each successive NDC would represent a progression beyond a country's current NDC and ultimately allow to meet the aims of the Paris Agreement goal.


Following the submission of each NDC to the UNFCCC secretariat, governments are required to pursue domestic measures to achieve their mitigation objectives. While most of the submitted NDCs have contained information on adaptation, this is not required. Parties are invited to submit and periodically update communications on adaptation, which may describe adaptation priorities, implementation and support needs, as well as plans and actions, either through their NDCs or other relevant formats such as national adaptation plans or national communications (UNFCCC, 2015).

Tonga's Nationally Determined Contributions

The Government of Tonga developed its INDC and submitted it to the UNFCCC in 2015 and ratified the Paris Agreement on 21st September 2016. When the Paris Agreement came into force on 4th November 2016, Tonga's INDC submitted in 2015 automatically became Tonga's first NDC.

The Department of Climate Change is currently developing Tonga's second NDC. Specifically, the department is reviewing the progress made to date towards achieving the targets identified in the 2015 INDC and identifying means of how to enhance the 2020 NDC. As part of this process, the Department of Climate Change takes a coordinating role in gathering input from stakeholders, both for evaluating progress on the 2015 INDC and designing the 2020 NDC. Once the 2020 NDC has been drafted, its contents will be agreed across ministries and departments,

¹ A party to the Paris Agreement is a country which has ratified the agreement.



prior to seeking approval from cabinet. Finally, the document will be approved by the cabinet prior to being communicated to the UNFCCC secretariat.

This report presents the progress made towards achieving the targets set in Tonga's 2015 INDC. It also presents a set of recommendations to be considered for the development of the country's 2020 NDC. The Department of Climate Change seeks input from all relevant stakeholders on the findings of this report as guidance for drafting Tonga's 2020 NDC. The department expects to draft the 2020 NDC in the fourth quarter of this year.

This report is one of the deliverables of the project *Review and Enhancement of Tonga Nationally Determined Contribution*. The project is part of the Regional Pacific NDC Hub's support to the Government of Tonga in implementing, enhancing and financing its NDCs. The project is being led by the Department of Climate Change and implemented by the Global Green Growth Institute (GGGI), on behalf of the Regional Pacific NDC Hub.

2. Methodology

This report has two principal purposes. First, it reviews the 2015 INDC, determining the progress made to date towards achieving the identified targets. Second, it puts forward recommendations for the formulation of the 2020 NDC.

First, the review presented in this report addresses the progress made towards existing goals and targets for both the mitigation and adaptation components of Tonga's 2015 INDC. Within each component, the review considered three elements:

1. To what extent identified targets have been achieved,
2. To what extent implementation is supported by identifying specific measures — or the lack thereof — to achieve the identified targets,
3. How targets and measures are communicated, with a particular focus on the available data, including important gaps and inconsistencies.

Second, recommendations were developed to inform the scope and content of the 2020 NDC. There are a number of options for governments of how to enhance or update their NDCs. Following Fransen et al. (2017), these options include (Figure 1):


- Updating or adding relevant information,
- Revising and/or expanding the existing goals and targets,
- Providing information on specific measures to achieve those goals, and
- Improving the clarity, transparency, and understanding of their NDCs.

Figure 1. Options for enhancing Nationally Determined Contributions

	MITIGATION	ADAPTATION
Identification of Targets	Strengthen or add GHG emissions and non-emissions targets	Update or add goals
Implementation	Strengthen or add actions and measures	Update or add actions and measure
	Align actions and measures with targets	Align measures with goals
Communication	Provide relevant information to enhance clarity and transparency	Update or add monitoring and evaluation
		Update or add information on trends, impacts and vulnerabilities
		Update or add information on gaps and barriers

Source: Adapted from Fransen et al. (2017)

The analysis presented in this report was informed by publicly available data sets and reports, in-country interviews with stakeholders in Tonga facilitated by the Department of Climate Change, and data gathered as a result of these interviews.



Interviews were held during the period of 9th March to 30th April 2020. Travel restrictions imposed as a result of the COVID-19 pandemic prevented the GGGI team from travelling to Tonga for face-to-face interviews. Therefore, all interviews were conducted remotely via video calls. A summary of these interviews is available in Annex 1 of this report. The list of the individuals interviewed from both public and private entities is available in Annex 2.

The contents of this report were discussed and its findings were validated by the JNAP technical team on 24th July and during a 2-day validation workshop with relevant stakeholders on 30th and 31st July 2020. At the validation workshops, the following 3 questions were asked:

- Question 1. Do you agree with the results of the review of the 2015 INDC? Would you like to add any comments regarding the achievement of targets in the 2015 INDC?
- Question 2. Do you agree with the recommendations made for your sector for the 2020 NDC? Other than the recommendations presented, do you have any other recommendations for the 2020 NDC?
- Question 3. How can the suggested 2020 NDC targets be achieved in Tonga? What are the barriers and opportunities? What enabling actions need to be taken?

The feedback in response to questions 1 and 2 was integrated into the review and recommendations of this report. Responses to question 3 on barriers, opportunities and enabling actions will be considered for drafting the 2020 NDC. Feedback collected addressing question 3 is presented in this report in Annex 3.

3. Mitigation

This is also in the NDC!

Mitigation refers to human interventions to reduce the emission of greenhouse gases from anthropogenic sources or enhance their removal from the atmosphere (UNFCCC, 2009). In other words, mitigation can be broken down into two components. First, it includes any activities that decrease the emission of greenhouse gases, such as switching from fossil fuels to renewable sources for electricity generation. Second, mitigation refers to removing GHG emissions from the atmosphere via carbon sinks, such as vegetations and soils absorbing carbon dioxide (CO₂). The 2019 refinement to the 2006 IPCC guidelines for national greenhouse gas inventories identifies the following sectors as relevant sources for GHG emissions (IPCC, 2019):

- Energy, including electricity generation, transport, and commercial, institutional and residential end-use,
- Industrial processes and product use (IPPU),
- Agriculture, forestry and other land use (AFOLU), and
- Waste.

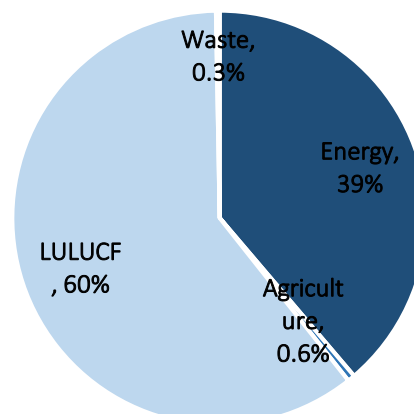
Available information suggests that Tonga's GHG emissions originate from two main sources:

1. Burning of fossil fuels, and
2. Conversion of forest and grassland (Government of Tonga, 2019; Figure 2).

Figure 2. Estimated greenhouse gas emissions by sector in gigagrams (2006)²

	GHG emissions (in Gg)	Share in total GHG emissions
Energy	120.4	39%
Agriculture	1.8	0.6%
LULUCF	187.4	60%
Waste	0.9	0.3%
Total	310.2	100%

Source: Government of Tonga (2019)



Tonga's 2015 INDC includes the following mitigation targets (Government of Tonga, 2015):

- 50% of electricity generated from renewable sources by 2020,
- 70% of electricity generated from renewable sources by 2030,
- Reduction of line losses of electricity to 9% by 2020,

² The Government of Tonga's Third National Communication to the UNFCCC distinguishes between (1) agriculture and (2) land use, land-use change and forestry (LULUCF) as separate sectors for GHG emissions (Government of Tonga, 2019). While this report generally follows the guidance provided by the 2019 refinement to the 2006 IPCC guidelines for national GHG inventories (IPCC, 2019), figure Figure 2 presents data as reported by the Government of Tonga in order to be consistent with the source of the data.

- Double the number of Marine Protected Areas by 2030, compared to 2015,³
- Development of GHG emission reduction targets for the following sectors: transport, agriculture, waste, and forestry.⁴

None of these targets was formulated in the form of quantifying reductions in GHG emissions. For the 2020 NDC, it is recommended that targets are formulated in terms of GHG emissions reductions, to the extent possible.

This chapter summarizes the 2015 INDC distinguishing between the four sectors put forward as part of the 2006 IPCC guidelines and assesses the progress made towards achieving the identified targets. It also highlights important gaps within the 2015 INDC, such as missing sector targets, gaps in identifying measures to achieve the existing targets, and lack of and inconsistencies in the available data and calculations. Finally, under each section, the report suggests a set of recommendations for the 2020 NDC.

3.1 Energy

3.1.1 Targets

Targets for the energy sector only refer to electricity generation, with the aim to generate 50% of electricity from renewable sources by 2020 and 70% by 2030, as well as to reduce line losses to 9% by 2020 (Government of Tonga, 2015). These targets are largely consistent with other policy documents, such as the second Joint National Action Plan on Climate Change and Disaster Risk Management 2 (JNAP 2) and the Tonga Energy Road Map (TERM) (Table 1).

³ The 2015 INDC lists the target of doubling the number of Marine Protected Areas (MPAs) as part of mitigation. However, in-country interviews suggested that this target should be considered under adaptation. This review discusses MPAs under adaptation (see Box 1. Marine Protected Areas).

⁴ The 2015 INDC refers to “Sector Emission Reduction Targets: Transport, Agriculture, Environment Friendly Waste Management and Reforestation”. It is not clear whether this refers to the objective of (1) setting GHG emission targets for these sectors or (2) reducing GHG emissions from these sectors. In the context of this review, the statement is interpreted as referring to setting GHG emission targets for the mentioned sectors.

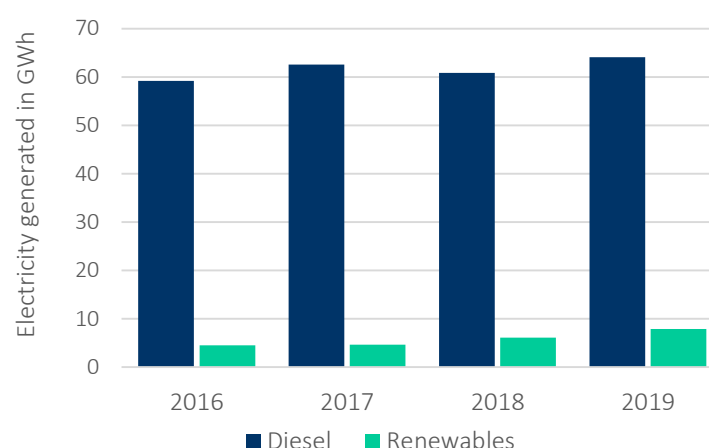
Table 1. Targets for the electricity sector

Target	Source
50% of electricity generated from renewable sources by 2020	2018 Joint National Action Plan 2, 2015 Intended Nationally Determined Contributions, 2010 Tonga Energy Road Map
50% of electricity generated from renewable sources by 2025	2015 Tonga Strategic Development Framework 2
70% of electricity generated from renewable sources by 2030	2018 Joint National Action Plan 2, 2015 Intended Nationally Determined Contributions
100% of electricity generated from renewable sources by 2035	2018 Joint National Action Plan 2
Reduction of line losses to 9% of total generation in 2020	2015 Intended Nationally Determined Contributions, 2010 Tonga Energy Road Map

Source: Compiled by GGGI

In Tonga, electricity is generated from diesel, solar and wind. According to in-country interviews, Tonga is on track to achieve the target of 50% electricity generation from renewable sources by 2020. The target refers to the fiscal year 2020, which ends in June 2021. Data made available by the utility — Tonga Power Limited (TPL) — shows that the share of electricity generated from renewables increased from 7% in 2016 to 11% in 2019 (TPL, 2020a; Figure 3).

Figure 3. Electricity generation by fuel in Tonga



Shares of electricity generated from renewable sources diverge considerably across the four main

networks, with the highest share reported for Ha'apai at nearly 29% in 2019 (figure 5) and the lowest share in Vava'u at less than 3% in 2019 (figure 6). Tongatapu, as the largest network by far, saw a share of slightly more than 11% of electricity generation from renewables in 2019 (figure 4). Data for the 'Eua network shows a share of approximately 5% of electricity generation from renewables in 2019 (TPL, 2020a; figure 7).

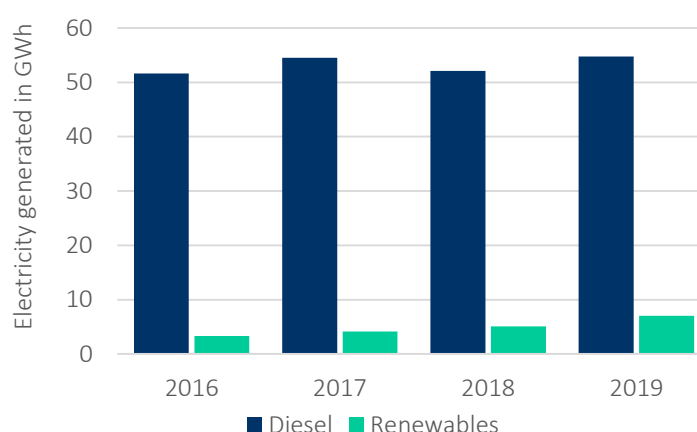
Currently, solar and wind farms represent approximately 30% of total installed electricity generation capacity. Planned additions of generation capacity will increase the share of renewables in total capacity to more than 60% over the next two years (TPL, 2020c; in-country interviews).⁵ Given these capacity additions, it is expected that the share of electricity generated from renewable sources will increase further. However, achieving the target of 50% electricity generation from renewables in 2020 is extremely ambitious.

In addition to the four networks, solar off-grid systems represent a total of approximately 0.8 MW, equivalent to 4% of total installed capacity (Department of Energy, 2020). Information on electricity generation from these systems is not available. Therefore, this review does not consider them when assessing electricity generation by fuel. However, it is estimated that they would only marginally increase the overall share of electricity from renewables.

According to in-country interviews, TPL and the Department of Energy are committed to achieve the target of 70% electricity generation from renewable sources by 2030. The existing project pipeline is aimed at meeting the 50% target and it is assumed that further generation capacity will be needed to meet the 70% target by 2030. It is also assumed that considerable battery storage would be required in order to meet the 2030 target.

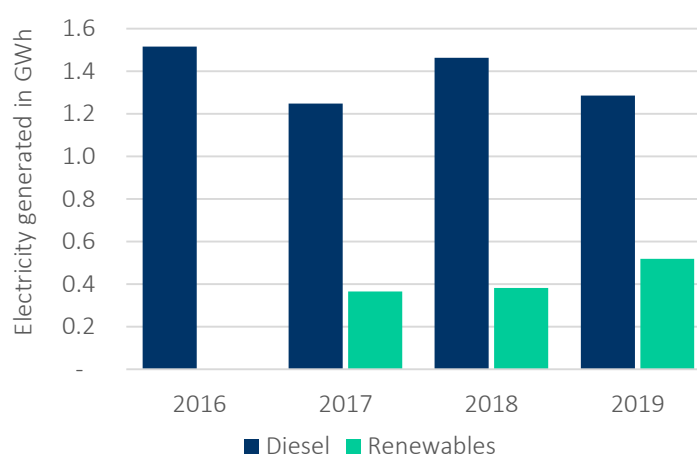
According to data shared by TPL, line losses have been successfully reduced to below 9% of electricity generated for all four networks since 2018 (TPL, 2020b). In the period from 2015 to 2019, line losses were reported below 9% across all four networks for four out of five years (Table 2). In-country interviews confirmed the achievement of this target as a result of significant improvements in the network infrastructure reducing technical losses and the introduction of meters curbing non-technical losses.

Figure 4. Electricity generation by fuel in Tongatapu



Source: TPL (2020a)

Figure 5. Electricity generation by fuel in Ha'apai

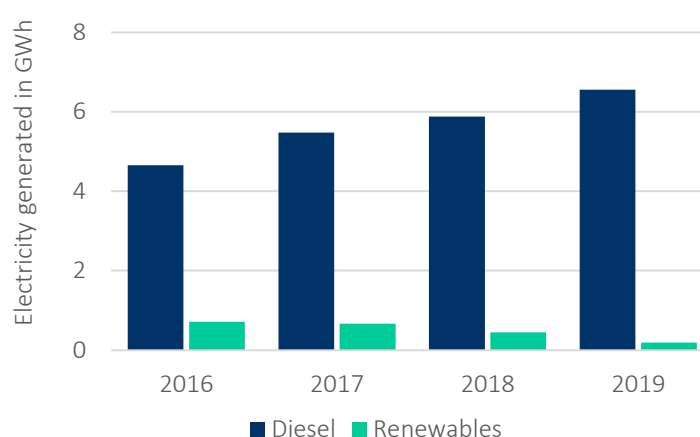


Source: TPL (2020a)

⁵ Planned additions will nearly quadruple total installed capacity of electricity generation from renewables, from 6,642 kW in 2Q2020 to approximately 25,292 kW (TPL, 2020c).

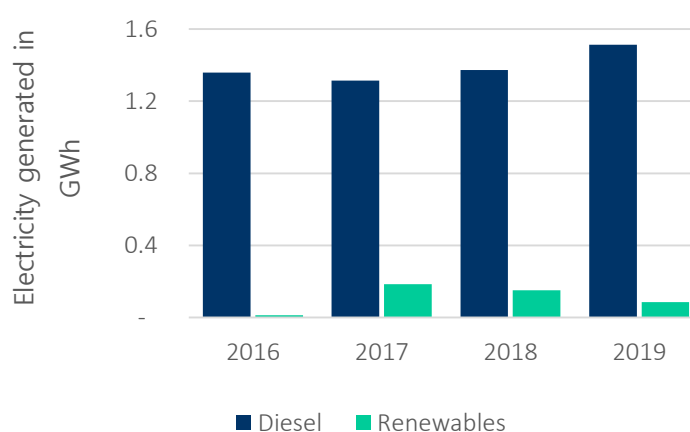
The 2015 INDC neither includes any targets for transportation nor for commercial, institutional and residential end-use of energy. The document states that no targets for reducing GHG emissions from the transport sector have been identified, due to the lack of viable alternatives for fossil fuel in transportation (Government of Tonga, 2015). In-country interviews confirmed that no targets for reducing GHG emissions have been developed for these sectors since 2015. The Joint National Action Plan on Climate Change and Disaster Risk Management 2 (JNAP 2) highlights energy efficiency measures as an important means to reduce GHG emissions. However, the document does not set any specific targets (Government of Tonga, 2018). Therefore, it is recommended to derive relevant targets for reducing GHG emissions from the transport sector as well as from commercial, institutional and residential end-use of energy from the upcoming Energy Efficiency Master Plan (Government of Tonga and CTCN, 2020).

Figure 6. Electricity generation by fuel in Vava'u



Source: TPL (2020a)

Figure 7. Electricity generation by fuel in 'Eua



Source: TPL (2020a)

Table 2. Transmission and distribution losses across Tonga's four main networks

Year	Generated electricity (MWh)	Billed electricity (MWh)	Parasitic losses (MWh)	Line losses (MWh)	Share of line losses (%)
2015	56,844	50,730	1,572	4,542	8.0%
2016	63,248	56,236	2,308	4,704	7.4%
2017	68,040	59,413	2,101	6,526	9.6%
2018	66,430	59,231	1,809	5,390	8.1%
2019	77,979	69,815	2,265	5,900	7.6%

Source: TPL (2020c)

The 2020 Energy Efficiency Master Plan — in its current draft versions — does not propose a target that quantifies the reduction of GHG emissions from transport. However, the plan suggests that a combination of targets would lead to an estimated reduction of 28% compared to GHG emission levels in 2030 under a business as usual scenario.⁶ Among the targets included in the plan, the following selection is regarded as the most relevant to be considered for formulating the 2020 NDC:⁷

- 30% improvement in fuel efficiency for newly registered light-duty vehicles, reducing consumption from 10.1 litres per 100 km in 2016 to 7 litres per 100 km in 2030, through registration fees, import tariffs, or fuel economy standards,
- 10% of all newly registered light-duty vehicles to be electric or hybrid vehicles by 2030.⁸

Similarly, the Energy Efficiency Master Plan does not propose a target that quantifies the reduction of GHG emissions from commercial, institutional and residential end-use of energy. Instead, the plan proposes several targets. Together, these targets would accumulate to a 35% reduction of GHG emissions from electricity generation, compared to a business as usual scenario.⁹ Among the targets included in the plan, the following selection is regarded as the most relevant to be considered for formulating the 2020 NDC:¹⁰

- Adoption of minimum energy performance standards by 2022, following Australian and New Zealand standards for all fridges, freezers, air conditioners, water heaters, televisions, computers, clothes washing machines, dryers, cooking appliances,
- Curtailment of import of non-LED bulbs,
- Implementation of energy efficiency standards for buildings and performance of energy audits,¹¹
- 100% of streetlights retrofitted with LED bulbs.

3.1.2 Implementation

The 2015 INDC does not identify specific measures or technologies of how to achieve the proposed targets for the energy sector, nor does it identify technical and financial requirements. While Annex 2 of the document provides a summary of initiatives that are related to mitigation, there is no indication to what extent these initiatives will contribute to reducing GHG emissions (Government of Tonga, 2015). According to in-country interviews, several of the listed initiatives have proven to be technically and/or financially unfeasible. This includes, among others, the development of coconut oil and tidal power as sources for renewable energy. As noted above,

⁶ The Energy Efficiency Master Plan states that this would be equivalent to an increase of GHG emissions of 1% compared to 2018 (Government of Tonga and CTCN, 2020).

⁷ The Energy Efficiency Master Plan is also introducing the target of reducing vehicle kilometers traveled by light-duty vehicles by 20%, compared to 2030 business as usual scenario. However, this target is considered as challenging to verify, given current limitations on traffic data. Therefore, it is not recommended to adopt this target as part of the 2020 NDC.

⁸ This target is identified in the Energy Efficiency Master Plan. However, during consultations, stakeholders only regarded hybrid vehicles as a viable option. Therefore, the specific content of the target will need to be elaborated further.

⁹ The estimate of a 35% reduction of GHG emissions from electricity generation, compared to a business as usual scenario, is based on data provided as part of the Energy Efficiency Master Plan. The plan itself does not refer to this estimate.

¹⁰ The form in which these targets are currently formulated, they rather take the form of measures. However, relevant targets for reductions in GHG emissions can be formulated when assessing the potential impact of these measures.

¹¹ The Energy Efficiency Master Plan does neither specify the energy savings to be achieved by new building standards nor what these standards would entail.

the technologies that have played the largest role towards achieving the renewable energy targets in the energy sector are solar and wind, combined with battery storage. Planned capacity additions suggest that the role of solar and wind will increase further during the next decade.

While the 2015 INDC does not include any target for the transport sector, the document mentions public awareness programs for vehicle maintenance, public transport, as well as use of biofuels, electric vehicles and bicycles as means to reduce emissions from the sector — without quantifying their mitigation potentials (Government of Tonga, 2015). It is recommended for the 2020 NDC to identify relevant measures, if any targets for the transport sector are to be included. In many cases, relevant measures can be drawn from existing policies and plans. For example, relevant measures can be derived from the upcoming Energy Efficiency Master Plan. To reduce GHG emissions from land transport, the plan proposes improving user-friendliness of public transportation, increasing vehicle efficiency through adjusting vehicle registration tax and import fees, and introducing a mandatory minimum standard for blending of biofuels (Government of Tonga and CTCN, 2020).¹²

Similarly, the 2015 INDC does not include any target for commercial, institutional and residential end-use of energy. It is recommended for the 2020 NDC to identify relevant measures, if any targets for commercial, institutional and residential end-use are to be included. The upcoming Energy Efficiency Master Plan proposes a number of measures that could be reflected in the 2020 NDC. For example, the plan suggests introducing building standards and energy audits to reduce electricity consumption in buildings. Furthermore, it proposes establishing minimum energy performance standards for electrical appliances and creating a revolving fund to finance the adoption of more energy-efficient equipment (Government of Tonga and CTCN, 2020).

3.1.3 Communication

There are considerable gaps in the 2015 INDC regarding transparency and clarity for the energy sector. There is no information on which data and which conversion factors were used to estimate GHG emissions from the combustion of fossil fuels. Both the 2015 INDC and the 2019 Third National Communication (TNC) refer to 2006 data in order to estimate GHG emissions. However, for these two data sets are not consistent (Government of Tonga, 2015; Government of Tonga, 2019; Table 3). This is the result of data for GHG emissions having been revised and updated prior to the Third National Communication (in-country interviews). While the amount of total GHG emissions remained largely unchanged, the sectoral breakdown shows considerable revisions. Therefore, data published as part of the TNC is considered to be more accurate and is generally used for reference in this report, unless stated otherwise.

Attempts to recalculate the 2006 data are prevented by the paucity of raw data and uncertainty about the methodology and conversion factors used. However, calculations based on the Department of Energy's 2018 energy balance are consistent with GHG emissions reported in the Third National Communication. The numbers suggest that little change has occurred in the overall amounts of fossil fuels consumption. Therefore, GHG emissions from the combustion of fossil fuels should also remain largely unchanged.

¹² However, the Energy Efficiency Master Plan does not quantify the contribution of individual measures to achieve the suggested targets. Furthermore, during the validation workshops, stakeholders regarded the blending of biofuel as not feasible, noting that coconut oil is too expensive to be used for biofuel blending and other feedstocks are not available in Tonga.

Table 3. GHG emissions reported in the 2015 INDC and Third National Communication (in gigagrams)

	Total	Electricity	Transport	Other energy	Agriculture	Land conversion ¹	Waste
2015 INDC	300.5	69.1	120.2	15.0	63.1		33.1
Third National Communication	310.4	40.2	72.3	7.8	1.8	187.4	0.9

Source: Government of Tonga (2019), Government of Tonga (2012)

¹ According to Tonga's Second National Communication, conversion of forests and grasslands represents a source of emissions that is comparable to the amount emitted by the combustion of fossil fuels (Government of Tonga, 2012). However, no information is provided on the calculated amount. The 2015 INDC and the Third National Communication both report Tonga to be a net carbon sink, with the INDC reporting carbon removals by forests of approximately 1,691.97 gigagrams for 2006 and the Third National Communication reporting removals of 1,879.37 gigagrams for the same year.

It is recommended to ensure the publication of relevant data and calculations in order to permit verification by third parties. This can be done either as part of the 2020 NDC or as part of the national communications to the UNFCCC. If relevant data and calculations are published separately from the NDC document, it should be ensured that the information published is consistent across documents. Furthermore, it is recommended to use the most recent data available for calculating and reporting GHG emissions. Data that is more than 10 years old should be considered outdated.

3.2 Industrial Processes and Product Use (IPPU)

The 2015 INDC does not include any targets, measures, or data related to industrial processes and product use (IPPU). However, the sector's omission does not necessarily reflect a gap in the document. Given the absence of mineral, chemical, metal, electronics and other manufacturing industries as well as the limited use of lubricants, paraffin waxes and solvents, the IPPU sector might have been considered as not sufficiently relevant to be considered as part of the 2015 INDC.

For the 2020 NDC, it is recommended to not include a GHG emissions target for the IPPU sector. However, in the light of clarity and transparency, it is suggested to explain that there is no target for two reasons: First, GHG emissions from the sector represent only a fraction of Tonga's total greenhouse gas emissions. Second, the paucity of data on GHG emissions from the IPPU sector prevents the establishment of a variable target.

3.2 Agriculture, Forestry and Other Land Use (AFOLU)

3.3.1 Targets

The 2015 INDC recognizes agriculture, forestry and other land use (AFOLU) is crucial for both mitigation and adaptation. However, the document does not set any targets to reduce emissions from the sector.

Given the uncertainty of the extent of carbon sequestration, it is recommended for the 2020 NDC to identify a non-emission target for the AFOLU sector. For that purpose, it is suggested to include the establishment of forest inventory to improve clarity and transparency for the sector.

In addition, in-country consultations asked for including a second non-emission target envisioning the planting of one million trees by 2023. While such a target can be considered for the 2020 NDC, it is recommended to ascertain the feasibility of this target prior to its inclusion.

Finally, it is recommended to include a GHG emissions target for the AFOLU sector in the 2025 NDC, after the successful establishment of a forest inventory. Any such target could be derived from existing targets identified in the 2009 National Forest Policy, including halting deforestation and further degradation of indigenous forests, establishing and managing forest reserves, promoting reforestation and rehabilitation of cleared and degraded forests, and promoting agroforestry (Government of Tonga et al., 2009). However, establishing a forest inventory is required in order to be able to quantify any of these targets in terms of emission reduction or emissions removal.

3.3.2 Implementation

The 2015 INDC does not identify any specific measures to reduce GHG emissions from the AFOLU sector. However, existing policies and plans identify relevant means, which could be drawn upon for the formulation of the 2020 NDC. Among others, the National Forest Policy identified intercropping and agroforestry as an option to mitigate GHG emissions. In-country interviews also specifically highlighted these two measures. Complementarily, the Forest Management Plan identified a range of measures to reduce deforestation, such as improving the enforcement of illegal tree clearing, capacity building to promote agroforestry, and applying certification in order to adhere to international standards for sustainable timber production (Ministry of Agriculture Food Forestry and Fisheries, 2017).

However, a prerequisite for setting specific targets and identifying measures to reduce GHG emissions is to improve data collection and establish a forest inventory. This is reflected in the National Forest Policy stating that “Tonga needs a comprehensive inventory of its forest resources” (Government of Tonga et al., 2009). Such an inventory will serve as the foundation for analysis, identifying trends and appropriate actions, and evaluating the impact of specific policies and interventions. Currently, the paucity of reliable data leads to significant uncertainty in any larger-scale assessment undertaken in the agriculture and forestry sectors. With basic information regarding forest cover and forest cover change lacking, assessing more complex issues — such as forest regeneration following clearing for agriculture — becomes largely impossible. In return, the paucity of reliable analysis impedes the development of relevant policies to address the issues faced within the sector. Finally, the absence of reliable data also prevents monitoring the impact and evaluating the effectiveness of policies and other interventions.

3.3.3 Communication

Tonga's 2015 INDC states that, when land use and forestry are considered, Tonga is a net carbon sink of approximately 1,691.97 gigagrams of CO₂e per year, with its forests absorbing substantially more GHG emissions than the amount emitted by all other sectors combined (Government of Tonga, 2015).

According to the Third National Communication to the UNFCCC, within the land use and forestry sector, the conversion of forests and grasslands represents the single largest source of GHG emissions in Tonga, accounting for 187.4 gigagrams of CO₂e (Government of Tonga, 2019). The Third National Communication also states that GHG emissions from land-use are entirely offset by carbon sequestration from the country's forests, with changes in forest and other woody biomass capturing an estimated 1,437.54 gigagrams of CO₂e and abandonment of managed lands sequestering a further 441.8 gigagrams of CO₂e (Government of Tonga, 2019). However, this could not be confirmed by the available land use data. Rather, estimates based on available data shed considerable doubt on whether Tonga constitutes a net carbon sink.

Table 4. Estimated carbon sequestration

Land category	Area (ha)	Factor for annual above-ground net-biomass growth (tonnes/ha/year)	Ratio of below- to above-ground biomass	Estimated carbon sequestration (gigagrams/year)
Woodland	6,458.7	3-11	0.37	27-97
Coniferous plantation	371.7	10-50	0.37	5-25
Non-coniferous plantation	129.8	10-50	0.37	2-9
Coconut (grassland, shrubland and cropland)	51,093.4	2-6	0.4	143-429
Mangroves and wetland (saline and estuarine)	1,767.1	3-11	0.37	7-27
Other¹	8,866.5	0		0
Total²	68,687.2			184-588

Source: GGGI calculated based on Government of Tonga et al. (2009), IPCC (2006)

¹ The category 'other' is assumed to represent land covered by settlements. This assumption is based on the following premises: First, according to the National Forest Policy, Tonga's total land area amounts to 75,210 hectares. Second, the National Forest Policy reports the area covered by lakes and freshwater bodies at 6,523 hectares. Third, the remaining 68,687 hectares fall within the land categories shown in table 3. Within these categories, 'other' is the only category eligible to represent land area covered by settlements.

² Total land area of Tonga does not include lakes and freshwater bodies. Estimates for total land area differ between sources. Table 4 is consistent with the figures published as part of the 2009 National Forest Policy.

First, based on the size of different land categories published in Tonga's National Forest Policy (Government of Tonga, 2009) and applying default factors for average annual above-ground biomass net growth as well as default ratios of below-ground biomass to above-ground biomass for specific vegetation types

(IPCC, 2006a), it is estimated that changes in vegetation capture between 183 to 588 gigagrams of CO₂e per year (Table 4).¹³ Even under the most optimistic assumptions, this estimate falls short considerably of the 1,437.54 gigagrams of CO₂e reported in the Third National Communication and accordingly of the figures referred to in the 2015 INDC. In addition, the estimated range is considered to rather overestimate actual carbon sequestration, since annual carbon losses due to wood removals, fuelwood removal, and disturbance are not captured (IPCC, 2006a). The large variation in the estimate is a result of uncertainty regarding which default factors for above-ground net-biomass growth to apply. In particular, the category covering the largest share of land area — coconut (grassland, shrubland and cropland) — does not distinguish between natural and plantation areas, resulting in a large variance in the estimated amounts.

Second, no separate estimate could be made to verify the numbers reported for carbon sequestration as a result of the abandonment of managed lands, as the necessary data was not available. However, if any estimates for abandonment of managed lands were included, the numbers for carbon sequestration from changes in forest and other woody biomass would diminish accordingly.

Third, the Third National Communication states that forest area covers 12.5% of Tonga's landmass, while 43.1% consists of agricultural land, and 44.4% of the land is covered by settlement areas (Government of Tonga, 2019). Given the large share of settlement areas compared to the data published in Tonga's National Forest Policy, the high amount of reported carbon sequestration becomes even more questionable.

In-country interviews confirmed the paucity of reliable data for forestry in Tonga. While a forest inventory is scheduled to be established in 2020-2021, interviewees highlighted the need for capacity building and funding within the Ministry of Agriculture, Food and Forestry to collect and analyse forestry data.

3.4 Waste

3.4.1 Targets and implementation

Similar to the AFOLU and transport sectors, while the 2015 INDC calls for reducing GHG emissions from waste management, no specific targets are set, and no relevant measures are identified for this sector (Government of Tonga, 2015). In-country interviews confirmed that no targets for reducing GHG emissions from waste have been developed since 2015.

Given that the waste sector represents only a fraction of Tonga's GHG emissions — approximately 0.3% according to the Third National Communication, compared to 11% reported in the 2015 INDC (Government of Tonga, 2019; Government of Tonga, 2015) — and the uncertainty in the available data, it is recommended for the 2020 NDC to not include a target for reducing GHG from the waste sector.

Instead, it is suggested to include a non-emissions target, establishing the necessary preconditions to be able to identify a GHG emissions target for the sector in the 2025 NDC. For that purpose, it is recommended for the 2020 NDC to include the target of expanding the formal waste collection system in Tonga beyond Tongatapu. In that context, relevant data should be collected in order to be able to set a quantifiable GHG emissions target for the next NDC cycle.

¹³ The Forest Management Plan refers to nearly identical figures for the estimated area under the same set of land categories (Ministry of Agriculture Food Forestry and Fisheries, 2017).

3.4.2 Communication

There are considerable gaps in the 2015 INDC regarding transparency and clarity for the waste sector. There is no information on the amounts of waste, based on which GHG emissions were calculated. In addition, there is no information on the calculation for converting available waste data into estimates for GHG emissions.

Both the 2015 INDC and the 2019 Third National Communication refer to 2006 data in order to estimate GHG emissions. However, for these two data sets are not consistent (Government of Tonga, 2015; Government of Tonga, 2019; Table 3). Instead, data for GHG emissions was revised prior to the Third National Communication and is considered to be more accurate (in-country interviews).

According to the 2006 IPCC guidelines, GHG emissions from the waste sector include emissions from (1) solid waste disposal, (2) biological treatment of solid waste, (3) incineration and open burning of waste, and (4) wastewater treatment and discharge (IPCC, 2006a). First, in-country interviews confirmed that only data capturing total amounts for solid waste is available, with no information on composition. Second, according to available data and in-country interviews, there is no biological treatment of solid waste in Tonga. Third, according to the 2016 census and in-country interviews, open burning of waste remains a common practice in Tonga, particularly outside Tongatapu (Tonga Statistics Department, 2017). However, information on the amounts of waste disposed of through the practice of open burning are not available. Finally, there is insufficient information on wastewater treatment and discharge in Tonga.

Using the IPCC waste model (IPCC, 2006b), extrapolating the amounts for municipal solid waste reported for Tongatapu (Waste Authority Ltd., 2017), applying default factors for *Other Oceania*, assuming methane generation rate under moist and wet climatic conditions and no methane recovery at the landfill site, results in minimal GHG emissions from municipal solid waste of less than 1 gigagram.

4. Adaptation

4.1 Targets

The 2015 INDC refers to strengthening resilience against the adverse impacts of climate change, mentioning specifically the following sectors and areas (Government of Tonga, 2015):

- Public infrastructure,
- Buildings,
- Coastal protection, and
- Agriculture sector, mentioning measures such as improved soil management and agroforestry.

In alignment with the National Forest Policy, the 2015 INDC also identifies goals to increase resilience in the forestry sector, including (Government of Tonga, 2015; Government of Tonga et al., 2009):¹⁴

- Halting deforestation and degradation of indigenous forests,
- Maintaining national parks, reserves and protected areas,
- Establishing and managing forest reserves,
- Promoting reforestation and rehabilitation of cleared and degraded forests with climate change resilient, and ecologically and socially appropriate tree species,
- Promoting integrated agroforestry in areas earmarked for agriculture,
- Discouraging tree removal on tax allotments,
- Encouraging tax allotment holders to plant and manage trees on their properties.

In addition to the goals mentioned above, the 2015 INDC also refers to the importance of trees for the protection of coastal areas.

While references to strengthening resilience against and adapting to the adverse impacts of climate change are made throughout the document, the 2015 INDC lacks a systematic assessment of adaptation options. This is reflected in the document's neglect to distinguish between goals and measures to achieve these goals.

It is recommended for the Government of Tonga to focus on targets related to coping with the impact of an increase in temperature and a rise in sea level, as there is a high confidence in the available scientific evidence that these two phenomena are a direct manifestation of climate change in Tonga. Other phenomena either entail considerable uncertainty (change in rainfall patterns, occurrence of droughts, occurrence of cyclones) or there are no feasible measures available to respond on a national scale (ocean acidification).

In this context, several targets identified by the Joint National Action Plan 2 on Climate Change and Disaster Risk Management (JNAP 2) can be regarded as relevant. JNAP 2 identifies electricity, transport, agriculture, fisheries, coastal protection and flood management as important areas for adaptation (Government of Tonga, 2018). More importantly, JNAP 2 introduces 20 targets to strengthen resilience against climate change. Several of these targets could be included in the 2020 NDC (table 5).

¹⁴ While the 2015 INDC lists these goals in the context of strengthening resilience towards the adverse impacts of climate change, the National Forest Policy lists them as measures in the context of mitigation.

Table 5. JNAP 2 targets by category

Increase in temperature	Rise in sea level	Other
30% of land in Tonga utilized for agro-forestry or forestry	Resilient coastal development, infrastructures, and integrated coastal ecosystems management	Resilient tourism and tourism infrastructures
	Resilient land, air, and marine infrastructures	Strengthened capacity and awareness of climate change and disaster risk management among population
	Resilient public and community infrastructures,	Strengthened climate services and early warning systems
	Water security through integrated water management and conservation	
Resilient fisheries and marine and coastal ecosystems	Resilient fisheries and marine and coastal ecosystems	

Source: GGGI

If any of these targets were to be included in the 2020 NDC, it is recommended to define them more closely and/or make them quantifiable in order to be able to evaluate progress.

In addition, JNAP 2 identifies a number of objectives, including:

- Mainstreaming climate resilience by strengthening existing decision-making structures, reflecting considerations related climate resilience in government planning and implementation, and developing guidelines,
- Strengthening data collection and dissemination by building capacity and systematically sharing data across entities,
- Developing a monitoring system to strengthen meteorological services, to assess water and soil conditions,
- Raising awareness and increasing access to information within government, private sector, communities, and private households through trainings and web portals,
- Increasing access to finance by establishing a coordination mechanism for funding from development partners, simplifying and harmonizing procedures for disbursement.

However, it is unclear how these objectives relate to the targets identified earlier. Nevertheless, objectives from the JNAP 2 related to data gathering and monitoring are regarded as the most relevant to be reflected in the 2020 NDC. Both would allow to develop specific targets, increase transparency, and improve communication in later iterations of the Nationally Determined Contributions(post-2020).

Box 1. Marine Protected Areas

The 2015 INDC included a provision calling for the doubling the number of Marine Protected Areas (MPA) by 2030, compared to 2015. However, the document does not elaborate on how an increase in Marine Protected Areas would reduce GHG emissions or strengthen Tonga's adaptive capacity towards the adverse impact of climate change (Government of Tonga, 2015).¹⁵

In-country interviews provided conflicting information on whether increasing the number of Marine Protected Areas is considered a mitigation or an adaptation target. On the one hand, it was mentioned that Marine Protected Areas were included in the 2015 INDC, because they were regarded as a means to maintain or increase the absorption of carbon from the atmosphere by sea organisms. However, the document does not provide any evidence that establishing Marine Protected Areas has a positive effect on carbon sequestration. On the other hand, in-country interviews suggested that the expansion of Marine Protected Areas should be considered as an adaptation target as the aim of MPAs is to preserve marine biodiversity and fish populations. However, the 2015 INDC does also not elaborate on how an increase in the number of MPAs would strengthen adaptive capacity (Government of Tonga, 2015).

Independent of the questions whether or not MPAs are a suitable means to support mitigation or strengthen adaptive capacity, in-country consultation suggested that the number of Marine Protected Areas has increased from six in 2015 to ten in 2020. However, this change could not be confirmed by other sources with available data for the period from 2016 to 2018 showing no change in the size of Marine Protected Areas. World Bank (2019) reported a constant 1.5% of Tonga territorial waters — equivalent to approximately 10,050 km² — to be covered by Marine Protected Areas.¹⁶ This figure coincides with data published as part of the Tonga Fisheries Sector Plan 2016-2024, reporting 10,100 km² of marine conservation area (Government of Tonga, World Bank, and International Fund for Agricultural Development, 2016).

For the 2020 NDC, in-country consultations recommended to consider Marine Protected Areas as a means for mitigation as well as a means for adaptation. Therefore, it is suggested to include a non-emission target for preserving Tonga's marine biodiversity to function as a carbon sink, considering MPAs as a measure to achieve this target. In addition, Marine Protected Areas could be mentioned under adaptation as a means for coastal protection and food security. However, it should be noted that connecting MPAs to a measurable target is unlikely. While the area covered by MPAs can be measured, it will not be possible to express their impact to function as a carbon sink as well as their effect on resilience as a quantifiable target.

¹⁵ This report discusses MPAs as part of adaptation. Independent of whether MPAs are considered under mitigation or adaptation, the principal findings remain unchanged.

¹⁶ The total area of territorial waters for Tonga is reported at 668.055 km² (UNEP-WCMC, 2020).

4.2 Implementation

The 2015 INDC does not identify measures to strengthen adaptation. In that context, it is very important to distinguish between goals and the means to achieve these goals. This is not the case in the 2015 INDC. While the 2015 INDC refers to a list of goals related to resilience, the National Forest Policy enumerates the same statements as measures (Government of Tonga, 2015; Government of Tonga et al., 2009). Therefore, in the 2020 NDC, it is recommended to systematically identify relevant goals and the related measures to achieve them. Examples are provided in Table 6 below.

Table 6. Example of matching goals with measures

Goal	Example of related measure
Halting deforestation and degradation of indigenous forests	Conduct a forest inventory identifying drivers of deforestation Enhance forest monitoring and enforcement of policies by increasing the number of staff.
Maintaining national parks, reserves and protected areas	Provide necessary funding to enforce logging ban
Promoting integrated agroforestry in areas earmarked for agriculture	Develop detailed guidelines for integrated agroforestry practices Establish agroforestry pilot projects in selected villages involving extension service workers

Source: GGGI

Several existing policies and plans identify relevant measures, which could be drawn upon for the formulation of the 2020 NDC. Among others, the 2016 Tonga Agriculture Sector Plan includes measures to support climate-resilient agriculture. In that context, the plan refers to the maintenance of soil conditions, rotational and mixed cropping, diversity in life stock, and water management, among others. For example, in order to maintain soil conditions, the plan proposes to conduct soil surveys and trials with fertilizers and vermiculture. To improve water management, the plan suggests estimating groundwater resource and their current exploitation as well as identifying potential use and/or need for protection (Government of Tonga, World Bank, and IFAD, 2016b).¹⁷ Similarly, the National Forest Policy and the Forest Management Plan contain measures to enhance coastal protection in Tonga (Government of Tonga et al., 2009; Ministry of Agriculture Food Forestry and Fisheries, 2017).

In addition, JNAP 2 identifies a range of activities to achieve its objectives. Some of these activities could be included in the 2020 NDC if it was to reflect any of the objectives from the JNAP 2.

¹⁷ The Tonga Agricultural Sector Plan does not specify the geographical scope of the proposed interventions (Government of Tonga, World Bank, and IFAD, 2016b)

4.3 Communication

The 2015 INDC refers to adaptation in various sections of the document. However, adaptation is not addressed systematically. Following the example of the JNAP2, it is recommended for the 2020 NDC to provide an overview of the different phenomena related to climate change — including changes in temperatures, shifts in rainfall patterns, a rise in sea levels, ocean acidification, and the occurrence of tropical cyclones — and their impact on Tonga (Table 7). This overview should summarize what can be regarded as consensus in the existing literature, highlight areas of uncertainty, and indicate areas in need of future research.

Table 7. Overview of phenomena related to climate change in Tonga

Phenomenon	Confidence (direction of change)	Projections in existing literature		Potential Impacts
		PACCSAP 2014	TNC 2019	
Rise in temperatures	Very high	Increase in temperatures by up to 1.0°C by 2030 and up to 1.8-4.1°C by 2090	Increase in surface air temperature by up to 0.7°C ± 0.2°C by 2030, 2.6°C ± 0.3°C by 2090 (high emissions)	<ul style="list-style-type: none"> Decreased yield and quality of crops Reduced fish catch and increased destruction of corals Increase in vector-, foodborne and waterborne diseases
Increase in rainfall	Low	Little change in annual mean rainfall.	Increase of annual mean rainfall by 2-3% by 2030 under a high emissions scenario	<ul style="list-style-type: none"> Increase in flooding and damage to infrastructure Decrease in agricultural productivity Degradation of coral reefs as a result of pollution of coastal areas by sediments and debris Increase in vector- and waterborne diseases
	High	More extreme rain events	More extreme rain events	
Occurrence of droughts	Low	Decrease slightly in frequency of droughts	Little change is projected in the incidence of droughts	<ul style="list-style-type: none"> Decrease in agricultural productivity Reduced access to drinking water and reduced food security.

Source: Compiled by GGGI

Table 7. Overview of phenomena related to climate change in Tonga (continued)

Phenomenon	Confidence (direction of change)	Projections in existing literature		Potential Impacts
		PACCSAP 2014	TNC 2019	
Rise in sea levels	Very high	Rise in sea levels by 7–18 cm by 2030 and 41–88 cm by 2090	Rise in mean sea levels by 7cm - 27cm by 2030 and 11 - 51cm by 2055	<ul style="list-style-type: none"> • Land loss, including agricultural land • Damage to infrastructure and property • Salinization of groundwater • Migration of population • Degradation of coral reefs
Increase in ocean acidification	Very high	Aragonite saturation levels in the ocean will decrease to 3.5 Ω_{ar} by 2035 and continue to decline after	Continue trend of acidification	<ul style="list-style-type: none"> • Destruction of coral reefs • Reduced catch of calcifying invertebrates and demersal fish
Decline in frequency but increase in intensity of cyclones	Medium	<p>Decrease in frequency of cyclones of 6% to 35%</p> <p>Increase in mean maximum wind speed of cyclones of between 2% and 11%</p>	Decrease in number but increase in intensity of cyclones in the southeast Pacific Ocean basin	<ul style="list-style-type: none"> • Decrease in agricultural productivity with severe damage to perennial tree crops such as coconuts, bananas, and breadfruit • Destruction of infrastructure • Damage of coral reefs • Increase in vector- and waterborne diseases

Source: Compiled by GGGI

5. Recommendations

This report reviewed and assessed Tonga's 2015 Intended Nationally Determined Contributions regarding the identified goals and targets, the proposed measures to achieve those targets, and the clarity and transparency of communicating the relevant information. Based on the results of this review process, recommendations were developed for the scope and content of the 2020 NDC (see Table 8 for a summary of the recommendations).

First, following international best practice, to the extent possible, it is recommended that mitigation targets in the 2020 NDC are formulated in terms of GHG emission reductions.

Second, it is recommended to follow the 2006 IPCC guidelines for reporting GHG emissions and selecting targets for reducing emissions. This will considerably enhance transparency and clarity.

Third, it is recommended to keep the focus of mitigation targets on the energy sector. However, the 2015 INDC largely focused on reducing emissions from electricity generation. It is recommended to expand the scope for the 2020 NDC and includes targets for the transport as well as for commercial, institutional and residential end-use. Such targets could be based on the upcoming Energy Efficiency Master Plan.

Furthermore, given that none of the existing targets for the AFOLU sectors is quantified in terms of emission reduction or emissions removal as well as the uncertainty of the extent of carbon sequestration, it is recommended for the 2020 NDC to identify a non-emission target for the AFOLU sector. For that purpose, it is suggested to include the establishment of forest inventory to improve clarity and transparency for the sector. Based on data obtained through the forest inventory, it is recommended to include a GHG emissions target for the AFOLU sector in the 2025 NDC.

Similarly, given the minimal amount of emissions from the industry and waste sectors, combined with the paucity of relevant data, it is recommended to not include emission targets for these two sectors in the 2020 NDC. It is suggested for these non-emission targets to focus on increasing clarity and transparency. In case of the waste sector, it is recommended to expand the formal waste collection system, including the collection of relevant data in order to define relevant GHG emissions targets for the 2025 NDC.

In addition, for the 2020 NDC, in-country consultations recommended to consider Marine Protected Areas as a means for mitigation as well as a means for adaptation. Therefore, it is suggested to include a non-emission target for preserving Tonga's marine biodiversity to function as a carbon sink, considering MPAs as a measure to achieve this target. In addition, Marine Protected Areas could be mentioned under adaptation as a means to support coastal protection and food security. However, either target will likely not be quantifiable, and — as a result — their achievement will be difficult to verify. Stakeholders suggested also considering Special Management Areas (SMAs). However, there is a need for clarification on the concept, definition and relationship between MPAs and SMAs (see Annex 4 to this report). Therefore, it is recommended to include only MPAs in the 2020 NDC. This would also provide consistency with the 2015 INDC.

Fourth, the 2015 INDC generally omits to identify measures to achieve the proposed targets. However, identifying relevant means is crucial to establish realistic targets and to measure progress. It is suggested that once targets for the 2020 NDC have been identified to draw upon relevant measures from existing policies and plans for the formulation of the 2020 NDC.

Fifth, the 2015 INDC's clarity and transparency are undermined by a paucity of relevant data and an inability for third parties to re-calculate results based on publicly available data. Therefore, it is recommended to ensure the publication of relevant data and calculations to permit verification by third parties. This can be done either as part of the NDC or as part of the national communications to the UNFCCC. In particular, there is a high uncertainty regarding GHG emissions from agriculture, forestry and other land use. Therefore, it is suggested to recalculate figures for carbon sequestration. If recalculation is not possible as part of the 2020 NDC, it should be considered to exclude GHG emission data for the AFOLU sector from the document and highlight the existing uncertainty instead.

Finally, it is recommended for the 2020 NDC to clearly distinguish between mitigation and adaptation. For adaptation, it is suggested for the 2020 NDC to highlight that coping with the impact of an increase in temperature and a rise in sea level are priorities for Tonga. If specific targets for adaptation are to be identified as part of the 2020 NDC, it is recommended to select targets related to increasing temperatures and a rising sea levels. In this context, several targets identified by the Joint National Action Plan 2 on Climate Change and Disaster Risk Management are regarded as relevant. However, if any of these targets were to be included in the 2020 NDC, it is recommended to define them more closely and/or make them quantifiable in order to be able to evaluate progress. In order to improve clarity and transparency, it is recommended for the adaptation section of the 2020 NDC to provide an overview of the different phenomena related to climate change and their impact on Tonga, summarizing what can be regarded as consensus in the existing literature, highlighting areas of uncertainty, and indicating areas in need of future research.


Table 8. Summary of recommendations

Category	Recommendation
Structure	Have a clear structure of the NDC, distinguishing between mitigation and adaptation. The mitigation section should distinguish between the four main sectors identified by the 2006 IPCC guidelines for national greenhouse gas inventories as relevant sources for GHG emissions.
	Follow the 2006 IPCC guidelines for reporting GHG emissions and selecting targets for reducing emissions. This will considerably enhance transparency and clarity.
Targets	Following international best practice, to the extent possible, formulate mitigation targets in terms of GHG emission reductions.
	Keep the focus of mitigation targets on the energy sector but expand the scope beyond reducing emissions from electricity generation and include transport as well as for commercial, institutional, and residential end-use. Relevant targets for the transport sector as well as for commercial, institutional and residential end-use could be based on the upcoming Energy Efficiency Master Plan.
	Maintain the target of achieving 70% of electricity generated from renewable sources by 2030. Consider updating the target of achieving 50% of electricity generated from renewable sources from being achieved in 2020.

Source: GGGI

Table 8. Summary of recommendations (continued)

Category	Recommendation
Targets	Given that none of the existing targets for the AFOLU sectors is quantified in terms of emission reduction or emissions removal, include a non-emissions target in the 2020 NDC and include an emissions reduction target in a later iteration of the NDC. The non-emission target should include the establishment of Tonga's national forest inventory as a means to enhance clarity and transparency.
	Given the minimal amount of emissions from the industry and waste sectors, combined with the paucity of relevant data, do not include any GHG emission targets for these two sectors in the 2020 NDC. Include the target of expanding the formal waste collection system in Tonga beyond Tongatapu, as a prerequisite for collecting relevant data and setting a quantifiable GHG emissions target during the next NDC cycle.
	Highlight that coping with the impact of an increase in temperature and a rise in sea level are priorities for Tonga.
	If specific targets for adaptation are to be identified as part of the 2020 NDC, select targets related to increasing temperatures and a rising sea levels. In this context, several targets identified by the Joint National Action Plan 2 on Climate Change and Disaster Risk Management are regarded as relevant. However, if any of these targets were to be included in the 2020 NDC, define them more closely and/or make them quantifiable in order to be able to evaluate progress.
Implementation	Complement targets with relevant measures to achieve them. In many cases, relevant measures can be drawn from existing policies and plans, such as the Energy Efficiency Master Plan, the National Forest Policy, and the Forest Management Plan.
	Consider the expansion of Marine Protected Areas as a means for mitigation as well as a means for adaptation rather than a target in itself. In that context, include a non-emission target for preserving Tonga's marine biodiversity to function as a carbon sink, considering MPAs as a measure to achieve this target. In addition, Marine Protected Areas could be mentioned under adaptation as a means to support coastal protection and food security.
Communication	Ensure the publication of relevant data and calculations to permit verification by third parties. This can be done either as part of the NDC or as part of the national communications to the UNFCCC.
	Recalculate figures for carbon sequestration. If recalculation is not possible as part of the 2020 NDC, consider excluding GHG emission data for the AFOLU sector and explain the uncertainty in the available data.
	In order to improve clarity and transparency, provide an overview of the different phenomena related to climate change and their impact on Tonga, summarizing what can be regarded as consensus in the existing literature,



highlighting areas of uncertainty, and indicating areas in need of future research.

Source: GGGI

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A1. Interview Notes

A1.1 Department of Climate Change, Greenhouse gas inventory working group

Context	Key points
GHG from burning fossil fuels	Estimates are based on figures from oil companies. Sales figures from oil companies differ from imports/consumption data from Statistics Department.
Diesel	<p>Sales data from oil companies to different consumers used to estimate breakdown between road transport and maritime transport (also relevant for gasoline). However, records are not always clear to make distinction.</p> <p>Fuel oil deliveries are not clearly distinguished in report, but all fuel oil deliveries counted towards maritime transport, as newer domestic ferries run on diesel.</p>
Data (energy)	<p>Approach followed for national communication: figures collected from shipping and aviation companies and authorities</p> <p>Willingness of oil companies to share data is limited as data regarded as commercially sensitive.</p> <p>Stock changes had to be estimated.</p> <p>Situation should improve once energy yearbook is available in 2021.</p>
Marine bunkers	Data on deliveries to marine bunkers is difficult to obtain as some oil directly sold to vessels.
Targets (energy)	<p>Target for electricity losses has been achieved.</p> <p>Renewable energy targets on track.</p> <p>Generation target has never been an official policy.</p> <p>Goals and targets for energy efficiency will be determined based on general direction provided by Energy Efficiency Master Plan. Key sector for energy efficiency measures is transport, particularly road transport (followed by maritime transport, with very limited contribution from aviation), and to a lesser extent residential sector.</p> <p>Lack of data as a hindrance to determine relevant targets and measures.</p>
GHG from forestry	<p>Formal figures for only one logging company/forest plantation in 'Eua.</p> <p>Estimates for harvesting of trees for fuelwood, based on samples. Basing estimate on Department of Statistics expenditure survey would only capture fuelwood that is sold commercially. Particularly in outer islands, fuelwood represents the main source of energy.</p>

	<p>Estimate for CO₂ sequestration of forests is likely too high in 2015 INDC, as figures for forest cover were probably too high. Using data from the National Forest Policy regarded as a good option.</p> <p>Age of trees is considered as low, due to considerable replanting in recent years and cultivation of fast-growing trees for fuel wood harvesting. This would have an impact when using IPCC default emission factors.</p>
GHG from agriculture	<p>Conversion of land for agriculture as the main contributor, including slashing and burning of forests, ploughing, agrichemicals, etc.</p> <p>Livestock not considered currently, but useful to capture in the future.</p>
Data (agriculture and forestry)	<p>Need to improve data.</p> <p>Need for capacity building for data collection and analysis of forestry data. Current capacity within the Ministry of Agriculture, Food and Forestry considered as limited.</p> <p>FAO forestry inventory scheduled to be concluded by 2021, by a Japanese consultant.</p>
Goals and targets	<p>Proposed goal of planting one million trees has to be put into context. Setting a single number is too simplistic. Tonga National Agriculture Sector Plan might include more practical goals.</p>

A1.2 MEIDECC, Department of Energy

Context	Key points
Electricity	<p>Main concern in Energy sector has shifted from access to electricity (100% access likely to be achieved by end 2021) to affordability (which will remain a concern for the near future) and will shift to acceptability of generation source in the future, with the necessity to move away from fossil fuels to renewables</p>
Access to electricity	<p>Access is defined broadly; anyone who is connected to main grids, mini-grids, or home systems being counted.</p> <p>Essential services include: lighting, refrigeration, an water pumping</p>
Renewables targets	<p>Prior to 2015: none</p> <p>2015-2020: 14-17% of electricity generation from renewable sources</p> <p>2020/25: on track to achieve 50% of electricity generation from renewable sources</p> <p>2030: political target to achieve 70%</p> <p>2035: political target to achieve 100%</p> <p>Conditional on:</p>

	<ol style="list-style-type: none"> 1. Tonga government: providing enabling environment (policy and regulation) 2. Donors providing funding for hardware
Solar capacity	Current: about 4.2 MW in Tongatapu, 400 kW in Vava'u, 500 kW in Ha'apai, and 200 kW in 'Eua.
Wind capacity	<p>Current: 1.3 MW in Tongatapu, 11 kW in Nakolo, 11 kW in Ha'apai</p> <p>By end 2020: 2.1 MW</p> <p>Future capacity additions:</p> <p>3.6 MW</p> <p>6 MW at western site</p> <p>6 MW at eastern site</p>
Energy efficiency	Energy Efficiency Master Plan to be finalized by end-March
Legislation	<p>Energy bill as umbrella for all energy-related acts, including electricity, petroleum, pricing, renewable energy, etc.</p> <p>Coordination of all acts and update of all acts accordingly</p>
IPP	Companies from China, France and New Zealand
Transport	<p>Electric vehicles: main concern about costs</p> <p>Efficiency of roads/infrastructure</p> <p>Ministry of Infrastructure expected to provide recommendation on vehicle efficiency. Vehicle efficiency testing through technical verification agency required.</p>
Transmission and distribution losses	From 18% in 2011 to under 11%, as a result of grid improvements

A1.3 Department of Environment

Context	Key points
Forest data	If forest data in 2009 National Forest Policy came from Department of Environment, it would have been as part of the communication to CBD (part of the mandatory reporting as part of multilateral environmental agreements). The specific report in question is the 5 th National Forestry Report. ¹⁸ However, the data in the report comes from the Department of Forestry.
Forest targets	Relevant targets are formulated as part of the 5 th National Forestry Report, referring to forest cover and mangroves, among others. The 2020 NDC could refer to these existing targets.
Marine Protected Areas	<p>Marine Protected Areas were included in the 2015 INDC as part of mitigation, because they were regarded as a means to maintain/increase the absorption of carbon by sea organisms. However, there is no system or methodology to measure the impact of establishing Marine Protected Areas on carbon sequestration.¹⁹</p> <p>The 2015 INDC included the general goal of increasing the number of Marine Protected Areas. However, among the guidelines to establish Marine Protected Areas, the size of the area is one criterium.</p> <p>The current target is for 30% of Tonga's exclusive economic zone to be covered by Marine Protected Areas, included in the Marine Spatial Plan. The plan itself is currently being drafted, but materials informing the plan are available.</p>
Adaptation	<p>Adaptation, as part of the 2020 NDC, should include measurable and realistic goals and targets. Targets have to be measurable and realistic as a prerequisite for funding and implementation.</p> <p>JNAP2 and the National Environmental Management Strategy (being drafted) are sources that could inform adaptation as part of the 2020 NDC.</p> <p>The State of the Environment Report could help to capture evaluate current development and identify gaps and barriers (e.g. terrestrial protected areas).</p>
Waste	<p>Department of Environment collects waste data from Waste Authority Ltd. Currently, no distinction between waste streams. However, there is an aim to collect waste information distinguishing between different categories of waste. No collection of data on methane emissions from landfill.</p> <p>Specific measure to be implemented concerns phase-out of single-use plastics.</p>

¹⁸ GGGI was not able to obtain the 5th National Forestry Report.

¹⁹ In a follow up discussion, the Department of Environment suggested that the target of doubling the number of marine protected areas should be regarded as a means to strengthen adaptation.

A1.4 Tonga Bureau of Statistics

Context	Key points
Biomass	Information on consumption in “household income and expenditure survey” (2015)
LPG	Information on consumption in “household income and expenditure survey” (2015)
Oil products	Information on imports (quarterly) in “foreign trade report”, based on customs data. Note: “Re-export” refers to international marine bunkers. No data on consumption.
Transport	No data beyond census and household survey. No data on passenger and freight kilometers. Ask for vehicle registry data from the Ministry of Infrastructure.
Waste	No data beyond census and household survey. No data on amounts and waste composition. Ask waste authority.
Labour	Labour force survey (2018)
Data gathering	Census in 2021. Currently collecting input on design and content Generally, data gathering through census in order to gain an overview. Detailed data can be gathered through specific survey, covering specific topic. Data shared between ministries/departments once agreement on what data is shared, for what purpose and with whom. Arrangements are made based on Statistical Act with other line ministries (letter from CEO).
Follow up	Questions from Bureau of Statistics: Specific data collected as part of the preparation of Fiji LEDS? Answer from GGGI: Nothing specifically collected due to budget and time constraints.

A1.5 Department of Transport, Ministry of Infrastructure, Land Transport Division

Context	Key points
Infrastructure	Considering the impacts of climate change during the planning and design process Upgrading and maintaining roads as a key activity
Data	Check national infrastructure investment plan (2013-2023) Can share data on fuel consumption, vehicle registry, and traffic count (Tongatapu) Contacts for buildings control, maritime transport and aviation to set up interviews
Goals and measures	No vehicle standards No consideration of fuel switching or alternative technologies
Transport modes	Preference for car over motorbike, cycling, walking Lack of infrastructure for non-motorised transport

A1.6 Department of Transport, Ministry of Infrastructure, Maritime Transport Division

Context	Key points
Data	Collecting data of fuel sales to domestic shipping for registered vessels (>8 meters). No data for smaller vessels that would often get gasoline/diesel directly from gas stations. Data on number of port calls by vessel. No data on passenger and freight numbers, only weight estimates when vessels cross load line. No projections on fuel consumption. Maybe collected by shipping companies.
Diesel/fuel oil	There are no domestic vessels using high sulphur fuel oil (HFO). HFO only used for international marine bunkers.
Goals and targets	Negotiations at IMO on GHG emissions from vessels. Tonga would need to adhere to any agreements achieved there. Contribution of domestic shipping to GHG emissions considered as insignificant, particularly on a global level. Energy Efficiency aster Plan focused on land transport, as major share of GHG emissions from land transport in Tonga. Any regulation on engine or fuel standards would likely impose an additional cost on vessel owners,

who often can barely afford to pay the fuel. Also, it is unclear whether higher standards fuel can be used in existing engines.

No impact on domestic shipping from IMO regulation on sulphur content.

A1.7 Civil Aviation Division

Context	Key points
Data on fuel consumption	<p>No systematic collection of fuel consumption data in aviation under Transport by the Civil Aviation Division. Information is requested from operators and Pacific Energy (which is responsible for fuel deliveries to aviation).</p> <p>As part of Tonga's requirement as a member of the International Civil Aviation Organization (ICAO), the Civil Aviation Division will start to collect data on fuel consumption for international flights, starting from the second half of 2020. Data is expected to be published in 2021.</p> <p>Ad-hoc request to operators is possible, if it is specified what data is needed and for which purpose.</p>
Passenger and freight data	<p>No systematic collection of passenger and freight data in aviation by the Civil Aviation Division. Civil Aviation Division can request data on passenger numbers from operators. Similar request can be made for freight data, but uncertain whether operators collect that data.</p> <p>Freight transport via aviation in Tonga is limited. Freight is rather transported via maritime transport. Domestic planes are small and mostly serve for passenger travel. There are no dedicated cargo planes.</p>
Targets for GHG emissions	<p>Establishing targets to reduce fuel consumption/GHG emissions from aviation was regarded as unrealistic, due to the lack of alternative fuels and technologies. Alternative fuels are currently not commercially viable. Introducing stricter engine standards would come at considerable costs for operators as airplanes would need to be replaced.</p>

A1.8 Department of Forestry

Context	Key points
Data	<p>No reliable data for forestry, no forest inventory in Tonga.</p> <p>Work on forest inventory to commence in 2020 with support of FAO</p> <p>2009 National Forest Policy uses data from the Department of Environment. Recommended to contact Department of Environment about the origin of this data. Also recommended to consult 2017 Forest Management Plan</p> <p>Land area used for agriculture: annual crop survey + recheck census</p>
Estimates	<p>Difference between FAO estimate (9,000 ha) and National Forest Policy (68,000ha) as a result of different definition for forests</p>
GHG targets	<p>Limited land area in Tonga: Conflict between food security/income and need to clear land for agriculture vs reducing emissions</p> <p>Forestry</p> <p>Makes sense to have targets for forestry, but not for Tonga where no forest harvesting and forests are generally small on a global scale</p> <p>2019 Corporate Plan of Ministry of Agriculture, Food and Forests (MAFF CP) envisions planting of 1 million trees</p> <p>Agriculture</p> <p>Reducing land need (emissions from agriculture) requires considering most suitable crops/change in crops/viable alternatives with price and sustainability as two important determinants</p> <p>Agroforestry, intercropping of crops and trees, and mixed cropping as important measures to reduce the impact of climate change, droughts, pests and diseases, but dependent on funding</p> <p>Need for more efficient land use</p>

A1.9 Ministry of Revenue and Customs

Context	Key points
Petroleum data	<p>Data collected by customs and shared with the Department of Statistics. Gaps in publicly available foreign trade report (Department of Statistics) are likely the result of outage of automated customs system. In case of an outage, the system is updated manually afterwards, but statistics reports might not reflect those updates.</p> <p>Customs data can be shared and includes concession codes (tax exemption based on use) that allow for some distinction between product use.</p>
Oil supply chain	<p>While direct shipments from Singapore were under discussion a few years ago, they never materialized.</p>
Subsidies	<p>Subsidies entail the removal of excise tax and for some products/use consumption tax. Excise tax amounts to 65 cents per litre for all petroleum products, except lubricants.</p> <p>Weekly/monthly reports on subsidies contain details on concessions, such as amounts and categories of use that they apply to. These reports can be shared.</p>
Vehicle data	<p>Customs collects data on vehicle imports. Excise tax is based on engine size, which would allow to distinguish between vehicle categories. This data can be shared.</p>

A1.10 Tonga Power Limited

Context	Key points
Renewable energy	<p>Achieving 50% electricity generation from renewable sources as the main challenge, to be achieved by wind, solar and battery, with 10 major projects over the next two years (53.2 million USD)</p> <p>Implications on network/change to the network, even more so for achieving 70% by 2030 and 100% by 2035</p> <p>Options to diversify renewable energy options: currently solar and wind, with the need for battery storage to possibly waste/biomass, tidal/wave in the future</p> <p>Implications on costs/electricity tariffs</p>
Demand	Growing demand: TPL projects 2.5-2.7% year-on-year demand growth for 2020-2025, driven by construction of commercial and residential buildings
Data	<p>Able to provide load curves, installed capacity, losses</p> <p>Check Pacific Power Association for benchmarking</p> <p>World Bank (2016) study on resilience/adaptation in Energy sector</p> <p>Request overview for planned capacity additions</p>
Metering	Ongoing with focus on Tongatapu where 85-90% coverage achieved
Losses	Loss reductions as a result of significant improvements in network infrastructure (technical losses) and the introduction of meters (non-technical losses)
Off-grid	Outside of TPL responsibility
Goals and targets	Goals and targets set by government, with TPL focusing on implementation and providing feedback on technical feasibility (impact on grid and security of supply)
Financing and costs	<p>Funding to build infrastructure to achieve targets mostly from outside TPL</p> <p>2015-2020, grand funding for solar and wind as well as technical assistance, but increasingly private investment under power purchase agreements</p> <p>Drive towards private sector investment, with support from financing institutions</p> <p>If diesel prices drop considerably (March 2020), then solar/windless competitive. However, (1) low prices are considered to be a short-term phenomenon and (2) willingness for a temporary premium to be paid to achieve emission reductions.</p>

Wind	<p>First system installed in July 2019 by Japan</p> <p>Providing baseload, particularly at night.</p> <p>Output changes much more gradual than solar, as a result, easier to operate (but only 7 months of data)</p> <p>Upfront costs for wind even higher than solar</p>
Solar	<p>Tongatapu: baseload, with diesel for meeting peak demand</p> <p>Ha'apai: solar and battery storage cover entire demand during daytime</p> <p>Cloud cover as the main challenge, requiring diesel backup. Modern diesel generator fleet, but use for backup generations reduces efficiency as generators are run on lower frequencies</p> <p>Solar for main grids is cost-competitive with diesel, as evidenced by private sector investment. For off-grid systems, diesel is cheaper</p> <p>Upfront costs as a challenge. Grant-funded upfront costs not passed on to consumers</p>
Battery	<p>Two facilities in 2020</p> <p>12-years life expectancy for batteries (at current cost of 30 million USD), impossible for TPL to fund replacement of components</p> <p>Options other than battery considered, but currently not economically viable</p>
Biomass/waste	<p>Biomass and waste regarded as options to replace firm capacity diesel</p>
Adaptation	<p>1. Hardening of infrastructure with project specifications and design of generation infrastructure to withstand cyclones + network upgrades to improve resilience</p> <p>2. Rebuilding, with more flexible designs to re-establish power faster, instead of building infrastructure that can withstand all phenomena</p>
Rooftop solar	<p>Currently 30 systems, mainly as trials</p> <p>Regarded as an option for (1) reducing investment burden on TPL, as consumers pay for infrastructure, and (2) demand-side management</p> <p>Assessment of impact on-grid and requirement to upgrade grid</p> <p>TPL involved in system design, TPL permission required to connect systems to network</p> <p>Missing policies and incentives to encourage installation/investment. For example, unclear whether or not import fees and taxes are imposed on equipment. Currently, no policy/regulation but decision is project-based</p>
Energy efficiency/demand-side management	<p>TPL heavily involved. Examples include street lighting (LED), distribution of light bulbs to consumers (15,000), energy auditing and training,</p>

development of standards, studies on consumer behaviour in cooperation with universities

A1.11 Tonga Waste Authority Limited

Context	Key points
Data	<p>Only total amounts in cubic meters, based on collection vehicles</p> <p>No data on composition, but high amount of plastic</p> <p>Can share annual plan/business plan for projections</p> <p>Can share data for total amounts</p>
Recycling	The entirety of the collected waste goes to the landfill, no recycling
Waste collection	<p>Practice of burning waste has reduced, due to regulation (fine) and collection system in place. Fixed fee for households and commercial users provides incentives to use the system.</p> <p>A system established in Tongatapu and Vava'u, to be established in Ha'apai and 'Eua in 2020. Further expansion to other islands required in the future.</p> <p>Willingness to pay is an issue in some areas, but regulation/fines has been helpful in enforcement</p>
Targets and measures	<p>Target to reduce waste/increase recycling, but need for equipment and funding</p> <p>Limited financial capacity of waste authority. Improvement in infrastructure requires improvement in financial situation for necessary investments. Currently dependent on donor funding. Fees are barely sufficient to cover operational costs, but not investments.</p> <p>Considering waste to energy as an option, but capacity and resources to assess viability are limited</p>

A1.12 Real Tonga Airline

Context	Key points
Data	<p>Collect data on fuel consumption for domestic flights. Collect data for domestic passenger numbers and distance travelled. Data can be shared pending approval from company CEO.</p> <p>No data on international flights.</p>

Goals and targets	Setting emission reduction targets for aviation is not regarded as realistic for two reasons: (1) there are no alternative fuels and (2) costs would be too high.
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A1.13 Pacific Energy

Context	Key points
Petroleum consumption	<p>Diesel reflects Approximately 40% of total product sales. Half of the diesel is used for road transport, 40% for power generation, and 10% for marine bunkering (ferries, fishing, international).</p> <p>No reduction in diesel sales observed for electricity generation, despite increased deployment of renewables.</p>
Data	Suggestion to use customs data as company data is confidential.
Policy	The only major change over the last 10 years is the tightening of fuel specifications, in particular regarding lower thresholds for Sulphur content.

A1.14 Total

Context	Key points
Petroleum consumption	End-use of diesel sales (from Total) can be roughly broken down as follows: 60% for electricity generation, 30% for road transport, 10% for shipping
Data	Sales data is confidential. Suggestion to rely on customs data.

A2. List of interview participants and contact information

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A3. Barriers and opportunities for achieving the 2020 NDC targets

The information below was collected from stakeholders at two workshops on the 30th and 31st of July 2020. The stakeholders represented participants from the energy, IPPU, AFOLU, waste and adaptation sectors and cross-cutting areas such as finance, planning, local government and gender.

The questions asked to stakeholder during the workshop were:

- How can the suggested 2020 NDC targets be achieved in Tonga?
- What are the barriers and opportunities?
- What enabling actions need to be taken?

Barriers	Opportunities	Enabling Actions
Adaptation		
Lack of enforcement of MPAs and SMAs so this needs strengthening	Marine spatial planning to better manage our ocean	Introduce and Enforce Marine Spatial Planning (MSP) Act
No regulation specific under Parks & Reserves concerning the MPA and SMA	Strengthen and develop skills in ocean management and monitoring	Funding and resources
Lack of awareness	Cooperation between all stakeholders	Technical assistance e.g. to strengthen marine monitoring teams
Conflict of users (private sector)	Closely collaborate between agriculture, transport, waste, water to understand each other's targets and be involved in each other's planning and budget processes	Specifically distinguish between MPAs and SMAs
Political and institutional threats	Use existing resources and activities e.g. MPAs	Conduct a quarterly, biannual or annual monitoring and evaluation for all NDC sectors implementing the targets
Lack of funding, resources and activities to implement the targets.		To achieve the Collaboration with all institutions <ul style="list-style-type: none">- Understand the NDC targets

Barriers	Opportunities	Enabling Actions
		<ul style="list-style-type: none"> - Incorporation of the targets to the corporate plans - Incorporation of targets to the government budget <p>Gaps need to be identified early so that it can be addressed early rather than being identified in the review.</p>
AFOLU		
Not enough budget allocated Lack of funding	Include NDC goals in Ministry corporate plans NDC targets should be included in the National Development Plan	Improve awareness Improve communication and collaboration at a high level including within Ministries and with other stakeholders
NDC targets not included in ministries plans and strategies Lack of expertise	Make NDC goals a priority for Ministries	Commitment to data and survey and maintaining data system To update or establish an Agriculture, Forestry and Fisheries Census Review the Tonga Agriculture Sector Plan and Forestry Policy Allocate national budget to achieve the targets
Waste		
Lack of capacity	A centralized database should be in place to prevent duplication of works	Technical support
Lack of data and consistency of data	Improve the consistency of data	Waste composition survey

Barriers	Opportunities	Enabling Actions
Limited availability of data and it is scattered across sectors		Construct a Weighbridge in landfills and Waste Facilities
Duplication of efforts		Capacity building Landfill upgrade
Energy		
Impacts of Climate Change for example occurrence of intensive events such as Tropical Cyclones has affected the implementation of RE projects resulting in delays in implementation.	Opportunity to conduct high-level consultation for decision-makers.	Carry out more high-level consultations and awareness-raising so decision-makers know the challenges.
Cyclones have affected the RE equipment.	Opportunity to make alignment of different policies and national plans for future purposes and avoid contradictions	Better align national and sectoral policies and plans towards the same goals
Novelty of projects, different project requiring different procedure with different donor demands and procedures	Tax and tariffs are focused on some goods while others are neglected thus need of fair and evenly tax imposition	Remove concessions on fuels
The availability of land is an issue for new upcoming RE projects	Through targets can enable aid in achieving the targets through such as Tax exemption on certain goods	
Lack of funding and capacities.	Opportunity to get the private sector more involved	
Lack of in-country capacities in some specific areas which are needed for renewable energy projects and cannot fly-in specialists due to covid-19. This has caused delays		
Political issues are one of the challenges. Elections in		

Barriers	Opportunities	Enabling Actions
<p>2021, changing the government priorities thus affecting the targets progress.</p> <p>Lack of aligning policies and national reports in Tonga</p>		

A4. Marine Protected Areas and Special Management Areas

There are two major strategies for Marine Managed Areas in Tonga. These are:

1. Marine Protected Areas (MPAs); and
2. Special Management Areas (SMAs).

Both strategies are managed by Government of which MPAs are managed under the Ministry of MEIDECC (Department of Environment) and SMAs under the Department of Fisheries.

MPAs are areas of marine protection that are remote from communities, where community management is not possible, and are managed exclusively by the government. MPAs are labelled as 'parks' or 'reserves' designated under the Parks and Reserves Act 1979 (Rev. 1988) and are exclusively 'no-take zones'. SMAs are areas of marine protection that are located near island communities where they can be locally managed under government supervision of the Department of Fisheries (DoF). All SMAs are designated under the Fisheries Management Act 2003 and are 'multi-use' zones. The above-stated government ministries (MEIDECC and DoF) are also responsible for the monitoring of MPAs and SMAs.

	MPAs	SMAs
Regulation for human usage	Exclusive 'no-take' area - non-extractive activities (snorkeling, diving, etc.) only.	'Multiple-use' area - fishing in designated zones only
Area location	Remote areas – areas remote from communities	Areas adjacent to local communities
Management Strategy	Government-managed by Ministry of MEIDECC (Department of Environment)	Locally managed by island communities under the Department of Fisheries
Legislation	Parks and Reserves Act, 1979 Fisheries Management Act, 2003 (Rev. 1988)	Fisheries Management Act, 2003
Fines	<TOP \$500 & imprisonment <3 months	< TOP \$50,000

At the NDC review and recommendation validation workshops, the point was raised with regard to whether both MPAs and SMAs should be included in the 2020 NDC. This led to discussions of some points which need to be decided first before making further decisions on how MPAs and SMAs are included into the future NDCs. At the validation workshops, it was recommended that there is a need to clarify definition of MPAs and SMAs, including that MPAs are all no-take zones and SMAs also in some cases include no-take zones so there are overlaps. The concept of MPA and SMA having a no-take policy is their similar characteristic that warrants them to be categorized together. There was a suggestion to use Marine Managed Areas to house both the MPA and SMA. However, the MPA is a global definition recognized by the Convention for Biological Diversity while the SMA is a national term dictated by Tonga and MMA is a regional term. To house the MPA & SMA under MMA was thus not regarded as ideal and stakeholders agreed there is a need for further discussion between the Department of Environment and the Ministry of Fisheries regarding this issue.



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